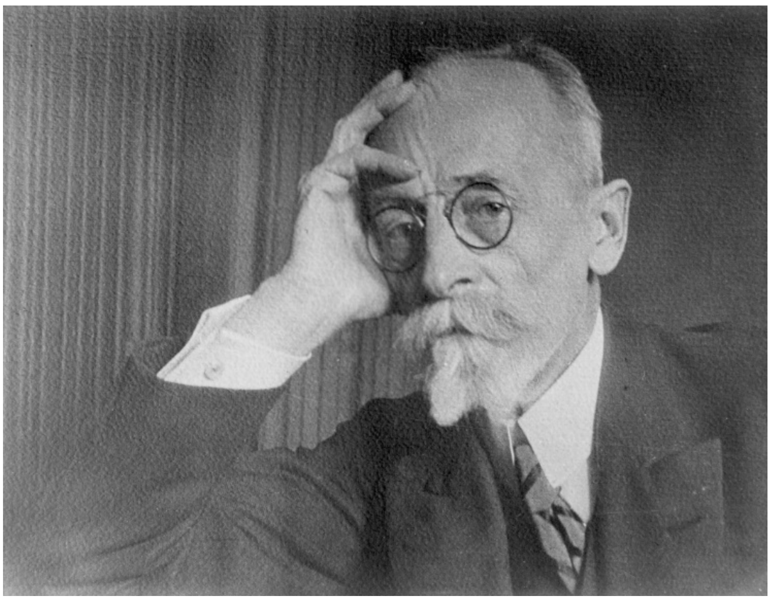
Harmonic Leadership:
The Collected Works of Karol Adamiecki

Translated by Craig Stritar and Olga Stritar



Karol Adamiecki
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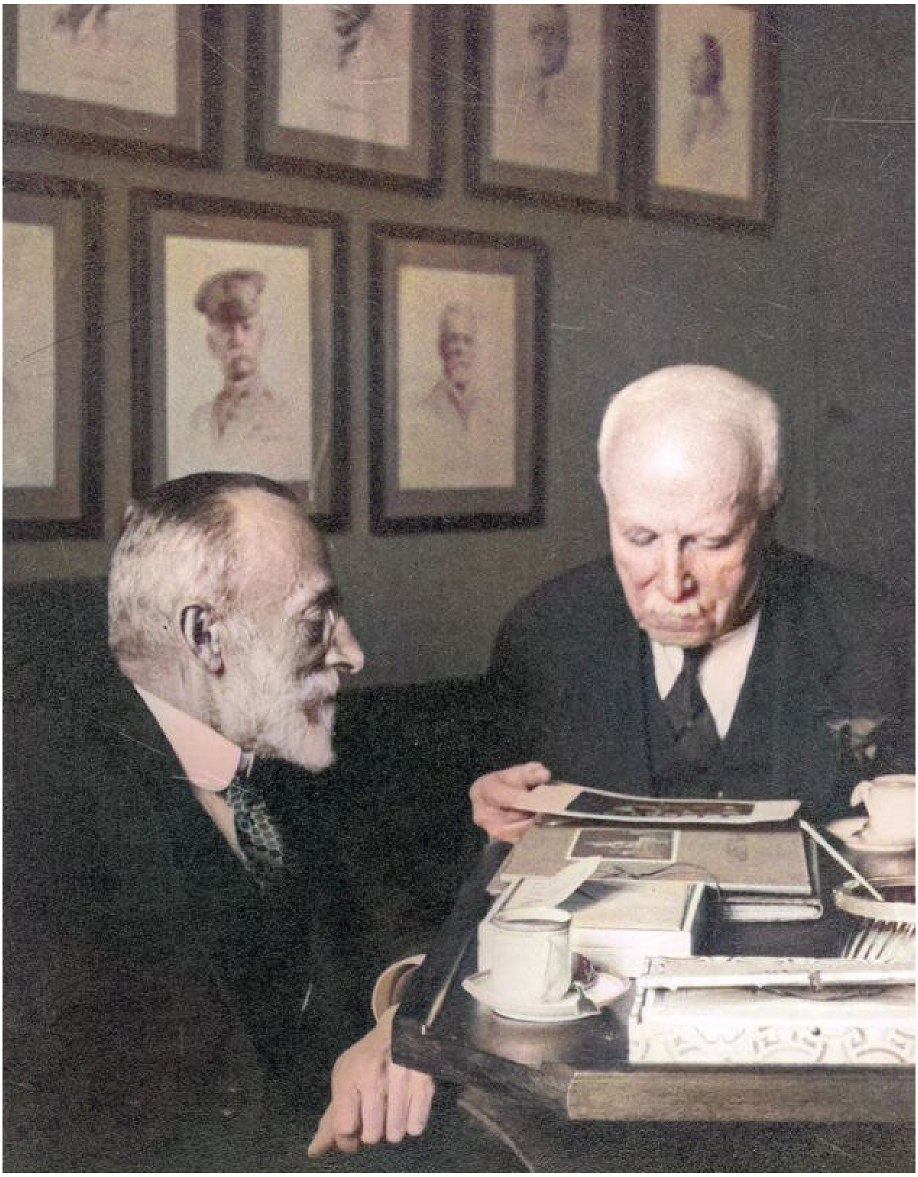
Thank you to Sylwia Szulik of the Scientific Information Centre and Academic Library Center for History and Tradition of the University of Economics in Katowice for your assistance in providing additional references, combing through the collections for photographs, and for tracking down that final "missing" article to complete these collected works.



Karol Adamiecki and Harrington Emmeron
Source: National Digital Archives (Poland)

Contents

Laws and Principles of Scientific Management*

*as discussed in these collected works

Law of Inertia of Habits: “as important as the law of physical inertia” (Adamiecki)
Law of Counteraction (applied to scientific management, Adamiecki referenced Le Chatelier and Van’t Hoff)
Le Chatelier’s principle: When a simple system in thermodynamic equilibrium is subjected to a change in concentration, temperature, volume, or pressure, (1) the system changes to a new equilibrium, and (2) this change partly counteracts the applied change.

2. The Van’t Hoff factor can be defined as the ratio of the concentration of particles formed when a substance is dissolved to the concentration of the substance by mass. The extent to which a substance associates or dissociates in a solution is described by the Van’t Hoff factor.

Law of Contrariness (Newton’s third law): “for every action (force) in nature there is an equal and opposite (contrary) reaction.” Applied to organizations, this describes the correlation between pace of change and resistance to it from individuals or groups.

Laws of economy

1. **Law of Division of Labor** (Adam Smith)
2. **Law of Concentration or Integration** (biological law. Applied to organization by Henry Le Chatelier): cells of the same type or similar function join together for common action creating cooperation and even whole organs serving a purpose.
3. **Law of Harmony** (Adamiecki)
    a. **Harmony of Selection**: selection of work cells
    b. **Harmony of Operation/Action**: coordination and timing of operation
    c. **Harmony of Spirit**: Human factors and “psychotecnics”

Revised Laws of Economy (Adamiecki, Prague, 1924)

1. **Laws of Division of Labor alongside Concentration of Labor**
2. **Laws of Optimal Production**
    a. **General Law of Nature**: “all phenomena of energy and matter transformation always have a strictly defined speed at which they occur most economically”
3. **Laws of Harmony**

Law of Minimum: growth of plants depends on many nutrients, but the yield is dependent on the one that is the least present.
Law of Least Effort: concerns efficiency and return on natural energy
Law of Supply and Demand
Law of Cost Flow in Unit Time
Law of Expenditure and Income

Law of Causality: Adamiecki applied this to the future direction of technical education. If students are taught correctly, businesses run according to principles of scientific management, and economic life will improve

Purpose of the enterprise:
1st - Exchange of goods needed by people at an affordable price
2nd - Profit and well-being of employees
*Note, Adamiecki stated the goal of the organization is NOT profit above all else

General Principles

1. Harmonization
2. Cooperation and collaboration
3. "Cheap, but dissatisfied worker is lethal to the profits of the enterprise"
4. Obtain the greatest useful output with the least input (law of least effort)
5. Gradual Progress/Gradual Introduction of Improvements
    a. (laws of inertia of habits, counteraction, contrariness, harmony of human spirit)
6. Cycle of Organization (after understanding the vision/goal)
    a. Analysis
    b. Planning
    c. Execution
    d. Control (as in control of experiments and responding to variation to plan)
7. Private Initiative
8. Free Competition
9. Selection
10. Economic Life Development

Value Stream Principles see 1924 article: The position of an Engineer as a Manager of Manufacturing Plants)

1. Expenditure – costs of producing certain quantity of product
2. Income – sum obtained by sale of the product
3. regulating these flows is the main task of the plant manager

*for value stream map see figure 7 in the article

Foreword to the English Edition

I went to one company and I thought "I haven't managed much before." So I read 20 management books. And I started talking to [other leaders] and compared to all the other VP's … I read 19 more management books than anybody else.

-Jim Keller[1]

Navigating the complex world of management can feel overwhelming. With a plethora of advice stemming from formal education programs, books, and "efficiency experts," how can we discern which ones actually add value, both to ourselves, and to our organizations? Most of us can relate to Jim Keller's advice above when we realize we fell into the camp that read 19 fewer management books than we probably should have! However, considering the unrelenting time demands on modern leaders and the business sections of bookstores overflowing with summaries of an infinite catalogue of improvement tools and techniques, which works should we prioritize?

Over a century has passed since the advent of scientific management, which transformed the profession from an art into a field grounded in foundational principles as rigorous as those of chemistry or physics - a sentiment echoed by renowned chemist and physicist Henry Le Chatelier.[2] Yet, despite this, the high failure rate of modern organizational transformations starkly contrasts with the replicability expected from a process rooted in the scientific method. Although most companies struggle to adhere to the principles of scientific management, a few have emerged as exceptions with Toyota Motors, at least throughout the last half of the 20th century, as a notable example. The tools and techniques produced as a result of practicing "The Toyota Way" were so effective that their study became an industry in and of itself. Yet, even after four decades of striving to replicate the Toyota Production System through programs such as "Just-in-Time," "Lean manufacturing," and "Agile," we had failed to replicate a "second Toyota."

This systemic issue is compounded by entrenched pedagogical approaches in MBA programs, which have only recently begun to veer away from the short-term, profit-driven philosophy of Sloanian financialism. Outside the realm of academia, we all-too frequently read headlines of formerly innovative, customer-centric, organizations to adopt profit-maximizing, and people-minimizing, strategies, such as the "planned obsolescence" model pioneered by Alfred P. Sloan and General Motors. Most astonishingly, even Toyota is not immune, now grappling to replicate the principles that once drove its unparalleled success.

Lest we be accused of hyperbole, let's briefly examine the consequences of deviating from these principles. In 2009, just a decade after Toyota Motors' listing on the NYSE, then honorary chairman and former CEO Shoichiro Toyoda—son of company founder Kiichiro—publicly rebuked the outgoing president "for being so anxious to boost sales and profits that he'd let Toyota emulate now-bankrupt General Motors and Chrysler."[3] Tragically, a decade after he appointed his son, Akio, to turn the ship around, Toyota Motors has become the most indebted company in history, grappling with declining sales in a disruptive market. Its once-glowing reputation as a market innovator had been tarnished, viewed instead as an industry laggard—even within Japan.[4]

When even companies that achieved greatness through a culture of continuous improvement based on the principles of scientific management can succumb to short-term thinking, the task of reversing this trend becomes even more daunting. Beyond the pressures of a market that rewards short-term focus, the ingrained habits of senior leaders - cultivated by an education system that was entrenched in a flawed model - pose a significant obstacle. Today, if scientific management, or "Operational Excellence," is taught at all under its various incarnations — such as Lean, Six Sigma, and Agile — it is frequently treated as merely a set of tools and techniques, offering quick fixes for systemic issues rather than a holistic approach of synchronizing and harmonizing an enterprise's activities, as was observed on the factory floors of the aforementioned Toyota. As we often hear with championship sports teams after a successful turnaround: we need to get back to the fundamentals.

However, the field of scientific management presents a rather unique obstacle for those of us looking "get back to the fundamentals" of our field: despite his mastery of the scientific method in the study of factory processes, the individual most often associated as the founder of the field, Frederick "Taylor did not have the gift of expressing his thoughts" as noted even by his close friends and supporters like Frank and Lillian Gilbreth and famed chemist Henry Le Chatelier.[5, 6] This leads to a counterintuitive recommendation for serious business professionals: to understand Taylorism, read Henry Le Chatelier; but to thoroughly comprehend the foundational principles of scientific management, read Karol Adamiecki.

The following collected works deliver a comprehensive understanding of scientific management's evolution, clarifying the foundational principles that underpin all the successful tools, techniques, and leadership methodologies we employ today. Adamiecki's writings underline the significance of the human element, and they establish a vision of leadership that goes beyond mere administration, delving into the importance of, and approach to, fostering harmonious work relations. Furthermore, by firmly grounding oneself in these foundational principles, successful organizational transformations — similar to those frequently achieved by businesses a century ago — transition from being a distant aspiration reliant on luck, to a reasonably-expected outcome rooted in knowledge and skill.

The validity of these claims isn't merely rooted in theory but is substantiated by tangible, practical examples in these works, such as the numerous successful organizational transformations observed firsthand in Polish factories by Karol Adamiecki and Henry Wallace Clark (co-author, with Henry Gantt, of *The Gantt Chart*). During their tours, they noted that successful transformations began with harmonizing the system, that is, the rhythm of production—better known today as "takt"—prior to any attempts at modifying job methods. By producing exactly what was needed, when it was needed—"neither earlier nor later"—factory output frequently doubled or even quadrupled overnight. Once the system was optimized, the focus shifted towards technical optimization of individual work cells, or as one of the plant managers succinctly put it: "First Harmonization, then Taylorization."

At the heart of these success stories was an unwavering adherence to the principles of scientific management, as opposed to the rote application of techniques. Besides the established Laws of Division of Labor, and Concentration and Integration, it was Adamiecki's vital contribution of the Laws of Harmony that brought the field to full fruition, much like the addition of genetic causes to the well-established germ theory of disease transformed our understanding of medicine. These laws encompassed three distinct elements: the Harmony of Selection, which pertained to the appropriate sizing of equipment and work cells; the Harmony of Operation, which focused on setting the optimal rhythm of coordinated actions; and, most importantly, the Harmony of Human Spirit.

Adamiecki ventured beyond the simplistic "carrot and stick" approach of many of his contemporaries when he delved into the concept of the "harmony of spirit." He not only emphasized the importance of aligning interests between workers and management, but also identified a clear link between successful implementation of harmonizing selection and operations and the emergence of team spirit and job satisfaction. Drawing a parallel between management and music, he noted, "The main goal in creating a musical piece is to make sure that each sound is played at the right time, neither earlier nor later. In this regard, the role of the composer is similar to the role of the manager: both aim for harmony. The musician seeks harmony of sounds, and the manager seeks harmony of work elements."

Although Karol Adamiecki may not yet be as widely recognized as Frederick Taylor, it is our hope that his reestablishment as a co-founder of scientific management will help the field regain its robust foundation. By acknowledging his contributions, we can make progress without having to reinvent or rediscover principles that were "settled science" a century ago.

The tragedy of this loss is amplified by the fact that these principles were not merely the works of an undiscovered genius collecting dust in a basement before being suddenly discovered and unveiled to the world. Rather, Adamiecki was a key player in the propagation of scientific management, and his renown was global by the time of his death. Recognized and respected by the Taylor Society, notable figures like Harrington Emerson, Henry Le Chatelier, and other internationally acclaimed entities, his contributions were substantial. He co-founded the International Management Congress (CIOS) alongside Herbert Hoover and Tomáš Masaryk, and was the recipient of a gold plaque from the same organization. Remarkably, even in the aftermath of widespread destruction and severe restrictions imposed on the Polish economy post-World War II, the American Management Association continued to acknowledge his foundational role in the field as late as 1947.[7]

Engaging with these collected works offers benefits that extend far beyond historical enrichment. Readers will acquire the foundational knowledge needed to successfully navigate the complexities involved in leading a modern organization. In essence, this book is more than a collection of writings—it's a roadmap of the timeless scientific foundations required for effective leadership in our complex, modern business landscape.

-Craig Stritar and Olga Stritar
July 6, 2023

1. Keller, J. (Interviewee) & Fridman, L. (Interviewer). (2020, January 15). Moore's Law, Microprocessors, and First Principles [Interview]. Lex Fridman Podcast #70. YouTube. https://www.youtube.com/watch?v=Nb2tebYAaOA
2. H. Le Chatelier. Filozofia systemu Taylora. Warszaw 1926
3. Ohnsman, A., Lippert, J., & Inoue, K. (2009, July 5). Toyota's Toyoda scolds execs for emulating U.S. car companies' mistakes. Seattle Times.
4. Hayashi, E. (2023, June 1). Toyota, Honda, Nissan trail Tesla and BYD in global EV race: report. Nikkei Asian Review.
5. Adamiecki K. A brief outline of the history of the scientific development of an organization in Poland against the background of its development in other countries. Przegląd Organizacji. 1929;4(5):151-162.
6. Gilbreth, F. B., & Gilbreth, L. M. (1924). Scientific Management in Other Countries Than the United States. Bulletin of the Taylor Society, 9(3), p.136.
7. Hopf, H. A. (1947). Who were the pioneers of scientific management? (Conclusion of review by Dr. Harry Arthur Hopf of Volume I of 'The Making of Scientific Management,' by Urwick and Brech). The Management Review, February, 1915.

Notes on Content and Formatting

This volume comprises a collection and translation of Karol Adamiecki's works on scientific management, arranged with the dual goals of promoting ease of reading and a seamless narrative flow. In the original text, Adamiecki often presented lists within single paragraphs. To facilitate clearer comprehension, these have been formatted into numbered lists.

These works are generally presented in chronological order, with a few exceptions made to enhance narrative continuity. For instance, “The graphical method of organizing collective work in rolling mills,” his 1909 work describing harmonization and the use of a harmonograph, is succeeded by a succinct instructional article published two decades later. This deviation from strict chronology is intended to provide a more cogent narrative for the reader.

The original figures in these works have been digitally enhanced for this collection, while the original tables have been retained in their initial form, with the exception of instances where reformatting significantly improved readability.

While Adamiecki's early technical papers were substantial contributions to late 19th-century technical literature, they have been excluded from this collection to maintain a focus on his timeless contributions to the field of scientific management. Similarly, a comparative analysis on piece-rate pay, written originally in 1906 and unpublished until 1931, has been omitted. Given that piecework is exceedingly rare in today's work settings, the relevance of this analysis for modern readers is limited.

Included in the appendices are his memorial addresses, and the letters of condolence he received from the scientific management community.

Finally, Adamiecki's books, comprised of selected articles from his corpus, have been omitted, as the content does not deviate substantially from the original articles. For those who are interested, the technical papers are available by navigating to https://www.firstprinciplesleadership.org/harmonic-leadership or by scanning the QR code.

Harmonic Leadership Supplemental Documents

Part I – Articles on Scientific Management and Education

№ 41—42. Warszawa, dnia 16 Października 1923 r. Tom LXI.

PRZEGLĄD TECHNICZNY

TYGODNIK POŚWIĘCONY SPRAWOM TECHNIKI I PRZEMYSŁU.

REDAKTOR Inżynier-technolog **CZESŁAW MIKULSKI.**

2-GI ZESZYT, POŚWIĘCONY ZJAZDOM INŻYNIERÓW.

TREŚĆ:

SOMMAIRE:

Znaczenie społeczne pracy inżyniera w przemyśle.

Referat prof. **K. Adamieckiego.** [1])

W niniejszym referacie nie będę uzasadniał, jak doniosłe znaczenie mają dla społeczeństwa i wogóle dla cywilizacji rezultaty widome pracy technicznej w przemyśle, w postaci różnych budowli, urządzeń, maszyn i produktów.

Na ten temat zbyt już wiele mówiono i pisano, a dla nas techników sprawa ta jest już dostatecznie wyjaśnioną, natomiast chciałbym tu rzucić nieco światła na znaczenie samej *istoty naszej pracy* w tym olbrzymim organizmie, który nazywamy społeczeństwem i którego organy wykonywują jakąś funkcję, potrzebną do normalnego życia całego organizmu.

I. Rola i odpowiedzialność inżyniera w przemyśle.

Jednym z takich organów, który wykonywa niezmiernie ważną funkcję, jest przemysł, przedstawiający jedno z największych pól pracy inżyniera. Jak wiemy, wszystkie czynniki wytwórcze, działające tutaj, sprowadzają się do pracy ludzkiej, kapitału i energji przyrody, pośród nich zaś *praca technika jest kierowniczą*, a więc rola nasza w przemyśle jest tak ważną, jak rola mózgu i systemu nerwowego w żywym organizmie. Nic więc dziwnego, że ponosimy wielką odpowiedzialność za rozwój i sprawne działanie tego organu.

Ponieważ jedynym celem techniki jest otrzymanie największego pożytecznego wyniku przy najmniejszym zużyciu środków, to my, jako kierownicy, musimy sobie zadać pytanie: czy tym mechanizmem umieliśmy kierować tak, aby dawał najwyższy spółczynnik pożytecznego działania dla całego organizmu. Jednem słowem, robiąc bilans naszej pracy kierowniczej w przemyśle, musimy przedewszystkiem sporządzić go z punktu widzenia *strat i zysków ogólno-społecznych*.

Kierując zakładem przemysłowym, rozumie się, musimy bilansować wyniki naszej pracy również z innych punktów widzenia, a więc pod względem korzyści dla danego zakładu przemysłowego, w którym pracujemy, dla całych gałęzi przemysłu, korzyści dla pracowników, dla kapitału, włożonego w zakład przemysłowy, wreszcie korzyści osobistej kierownika.

Ale ponad wszystkiemi temi bilansami stoi bilans ogólno-społeczny. Jako obywatele kraju cywilizowanego, *nie mamy prawa* podsumowywać rezultatów naszej pracy z jakiegokolwiek punktu widzenia, *ignorując* interesy ogólno-społeczne.

II. Mała korzyść społeczna w dotychczasowej pracy inżyniera w przemyśle. Przyczyny.

W ciągu mojej długoletniej działalności w zakładach przemysłowych, miałem możność przyjrzenia się zbliska życiu wewnętrznemu tych zakładów i warunkom pracy inżyniera, pełniąc funkcje kierownicze na wszystkich szczeblach hierarchji aparatu kierowniczego. Na podstawie obserwacji oraz osobistych przeżyć, często nawet bardzo dotkliwych, muszę, niestety, naogół stwierdzić, że sprawność działania zakładów przemysłowych, z punktu widzenia dobra całego narodu, była dotychczas *bardzo małą*, jak również, że wynik naszej pracy jako kierowników, mających za zadanie podnieść ten spółczynnik, jest dotąd *tak nieduży*, iż prędzej możnaby powiedzieć, że byliśmy *biernemi kółkami* w całym tym mechanizmie, aniżeli jego rzeczywistymi kierownikami.

Nasza rola sprowadzała się przeważnie do *rozwiązywania różnych zagadnień technicznych*, natomiast mieliśmy niezmiernie mały wpływ na niezwykle złożony wir zjawisk, odbywających się wewnątrz samych zakładów i mających bardzo doniosłe znaczenie ogólno społeczne.—A wiele z tych zjawisk oddziaływało *w wysokim stopniu ujemnie* na sprawne i prawidłowe działanie tych tak ważnych organów życia gospodarczego. Postęp techniczny sprawił, że zakłady przemysłowe rozrosły się wprawdzie do olbrzymich rozmiarów, ale dzięki różnym tarciom wewnętrznym, zachodzą w nich również *olbrzymie straty energji ludzkiej i innych czynników wytwórczych*, tak iż w ostatecznym bilansie otrzymujemy *zbyt mały* wynik pożyteczny, abyśmy mogli być z niego zadowoleni. Przeciwnie, dla nas techników-kierowników, jako obywateli kraju, a więc do pewnego stopnia odpowiedzialnych przed społeczeństwem za ten wynik, jest on poprostu opłakanym.

Aby jednak nie spotkać się z zarzutem, iż tak pesymistyczny mój pogląd jest gołosłowny, muszę wyjaśnić w czem widzę największe straty i jakie są ich główne przyczyny.

Każdy z nas, obserwując wewnętrzne życie przedsiębiorstw przemysłowych, czy to biorąc w niem udział bezpośredni, czy stojąc z zewnątrz, musi przedewszystkiem przyznać, że jest to *olbrzymia arena ścierania się interesów* pracowników i pracodawców, na której praca wytwórcza odbywa się pośród *zaciętej walki* tych dwóch obozów.

Już sam ten fakt dla nas—techników jest wystarczającym powodem do twierdzenia, że muszą tu zachodzić wielkie straty w czynnikach wytwórczych, a więc pracy ludzkiej,

[1]) Wygłoszony na Zjeździe Inżynierów Mechaników.

The graphical method of organizing collective work in rolling mills (1909 Article Series)

Forward to the English edition:
This four-part series was Karol Adamiecki's first known surviving publication discussing scientific management.

Part I discusses the value of time and operating costs and pinpoints time loss as the primary cause of inefficiency, not only in rolling mills, but across all industries. Adamiecki likens the manufacturing process to a series of taps through which gold (money) flows, a literal "value stream," with the aim of minimizing waste and maximizing production. In addition to graphing cost flows, he introduces modern management concepts like production leveling, workload balancing, visual management, minimizing downtime, and fostering cross-functional collaboration.

Part II serves as a case study with graphs mapping the course and distribution of work throughout the entire series as well as designing the "most rational" future state system.

Part III draws attention to the traditional engineering approach that had favored machine-level optimization while neglecting the interoperability and synchronization of the system, creating dissonance akin to an out-of-sync orchestra. These discrepancies, often masked by long work periods, cause costly stoppages. Visual representation of the workflow uncovers these inefficiencies, enabling a more effective work plan. The focus here is on system thinking, downtime reduction, and visual management for problem detection and resolution.

The final section concludes with a discussion of how to engineer the system with special attention to human factors. Adamiecki cautions against treating humans the same as machines, advocating for a balance that avoids overloading workers and promotes a calm, steady pace of work. He contrasts planning organization with self-adaptation as two paths for improvement, outlining the steps for successful implementation for each.

Part I
Originally published in Technical Review [*Przegląd Techniczny*], 1909, Vol. 47, No. 17, pp. 197-201

The value of time versus operating costs.
Since efficient time management is of paramount importance in any production work organization, before delving into the proper content of this article, I would like to say a few words about the influence that the amount of time used has on the final result of the technical economy, namely on its total operating costs.

Although we have an inexhaustible supply of time, which in and of itself costs us nothing, it is one of the most expensive "materials" we use in the production of industrial products. One might think that anyone engaged in production work should understand and feel its value, yet if we take a closer look at the technical and industrial economy, we will notice that we do not handle any material or type of energy as wastefully as we do time. It is therefore often the case that when we examine the causes of the high operating costs of our products, we have to conclude that the main reason is excessive use of time.

Examining all the expense categories where accounting typically calculates operating costs, we find none that directly account for the expenditure of time used. However, upon closer analysis, we uncover numerous categories where time plays a pivotal role and their cost is directly proportional to the amount of wasted time. These are all the expenses that flow more or less independently of how much product was produced in a given period, and although we do not express these expenses in the form of time consumption, the importance of its value appears completely clear in them, and losses due to non-productive work breaks or low efficiency can accurately be expressed by the size of the unit of time lost.

In this sense, we can even say that each unit of time costs us a certain amount. For example, if we pay a fixed annual sum for general technical supervision, let's say 12,000 rubles, regardless of the amount of product produced, we can say that each minute of this supervision costs us 12.32 kopekks.

[12,000 rubles = 1,200,000 kopekks. Dividing this by the cost per minute of 12.32 kopekks, yields just over 1600 hours per year. Assuming year-round operation, this would amount to around 30 hours per week allocated for "general technical supervision." -ed.]

By attributing a specific value to time within each category of our operating costs, we could, in effect, account for some of these costs in terms its time units at a given price - just as we would for any other material expense.

I will not predict whether such a focus on time in industrial accounting would be practiced from the point of view of pure bookkeeping. However, there is no doubt that it is entirely possible and would be highly desirable in the progress in technical management. The presentation of losses in the form of the value of lost time would provide a strong incentive to seek methods to save time.

There is no doubt that the level of awareness regarding the value of time among workers is largely determined by their level of education and job training. However, when it comes to intellectual work, where the entire process relies on calculations and technical knowledge, inadequate education and training aren't the sole reasons for a poor appreciation of the value of time. I believe that the frequent encounters with this deficiency, especially in areas where it's least expected, the reason largely lies in the fact that in the numbers on which we usually base our decisions, the value of time is too masked, and that we still have too few technical and economic studies completed in this area.

The weak sense of the value of time is particularly noticeable directly in the field of work organization, where it is the canvas into which we weave the operational structure. However, this undervaluation of time also indirectly influences factory design and construction. We frequently encounter fundamental flaws in our machinery and various tools, implying that their designers did not prioritize minimizing time waste for the operators who would ultimately use them.

Examining individual items of expenditure in each factory, we will notice three types of expenses, namely:

1. expenses in which time plays no role; the amount of these expenses depends solely on the quantity of the product produced;
2. expenses that, on the contrary, are completely independent of the product's quantity. They remain uniform over time, with their size during a given period solely reliant on the length of that period, i.e., they are directly proportional to elapsed time, and finally,
3. expenses that exhibit characteristics between the first and second categories. These fluctuate in tandem with production but not exactly in proportion. In other words, a substantial portion of such costs remains constant and does not change with production volume.

To explain this better, I will give a few examples, presenting the course of different expenses using parallel graphs (Fig. 1).

Let us assume that the coordinates of the points on the *P* curve express the amount of the product produced per unit of time (in this case, in pounds per hour), while the abscissa expresses time. Of course, area *S* will express the amount of the product produced during the period of time *ab*.

Curves A B_1 B_2 B_3 B_4 C_1 C_2 C_3 C_4 represent the course of operating costs in various categories. The ordinates of these curves represent expenditures per unit of time (in rubles per hour), and the areas between two ordinates represent expenses for a given period.

All of these curves can be divided into three groups:

Group A. The ordinates of these curves are completely proportional to the ordinates of the corresponding points on the curve *P*, i.e. they express costs that vary completely proportionally to production. Examples of costs that can be included in this group are raw material costs (if they do not depend on time and if the amount of waste and defects is always in the same proportion to the amount of finished product); any piecework labor can also be represented with a similar curve, i.e. the wages of workers, which depend solely on production.

Group B. These are horizontal straight lines; some extend continuously throughout the year or as long as the enterprise exists, while others are intermittent and disappear completely during certain periods, such as holidays or for any other reason. Many examples of expenses of this type can be given, including annual fixed expenses for administration, taxes, depreciation, expenses for lighting, wages paid on a daily basis, etc.

Group C. Although these curves vary depending on production, these variations are not proportional to it. When production falls to zero, the expense curve does not break and does not fall to zero, but becomes a straight horizontal line; in general, it can be said that production variations have a relatively small effect on these curves.

Most of the items in the cost of production related to the manufacturing of various types of energy and maintenance of mechanisms and equipment have precisely this character and can be expressed with the help of C-type curves. For example, energy consumption on the main motor shaft, driving a given workshop, which generally increases with the increase in production, but during downtime it does not disappear completely, because fuel consumption to maintain steam in the boilers during idle periods is still significant. With the current state of technology, the cost of obtaining power is generally very high, and the difference between the costs at the highest and lowest loads is still very small. This small dependence of costs on production is sometimes manifested to an even greater extent, for example in the consumption of fuel in metallurgical furnaces, let's say in furnaces for heating blocks. The combustion and heat transfer here are so far from perfection that sometimes the furnace production can be increased two or three times, and we will hardly notice any difference in fuel consumption. This category can also include a whole range of expenses for various auxiliary materials, salaries with guaranteed bonuses, and the like. Finally, the curve *R* expresses the sum of all costs; of course, this curve must have a character similar to the C-type curves. Therefore, the total sum of operating costs is expressed by a curve whose ordinates consist of two parts, one constant and the other proportional to production.

The comparison of the operating cost curve with the production curve clearly indicates that the cheapest moments of production are those when production reaches its maximum, because then the operating costs per unit of product, i.e. the ratio of ordinates r/p, are the smallest. If such moments occur frequently, we have the right to consider this cost as normal and practically achievable for a given production. Let us draw the curve of normal operating costs T; accordingly; the ordinate of any of its points $t = p_1 r/p$ where p_1 denotes the ordinate of the corresponding point of the curve *P*.

The area between curves *R* and *T* (hatched individually on the chart) expresses the cost that we can consider completely lost. This is precisely the loss that comes, of course, from the loss of time, whether it is due to breaks or too low an intensity of production. The chart shows the course of operating costs in rolling the so-called universal iron (bridge belts) over several days. The period *ef* is the holiday season, periods *bc, de, gh, ij, kl* correspond to the idle running of the rolling mill and various stops (marked). The curves express:

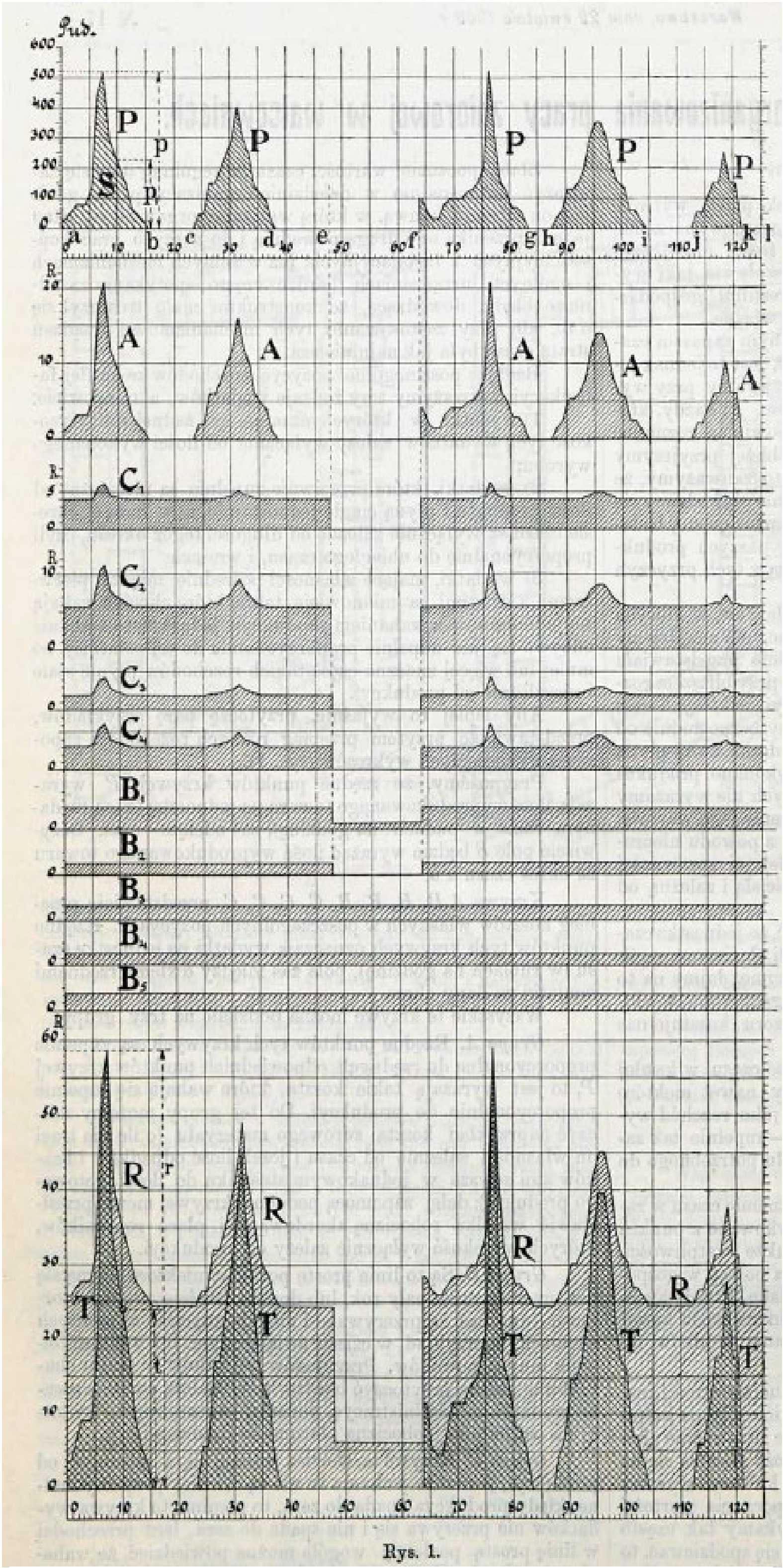


Figure 1

A piecework labor cost,
C_1 fuel cost for heating blocks,
C_2 steam consumption, calculated at the valves of steam engines,
C_3 maintenance of various mechanisms and instruments,
C_4 maintenance of the universal rolling mill, furnaces, and rolls,
B_1 cost of lighting and water,
B_2 labor on a daily basis,
B_3 technical management,
B_4 maintenance of buildings, yards, and railways,
B_5 general administrative costs.

The total production of finished sheet metal for a given period of time was 11,350 pood [*for "pudów," an old Russian unit of mass, equal to approximately 16.38 kilograms]*. The total processing costs (excluding raw materials) amounted to 3,342.50 rubles, which averages out to 29.6 kopeks per 1 pood of product.

The loss caused from a suboptimal production rate, expressed by the singly-shaded plane, amounts to 2,118 rubles, which represents 63.5% of the total costs. On an hourly basis, this loss amounts to an average of 2118/125 = 17 rubles.

If we took the trouble to create similar charts for every manufacturing process, we would convince ourselves that these losses are often very large and sometimes, as in the present case, downright enormous.

Looking at the charts presented, we cannot help but make a certain analogy, namely that all the manufacturing cells and expenses consumed by them can be seen as a series of channels or pipes through which gold (that is, money) flows.

To start producing something, we need to set all the cells in motion, that is, open the taps in all the pipes. These taps have different properties: during the manufacturing process, some are automatically regulated according to production, while others are not regulated at all, and the taps remain fully open.

Finally, we have taps that are automatically regulated to some extent, but only to a very limited extent, so that even when production stops completely, there is still a considerable opening through which gold continues to flow. In short, gold flows through all the cells of production, and it only benefits us as much as we collect it in the form of a product during production. Viewing the technique of every manufacturing process from this perspective, we come to the conclusion that its task boils down to two main activities.

a) First of all, when setting up a factory or enterprise, it is essential to set up machinery and devices, and choose such economic factors so that every work cell, like a gold filter, allows as little waste as possible. That is, each of them should be a conduit with the smallest possible cross-section and then, if possible, the largest number of these conduits should have sensitive taps that can be easily regulated and closed, especially automatically adjusted appropriately to the production. Finally, the entire organization of the enterprise should be as responsive as possible to working conditions. In other words, it is necessary to set up the cheapest and most perfect equipment, introduce the most cost-effective and production-dependent employee compensation, etc. This is the first task of design and installation.

b) The second task concerns the actual management of the enterprise. One should strive to ensure that each conduit is in good condition, works correctly, and then, that the factory operates as efficiently as possible, with the least amount of time lost, because the first task can never reach an ideal state and there will always be work cells through which gold constantly pours out independently of our responses or the amount of the product produced.

Since, in most organizations, the amount of gold continuously pouring out is quite large and continuous, this task is very important. It is often the case that we can lower product costs to a much greater extent by saving time, that is, by increasing the pace of production, than by weakening the flow of gold in the individual conduits.

Unfortunately, the current state of technical economy leaves much to be desired in this regard. The low efficiency of our workshops is particularly noticeable when we deal with collective work, when successful progress depends mainly on the mutual adjustment of all individual cells. Let us now see how this matter looks in the light of detailed research.

Examples of collective work charts.

One of the industries in which enormous losses occur due to imperfect time utilization is rolling mills, and it is no exaggeration to say that the main cause of high operating costs in iron rolling is precisely the loss of time. This loss is of particular importance here because most of the expenses belong to groups B and C, that is, to more or less fixed costs.

The research methodology I employed in my studies on iron rolling, along with its ensuing conclusions, can be applied not only to rolling mills but also to any situation involving collective work. Thus, I am of the belief that the examples provided below, despite being drawn from the context of rolling mills, may capture the interest of a broader group of technicians, extending beyond the niche of specialist rolling mill workers.

Low work efficiency in rolling mills is not sporadic, encountered in this or that rolling mill, on the contrary, we encounter it everywhere, even with the latest machinery.

The figures below sufficiently explain the enormous losses of time we incur in rolling.

Device type	Type of rolled iron	Average production per shift (12 hours) in pood	Actual working time for the whole shift in minutes
Small rolling mill, started in 1906	Flat iron 3/4" x 1/2"	1860	78
Wagon rail mill, consisting of 3 sets, started in 1898.	Flat iron 1 1/4" x 1/4"	2880	83
Rail mill, consisting of 3 trios, started in 1898	24 1/2 pound rails	14500	56
Large rolling mill, consisting of 3 trios, started in 1902	N2 22 channel iron	5040	18

The method I used to study this colossal waste of time involves graphically representing the entire course of work. The graphs we obtain represent a kind of cinematic image of the contemporary action of all the individual cells in the rolling mill. The method of compiling graphs is best explained by means of examples.

Let us take, for example, Figure 2, which shows the rolling of flat iron with a cross-section of 3/4" x 1/4" from bars 50 x 50 x 1520 mm weighing 29.5 kg. This iron is rolled on the so-called small mill, consisting of 2 roller lines, schematically shown horizontally next to the graph.

Preparatory trio A: Roller diameter 450 mm
- Number of revolutions per minute: 160
Second line: consists of 7 pairs of rollers 1, 2, 3, 4, 5, 6, and 7.
- Roller diameter: 320 mm.
- Number of revolutions per minute: 295.

Each bar is passed through the preparatory rollers back and forth 5 times (passes through the rollers are indicated by arrows in the sketch), then the bar goes to the second line, passes twice through rollers 1 and 2, and at that point, it is so thin that the rolling mill can easily bend it. Without waiting for it to completely exit the previous calibre, the bar is fed into rollers 3, 4, 5. After exiting these last rollers, the iron has the desired cross-section of 3/4" x 1/4".

The work graph consists of a series of parallel segments along which we mark time, in this case on a scale of 1 mm = 1 second. Each of these segments corresponds to one pair of rollers, namely segment *a* represents the course of work of the preparatory pair A, while segments I, II, III, IV, V represent the course of work of the corresponding pairs of the second line.

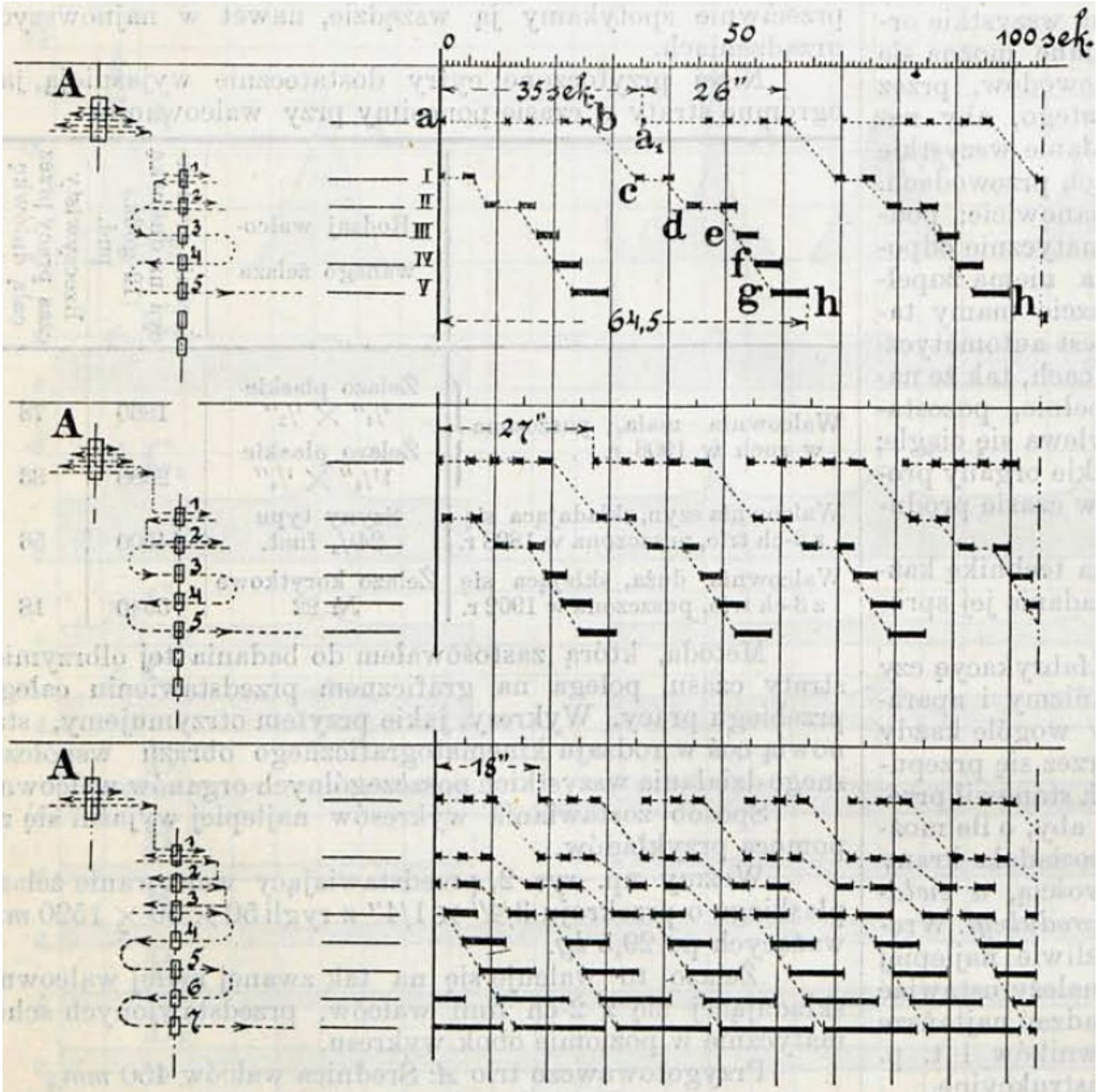
The thicker segments represent the time it takes for the bars to pass through the rollers. The initial points of these segments correspond to the moments of entry into the calibre, and the final points correspond to the moments of exit. The gaps between the black segments represent idle time and any other work interruptions.

Let us consider the process of rolling one bar according to these lines. At point *a*, the billet was fed into the first stand of the preparatory pair. After five passes (which took 26 seconds, including stops), the rolling is completed on the preparatory rolls at point *h*. Then, at points *c, d, e, f, g*, the bar enters the rolls of the second line, and finally, at point *h*, it exits the last stand as a finished iron with the desired cross-section. Thus, the entire rolling process lasted 64.5 seconds.

We obtain the same charts for all other bars, so the segments from *ax* to *hx* represent the rolling process of the next bar, and so on.

The data is based on several dozen observations made during normal operation. We find that the average rolling period, i.e., the time between the beginnings of successive rolling cycles, was 35 seconds. With this period, the production for a 12-hour shift (10 hours of work and 2 hours of various breaks) is 30,500 kg, or 1,860 pood.

This is a production level that was only occasionally achieved in this ironworks for this grade of iron; typically, production was slightly lower due to various minor interruptions in work.



Figures 2, 3, and 4 (Harmonographs)

As for the idle time, the chart clearly shows that it is enormous compared to the working time (passing through the rolls). If we add up the actual working and idle times, then for a production of 30,500 kg per shift, we get:

Equipment Type	Actual Work Time	Idle and Downtime
Preparation rollers A	79 minutes	10 hours 41 min
Line 2, Roller 1	79 minutes	11 hours 18 min
Line 2, Roller 2	86 minutes	10 hours 34 min
Line 2, Roller 3	64 minutes	10 hours 34 min
Line 2, Roller 4	82 minutes	10 hours 38 min
Line 2, Roller 5	106 minutes	10 hours 14 min

Let us now examine the causes of such huge losses of time according to the presented graph.

Firstly, it is obvious that the main reason for the slow pace lies in the first preparatory pair *A*, especially in the immensely long breaks between the first and second passes. These breaks, of course, depend on the skill of the mill operator, but only to a certain extent because the ability to roll depends on working conditions, and above all, on the speed of the exit of the billet from the calibers. In fact, the slower the speed, the less often the billet will be rejected from the rolls, the work will proceed more calmly, the mill operator will be far less tired, and undoubtedly waste far less time in grabbing the billet and feeding it into the next caliber. On the other hand, the faster the speed, the more difficult the maneuvering will be, and the greater the delays in returning the billet between the rolls. In addition to this, the slower the rolls rotate, the easier they grip the billet, and rarer are stops due to slippage.

In this case, the reason for the immensely long breaks during rolling on the preparatory pair is precisely the too high of a speed at the circumference of the rolls (u = 3750 mm/sec.). Therefore, the only way to solve this is to reduce the number of revolutions. Of course, when reducing the speed, the time of the rolling itself (thick sections) will increase, so the reduction should not exceed certain limits. In any case, it is beyond doubt that if we take into account all working conditions, we can say from the outset that during the passage of the billet through one pair of rolls, there is a certain, completely defined and most appropriate speed for each case, at which the total rolling time together with the breaks will be minimal, and which should be unconditionally not exceeded in either direction if we do not want to significantly reduce the efficiency of the rolling mill.

Thus far, engineers have almost never paid attention to this circumstance and have instead universally applied the rule to all cases that the faster the rolls rotate, the greater the production will be. This mistake is so widespread that we still encounter today it in the newest rolling mills.

In the example given, the speed at the circumference of the rolls should be reduced to at least 2200 mm/sec. At this speed, the rolling period could reach an average of 27 seconds, and the average production for a 12-hour day (10 hours of work) would be 39500 kg = 2400 pood. The rolling time graph would then look like the that of Figure 3.

Although the ratio of working time to idle time is now better, the loss is still huge, and as can be seen, it comes mainly from the poor distribution of work between the separate pairs of rolls. From the graph, it is clear that the rolling period could be significantly reduced if we transferred part of the work from the first preparatory pair to the second line of rolls, and in general, if the work were evenly distributed between all parts of the mill. Because to achieve maximum efficiency, it is not only important to have a good distribution of work but also to have the shortest possible breaks in movement.

Knowing the speed of the rollers and the cross-sections of the calibers, it is possible to create a graph that results in the highest efficiency. This way, we can find the most appropriate distribution of calibers and the dimensions of bars at which the highest production can be achieved. Graph 4 shows such a distribution for rolling 3/4" x 1/4" iron on a given rolling mill with bars measuring 74.5 x 74.5 x 1750 mm, weighing 76 kg each, over a period of 18 seconds. The average production for a day shift will then be 152,000 kg or 9,300 poods. The entire length of the bar exiting the last caliber will be about 82 meters. Since the length of the bar exceeds the length of the rolling mill building, special shears can be placed right after the last pair of rollers to cut it into several pieces during the exit from the caliber.

This length couldn't fit in this example, but special shears could be placed just behind the last pair that would cut it into several pieces as it exits the calibrator. We see that with the help of graphs, we can easily come to conclusions about how to organize the work and what changes to make in the mill to achieve the highest efficiency.

(C. d. n.) K. Adamiecki
(End part 1 of 4)

Part II – Technical Discussion

Originally published in Technical Review, 1909, Vol. 47, No. 18, pp. 213-216
(Continued from page 201 in the 1917 yearbook)

Figure 5 shows the process of rolling flat iron of dimensions 75 X 70 X 1400 mm on the same rolling mill with a bar size of 57.5 kg.

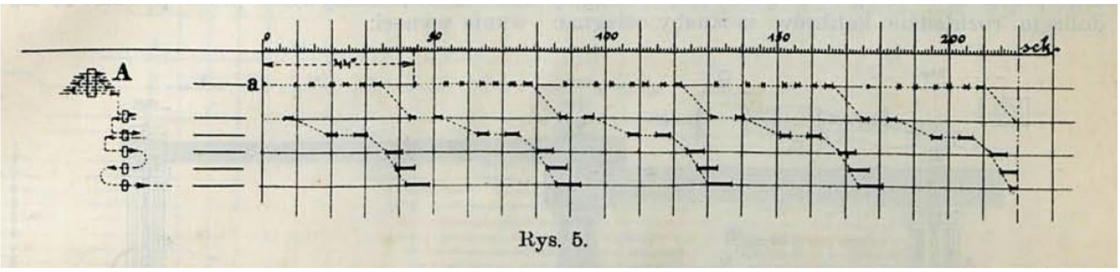


Figure 5 - Harmonograph

The average period was 44 seconds, which corresponds to production of 47,000 kg, or 2880 pood per shift. This is a production rate that is usually considered very good for small rolling mills - however, we can still see that the work time is not better than in the previous example.

For the entire shift, the total work time was:

Step	Time in minutes
Preparatory steam	104
Second line roll 1	57
Second line roll 2	93
Second line roll 3	64
Second line roll 4	82
Second line roll 5	98

Here, too, by reducing the speed of the preparatory rolls, improving the distribution of calibers, and selecting appropriate dimensions of the bars, we can significantly increase production. If we leave the speed of the rolls unchanged and transfer only 2 calibers from the preparatory rolls to the second line, and then take bars of the same cross-section but length 1750 mm, we can easily achieve a period of 30 seconds, which will give an average production rate per shift of 86,000 kg, or 5250 pood. Diagram Figure 6 represents the average time to roll railway tracks of $24\frac{1}{3}$ pounds from steel blocks weighing 46.5 pood.

The rolling mill consists of three sets: *A*, *B*, and *C*.

The diameter of the rolls is 750 mm.
The number of revolutions per minute is 70-90.

The bar passes through the preparatory set *A* 8 times, then 6 times through set *B,* and 5 times through set *C*.

The average period of rolling was 84 seconds, which corresponds to production of 326 tons, or 20,000 pood per 12-hour shift.

In reality, the average daily production never reached this number, but was 14,500 pood, because there were quite frequent stops during the day due to the fact that the furnaces could not keep up with the rolling mill.

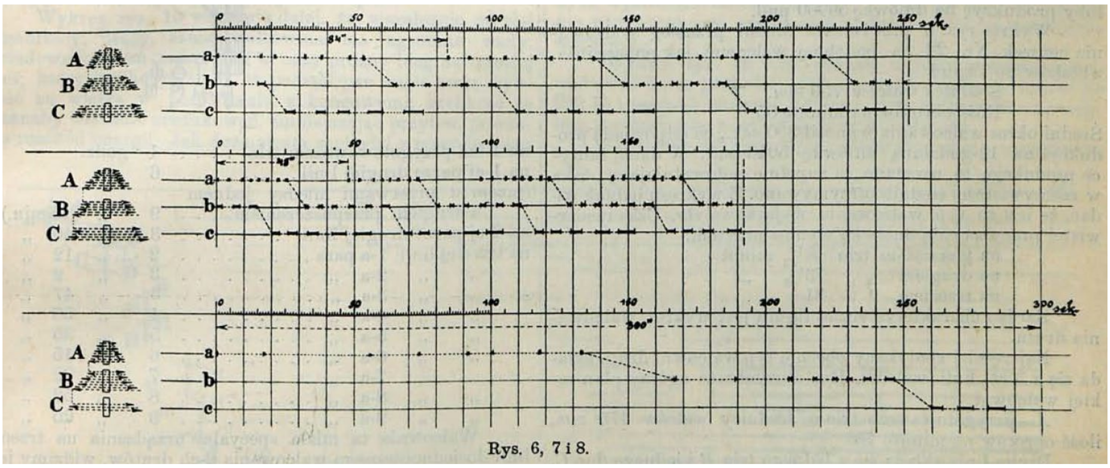


Fig. 6, 7, and 8 (Harmonographs)

Although the above production is considered very large for such a rolling mill, as we can see, the actual rolling time is ridiculously small, namely for the production of 14,500 pood for the entire shift:

on trio A . . . 19 minutes
on trio B . . . 47 minutes
on trio C . . . 102 minutes

It is easy to understand how enormous the losses are due to such work, let us take for example, energy consumption. The indicator showed that during rolling, the machine developed 1200 hp, and during idle running 400 hp. Even if we assume that the average rolling time was 2 hours, and idle running 8 hours, the energy consumption would be:

For rolling, it was:	3 X 1200 = 2400 horsepower-hours
For idle running, it was:	8 X 400 = 3200 horsepower-hours

Such a huge amount of idle running time cannot be explained by the need to accumulate kinetic energy by the flywheel, because there were quite frequent moments when the rolling was going at the pace indicated in the graph, and the machine was not observed to slow down.

One of the important reasons why so much time is wasted on idle running is the same circumstance as in the examples already cited, namely the huge gaps between one and the other pass on the first trio, resulting also from the excessive speed of the rolls.

As shown in figure 7 (48 seconds), the speed obtained varied only momentarily, but continuously at a circumferential speed of 3140 mm per second on the rollers, and could not be maintained. Looking at the charts presented, we can easily conclude that this rolling mill should be built completely differently if losses due to idle operation are to be minimized.

The first preparatory unit should stand separately, having a speed on the rollers at least three times slower, while the finishing line could have two or better yet, three preparatory units. Such a device for a large rolling mill would of course be more expensive, but there is no doubt that the costs of the modification on such a rolling mill would be incomparably smaller than they are currently. The output could be enormous, and a rolling mill so arranged would undoubtedly produce results even better than reversible mills. In a large, rationally constructed rolling mill consisting of one preparatory unit and three units in the second line, with a good distribution of calibers, an average rolling period of 30 seconds could be achieved, which with blocks of 46 1/2 pood would give a production of 56,000 pood per day.

Figure 8 shows the average rolling process of strip No. 22 on a similar rolling mill to the previous one, with blocks of 42 pood.

Roll diameter 750 mm.
Rotational speed 85 revolutions per minute.

The average rolling period was 300 seconds, which corresponds to a production of 5040 pood. for a 12-hour day. This production was considered completely satisfactory in the given factory and was usually obtained. However, it can be seen from the chart that this is an exceptionally poor type of rolling process. The actual working time for the whole day is as follows:

8 ½ minutes for the first unit
13 ½ minutes for the second unit
31 minutes for the third unit.

The rolling process of wire is represented by a very characteristic figure. The most commonly used type of wire rolling mill today consists of three lines of rollers.

Figure 9 shows the general plan of such a rolling mill.

A - preparatory unit with a roller diameter of 475 mm and a rotational speed of 75 revolutions per minute.

The second line consists of one unit B and one duo *C*, with roller diameter of 335 mm and a rotational speed of 150 revolutions per minute.

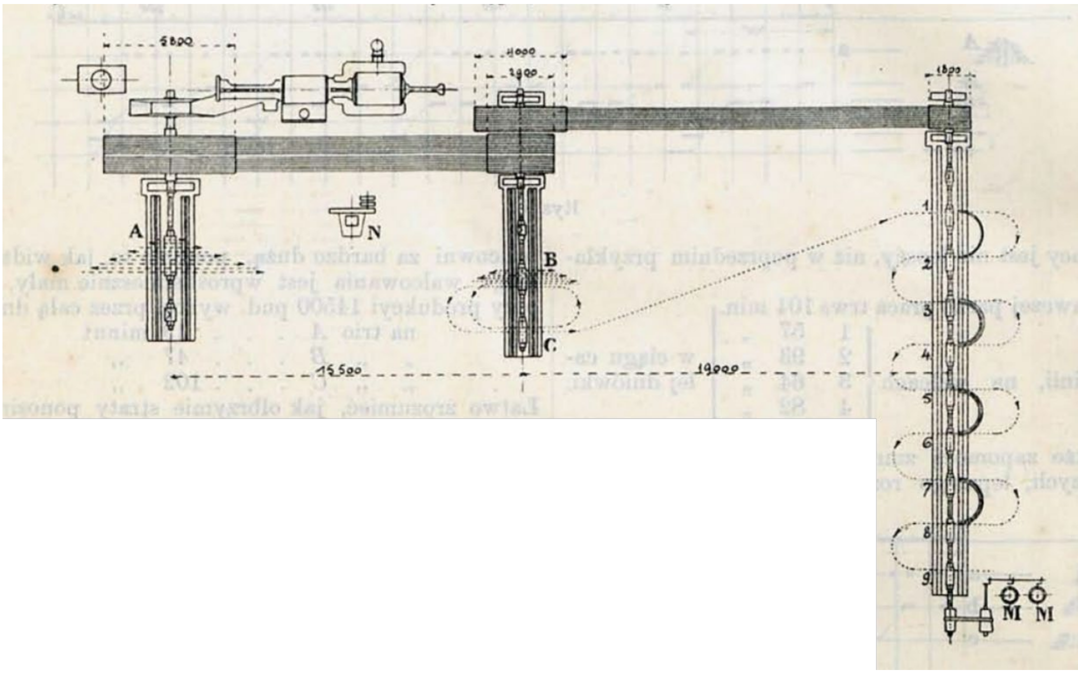


Figure 9

The third line consists of nine pairs of rollers 1, 2, 3, 4, 5, 6, 7, 8, 9, with a roller diameter of 280 mm and a rotational speed of 333 revolutions per minute.

N - shears for cutting bars after the first rolling.

M, M - spools.

The rolling mill is operated by a steam engine with a capacity of 1200 horsepower, with a belt drive.

Figure 10 shows the average time for rolling wire with a diameter of 5 ¼ mm from blocks weighing 148 kg (175 X 175 X 800 mm).

After nine passes through the first preparatory trio, each block yields a rod with a cross-section of 50x50, which is immediately cut into two parts (bolt) with the *N* scissors. The average time of this rolling process, denoted as *ab*, is 63 seconds. Each bolt then proceeds in turn to the second line B; the first at moment *c*, the second at moment h. After six passes through the *B* trio, the rod is already so thin and long that the roller, without waiting for it to emerge from the caliber, feeds it into the next caliber on the *C* duo (moment *d*). From this moment, the rod weaves through the remaining calibers on the second and third lines. At moments *e* and *f*, the rod enters the first and last pair of the third line, and finally, at moment *g*, it emerges from the last pair as the finished wire. The rolling time of the second bolt is represented by the lines *h, i, j, k*.

After nine passes through the first preparatory trio, a 50 x 50 cross-section bar is obtained from each block of the billet, which is immediately cut in half (into billets) using N scissors. The overall time for this rolling process, denoted by ab, is on average 63 seconds. Each billet is then sent in sequence to line *B*, with the first billet at time c and the second billet at time *h*. After six passes through trio *B*, the bar is already so thin and long that the roller, without waiting for it to exit the calibration, feeds it into the next calibration on duo *C* (at moment *d*). From this moment on, the bar passes through the remaining calibrations on the second and third lines in a zigzag pattern. At moments *e* and *f*, the bar enters the first and last pairs of the third line, and finally at moment g, it exits the last pair as a finished wire. The time for rolling the second billet is represented by lines *h, i, j,* and *k*.

The average rolling time between the first and second billets is 75 seconds, which results in a production rate of 31,700 legs or 1,940 pood per 12-hour shift, a perfectly acceptable production rate.

Looking at the chart, the uneven distribution of work between the individual pairs of rollers is immediately noticeable. The actual working time during 10 hours of rolling is as indicated in the table.

Step	Hours:Minutes
on the first preparatory trio	1:00
on the first pair of the second line	6:00
(together with breaks between the first and second passes on the second line)	9:15
on the third line: first pair	2:12
on the third line: second pair	3:02
on the third line: third pair	3:47
on the third line: fourth pair	4:53
on the third line: fifth pair	5:35
on the third line: sixth pair	6:15
on the third line: seventh pair	7:22
on the third line: eighth pair	8:52
on the third line: ninth pair	9:20

Although two wires can be rolled simultaneously on each line, the chart shows that it was almost impossible with the given organization, as the first pair on the second line was already working almost at full capacity. Only in exceptional cases did two wires overlap in the last pair for a short time, but this usually caused a longer break in the previous wire.

With this distribution of work and the best skill level of the workers, the smallest average pace that can be achieved is 65 seconds, which results in a production rate of 37,000 kg = 2,250 pood. This production rate was achieved as an average at a given rolling mill after several years of work.

Here we have a vivid example of how, as a result of not taking into account the working conditions when designing the rolling mill and calibrating the rollers, the expected result was not achieved. If we really wanted to achieve the rolling process in which two wires continuously come out of the last pair of rollers, we would have to change the distribution of the rollers - move some of them from the second line to the third, and some to the first. Using the graphical method, we can easily determine the best distribution. This also explains that, with the given rolling mill equipment, it would be most rational to start rolling not from blocks, but from bars, without cutting after leaving the preparatory rollers, i.e. the bars should be made on a different rolling mill.

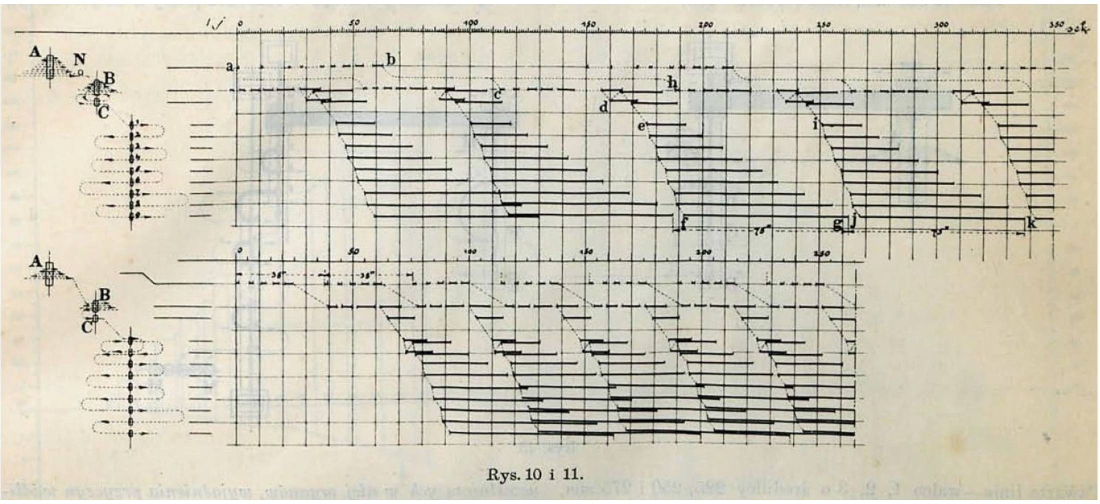


Fig. 10 and 11 (Harmonographs)

This way, we obtain the graph shown in Fig. 11, which gives the best distribution for rolling two wires simultaneously from bars weighing 66 kg and measuring 75 x 75 x 1500 mm.

The average rolling period is 38 seconds, which gives a production of 63,000 kg or 3,850 poods per day.

Further, the graph in Fig. 10 indicates that, regardless of poor work organization, the rolling mill itself has significant flaws. Firstly, the idle operation on the third line is noticeable, which results from the initial rollers having a speed that is too high compared to the final rollers; this speed could be significantly reduced, thereby reducing energy consumption. The extent of the loss due to this idle operation can be gauged from the fact that during the idle operation of the entire rolling mill, the machine operates under a load of 450 hp.

In addition to the energy loss due to idle operation caused by the too slow speed of the final rollers on the third line or too high speed of the initial rollers, we obtain huge loops, which again causes rapid cooling of the iron, and hence unnecessary energy loss and various difficulties in work.

To radically eliminate these unnecessary losses, it was necessary to give different speeds to the pairs of rollers on the third line, gradually increasing them, as is presently the case in American wire rolling mills with rollers set one after the other. In conventional rolling mills with rollers in a single line, a rational speed distribution can be achieved by dividing the entire line into pairs of series with two or three pairs, driven by separate shafts or motors. To increase production, the speed on the final rollers can be significantly increased.

If we take into account all the above conclusions regarding the proper distribution of work between individual organs in the rolling mill, minimizing the loss of idle running, achieving the fastest possible rolling speed and, in general, rational working conditions, we can design an appropriate work chart for a given production with given block or bar dimensions. From this chart, the overall distribution and construction of the rolling mill will be directly derived.

Figure 12 provides the best work distribution for a wire rolling mill with a thickness of 5.25 mm, rolled from blocks of 220 kg and an average length of 1000 mm, while continuously producing the last set of three wires.

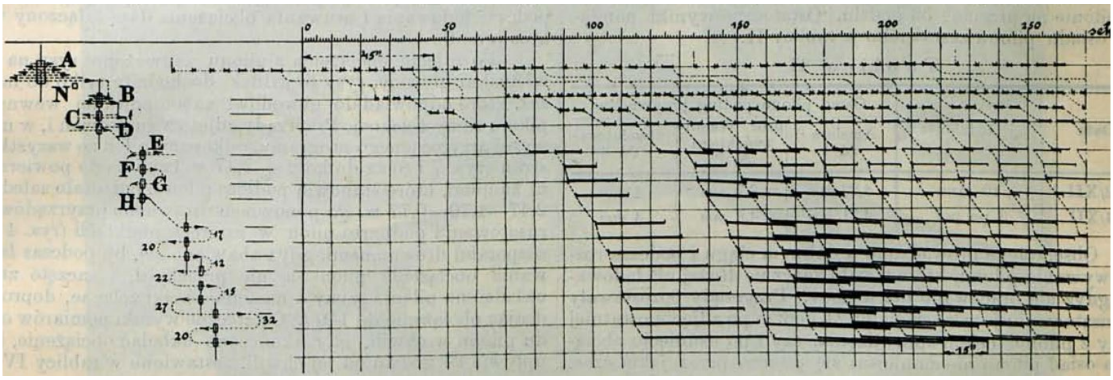


Fig. 12 (Harmonograph)

The rolling mill corresponding to the work conditions expressed in this chart is depicted in figure 13. It consists of 4 lines; after passing through 7 preparations in the first *A* trio, a square bar with a cross-section of 80 x 80 mm is obtained, which is then cut into three bars of 66 kg each, leaving an approximately 20 kg scrap. Each bar then goes to the second preparatory line, consisting of three trios *B, C,* and *D*, and then moves on to the third line, which consists of one trio *E* and three duos *F, O*, and *H*. On the third line, the bar starts to move in a zigzag pattern and finally passes through the fourth line, consisting of three sets of three pairs of rolls each. Each set is driven by a separate motor.

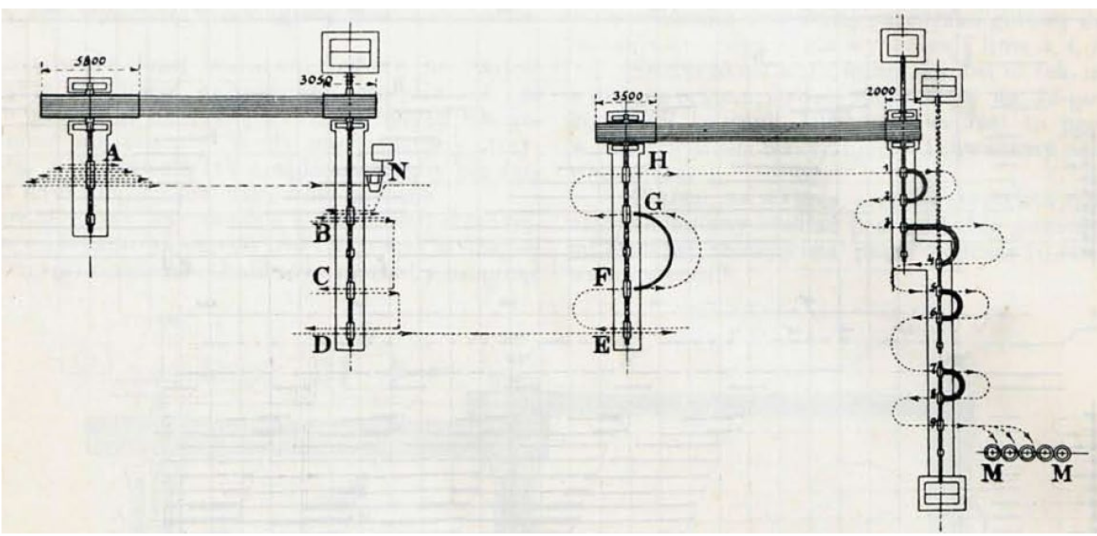


Fig. 13

Dimensions of the proposed rolling mill:
Trio *A* - roll diameter 475 mm, number of revolutions 50.
Second line - trio B: roll diameter 400 mm. Trio *C,D*: roll diameter 430 mm, number of revolutions 95.

Third line - diameter of rolls: trio *E* and duo *G* 320 mm, duo *F* and duo *H* 350 mm, number of revolutions 165.

Fourth line - rolls *1, 2, 3* with diameters of 225, 250 and 275 mm, number of revolutions 290.

Rolls *4, 5, 6* with diameters of 225, 250, 275 mm, number of revolutions 420.

Rolls *7, 8, 9* with diameters of 225, 250, 275 mm, number of revolutions 550.

The length of the loops is significantly shorter due to better selection of speeds than in the previous rolling mill.

The rolling period with such distribution will be on average 15 seconds per one bar, thus the average daily production will be 158,000 kg = 9,600 pood.

I believe that the examples given sufficiently explain the way of arranging the charts, as well as the significance of the proposed method in terms of:

a. Examining the course and distribution of work throughout the entire series.
b. Designing the most rational work systems and the overall arrangement of mechanisms, departments, and work cells that are to perform this work.

(Continued)
K. Adamiecki

Part III

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(Continued from page 216 in the No. 18 yearbook)

Causes of faulty operation of rolling mills.

The faulty operation of rolling mills and the enormous losses associated with them have their main source in the fact that we waste an enormous amount of time on idle running and various stops. The graphical method described here clearly shows all these reasons and illustrate that they lie, not only in the general design and construction of rolling mills, but also in the organization of their operation.

So far, the technical efforts in rolling mills have been mainly directed towards details - towards the construction and operation of individual devices and machinery. However, not enough attention has been paid to the issues of the proper, common operation of these devices and their adaptation to actual working conditions. The design and setup of rolling mills are predominantly governed by blind imitation and routine; as a result, we often encounter rolling mills arranged in such a way that many inconsistencies lie in the setup itself. It's usually a series of devices, often very good in themselves, but not corresponding to each other, and in operation, they give the impression as if we harnessed racehorses and oxen to the same heavy cart, i.e., animals with the most diverse pulling strength and character.

Based on my experience and thorough studies, I have come to the deep conviction that Germans make the most of these kinds of mistakes in the design of rolling mills. They have a special ability for detailing and blind imitation, and unfortunately, due to the fact that the main deciding argument for whom to award an order is cost-effectiveness and the reputation of a foreign brand, they have been the main suppliers of these faulty designs of metallurgical facilities to us and Russia so far.

I could provide many interesting examples to confirm the above statement, but I digress.

A faulty organization of work, and often even a complete lack of organization, has a profound influence on the outcome of the rolling mill operation. Here too, routine usually prevails; rarely do we encounter technical administration in charge of a well-thought-out and rational system for managing the rolling mill. The work is mostly done in well-worn paths, often with surprising lack of understanding of losses, especially those resulting from an infinite number of smaller and larger stops in the work. In short, it can be said that although the issue of organization is one of the most important in rolling, no serious attempts have been made so far to establish it on rational principles.

The question, partly a design issue and partly an organizational one, deserves special attention because, as we have seen, when it is improperly addressed, it becomes one of the major reasons for the low efficiency of rolling mills. The entire efforts of caliber designers are usually directed towards achieving an accurate profile, properly distributing pressures, and other purely design-related issues. However, the issue of distributing work among the separate organs of the mill, i.e., the rolls, is still completely stagnant. Here too we encounter routine and uncritical copying, which often leads to simply impossible results. From the graphs cited, we can see that in rolling mills consisting of several pairs of simultaneously working rolls, a common phenomenon occurs: some pairs are overloaded with work and hinder overall production, while other pairs mainly spin idly.

Work plan arrangement

If we now move on to the second task, which can be solved using charts, we can also get a sufficient idea from the examples given of how much the graphical method can contribute to rolling, whether in the general design of the entire device or in the distribution of work among individual parts.

With the help of charts, we can easily prepare a work plan for the entire set of components in advance, with the work of individual apparatus or mechanisms remaining in a certain relationship so that as a result, the entire set produces the maximum amount of product with the minimum expenditure of energy and time. We also receive precise guidelines for the general construction of all devices and their arrangement, where the greatest efficiency can be achieved.

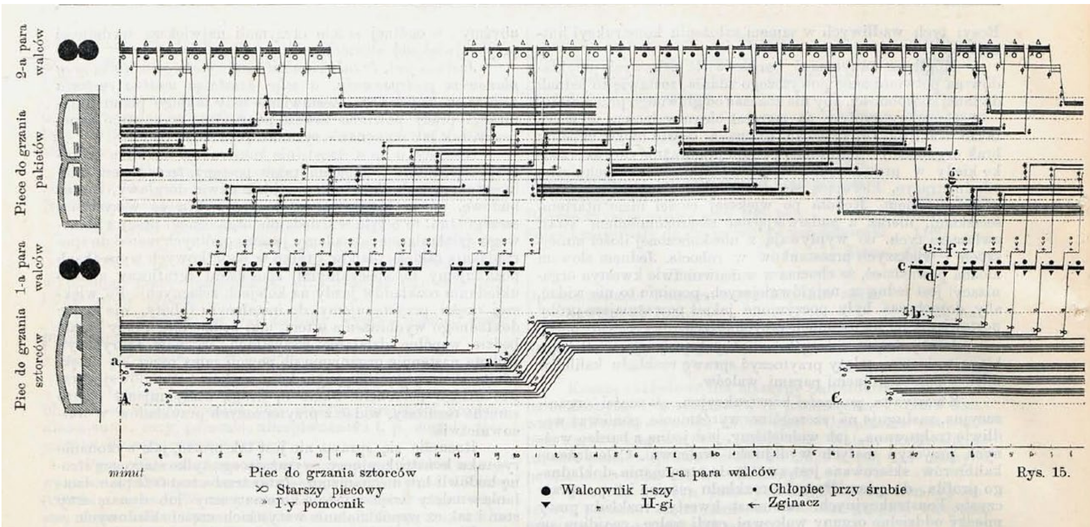
As for organizing work based on a pre-arranged plan, I have a few general comments:

The compilation of a precise plan or system of work is one of the most important conditions for achieving a good result - there is no doubt about it. However, despite the extraordinary importance of this matter, it is still one of the weakest aspects of technical management.

The development of an organizational plan plays the same role in the overall design and management of any manufacturing or work as drafting does in the construction of a machine, device, or building.

Just as in every machine and building, where all parts must fit together precisely to create a harmonious whole, so too in the case of collective work carried out by machines, equipment, and workers, the tasks of each must correspond closely with one another. Each one should not only exhibit the highest productivity, with minimal use of energy and materials, but its operation must also be linked in such a way that, in the overall sum, we achieve maximum efficiency with maximum economy.

It is clear that such a result *can only be achieved through planned action, that is, by following a carefully thought-out system.* Therefore, the compilation of such a plan of work organization should always precede the actual work, just as the construction of a drawing precedes the construction itself.



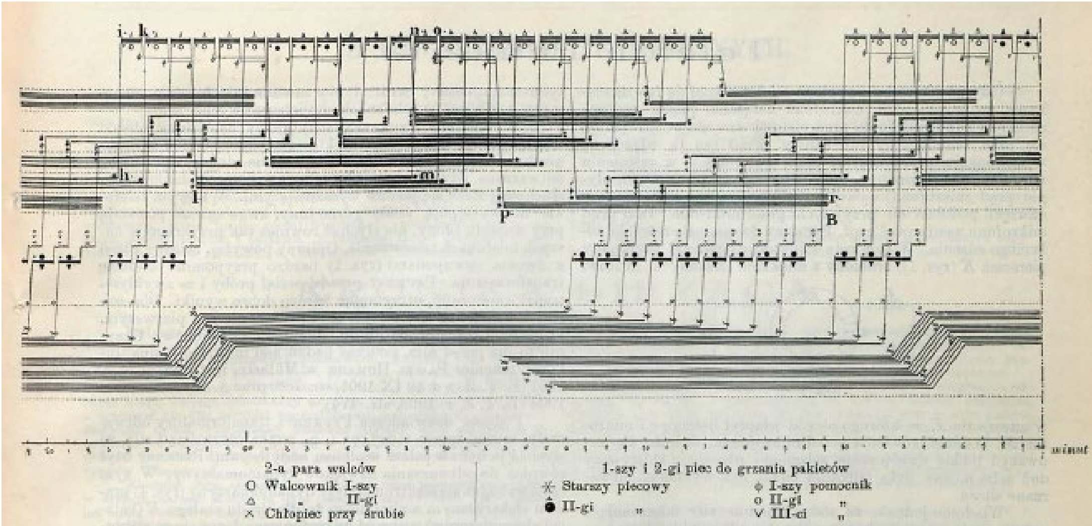
Unfortunately, while in the field of construction, no intelligent engineer would even think of starting a build without first making a detailed project plan, in the field of management, we still do not have general methods for preparing such plans, and only in exceptional cases do we resort to special methods (graphical method of arranging timetables on railways). For the most part, we proceed with installation and work without having a clear understanding of the course of work and the combined operation of all manufacturing elements. The work is then gradually self-organized thanks to the organizational skills of managers and the progressive experience of the entire staff. The often disappointing results we get from this approach can be seen in the examples cited in rolling mills.

Of course, the matter is not as simple as creating a construction drawing expressing only the static aspect of the building or mechanism - here one must compare the action plan - so it is necessary to express the kinematic or dynamic state and the corresponding cooperation of all component parts.

We must admit that our technical knowledge in this respect is still very meager, and we currently rely mainly on chaotic information.

Today, devices that continuously and automatically record various actions of mechanisms and machines are increasingly being used; we obtain charts that often give us great information. However, this is only the first step in resolving a given issue. This is only recording what is happening, and we are in the observation period. However, technology must take the next step and reach the creative period when we will not only record, but also design every work in detail with the help of charts, as we currently do with construction drawings.

The above chart represents an attempt at such a graphic method for designing work organization.



As we can see, this method can be easily applied to the working conditions of the rolling mill and already produces very positive results, even though it represents only the skeleton of the work, i.e., its time and breaks. Since there is no element in the basis of this method that applies exclusively to rolling mills, I think it can also be successfully applied to other works and fabrications.

Now let us take a closer look at the charts themselves and their characteristic features as an image of the course of collective work of the entire team of work cells.

Firstly, we notice that in order to achieve the goal of obtaining the highest efficiency of both individual cells and the entire organization (if the operation of these cells is closely related), the lines of work must follow each other not randomly, but create completely defined figures or waves strictly related to the working conditions. Since the work is collective, the slightest delay or acceleration of any line must have a corresponding impact on the entire figure and result in reduced productivity. Therefore, it can be said from the outset that the best result will only be obtained if synchronicity of action is maintained in even the smallest details, as required by the chart or plan made beforehand.

In this harmonious synchronicity of action of the group of machines, there is a certain similarity to the strict synchrony we encounter in music. Here, every tone, no matter how subtle, must have a strictly defined place in time and cannot be produced either earlier or later, otherwise it will create a dissonance, and the human ear is sensitive to this up to hundredths of a second. Just the same in any collective work, whether of devices or people, this synchronicity must be maintained—if it is not, there must inevitably be dissonances, and as a result, we will not achieve the highest efficiency. If the lines of work diverge, not according to strictly defined rules, there can be no talk of high efficiency. The graph of good synchronous action and collective work is quite similar to the music notes of mechanical devices that are used to play the piano, for example, player pianos. Here too, each line has a strictly defined place and cannot be moved with impunity.

With particular emphasis, it should be repeated that harmony in collective work is subject to the same law as harmony in music. Unfortunately, we do not have as sensitive an apparatus for controlling it as the ear. But nothing prevents us from arranging charts, or notes of the most purposeful organization, and executing them strictly.

I believe that this is a huge field where technology will make great progress. Today, as I have already said, in most cases in work organization, we are guided by occasional considerations or the requirements of a given moment, but the matter can eventually be based on rational foundations because we will undoubtedly find general principles and methods for it.

An example of collective work according to a chart.

In the examples mentioned above, the lines of work arrange themselves in a certain order on their own, because the work of individual mechanisms are closely related to each other. In works, however, where such a strict relationship does not exist, or where the work of workers has a predominant significance, the lines of work will only form correct figures if we connect individual tasks with some kind of organization, whether pre-planned or one that will develop on its own over time.

However, there is no question that in this case, too, the greatest efficiency can only be achieved if each individual task is performed in the right time, if the division of labor is as even as possible, in a word, if the work goes harmoniously even in the smallest details.

Arranging a chart for such collective work is already a somewhat more difficult task than dealing mainly with equipment and machines, but it is still a task that is entirely possible in many cases. In this case, the work chart is even more necessary because it is not enough to arrange all the work cells and set them in motion, but we also need to constantly maintain the planned organization; the work itself does not immediately force each cell to follow others, and at any moment, the whole organization can get out of tune if some cell or worker starts to act at the wrong time. Such collective work without a defined and strictly observed plan could be compared to an orchestra composed of deaf people playing without a conductor.

If we arrange a chart for such collective work, taking into account all the properties of each worker and each individual machine’s work, and then strictly execute it according to this plan, we will obtain, in many cases, a result that is almost beyond expectation.

During my practice, I had the opportunity to see many times how great and rapid progress can be made with such planned behavior in works in which a whole series of worker machines participated, and where the work itself did not directly force the need for systematic behavior.

I will give an example from the production of thin sheet metal. Figure 14 shows a general layout of the rolling mill. The process was as follows:

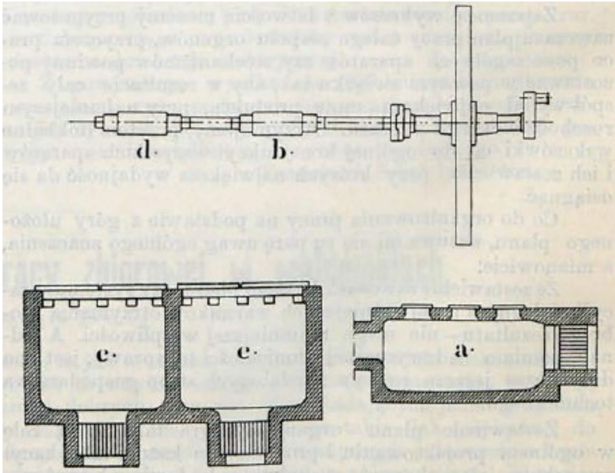


Fig. 14

1. the billets were loaded into furnace *a* and, after heating to the required temperature,
two pieces were taken for rolling on the first pair of rollers *b*.
3. After the first rolling of the pair, i.e. when two sheets were rolled together and bent in half (doubled), we obtained a package consisting of four sheets.
4. These packages were then placed in furnaces *cc*, and after heating,
5. each package was rolled on the second pair of rollers *d*.
6. If the sheets were to be so thin that the desired thickness was not yet achieved in the second rolling, the packages were returned to furnaces *c*, and after three more heatings,
7. they were rolled again on the second pair, then returned to furnaces *C* for annealing.

The entire process, from loading the billets into furnace *a* to removing the last package from furnace *c*, took about 1.5 to 2 hours for each of the three rolling operations.

As we can see, the individual operations are not closely related here; much depends on the worker's will, who decides when to start a given job, when to load into the furnace, how many billets to take for each charge, whether to arrange the quadruples immediately after rolling or later, and so on.

For a fairly long time, the production of this rolling mill was generally small, despite the considerable skill of the workers and the good performance of the furnaces and rollers. The production during a 12-hour shift, when rolling sheets of 1 arshin x 2 arshins x 0.7 mm [*an arshin is an old Russian unit of length, equal to approximately 71 centimeters*], averaged 2,500 kg. All incentive pay schemes and efforts by the foremen to speed up the work were of no avail.

Until now, my speculations were based on the various shortcomings of individual cells or on the overall production figures, and the reasons for the low efficiency of the rolling mill remained incomprehensible. Only a detailed investigation with a watch in hand and then a graphic representation of the entire process revealed immediately that the whole issue was about a multitude of breaks in work, sometimes barely noticeable, which resulted from the variations in the work of both people and equipment. It was explained that we were dealing with a similar example to lifting a weight with many people working simultaneously without any command, but as each one likes, and the result is that everyone is exhausted and the work does not progress. In this case, the only difference is that the causes of stoppages are masked because the working period is long enough, and delays or accelerations of a particular operation on one machine only affect others an hour or more later.

Longer observations of the work time of each cell allowed for the design of such an organizational type in which the highest efficiency is achieved, both for each individual work cells and for the entire organization.

The chart in Fig. 15 shows the course of work organized in this way during rolling of thin sheets, 1 arsh. X 2 arsh. X 0.7 mm.

For easier understanding, let's go through all the tasks one by one:

1. At point *a*, we put a series of billets into the furnace (12 pairs).
2. During time *aa*, these billets are heated.
3. At point *a*, when the first, hotter, part of the furnace has been emptied of the previous series, the heated series is moved into its place.
4. At point *b*, the billets start to be issued from the furnace, one pair at a time onto the first pair of rollers.
5. Single thick lines *cd* represent the time for the first rolling of each pair. Each rolled pair is immediately bent in half.
6. Lines *ef* indicate the doubling time.
7. At point *g*, each set of four billets is put into the package furnaces for the second heating. We place three packages on top of each other at each location in these furnaces, and we have four such locations. Two locations are reserved for roasting the sheets.
8. Double lines *gh* indicate the second heating time.
9. At moment *h*, each set *of* four billets is removed from the furnace after the second heating and goes to the second pair of rollers for the second rolling.
10. After the second rolling, the packages are returned to the furnaces three at a time.
11. The moments *l* indicate the beginning of the third heating.
12. The triple lines *lm* indicate the time of the third heating.
13. The triple thick lines *no* indicate the time of the third rolling.
14. At moment *p*, the fully rolled billets are placed in the roasting furnaces, three at a time.
15. The lines *pr* indicate the time of the final heating or roasting.
16. At moment *r*, the billets are removed from the furnaces and all operations with a given batch are finished.

We proceed in the same way with other series. As we can see, all these manipulations, represented graphically, pass through all the machines in the form of a specific figure or wave. The waves of each batch proceed sequentially, overlapping one another, as long as the individual machines are filled (in this case, package furnaces are significant in this regard).

When creating the graph, we encounter no difficulties, provided we know the average length of the heating, rolling, and other times from observation. Of course, these lengths must be taken very cautiously and with a certain margin for unforeseen work stoppages.

(D. n.)
K. Adamiecki.

Part IV

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[Human Factors]

Since maintaining this systematic approach usually depends on the workers, it is necessary to examine whether such a work mode is feasible for them. When we label all the workers using symbols on the first chart, the division of labor among them will be immediately explained. If we assign each worker work according to the machine chart, some will be overloaded with work, while others will have too little, and we can be sure that if we do not properly resolve this issue, directing work according to the chart will be impossible.

The situation with the workers' work chart is slightly different from that of machines. The chart of the latter should consist of lines that are as continuous as possible with the smallest possible breaks. Our aim should be to obtain the highest possible efficiency of machines and devices, but we must approach human work according to different principles. A human is not a machine capable of continuous operation; we can ask systematic work of them, but we cannot and should not overload them - on the contrary, we are obliged to give them the necessary rest for their body. When marking the time of these breaks, we must be guided not only by the work of machines and devices that the workers will work with but, above all, by the properties of the human body. Therefore, a priori, we can say that the correct chart of collective human work will have a slightly different character than the chart of machine operation. Naturally, from the point of view of current operations, that is, the arrangement of lines relative to each other, the chart of collective human work should also be harmonious, but the length of work lines and breaks will be different. For each worker, the number of work lines should be as small as possible, breaks should be frequent and sufficiently long for rest, whether it is momentary or longer for meals. There should not be too many concentrations of work lines, that is, temporary overload, but work should proceed at a calm, steady pace. If a particular worker has to perform very intense work at certain times, they must be given a sufficient break for rest without fail. Finally, the division of labor should be particularly fair.

Whenever we want to organize collective work using a chart, we should draw a second chart of workers' activities on the chart of machines and equipment, taking everything into account. Of course, we again enter the vast but rewarding field of technical studies.

On the chart presented (Fig. 15 preceding), the workers are marked with different symbols, so it is easy to check how the work is distributed among them.

During the design of the first chart, it was not possible to predict all the details of the work with the greatest care, so a few preliminary attempts had to be made during which it was explained how to resolve the matter best; in any case, we quickly arrived at completely satisfactory results by this means. It turned out that to achieve a distribution of work among workers, it was necessary to make some concessions from the machine chart.

The chart presented in Fig. 15, developed and refined through experience, has demonstrated improved usefulness in application.

Now let us see how to put into action such a work plan. The simplest way, rather than use a clock, is to follow the course of one of the machines, for example, the pace of rolling any pair of rolls—completely similarly to how in an orchestra all instruments can be guided by the first violin. It is only necessary to ensure that each worker knows when to start his work and is guided by, for example, which billet is starting to roll or which is finishing.

Initially, certain difficulties naturally arise, partly due to the workers' caring less for the new structure, and partly due to their aversion to working within a more rigid system; therefore, it is important to watch carefully so that no mistakes are made and the whole plan is not disrupted. To this end, it is far better at first not to speed up the work, and if necessary, intentionally slow down the pace, and instead focus primarily on maintaining the organization itself. After a certain, relatively short time, the work begins to flow smoothly and according to the plan.

The result that I had the opportunity to obtain through such a process simply exceeded all expectations. In just a few days, production reached 8500 pieces per day, instead of the usual rate of 2500 to 3000 pieces. I did not notice that the workers were overloaded with work; on the contrary, they even expressed satisfaction that they were less tired than usual. After a few days, we received another unexpected result, namely, thanks to such even work and uniform heating of the packs, the third rolling was completely eliminated, as all sheets could be brought to the required size already after the second rolling, whereas previously this was only possible with some packs.

Planning organization and self-organization.

The above example is a striking proof of how, with the help of a well-planned course of action based on knowledge of all the conditions and essential features of collective work organization, we can quickly achieve enormous efficiency, regardless of whether we are dealing with well-trained workers or not. This is a highly important conclusion.

Upon closer consideration of this matter, we can easily see that there is nothing strange about it; on the contrary, we would be surprised if we did not obtain the corresponding results by proceeding in this way. After all, the characteristic feature of any well-organized collective work is precisely synchrony and harmony of action, which can always be expressed by means of correct figures representing the working time. The training and experience of individual workers are of secondary importance. Therefore, it is not surprising that if we go the other way, that is, if we begin to influence the organization so that it corresponds to the predetermined system, we will undoubtedly obtain such mutual adaptation and the result we intended.

If we were to leave the entire team of working cells to themselves, without any intervention on the organization, then natural mutual adaptation will naturally occur after some time through purely natural adjustment. However, such a process left to its own devices progresses very slowly and is only possible if suitable conditions exist for it. Therefore, above all, if working conditions remain constant, and if the work process is simple and uncomplicated, the adaptation to collective work also depends on the level of training of the entire staff.

A very characteristic example of how slowly organization progresses through self-adaptation is the production of so-called white sheet metal. This is a relatively uniform production in which the skill of individual workers does play a significant role, but in any case, good organization has the greatest impact on the quantity of production. This production developed very slowly, and it took several decades for it to reach the intensity in England that had not yet been achieved in other countries where such metal was produced much later. In England, one pair of rollers produces about 5000 kg of sheet metal during a 12-hour shift, while in France or Germany, they do not produce more than 3500 kg.

If we were to plot the work schedule for this production, there is no doubt that it would be much smoother in English factories, and that is precisely the cause of the indicated difference in production. As far as the skill of individual workers is concerned, we will not find such a difference whether the workers is English, French, or Ural.

Therefore, we have two ways to achieve good organization: one is conscious intervention according to a preconceived system, and the other is the natural self-adaptation of work cells to working conditions.

To achieve high productivity on the first path, you need to:

1. Strictly examine the working conditions and properties of all individual cells;
2. Create a plan consistent with all the data obtained from observation and general principles of collective work, i.e., principles of
    a. division,
    b. timing (synchrony), and
    c. harmony; and
3. Proceed with the execution: operate the equipment and mechanisms strictly according to the plan, and develop people to the work discipline that arises from the general approach.

There is no doubt that uniform working conditions, which we encounter in mass production, can greatly facilitate this task. The situation will also be easier with more trained employees than with those less familiar with collective work. However, these are not essential conditions for achieving well-organized and intensive work. Just as the selection of only easy pieces and virtuoso musicians is not essential for creating a good orchestra.

Regarding the second path, which is self-adaptation, here on the contrary:

1. simplification of working conditions,
2. mass production,
3. [specialization:] transformation of human work into machine work, and
4. personnel training

are the main conditions for success. The more these conditions are fulfilled, the greater the likelihood of achieving a quick and good result.

The high efficiency of work in America, both collective and individual, depends on this specialization, i.e., simplified mass production.

If we take a closer look at the general progress in industrial engineering, we will notice a strong tendency to achieve high productivity on the second path, i.e., through simplification, specialization, and mass production. However, the desire for productivity through planned arrangement, i.e., direct impact on the organization, still lags far behind.

This is, I believe, to some extent a state of abnormality. The excessive pursuit of mass production sometimes goes so far as to suggest that mass production is the only condition for intensive and cheap production.

Of course, I do not intend to condemn the pursuit of mass production and specialization; on the contrary, I consider them a primary achievement of industrial engineering. I merely wish to draw attention to a certain lack of balance in the progress of this efficiency. The ultimate goal, after all, is to achieve the highest possible productivity and to minimize downtime, which, as we have seen, results in enormous material losses.

We have seen that there is still a huge field for progress in direct interaction with the organization, and therefore it is not always advisable to resort to mass production and uniformity of production in order to obtain high efficiency and low costs. Let us take the conditions of our market, for example. If there can be no doubt that, to obtain a cheap product, the efficiency of our production should be as high as possible, mass production in many cases cannot yet be used, for fear of overproduction.

Here, the main role should be played by the planning of organization, and the more complex the assortment of a given product, the more it should be observed.

Having obtained such tangible results in my practice, which I have mentioned above, I have come to the conclusion that this task is not as difficult as it might seem at first glance, even with a fairly complex range of products. Let us take, for example, the production of thin sheet metal mentioned above.

Under the conditions of our market, the thin sheet mill usually has to produce a huge variety of different dimensions. The variety of production is enormous, some sheets are produced in one pass, while others require 2, 3 or even 4 reheats and rollings, and we have dozens or even hundreds of different dimensions, so the work conditions often change several times a day.

Of course, good organization under these conditions is not a simple matter, and we cannot unconditionally count on it to develop by itself. With good intentions, however, it is always possible to introduce such organization, in which work efficiency will be, if not the same as that which can be obtained in uniform factories, at least close enough.

This matter can be greatly simplified with the help of graphical methods; the entire range of products should be divided into groups of sheets that are more or less similar in terms of execution conditions, and thus the task can be reduced to creating only a few typical charts, and carrying out the work according to them will no longer be too difficult.

With a complex range of products, the most difficult thing is to arrange and construct workshops, especially when most of the work is done by machinery and equipment. To achieve maximum efficiency, it would be appropriate to have a different selection of mechanisms for each type of work. A rolling mill for a certain type of iron, for example, tinplate, should be built differently than for another small type, such as square iron.

It is clear that building a workshop for each type of product is possible in our conditions only in exceptional cases. However, in many cases, the matter can be resolved somewhat rationally if we examine the course of work for each type of product in advance. Here, too, the graphical method can provide precise guidance on how to proceed.

For example, if it is a matter of building a rolling mill for small types of iron, the entire range can be divided into groups with similar dimensions, several typical work charts can be created, and a rolling mill device can be selected to more or less correspond to all types, especially the most important ones. Unfortunately, today the construction of rolling mills does not go this way, and rolling mills for small iron, built according to the generally accepted template, have a large range to handle, only by lucky coincidence they sometimes correspond to a few types, and most often do not correspond to any.

In conclusion, I would like to say a few words about the employees' attitude towards collective work, which is subject to the strict framework of a predetermined system.

In order to achieve the highest efficiency of the entire team, as we have seen, each employee must strictly adhere to the indications of the general plan or chart. Such discipline in work may seem at first glance like an attack on individual freedom - reducing people to the role of robots, bound together like machine parts into a whole. Therefore, it could be assumed that such discipline is undesirable because of the personal freedom of employees.

However, if we wanted to view this issue from this perspective, we would actually have to condemn all well-organized collective work because the main basis of such work is precisely the strict adherence of individual work to the work of the entire team.

On the other hand, we see that the desire to adapt individual actions to the actions of the entire group of employees is already present in the very beginnings of collective work, and this tendency always manifests itself, regardless of whether we influence it or not, because this subordination stems from the instinctive striving of the entire team to achieve the highest efficiency while expending the least amount of energy.

The energy savings resulting from good and well-organized work are too great for a person, having the choice between complete freedom, proper unsystematic work and the benefits that planning brings, to choose the former.

Therefore, we must reject the fear that by imposing strict rules on collective work, we will turn people into robots in the name of the main principles of the economics of this work - especially since the strict but rational organization of collective work is not really a limitation of individual work freedom, but its systematization, aimed primarily at saving human effort.

K. Adamiecki.

PRZEGLĄD ORGANIZACJI
MIESIĘCZNIK POŚWIĘCONY SPRAWOM ORGANIZACJI I ADMINISTRACJI ŻYCIA GOSPODARCZEGO
ORGAN INSTYTUTU NAUKOWEJ ORGANIZACJI
ROK VI WARSZAWA, KWIECIEŃ 1931 Nr 4

HARMONOGRAF.

L'harmonographe.

Prof. KAROL ADAMIECKI

PRZY ZESTAWIENIU planów roboty w postaci harmonogramów, a zwłaszcza przy różnych poprawkach, które później trzeba w nich robić podczas biegu roboty, zjawiają się dosyć duże trudności rysunkowe, a mianowicie, gdy zajdzie zmiana w jednej lub kilku czynnościach, to za każdym razem trzeba ścierać znaczną część lub nawet cały rysunek, aby na nowo go znowu odtworzyć w nieco zmienionej postaci. Zabiera to wiele czasu i wymaga dużej cierpliwości i uwagi. Z tego powodu niekiedy trudno jest z robotą rysunkową nadążyć za biegiem samego procesu, co zwykle kończy się tem, że wykresy nie są należycie wykończone, bywają zagmatwane lub tak mało przejrzyste, że utrudniają kierowanie robotą. Gdy poprawki zdarzają się często, to mniej cierpliwi kierownicy zniechęcają się do samej metody.

Dłuższa praktyka i próby doprowadziły nas do skonstruowania specjalnej tablicy, która usuwa te trudności (fig. 1). Tablicę tę możnaby nazwać harmonografem.

Główna zasada konstrukcji harmonografu polega na tem, że powierzchnia, na której zestawia się harmonogram, nie stanowi jednego niepodzielnego arkusza, lecz składa się z szeregu pasków papieru, ułożonych pionowo jeden obok drugiego. Paski te są przymocowane z obydwóch końców do deski przy pomocy uchwytów tak, iż każdy z nich może być założony lub zdjęty niezależnie od pozostałych. Na lewym brzegu paska zakłada się wąskie krawężniki z cienkiej blaszki metalowej lub celuloidu kolorowego, które odgrywają rolę kresek czasu. Na fig. 2 pokazany jest krawężnik w widoku perspektywicznym. Krawężnik zrobiony jest w postaci rowka w taki sposób, że obydwie jego strony sprężynują ku sobie i w ten sposób ściskają brzeg papieru. Ściskanie to nie jest jednak zbyt duże tak, iż przy pewnym niewielkim nacisku na koniec krawężnika można go przesuwać wzdłuż paska papieru.

Na paskach wydrukowana jest poziomemi kreskami skala czasu. Jedna podziałka może wyobrażać godzinę, dzień, tydzień i t. d., zależnie od tego, jaka dokładność potrzebna jest w każdym poszczególnym wypadku.

Każdy pasek służy do oznaczania czasu działania i danych, dotyczących wykonania, odnoszących się do jednego organu lub jednej operacji.

Z powyższego opisu widać, że zestawianie harmonogramu sprowadza się do obcięcia szeregu krawężników na długość, odpowiadającą czasowi przeznaczonemu na każdą operację, założenia ich na odpowiednie paski papieru i przesunięcia na swoje miejsce tak, jak tego wymaga kolejność i przebieg czynności. Dzięki temu robota rysunkowa zestawiania harmonogramu zupełnie odpada i sprowadza się do przesuwania krawężników. Przyśpiesza to wielokrotnie zestawianie harmonogramów, a wszelkie poprawki w rozmieszczeniu kresek czasu można uskutecznić podczas wykonania bardzo szybko i bez żadnych trudności.

Nad każdym paskiem umieszczona jes metalowa kieszonka, do którego wkłada się kartkę z objaśniającym napisem.

Paski nadają się również do robienia wykresów roboty wykonanej. Do tego celu służy prawa część paska szerokości 20 mm. Lewa część paska szerokości 5 mm, taka sama jak szerokość krawężników, przeznaczona jest do umieszczenia tych ostatnich, czyli zarezerwowana jest dla kresek czasu i znaków dotyczących zaprojektowanego harmonogramu.

Szerokość prawej części (20 mm) oznacza zawsze całkowitą ilość roboty zadanej. Jeżeli więc

Harmonograph (1931 Instructional Article)

Organization Review (*Przegląd Organizacji*), 1931, Vol. 6, No. 4, pp. 137-139

Forward to the English edition:
Despite the prevalent use of Harmonographs in European factories by 1931, and their frequent mentions in scientific management articles and conferences, this piece is Adamiecki's first instructional article explicitly aimed at newcomers. The article also presages an early iteration of an "A3" report; advising users to photograph the board before erasing it, documenting progress and providing a tangible record "in the normal A3 format."

Substantial drafting difficulties can occur when creating scheduled work plans, particularly when numerous adjustments need to be made as work progresses. For instance, in the event of a change in one or several tasks, each time a significant part, or even the entire drawing, must be erased and recreated. This process is time-consuming, requiring a great deal of patience and attention. As a result, it can sometimes be challenging to keep up with the pace of the actual process through the drafting work. This usually ends with the charts being inadequately finished, entangled, or so unclear as to hinder the management of work. When frequent corrections are needed, less patient managers may become discouraged with the method itself.

Extended practice and experimentation have led us to construct a special board that eliminates these difficulties (Fig. 1). This board could be called a harmonograph.

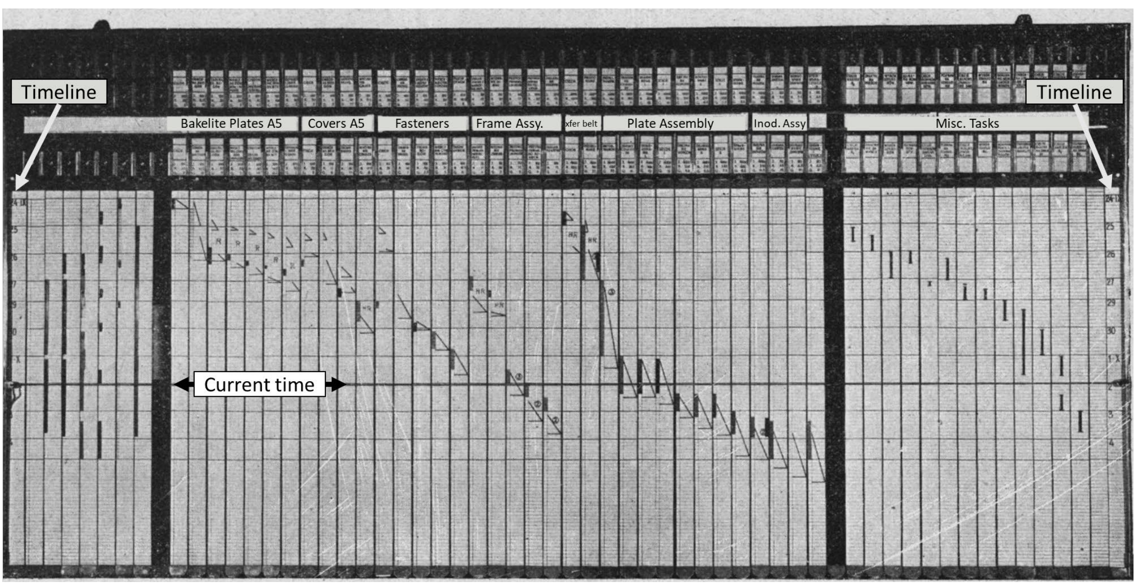


Fig. 1 [Additional labels added for clarity]

The main principle in the construction of the harmonograph is that the scheduling surface does not consist of a single indivisible sheet, but is composed of a series of paper strips arranged vertically next to each other. These strips are attached at both ends to a board using brackets so that each can be installed or removed independently of the others. Clamped on the left edge of the strip are narrow sliders made of thin metal or colored celluloid, representing timeline markers. Figure 2 shows the slider in a perspective view. It is designed with groove is made in such a way that both sides spring towards each other and thus clamp the edge of the paper [*similar to a modern plastic bar for binding booklet covers*]. However, this compression is not too great, so that with slight pressure, it can be moved along the paper strip.

Time scales, marked by horizontal lines, are printed on each strip. One division can represent an hour, day, week, etc., depending upon the accuracy required.

Each strip is used to mark the duration of a specific operation along with data relevant to the execution of that operation. This information is unique to individual tasks or workstations, enabling a nuanced representation of the entire workflow.

From the above, it's clear that the process of creating a schedule with the harmonograph boils down to cutting a series of sliders to lengths that match the time designated for each operation, affixing them onto the appropriate paper strips, and adjusting their positions to reflect the sequence and progression of operations. This eliminates the need for drafting the schedule. Instead, the task is as simple as moving the sliders. This significantly accelerates the creation of schedules, and any adjustments to the timeline can be made quickly and easily during execution.

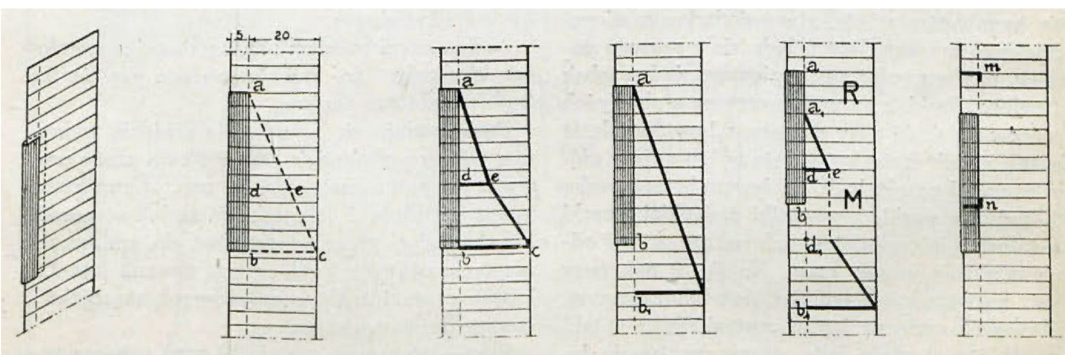


Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6. Fig. 7.

Above each strip, on the board, there is a metal pocket for inserting a piece of paper with a descriptive label.

The strips are also designed for creating charts of completed work. For this purpose, the right-hand side of the strip with a width of 20 mm is used. The left-hand side of the strip, with a width of 5 mm, matches the width of the sliders and reserved for their placement, that is, this column is designated for timelines and symbols corresponding to the planned schedule.

The width of the right side of the strip (20 mm) represents the total amount of work assigned. Therefore, if we have a given time, "*ab*" (fig. 3), it means that during this time 100% of the assigned work, "*bc*," should be completed. Assuming a steady pace of work, the horizontal coordinates "*de*" of the line "*ac*" will represent the percentage of work completed while the task is in still in process. For example, during "*ad*," the amount of assigned work will be equal to the percentage "*de*". To avoid confusion and to limit the amount of drawing corrections needed, the lines "*ac*" and "*bc*" are not drawn, and the assigned amount is not written on the strip, but should be included on the description label above.

As the reports of the progress come in, the percentage of work completed, expressed in relation to the assigned amount, is marked on the corresponding horizontal time divisions and a thick diagonal line is drawn in pencil to indicate the actual progress made. This way, we obtain a progress chart next to the slider indicating the assigned time. For example, the chart in fig. 4 will indicate that the work started and ended exactly at the designated time, then, up to the moment "*d*", "*de*" percent of the assigned amount was completed, and up to the moment "*b*," the entire assigned amount of work "*bc*" was completed.

The second example (fig. 5) shows that the start of the work was in accordance with the plan, but the total completion was delayed by the time of "*bb*".

In fig. 6, another case is shown. The start of the work was delayed by "aa_1," then, at the moment "*d*", after completing the amount of "*de*" work, the task was interrupted and started again at the moment "*d*," and finally completed at the moment "b_1", which means that the overall delay in completion is the length of time represented by the dashed vertical line "bb_1."

The examples provided above are sufficient to illustrate the method for creating progress charts. If the actual execution deviates from the planned schedule, different symbols or letters can be used next to the sliders to indicate the reasons for these deviations. For instance, “R” could signify a repair, while “M” might denote a material shortage, et cetera.

If it is necessary to shift the timelines below due to these deviations, for clarity, the previous position of the slider can be marked on the strip with a pencil as with marks "*m*" and "*n*" in figure 7.

For easier visualization, different colored sliders can be selected for each type of activity and the corresponding execution lines can likewise be drawn in the same color.

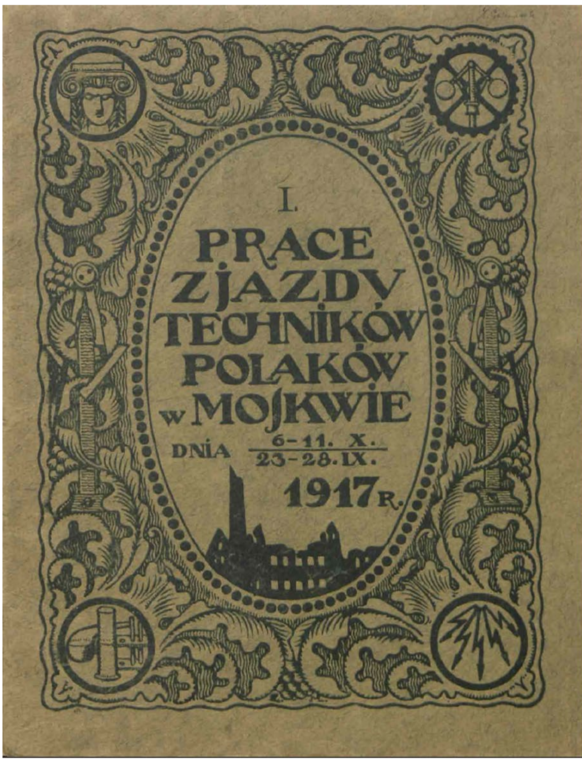
After all scheduled activities are completed, the strips are removed from the board and new ones are used to prepare the plan for the next series of work. However, before that, the entire board should be photographed. Such photographs serve as visual aids for drawing various conclusions, both regarding the work already completed as well as for the preparation of the next plan. With today's improvements in photography, photographic images are easy and available to even the smallest enterprise. It is best to photograph the boards using small film, e.g., 6 cm X 9 cm, and make enlarged prints in the normal A3 format, which is 420 mm X 594 mm.

Beyond featuring a row of pockets for cards describing current scheduled activities, the board displayed in Fig. 1 also includes two supplementary rows above for cards detailing subsequent tasks in the series. Constructed in this way, the harmonograph simultaneously serves as a distribution board, similar to the [*Gantt Chart*] boards used in workshops following the Taylor system. However, the harmonograph has an advantage in that it provides a visual representation of the entire process, significantly facilitating the manager's navigation through all the intricate aspects of job control and distribution.

The board itself is constructed using a of a series of identical sections, which can be joined together with two metal bars to form a single unit, with each section containing 10 strips. This type of construction allows the board to be freely expanded or contracted, depending on the number of workstations or activities involved. If there are many positions, two or more boards can be arranged side by side. To facilitate orientation along the board, a string or wire is stretched across it, which is continuously moved throughout the shift vertically along the timeline to the current date and time.

Charts and symbols related to execution should be made in pencil, allowing them to be erased once a particular series of tasks is complete, and the same strips can then be reused. The consumption of strips is generally minimal, as they are made of thick and very durable drawing paper, and time scales are printed on both sides, enabling the same strips to be used multiple times.

To prevent the need to cut new sliders each time, it's useful to keep a box within reach, containing a range of sliders of different colors and pre-cut to various lengths.




PRACE ZJAZDU
TECHNIKÓW POLAKÓW
w Moskwie $\frac{23-28\ \mathrm{IX}}{6-11\ \mathrm{X}}$ 1917 r.

CZĘŚĆ I-SZA
SPRAWOZDANIA.

Nakładem Stowarzyszenia Techników Polaków w Rosji.
MOSKWA.
1918.

Desirable direction of technical education in Poland [1917 Conference]

Proceedings of the Congress of Polish Technicians in Moscow [*Prace Zjazdu Techników Polaków w Moskwie*], September 23-28 and October 6-11, 1917. Part 1, Reports

Forward to the English edition:
A Congress of Polish Technicians was held in Moscow in September 1917, a month prior to the start of the Bolshevik revolution. In addition to technical issues, discussions focused on how to most effectively prioritize their efforts to rebuild Poland, as the tone of the conference reflected their confidence that they would soon regain independence from the former Tsarist Russia for the first time since 1795.

The following presentations were given:

- *Stefan Bryła's "On Higher Technical Education" and "Regarding Polish Technical Education in the Borderlands,"*
- *Professor Bryła (in place of absent Professor Wodyński) titled "On the Organization of Higher Technical Education in Future Poland."*
- *Stanisław Nietyksa on "Postulates Regarding Future Technical Education in Poland" and*
- *Karol Adamiecki on "Regarding the Future Education of Technicians in Poland."*

Marian Lutosławski
Photo credit: Muzeum w Drozdowie

Marian Lutosławski (1863-1918), a distinguished Polish engineer and technical activist, was instrumental in organizing the Congress and overseeing its proceedings. Despite the challenging circumstances of the subsequent year, he succeeded in publishing Part I of this report. It contained the stenographic record of the Congress, an alphabetical list of registered Polish technicians from the pre-congress survey, and the statute of the Association of Polish Technicians in Russia. Sadly, the presentations' texts, likely planned for Part II, were lost as it was never published due to Marian's arrest. On 23 April 1918, the Bolsheviks incarcerated him and his brother, Józef, at Butyrka prison in central Moscow, branding them as counterrevolutionaries. As they awaited trial, Maria, Józef's wife, visited them with their five-year-old son, Witold, who would grow up to become one of Poland's most distinguished composers, revered in many circles as second only to Chopin. Tragically, just days before their scheduled trial, the brothers were shot in a mass execution in Vsekhsvyatskoye on September 5th, 1918.

Included here is the introduction to the Congress along with selections of Adamiecki's remarks and debates.

Introduction

The idea of convening a congress originated in the Management of the Technical Section at the Polish House in Moscow, which in May sent an appeal to all Polish technicians whose names were known to them.

On June 21, the Organizing Committee was formed, which appointed Engineer Marion Lutosławski as chairman, Br. Słaboszewicz and Cz. Klamer as deputies, M. Kozerski and Cz. Benedek as secretaries, and M. Tyska as treasurer. The Committee was joined by J. Gryżewski, B. Okulicz, and subsequently commissioners of the following departments: Food Supply - S. Waberski, Housing - H. Gąlecki, and secretaries of sections: Economic - J. Iwanowski and Electrotechnical - M. Pożaryski and Klainborowski; Building - Z. Mączeński, Chemical - S. Kiełbasiński.

The following people were invited as correspondent members: Mr. L. Tołłoczko in Petrograd, Mr. S. Brył in Kiev, Mr. S. Stanowski in Yekaterinoslav, and Mr. L. Kotowski in Rostov-on-Don.

Immediately after the Organizing Committee was formed, a manifesto was published in the press containing the Program of the Congress of Polish Technicians in Moscow, which was sent out.

The Organizing Committee of the planned Congress of Polish Technicians, scheduled for September 23 of that year, developed the following program of proceedings:

1. Strictly technical matters,
2. papers dealing with new technical developments,
3. criticism of applied methods, inventions, etc.,

which will be directed to the Congress Sections and divided as reports are submitted.

In view of the prevailing conditions, the main attention will be given to general matters concerning the role of Poles in Russia, the relationship of Polish technology to Russia, and the issue of future technological development in Poland.

The proceedings of the Congress will be divided into three sections:

1. General,
2. Industrial-Technical, and
3. Agricultural-Technical;

Particular emphasis will be placed on technical trade, and therefore all traders working in technology are not only invited to the Congress but are also asked to participate.

In the General Section, the following matters will be considered:

a. the position of Polish technicians in Russia (the Association's draft law),
b. postulates concerning future technical education in Poland,
c. Polish technical publications,
d. the salary status of technicians.

In the Industrial and Technical Section:

a. the state and development of industry in Polish territories,
b. the exploitation or underutilization of natural resources in Poland,
c. the planned organization of Polish industry after the war.

In the Commercial and Technical Section:

a. Poland's role in commercial relations between the East and the West,
b. the dependence of Polish industry on foreign sources of supply and markets,
c. the state, development, and importance of land and waterways in Poland.

Proposals for papers and resolutions should be sent as early as possible to the Organizing Committee (Milutyńska 15 m. 15).

In addition, a survey will be conducted to collect data on Polish technicians working in Russia. The creation of an appropriate questionnaire is being handled by a section of the Organizing Committee, whose findings will be announced soon.

The committee developed and sent to members, correspondents, and technical associations in Kiev, Petrograd, Kharkov, and Yaroslavl the draft statute and draft regulations. The chairman of the committee invited the Economic Council, the Communication Engineers Club, and the Chief Military Committee in Petrograd. Regarding the organizational work, all daily letters were used to disseminate information, while colleagues residing in Moscow offered hospitality to the visitors, and 55 seats were obtained. Thanks to the kindness of Engineer Landsberg, head of the Department of Exploitation in the Ministry of Communications, a train was obtained for the journey to the congress from Petrograd, and two cars were provided for overnight stay for the participants of the Congress at the Aleksandrowski station in Moscow.

The plenary session of the Congress was held in a convenient hall at the European Electro-Theatre on Triumfalnaya Square, where, in addition to the conference room with a screen on which messages could be displayed, there was a spacious smoking room and buffet organized by the Committee's management with the help of Mr. Strąezyński. Sectional meetings were held in two halls of the Polish House, the C.K.O. School Department, and the Polytechnic Society. An exhibition of works and sketches by Professor Noakowski was organized in the School Department hall.

The incorrect announcement of a ban on entry into Moscow and the suspension of railway services on September 24 negatively affected the turnout of the Congress. A total of 285 identity booklets and 111 admission tickets for guests were issued, as well as 271 vouchers for a collegial lunch held from September 20 to 24 at the Metropol Hotel (including meal tickets attached to the identity booklets).

Proceedings

Fourth Day of the Congress, September 26.

Messrs. Adamiecki, W. Majewski, and J. Rakowski were appointed as scrutineers.

Fifth day of the Congress, September 27th.
After reading the agenda, the chairman gave the floor to Mr. S. Kaliński, who finished his lecture on "Communication networks in future Poland", which began at the meeting on September 25th.

After listening to the lecture, the Congress began a joint discussion on the lectures delivered on September 25th.

Then Mr. Fr. Bakowski read welcome letters received from the Technical Circle in Kazan and the Council of Mutual Aid Societies of Polish Workers in Petrograd, and then moved on to read the resolutions developed by the proposers' committee and presented by the speakers: Messrs. Kotarski, Boin, Kłosi, Żniński, Klarners, Lutosławski, Fiedorowicz and Gryżewski, followed by Messrs. Krzyżanowski, Kaliński, jointly by Widomski and Piotrowski and Mr. Ordyński's resolution. The Congress voted separately and accepted each resolution.

On behalf of the Scrutiny Committee, where Mr. J. Rakowski was joined by Mr. R. Gajdamowicz, Mr. Adamiecki read the minutes of the scrutineers, according to which the results of the elections to the Association's authorities …

In accordance with the statute, the heads of local technical organizations participated in the Central Board of Directors, and until their formation, the chairmen of existing technical organizations participated.

Resolutions:
Regarding the resolutions and the announcement of the Congress's publications, on the motion of Mr. M. Lutosławski, the Congress decided:

1. Publish the summary of the minutes and resolutions of the Congress,
2. hand over all the papers to the Committees and the Editorial Board of the Journal with the task of qualifying them for publication either in the Journal or in a detailed report on the course and work of the Congress, which should be published in a book edition,
3. call on Polish engineers and industrialists to contribute to a fund to cover the costs of this publication, as the remaining Congress fund for this purpose is not sufficient,
4. send the proposals that were submitted to the Presidium but not considered by the Proposals Committee to the Board of the Association of Polish Engineers.

Section III: Education Section.
The meetings were held in the building of the C.K.O. School (Rżewska 2) and in the C.K.O. office (Milutyńska 4).

Meeting of September 24, 1917:
Chairman Prof. W. Suehowiak gave the floor to Mr. T. Wasilewski for a report on the project of a middle technical school in Kiev. - The report of Prof. Wodzyński "On the organization of higher technical education in future Poland," which was read in the absence of the speaker Prof. Bryła,

was sent. - The report of Eng. St. Nictyksy "Postulates concerning future technical education in Poland" was heard.

The reports of Eng. K. Adamiecki "On the future education of Polish technicians" were heard. It was decided to conduct a general discussion on all reports addressing fundamental issues together.
…
W. Liebert is disagreeing with engineer K. Adamiecki regarding the omission of social-economic sciences in contemporary higher education programs. Liebert argues that they should only be deepened and, in addition, the French system of examinations should be introduced.

Meeting on 25th September 1917:
[Against the inclusion of Socio-Economics from Engineering/Management higher-ed]
Chairman Prof. W. Suehowski presented the request of the president of the congress to expedite the opinion of the sections on the resolution of Engineer Cz. Kłos, which will be considered in the Proposals Committee this evening. Only one resolution was unanimously adopted with the following content: "To draw the attention of the spheres that will lay the foundations for the new structure of the Polish state to the necessity of granting engineers and their positions in the new system that corresponds to the importance of engineers in modern life." It was decided to consider this during the general discussion only after listening to all the speeches.
…
During the discussion [following the speeches], Mr. T. Wasilewski emphasized the need to strive for the creation of a unified type of general secondary school, the need to develop workshops in higher education, and the expansion of socio-economic studies in higher technical schools. Mr. Zniński demanded the creation of a Crafts Section in the future Technical Association. Mr. Józef Lutosławski raised concerns about vocational high schools being treated as preparation for higher education, and the danger of attacking the idea of universities. Engineer W. Liebert engaged in a polemic with Engineer Karol Adamiecki about the omission of contemporary socio-economic studies in higher education curricula, arguing that they should only be deepened and that the French system should be more widely adopted.

Professor W. Suehowiak discussed the differences between the tasks and types of higher secondary schools, calling for the preservation of a thorough education despite changes in the curriculum. He suggested that the first year of higher education should be completed in larger intellectual centers, with later years specializing in areas that present the greatest opportunities for a given discipline. Mr. O. Kowalewski argued against the practice of lengthy apprenticeships before beginning higher education and wished for vocational schools to seriously consider transferring the necessary skills to agricultural workers. In the end, a text of resolutions and proposals was adopted, which the Section will present for approval at the Congress plenum.

Prof. Adamiecki (3:16-3:23):

[Encouraging Polish engineers to return to Poland]

He spoke not only on his behalf but also on behalf of the Technical Association in Yekaterinoslav [Dnipro], which was established last month. First of all, he wanted to supplement what was said by Mr. Stanowski. One of the main reasons why we made our proposal was to ensure that the local Technical Association would always be considered as a branch of the Technical Association in Warsaw. We all, those who have lived or are living in Russia, feel, so to speak, a certain obligation towards our country. As can be seen from Mr. Kotarski's report, we were here, as a group, very strong. We had the opportunity to observe the lives of our colleagues in our country over the past 26 years, and we can see from these observations that we were strong, not only qualitatively but also quantitatively. Although the number of Polish technicians in Russia was probably greater in recent decades than in the country, this was a huge loss for our country, because we were exporters of our best forces, our sons, who should have been working on their own land. We were completely different from Germany, which exported its goods but did not let its technical forces leave the country, while we, only to a much lesser extent, exported our own. Each of us who worked here feels deeply that it was a huge loss for us and that it is our duty to return to our country after the war. Therefore, our association with the Technical Association in Warsaw will be the link that connects us with our country and reminds us of our obligation.

For this reason, I would like to add here that if there is any law, then the motto on it should be written as follows: "Remember that it is your duty to return to your country and work there."

This issue is a problem for all of us. Our institutions in Russia have important, but much greater responsibilities towards our country. When we create our organization, it should contribute to mobilizing our forces so that they can return to the country and bring with them those who have forgotten about them.

There are many reasons why we are in this situation. However, it should be noted that there is a significant number of technicians among us who only care about making good money, no matter where they work.

It is beyond doubt that the situation here is much better and more extensive for developing our forces compared to the situation in the country, which has given us a broader perspective. Many of us have accumulated a certain amount of capital, which is needed for us. Additionally, the planned Association, as well as having a strong Polish institution in Russia, should strive to ensure that the best technical forces and capital in their possession can be returned to the country as soon as possible. These were the motives on which we based our three fundamental points of our declaration.

I would like to add that there is also a group of colleagues from Kąmienskoje who share the same position as us. This is a large and serious group, and on their behalf, I would like to state that we are very concerned about ensuring that the local association is not just a branch of the Association of Technicians in Warsaw.

Chairman: Due to the limited time, I ask the speakers to keep their remarks brief.

FOURTH DAY OF THE CONGRESS OF THE ASSOCIATION OF POLISH TECHNICIANS
Tuesday, September 26 (October 9), 1917.
The session was opened at 11:00 a.m.

Prof. Adamiecki, (12:08-12:10)
[Best chance for success is not the easy path]
Prof. Lutosławski demonstrated to us very well that agriculture alone is not enough for us and that we need to create industry - not just any industry, but one that satisfies us and enables us to work for exports. In addition to this, he presented to us a very enticing field of work for Polish technicians, namely, intermediation in the exchange of goods between friendly countries and Russia.

In this way, we have three fields of work:

1. our own industry,
2. exporting our industry to Russia, and
3. intermediation.

If we consider the main goal of technical work, which is good for the nation, we should think about which of these three fields has the highest productivity coefficient of our technical energy, i.e., which of these three fields produces the best results. On each of these three fields, we have, so to speak, obstacles. The greatest obstacle is the creation of industry. The least obstacle would be intermediation. Having gone through the whole series of stages in technical-industrial work, I have observed a lot, and I see that we, Polish technicians, have an extraordinary inclination to take the path of least resistance. As a glaring proof, there is an enormous number of Polish technicians in Russia, much greater than what we have in our own country. The main reason is the inclination to pursue the path of least resistance. An enormous number of them, even after finishing their studies, did not even try to work in Poland.

Next, I gave a second example from our national work. A huge percentage of Poles were engaged in intermediation for German products imported into the country. This unequivocally proves our tendency to seek the path of least resistance.

Do we achieve the best productivity coefficient for the national good on these paths? I doubt it! Because if we consider the groups that contributed so much energy, what did we get for the national good? We got fame. It's beautiful but not enough. A few houses in Warsaw, a few country estates bought by technicians working in Russia - that seems to be everything. There is also a small percentage of rentiers. The majority of this energy stayed in Russia. I am afraid that due to our tendency - if we are given new job opportunities - a large number of Polish technicians will seize the opportunity of intermediation for the allied countries and return nothing to the country.

It seems to me that we are faced with a situation where there is a lack of employment opportunities in the fields where the most energy is needed, such as in creative industry, and Germany, France, etc., occupy the free positions.
Therefore, attention must be paid to the fact that intermediation is an attractive but dangerous field. For this reason, I would propose the following resolution:

Considering that modern agriculture attaches the greatest importance to agricultural machinery, the Congress of Polish Technicians invites Polish technicians, industrialists, and capital to begin planning and organizing the manufacture of agricultural machinery without delay so that we can join in this manufacturing after the war.

Prof. Iwanowski rebuttal (1:50 pm - 1:56 pm):
I would like to comment on Mr. Adamiecki's accusation that we, Polish technicians, have chosen the path of "least resistance." No! The path of "least resistance" was the only path left for us. Have all of us, hundreds of thousands of individuals who went to work in factories after finishing higher education, worked there for low wages, only to be eventually thrown out by Russian police, just as our workers were thrown out to Russia or America with a loaf of bread? I welcome the idea of factory organization proposed by Mr. Szwentner, as it is the beginning of mobilizing our technical resources, which we will have to carry out when we return to the country. The work of organizing the purchase of raw materials is what we need to focus on now. It is essential to emphasize that this work has already begun, and we should all take an active part in organizing the purchase of raw materials and creating an appropriate commercial apparatus. At the same time, we need to mobilize technicians and assign each of us a place in this great army that is to rebuild our industry and our country.

Prof. Adamiecki, (2:46 pm -2:47 pm) Importance of publishing the material
Our congress has already gathered such a tremendous amount of material, and it's so interesting and instructive that we should think about our colleagues who couldn't attend. We need to have our work published as soon as possible. I believe there will be enormous obstacles due to finances; we simply lack the funds. Since the editorial committee for the future publication has been established, I suggest that these financial matters be referred to the permanent editorial committee.

Regarding financial matters, I appeal to all our colleagues to contribute materially. It's our obligation to vigorously advocate for this fund committee.

PROF. Rakowski (12:34-12:39).
During the discussion, the issue of the journal was raised and a resolution proposed by Mr. Ordynski was presented, which was prepared in agreement with the proposing Committee on the Editorial Board, which accepted it.
…
Mr. Lutoslawski's resolution on the role of Poland as a mediator between East and West in his speech caused some trouble for the Proposal Committee, as his proposal and comments by Mr. Adamiecki are somewhat contradictory to Mr. Lutoslawski's resolution. Therefore, I believe that it would be best to read both.

P. Wolski (12:39-12:40):
This is such a complicated matter that we cannot express a decisive opinion on it if we do not want to be accused of treating our duties lightly. I think that this matter must be considered for a longer time, by a larger group and in a more comprehensive way. Therefore, I believe that the lecture by Mr. Lutosławski, as well as the resolution by Mr. Adamiecki, should be handed over as material to the Board of the Association of Polish Technicians, which should work on it to come to a fully agreed and justified conclusion.

Prof. Lutosławski (12:40-12:45):
I believe that what Mr. Adamiecki is proposing is missing the point of these lectures, which were dedicated to this issue. We do not have any data that the Congress could have spoken on this matter and decided whether the task at hand is of primary or secondary importance. Economic issues cannot be resolved in this way. We cannot frame the issue as if we are calling on some technicians more weakly, and others more strongly. If we are calling for a certain task, then we are calling on all technicians, but we also recognize a certain economic situation that some are more suited for, or have a greater desire to devote themselves to. Mr. Adamiecki included in his resolution one point that I believe is worthy of acceptance, which is that only after satisfying the domestic market should we tackle the issue of foreign trade. Economic phenomena do not work that way. Nobody will wait for us to saturate our domestic market, but instead, foreign markets will be taken over. We are saying that this issue is too complicated for us to express an opinion on. In my resolution, there are no specific guidelines on how to proceed, but it states that the task of intermediating in foreign trade, which has thus far been exclusively in the hands of the Germans, can be taken over by us. Whether we take advantage of this opportunity immediately or wait for the domestic market to be saturated, that is the question. I believe that it would be a fundamental mistake if the Congress took a stand on this issue.

My second resolution is precisely aimed at preparing work with the goal of rebuilding and completing the organization of our industry in the country.

These are the two most important issues. We need to demonstrate that we can find people willing to take on this task, and I even suspect that we will also find capital, but finding people who are prepared to do this task immediately after the war will not be so easy if we do not call for it. I believe that this is not a matter that can be dealt with by committees, because these are just certain slogans. It is about stating a certain economic line. If the majority of the Congress is of the opinion that we should not be concerned with economic tasks and external trade, but should instead focus on saturating the domestic market upon returning to the country, then I believe that we should adopt the resolution of Mr. Adamiecki. If Congress takes the position that no field of work should be neglected and that we should prepare for them in advance, then it should accept my resolution.

Prof. Adamiecki (12:45-12:47) Clarification:
[All areas of work (production, internal trade, 3rd party exchange between countries) are important, but not equally so]
It may be that the wording of my supplementary proposal is imprecise and inaccurate because I did not have enough time to carefully consider it. For this reason, my idea may have been

expressed in an unfortunate way. I do not assume that Mr. Lutosławski's proposal is wrong or less important. I agree with all of them and I signed them all. I just want to supplement them, and this is not a contradiction. I meant to show that all three areas of work:

1. production,
2. internal exchange of products, and
3. third-party mediation in exchange between countries -

should be pursued simultaneously, but not equally in terms of importance, as different amounts of effort must be put into each one. If my resolution had been worded differently, it might have been understood differently.

Prof. Lutosławski.
I propose that we postpone the discussion on this topic and resolutions for now; I understand Mr. Adamiecki's idea and it seems to me that we will create a joint resolution by editing mine as an addition (p. 5).

The assembly agrees.

Prof. Adamiecki (12:18-12:19).
The issue of ceramics is very important in our country and will be even more important when we start rebuilding our country. We will need a lot of bricks, and agriculture will also need a lot of drainage tiles. This area has been neglected to such an extent that there are few among us who are familiar with it as specialists. Therefore, since I have been informed that it is possible to find such specialists in Yekaterinoslav, I propose that the Congress instruct the Association of Technicians in Yekaterinoslav to immediately address this issue and seek out these specialists.

Chairman: The Association's Board will already take care of this matter.

Prof. Adamiecki (14:46-14:49). Clarification on the Economic Section
(Regarding the vote on the resolution) I would like to explain the issue that Mr. Czaplicki mentioned, namely that his resolution was adopted by the Economic Section. The matter stood in such a way that whether or not to adopt this resolution was voted on by the Economic Section, either sending it to the Recommendation Committee or to the plenary. At least that's how I understood it when I voted on the matter. And the matter still stands that the Economic Section decided not to send this resolution to the Recommendation Committee, but to pass it on to the plenary without deciding whether to accept it or not, as there was no discussion on the matter.

Chairman: I consider the matter exhausted, and we move on to further resolutions.

№ 41—42. Warszawa, dnia 16 Października 1923 r. Tom LXI.

PRZEGLĄD TECHNICZNY

TYGODNIK POŚWIĘCONY SPRAWOM TECHNIKI I PRZEMYSŁU.

REDAKTOR Inżynier-technolog **CZESŁAW MIKULSKI**.

2-GI ZESZYT, POŚWIĘCONY ZJAZDOM INŻYNIERÓW.

TREŚĆ:

SOMMAIRE:

Znaczenie społeczne pracy inżyniera w przemyśle.

Referat prof. **K. Adamieckiego.** [1])

W niniejszym referacie nie będę uzasadniał, jak doniosłe znaczenie mają dla społeczeństwa i wogóle dla cywilizacji rezultaty widome pracy technicznej w przemyśle, w postaci różnych budowli, urządzeń, maszyn i produktów.

Na ten temat zbyt już wiele mówiono i pisano, a dla nas techników sprawa ta jest już dostatecznie wyjaśnioną, natomiast chciałbym tu rzucić nieco światła na znaczenie samej *istoty naszej pracy* w tym olbrzymim organizmie, który nazywamy społeczeństwem i którego organy wykonywują jakąś funkcję, potrzebną do normalnego życia całego organizmu.

I. Rola i odpowiedzialność inżyniera w przemyśle.

Jednym z takich organów, który wykonywa niezmiernie ważną funkcję, jest przemysł, przedstawiający jedno z największych pól pracy inżyniera. Jak wiemy, wszystkie czynniki wytwórcze, działające tutaj, sprowadzają się do pracy ludzkiej, kapitału i energji przyrody, pośród nich zaś *praca technika jest kierowniczą*, a więc rola nasza w przemyśle jest tak ważną, jak rola mózgu i systemu nerwowego w żywym organizmie. Nic więc dziwnego, że ponosimy wielką odpowiedzialność za rozwój i sprawne działanie tego organu.

Ponieważ jedynym celem techniki jest otrzymanie największego pożytecznego wyniku przy najmniejszym zużyciu środków, to my, jako kierownicy, musimy sobie zadać pytanie: czy tym mechanizmem umieliśmy kierować tak, aby dawał najwyższy spółczynnik pożytecznego działania dla całego organizmu. Jednem słowem, robiąc bilans naszej pracy kierowniczej w przemyśle, musimy przedewszystkiem sporządzić go z punktu widzenia *strat i zysków ogólno-społecznych*.

Kierując zakładem przemysłowym, rozumie się, musimy bilansować wyniki naszej pracy również z innych punktów widzenia, a więc pod względem korzyści dla danego zakładu przemysłowego, w którym pracujemy, dla całych gałęzi przemysłu, korzyści dla pracowników, dla kapitału, włożonego w zakład przemysłowy, wreszcie korzyści osobistej kierownika.

Ale ponad wszystkiemi temi bilansami stoi bilans ogólno-społeczny. Jako obywatele kraju cywilizowanego, *nie mamy prawa* podsumowywać rezultatów naszej pracy z jakiegokolwiek punktu widzenia, *ignorując* interesy ogólno-społeczne.

II. Mała korzyść społeczna w dotychczasowej pracy inżyniera w przemyśle. Przyczyny.

W ciągu mojej długoletniej działalności w zakładach przemysłowych, miałem możność przyjrzenia się zbliska życiu wewnętrznemu tych zakładów i warunkom pracy inżyniera, pełniąc funkcje kierownicze na wszystkich szczeblach hierarchji aparatu kierowniczego. Na podstawie obserwacji oraz osobistych przeżyć, często nawet bardzo dotkliwych, muszę, niestety, naogół stwierdzić, że sprawność działania zakładów przemysłowych, z punktu widzenia dobra całego narodu, była dotychczas *bardzo małą*, jak również, że wynik naszej pracy jako kierowników, mających za zadanie podnieść ten spółczynnik, jest dotąd *tak nieduży*, iż prędzej możnaby powiedzieć, że byliśmy *biernemi kółkami* w całym tym mechanizmie, aniżeli jego rzeczywistymi kierownikami.

Nasza rola sprowadzała się przeważnie do *rozwiązywania różnych zagadnień technicznych*, natomiast mieliśmy niezmiernie mały wpływ na niezwykle złożony wir zjawisk, odbywających się wewnątrz samych zakładów i mających bardzo doniosłe znaczenie ogólno społeczne.—A wiele z tych zjawisk oddziaływało *w wysokim stopniu ujemnie* na sprawne i prawidłowe działanie tych tak ważnych organów życia gospodarczego. Postęp techniczny sprawił, że zakłady przemysłowe rozrosły się wprawdzie do olbrzymich rozmiarów, ale dzięki różnym tarciom wewnętrznym, zachodzą w nich również *olbrzymie straty energji ludzkiej i innych czynników wytwórczych*, tak iż w ostatecznym bilansie otrzymujemy *zbyt mały* wynik pożyteczny, abyśmy mogli być z niego zadowoleni. Przeciwnie, dla nas techników-kierowników, jako obywateli kraju, a więc do pewnego stopnia odpowiedzialnych przed społeczeństwem za ten wynik, jest on poprostu opłakanym.

Aby jednak nie spotkać się z zarzutem, iż tak pesymistyczny mój pogląd jest gołosłowny, muszę wyjaśnić w czem widzę największe straty i jakie są ich główne przyczyny.

Każdy z nas, obserwując wewnętrzne życie przedsiębiorstw przemysłowych, czy to biorąc w niem udział bezpośredni, czy stojąc z zewnątrz, musi przedewszystkiem przyznać, że jest to *olbrzymia arena ścierania się interesów* pracowników i pracodawców, na której praca wytwórcza odbywa się pośród *zaciętej walki* tych dwóch obozów.

Już sam ten fakt dla nas—techników jest wystarczającym powodem do twierdzenia, że muszą tu zachodzić wielkie straty w czynnikach wytwórczych, a więc pracy ludzkiej,

[1]) Wygłoszony na Zjeździe Inżynierów Mechaników.

Social Importance of the Industrial Engineer (1923 Article Series)

Forward to the English edition
In this three part series, Karol Adamiecki delves into critical aspects of industrial management, including the resolution of conflicts, optimization of productivity, and hurdles that obstruct industrial growth.

Part I places emphasis on the crucial need to align the interests of employers and employees. Contrary to viewing them as adversaries, Adamiecki asserts they should be perceived as partners in a cooperative endeavor. He casts technicians and engineers in the light of essential organs within an industry, pivotal for its efficient functioning. He also emphasizes the role of technology in maximizing output and productivity and brings to attention various vantage points when managing an industrial plant. He encourages an approach rooted in cooperation within organizations, and in the management profession, underlines the importance of understanding human labor, finances, and time.

In Part II, Adamiecki challenges the prevailing belief of an inherent conflict between workers, entrepreneurs, and society. Using a series of illustrative graphs, he delineates the relationship between cost and production over time, asserting that time, as the most expensive factor in production, should be regarded as such. He emphasizes that each productive system possesses an optimal production intensity for achieving cost efficiency, cautioning against deviation from this point due to either wasted time or overwork. Adamiecki also critiques traditional methods that aim at reducing wages, arguing that maintaining a "cheap but dissatisfied worker" is directly detrimental to the profits of the enterprise.

Finally, in Part III, Adamiecki identifies the various impediments that hinder productivity increases in the industry. He categorizes these obstacles into those faced universally by technicians and organizers, those stemming from the perspectives of business owners, and those arising from the standpoint of workers. Criticizing business owners for their myopic understanding of cost flows and productivity, he also sheds light on the antagonistic perception held by workers who see their interests as being in direct opposition to those of their employers. Despite these challenges, Adamiecki concludes on an optimistic note, advocating for the recognition of the significance of time, the necessity of beneficial labor productivity, and the importance of harmoniously aligning the interests of employers and employees for sustainable industrial growth.

Part I

Technical Review [Przegląd Techniczny], 1923, Vol. 61, no. 41-42 pp. 415-417

In this paper, I will not delve into the justifications for the evident importance of technical work in industry to society and civilization at large, evident in the form of various buildings, devices, machines, and products.

Much has already been said and written about this subject. For us, as technicians, the issue has been thoroughly discussed. However, I aim to illuminate further on the inherent significance of our work within this vast entity we call society, where each organ, or component, fulfills a function vital for the overall harmony and well-being.

I. The role and responsibility of the industrial engineer.

One such key component is industry; representing one of the largest fields of engineering endeavors. As we know, all of the factors of production boil down to human labor, capital, and the energy of nature. Within these, the role of the industrial engineer is managerial, so our role in the industry is as important as the role of the brain and nervous system in a living organism. Therefore, we carry an immense responsibility for fostering growth and ensuring the seamless operation of this entity.

Since the sole purpose of technology is to obtain the greatest beneficial outcomes with the least expenditure of resources, we as managers must ask ourselves: have we been able to direct this mechanism so as to give the highest coefficient of beneficial activity for the entire organism? In a word, taking stock of our managerial work in industry, our primary task is to evaluate it from the perspective of *societal losses and gains*.

When managing an industrial plant, of course, we have to balance the results of our work from other viewpoints. This means considering the:

1. benefits for the specific facility in which we operate,
2. for all of industry,
3. for the benefits of workers,
4. for the capital invested into an industrial plant, and finally,
5. for the personal benefit of the manager.

But above all these balances stands the general social balance. As citizens of a civilized country, we don’t have the right to summarize the results of our work from any point of view while ignoring the interests of general society.

II. Little social benefit in our current work as industrial engineers. Causes.

During my many years of activity in industrial plants, having held managerial positions at all levels of leadership, I had the opportunity to look closely at the internal workings of those plants and the working conditions of the engineer. Based on observations and personal experiences, often very painful, I must unfortunately, admit, that the efficiency of the operation of industrial plants, from the point of view of the good of the whole nation, has hitherto been very small, and the result of our work as managers to raise this efficiency is so small that it would be more accurate to say we have been running in passive circles in the whole operation, rather than its actual managers.

Our role was mostly solving various technical issues, but we had very little impact on the extremely complex vortex of phenomena that had significant social importance and were taking place within our establishments. Furthermore, many of these phenomena had a negative effect on the smooth and proper functioning of these vital organs of economic life. Technological progress has enabled industrial plants to grow to enormous proportions, but due to various internal frictions, they also account for huge losses of human energy and other factors, so that in the final balance we get too little useful result to be cause for celebration. On the contrary, for us technician-managers, as citizens of the country, bear some responsibility to the public for this result, which is simply deplorable.

However, to avoid the accusation that my pessimistic view is unfounded, I must clarify where I see the greatest losses and what their main causes are.

Each of us, observing the internal life of industrial enterprises, whether participating directly in it or looking from the outside, must first admit that it is a massive arena where the interests of workers and employers clash, with productive work taking place amidst the fierce battle between these two camps.

This fact alone is enough for us engineers to reason that there must be great losses taking place in production factors, i.e. human labor, the energy of nature, and capital. Can we imagine the smooth operation of any living organism in which individual organs fight with each other, *instead of cooperating?*

Under these conditions, one can argue about which side gains more, but there can hardly be any discussion about any great benefit of such divisive work, both for the entire society and for the fighting parties. If we recall our main principle, which we follow in all technical issues, namely the coordination of all means and factors so that they work together, as otherwise, we will never achieve the desired result; if we then compare it with our actual management activity in industrial plants, where we have not had and could not even have the strength to properly coordinate the main factors, such as *labor and capital*, then I believe that we will all agree with the statement made above regarding the small results of our management activity from the perspective of general social benefits. After taking an objective look at the situation, and the lack of preparation for this role and the obstacles we faced, that it should be no surprise that none of us had, nor could we have had, the strength to take the helm of such a complex machine. I think the reader will agree with this opinion if they take even a cursory look into how we prepared for this role and the obstacles we faced.

As for our preparation, even a quick glance at the matter gives us an answer. I am not referring, of course, to pure technical knowledge, because in this respect we were prepared all too well and we must admit that in solving various technical issues encountered in management, we achieved outstanding results.

However, pure technology is not enough here. If we will consider the requirements placed on the managers of all levels in an industrial plant, then we unfortunately have to admit that we engineers were too *ill-prepared* theoretically and practically to respond well to the needs of such a complex organism, and in this *extremely convoluted* combination of phenomena where the clash of material and spiritual interests prevails, not only in internal cooperation, but also of the economic and spiritual interests of society as a whole.

It is not an overstatement to say that we have thus far concentrated our knowledge and research primarily in the field of taming the forces of nature through the building of machines and other works of engineering. We orientated ourselves perfectly in terms of ton, kilogram, milligram,—horsepower, kilowatt, meter, micron, etc., with which we constantly checked how far we were above the guide line.

However, in those areas concerning *people, human labor, money, and time*, we were ill-prepared, and sometimes even completely lost our sense of direction.

In my opinion, in industrial work we have had *only one strong point of support*, namely *technical proficiency*; but we needed an additional two so as not to lose balance in the control of the industrial plant and to harmonize the clashing currents.

One of these points should have been some kind of knowledge, based on scientific foundations, giving strict guidelines for reconciling the interests of conflicting parties, and the other – *a deep sense of our obligation to society.*

As for the first point, not only did we not have such knowledge, but we lived in an era of various narrow utilitarian theories and views which served only to introduce greater confusion in the minds of stakeholders.

The most widespread industrial management theory was: an industrial plant exists for one purpose only, *to earn profits on invested capital*, so that a financially prosperous company is useful to the country in and of itself, simply because it provided income for a multitude of workers, and increased personal capital increases overall.

It has often been said that the industry should not exist *primarily* for the benefit of the general public, because then it becomes, in a sense, a charitable enterprise, which tends to have a negative impact on the balance sheets of the plant and weakens its *productive power*.

It was a narrow, purely utilitarian way of thinking, taken a priori for granted. However, the conviction that industry and commerce should be concerned for the economic benefit to society above all else, and only then could consideration be given to personal gain, was considered idealism, dangerous especially for us Poles, so inclined to unproductive idealization and living in this fantasy world.

Such theories encouraged many industrial engineers holding leadership positions to simplify their activities and facilitate their careers. The manager who held such theories found it more convenient for them to adhere to their principles, as the vast majority of owners *cared only* for investment that gave *the highest percentages possible*, regardless of what the interest was based on.

Most industrialists considered a benevolent principle "laisse faire" for allowing you to follow all roads to profits, regardless of any social or national considerations.

The lack of culture allowed them to assert this principle in the same way as an unsocialized man suppresses personal liberty, not understanding that this freedom ends where the harm to others or to the whole begins.

A second, even *more dangerous,* theory is put forward by some directions of economic and political thought, and enjoyed almost universal recognition, namely: the interests of workers and owners *can never be aligned* because they are fundamentally contradictory. This theory thus sanctified the constant struggle and created an insurmountable barrier to the engineer, accustomed to harmonizing all the activities within the factory.

Regarding the second missing point of support, namely: a sense of *civic duty*, this feeling was not widespread among technicians, thanks to the general direction of educational upbringing, which placed too little emphasis on the development of civic virtues.

Taking all this into account, the theorem that we were not sufficiently prepared to lead such a complex organism as the modern industrial plant, and that we met impassable obstacles on our way does not seem too exaggerated.

It is no wonder we have been out of control. We were placed between *three* conflicting currents: the interests of capital, workers, and society; the last of which was the weakest.

In order to highlight main obstacles contributing to difficult conditions in the way of industrial engineers, let us take a look at the small things from the point of view of the *three* groups.

In the first, most numerous group, I would include all who regard capital as the greatest power in the modern economic life of civilized societies.

Included in this group are those who accept the theory that the success of an industry is measured solely by its prosperity, and by that very fact it is a national economic powerhouse. Also included in this group are those who hold no theory, but willingly follow the general trend, possibly just eyeing a high-paying career of their own.

The second group consists of people who prioritize above all else, the interests of the workers, whether because of their humanitarian feelings, or because they are supporters of the theory that the interests of owners and employees are fundamentally contradictory and the profit of one always ends up *exploiting the other*.

This relatively small group, when occupying managerial positions, constantly encounter contradictions in their duties, which paralyzes their creative work. For some people in this group, unable to endure these contradictions, stood in open opposition to the employer and joined political parties fighting capitalism.

The general and social importance of the professional work of this group of technicians and engineers is relatively small and can be considered only from the point of view of technical or material utility of a single class. Their activity, from the point of view of the industry itself, was destructive rather than creative.

Finally, the third group includes those engineers and technicians who consider it their first duty to act in such a way that their work will yield above all else the greatest possible benefit to the nation. They have a deep sense that the industry that gives the greatest profits for the nation also gives the greatest profits to owners and the greatest benefit to employees. In other words, that the greatest social profits derived from industry can always include the greatest profits of capital and labor, but not vice versa. These men do not deny the aspiration of capital for the greatest profits, but, on the contrary, regard them as perfectly right, and are convinced that these interests can be harmonized, but only on the basis of general social interests, and not on the basis of opposition between class egoism and the ensuing struggle.

It must be admitted, unfortunately, that this group was negligibly small. As managers, these people had almost no solid ground under their feet. The road they followed was the darkest of all, and they had to have an extraordinary strength of character and dedication to persevere.

Their best intentions were shattered by the narrow-mindedness of both sides.

For the time being, we will spare the details of the obstacles that stood in their way and return to it at the end of the paper, while pausing to acknowledge they had an extremely difficult task.

If we now sum up the results thus far of professional work of industrial technicians and engineers, from the point of view of social benefit, we unfortunately must admit that, beyond visible works of engineering, these results are relatively very small, and that the role of leadership was mostly reduced to the role of mindless drones.

III. A change of views is necessary

After such an incredible cataclysm for civilization as the world war, we must now look boldly into each other's eyes and ask ourselves whether we, technicians and engineers, followed the right path and what one has to do to benefit culture and society in the same manner humanity has benefited from the visible products of our work.

We have before us the task of rebuilding industrial life, that immense economic power on which the prosperity and strength of modern societies are based. If such concerns and questions are now troubling the minds of engineers of all civilized countries, if these questions are asked above all by the engineers of the United States, that is, a strong country with established statehood and an industry intact after our war in Europe, yet they believe that security of an endangered human culture depends on solving these issues,—how much more important is it for us, as Poles, when our nation and economy are just beginning after being so incredibly shaken by war and internal strife?

With the ever-increasing role played by technology in various fields of social life, and above all in industrial life, we must have clear and strict guidelines for our profession to make it work for maximum benefit to the whole nation.

American engineers, reflecting on the economic effects of a world war, concluded that the greatest power of a nation is in its ability to produce. They prove that the current economic system, based on the autocracy of capital, is erroneous, that capital has hitherto been regarded as the main power in economic life. This philosophy failed us; the proof in the fact that the war lasted four years instead of a few months, as all the financiers who had seen capital as the main factor in economic life, claimed that the war could not go on any longer, because funds will run out. These predictions would have been true had there not been an even more powerful factor upon which economic life is also based, and from which capital itself flows: this factor is productive work.

If, therefore, a nation *wants to be strong, it should raise their productive work to the greatest extent possible.*

I think we all came to this belief and that the slogan: “manufacturing work,” has for us, Polish engineers, an even deeper meaning.

I don't need to prove that we engineers, first and foremost, have found a calling in our work to act, so that not only our own work, but also the work which we direct, becomes as efficient as possible, and in this way to achieve the maximum useful production of which our nation is capable.

If we start from this assumption, we must revise all our past activities as managers of industrial plants, as well as adjust some of our views on our position on capital and other factors of labor.

In the hitherto development of industrial life, these two factors were, with few exceptions, opposed. Both sides took fighting positions, recognizing and believing almost sacredly that their interests are fundamentally contradictory. This belief was maintained, as I have said, by some economic theories, which ultimately held both parties to the belief that the only way to remove this conflict was through the autocracy of one of them, i.e. the *dictatorship of the capitalists or the dictatorship of the proletariat.*

Under these conditions, could the work of the technician-manager be efficient in relation to the ultimate goal—the service of the human good?

I think not. I even suppose that an industrial engineer with such ideals could fall into doubt and ask oneself: "to be or not to be?" ... Is it worth the whirlwind of clashing human passions? Will they not be used, instead of for culture and civilization, for its destruction and annihilation?

If it were really true that there is a fundamental conflict between the interests of the owners of capital, the workers, and the benefit to society as a whole, industrial engineers would have to really think about whether it's worth our time to expose our creative work to the same destruction and annihilation of all works of art and culture between the fronts of two warring armies.

I am convinced that this question has been asked of each of us more than once over the course of a lifetime. But no one lowered their fists, even though the assertion of a fundamental conflict of interest seemed so true that we ourselves were sometimes inclined to believe it. However, an inner voice told us that this was not true, that the phenomena that supposedly confirmed this contradiction were an illusion resulting from a one-sided view of things, and that the truth is there was no contradiction. But this voice does not yet give enough support for us to be able to oppose the prevailing currents.

Part II

Technical Review [Przegląd Techniczny] 1923 Vol. 61, No. 43 pp. 435-439
(*Delivered at the Congress of Mechanical Engineers).*

IV. There is no conflict between the interests of workers, entrepreneurs, and society

To have such a point of reference, instinct alone is not sufficient, of course. We technicians cannot operate on some elusive inner voice, but we must have real certainty. First of all, we should prove numerically that not only there is no fundamental conflict of interests here, but on the contrary, there is the greatest harmony.

If we succeed, then we will have an unshakable point of reference for our managerial work in industry.

I think that for us technicians, especially as Poles, it is high time to prove this claim. Taking advantage of this opportunity, I will try to present here the proof that seems sufficient to me in a few words.

Since the final result of the work of every industrial enterprise is expressed by comparing expenditure and revenue, which is the only criterion for judging material benefits or losses, it is necessary to examine whether there is any characteristic relationship between them, in other words, between the cost and production.

For the sake of clarity, I will use the graphical method, which is the most revealing.

Figures 1-4 show precisely the graph expressing the characteristic relationship between the cost and production, or rather between the cost and time.

The expenditure and revenue of every productive entity always take place over time, so the entire characteristic of the relationship between these quantities is only clear when they are presented against the background of time.

The entire characteristic of the sought-after relationship is included in graph I, while graphs II, III, and IV are the development of the first and serve only to highlight the importance of time in all production.

We will see from these graphs that time is the most expensive factor in production, that it has a strictly defined value that we can express in monetary units, so the popular aphorism "time is money" has truly real significance and should serve as the main criterion in all our activities, and not just be used as a bitter irony in the form of inscriptions in our offices, especially government offices, and finally, that rational use of time can give us incredible wealth that we can share with everyone instead of engaging in such fierce competition with each other.

Chart 1 shows the relationship between total expenses, or operating cost, and production per unit of time. The ordinate expresses the operating cost, and the abscissa - production per unit of time. The curve of this relationship is extremely characteristic, namely: it never comes out of the zero point, but always starts from a point located above zero, then, as the production per unit of time, or the intensity of production, increases, the curve ascends at varying rates, always maintaining a downward convex shape.

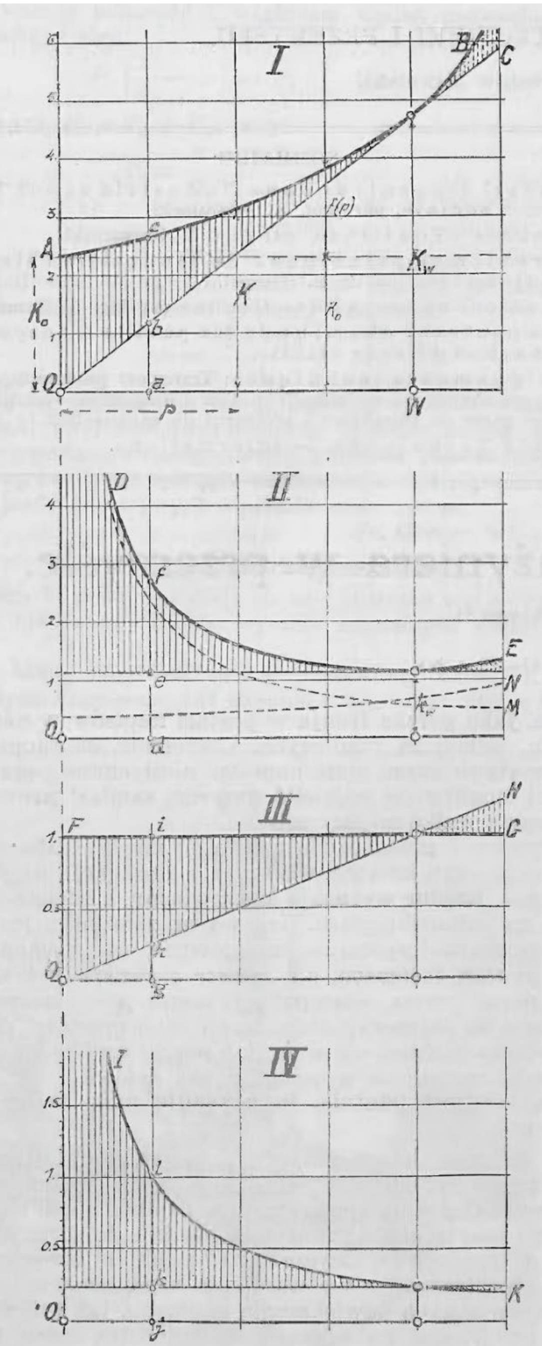


Chart 1

This is demonstrated to indeed be the case by the following observations:

1) We do not find a single organ or organism working productively, whether it is an industrial plant, a human being, or a machine, where its expenses fall to zero when its useful productivity drops to zero. Therefore, point *A* is always above the zero point.

2) We observe an increase in expenses in all productive organisms and organs as soon as we begin to increase production per unit of time. That is, curve *AB* rises upwards.

3) We do not find a single organ that does not have a certain strictly defined and unique production intensity at which efficiency it at its highest, that is, where the cost per unit of product manufactured it as its lowest.

These three observed characteristic features allow us to argue that the curve expressing the relationship between expenses and production per unit of time is precisely as we indicated above, and that if we draw a straight tangent line *OC* to this curve, the horizontal ordinate *OW* of the point of tangency will be precisely the most economically efficient standard production.

Exceeding this point, either to the left or to the right, results in losses, in other words, we do not produce as much in a unit of time as we could, which means that we waste time, or we produce more than our internal system allows, we work with overload, in other words, we work too fast.

We observe from Chart I that our total operating cost as always consists of two sums:
a) useful cost *ab*,
b) loss *bc*, resulting solely from the loss of time or overload, if we are outside of the standard, or optimal, production rate.

Graph II was derived from Graph I by dividing the total operating cost by production per unit of time, so curve *DE* expresses operating cost per unit of production. The smallest cost K_w falls at the standard production intensity (*de* is the useful cost, and *ef* is the cost of lost time for each unit of production).

Notably, Chart I is a graphic expression of one of the most general laws of nature, namely, that all phenomena of energy and matter transformation always have a strictly defined speed at which they occur most economically.

We can observe here that since the total operating cost per unit of time never drops to zero, which means that even during idle operation, we always incur certain costs - and these are usually quite high - the operating cost per unit of product quickly rises as the intensity of production decreases, with this increase reaching towards infinity. The ordinates of the curve *DE* are the sums of the ordinates of hyperbola *M* and curve *N*.

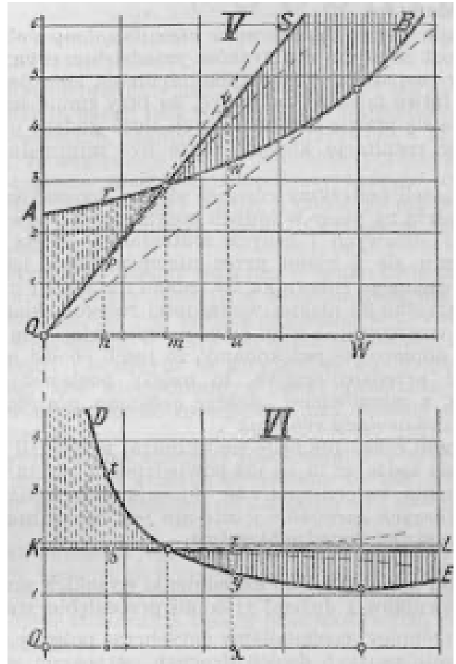
We must recall here that graph I shows the total operating cost per unit of time, which, in other words, means that curve *AB represents the cost of one unit of time or more strictly, the price of time*. Of course, this price of time is not the same for all operations and varies depending on the intensity of production.

To further illustrate this extremely important characteristic of operating cost, I will remind you of the comparison I used in 1908, presenting the first outlines of my theory of the flow of operating costs and the method of work harmonization to the Association of Technicians. I said then that we can look at each industrial plant as a faucet through which gold flows, meaning that it is only regulated to a certain extent by production. And if we want this gold not to be wasted, we must develop the maximum production per unit of time. This main property of this faucet is presented more precisely in Chart I.

Chart III is only an illustration of the assumption made in the first chart, namely, that we are talking about production per unit of time, that is, the vertical coordinates of the straight line *FG* can be considered as the total cost of time at different production intensities.

By drawing the straight line *OH*, we divide the total time cost into two parts: the time *GH* is used effectively, and the time *HI* is wasted uselessly.

Chart IV results from Chart III by dividing the total time cost by the total production made during that time, that is, it expresses the time cost per unit of production. Curve *IK* is, of course, a hyperbola and clearly shows the enormous time losses that individual production items contain if the production (work) intensity is low (*jk* is useful time, and *kl* is wasted time per unit of product).



Fig, 5 - 6

All of the above charts give us a clear idea of the value of time and the losses resulting from the dispersion of this precious factor.

If we consider that the curve *AB* of operating costs of not only our industrial plants but also of all social institutions, especially government ones, and also the average curve of expenses of all citizens of our country are located very high and approach horizontal lines passing through the standard point, and then to extremely low production intensity, in other words, low work efficiency, I believe I can say that our entire nation treats time barbarically and destroys the lion's share of wealth in the form of wasted time (Figure 2).

Having achieved a record low work efficiency among all industrialized nations, we no longer represent a faucet through which a thin stream of gold flows, but we instead allow the entire river of gold flow through us to draw only a small stream in the form of useful production, which we all rush to obtain, achieving a second record, in the form of high prices.

I am making this small deviation from my topic to emphasize, on occasion, that the tragic state of our finances and all the misfortunes associated with it have their main source in the lack of savings and our low work efficiency, and until we increase it, the stabilization of our economic and financial situation will be the work of Sisyphus.

But let's get back to our argument.

Proving our statement will be easier if we express production, or income, in the same units as expenses, namely in money, in the form of sales value, and if we also place it on the vertical coordinates.

Therefore, we must multiply production by the selling price. Of course, the selling price depends on supply and demand and is a variable quantity. But we can consider it constant if we assume that there is a continuous equilibrium between supply and demand, regardless of whether we produce little or much per unit of time. In that case, we can assume in our charts that the unit price of production is constant. By multiplying the quantity of produced goods by the unit price, we obtain the total sales value, or our total revenue, which will be expressed by line *OS*, originating from the zero point (Figure 5).

In this way, we will obtain Chart V, and from it Chart VI by dividing the vertical lines by production, which will represent our operating cost and selling price per unit of production.

A closer analysis of these charts will allow us to prove our theorem of the alignment of interests.

Firstly, we see that the company's profits can be discussed only when the straight line of the sales value intersects with the cost curve, and further, that profits begin only when production exceeds the point *m*.

If an industrial plant achieves a productivity less than *Om*, it has losses expressed in unit time by the size of *pr*, and in unit production by the size of *st*, while in the case of production greater than *Om* it has profits expressed in unit time by the size of *wv*, and in unit production by the size of *yz*.

Chart V - revenue and cost per unit of time - contains the whole mystery of reconciling seemingly conflicting interests that we spoke of earlier, and not through some artificial compromises, but with the help of real achievements of technology and rational methods of using the immense wealth with which nature has endowed us.

Let us first consider Chart V from the point of view of increasing the profits of the enterprise.

First of all, it is noticeable that we have three ways to do this, namely:

Method 1
Deviating line *OS* upwards, which means selling the product at the highest price. This path is the most known, as it does not require great wisdom to pursue it, but it operates under the inexorable law of supply and demand, and if we go too far, the consumer will "settle with us" by reducing demand. He demands a large amount but wants the product to be cheap.

Therefore, raising the price has a limit beyond which we cannot go. Although this path seems easy, it does not lead to the highest profits because it is blocked by an inexorable obstacle. I would say that this is a blind path that short-sighted people eagerly embark on, who are only interested in short-term profits.

Method 2
Lowering the curve of operating costs *AB*.

This path can take us much further than the previous one, but it requires much more knowledge than simply raising the selling price. The operating cost consists of a whole series of positions, lowering of which requires a large technical and economic knowledge.

We are dealing here with a multitude of streams of gold, so intricately interconnected and dependent on each other and on various external factors that we need exceptional knowledge and talent not to get lost in this labyrinth.

This is not a way of immediate action. We can go very far on it, but we will encounter great resistance if we try to break through using short-term measures. If we are guided here by ordinary blind savings, we will not go far, and such behavior could be called plundering.

Method 3
Chart V shows all too clearly that a company's profits can be increased by increasing production per unit of time, or in other words, by increasing the productivity of the entire plant.

This path could be called *time-saving*.

This path, just like the path of lowering the curve of operating costs, opens up extremely distant horizons. This becomes even more apparent if we compare the efficiency we usually encounter in practice with what an industrial plant and all of its cells could develop, i.e., with its model production.

A deeper examination of this matter usually shows an astonishingly low efficiency, which is the reason why a very large part of the entire stream of gold flowing every minute, hour, day, etc. is wasted uselessly due to lost time, and only a small fraction goes to actual benefit.

However, the path of saving time, just like the previous one, which could be called saving costs, is not easy. To avoid getting lost, one must also possess great technical and economic knowledge. One cannot walk on it for long in a predatory manner, aiming only at immediate profits.

To find rational methods of action on the last two paths, one must thoroughly analyze all the streams flowing, all their properties, all the factors on which they depend, and their mutual dependence.

I would go too far if I were to develop this entire analysis now, but I must shed some light on this matter in a few words, as it is necessary to prove our theorem.

Upon careful consideration of the stream of operating costs, we can notice the following four main components of the streams, namely:

For each vertical ordinate of the cost curve, we can write the following equation:

$$\underbrace{K}_{\text{total operating cost}} = \underbrace{\Sigma Q_1 C_1}_{\text{cost of raw materials}} + \underbrace{\Sigma Q_2 C_2}_{\text{cost of purchased materials}} + \underbrace{\Sigma T_1 C_3}_{\text{cost of labor}} + \underbrace{\Sigma T_2 C_4}_{\text{cost of capital}}$$

Each of these components is always a product of quantity and price, so we have:

Quantity	**Unit Price**
Q_1 - quantity of raw materials	C_1 - unit price of raw materials
Q_2 - quantity of auxiliary materials	C_2 - unit price of auxiliary materials
T_1 - amount of human labor time	C_3 - wage per hour of human labor
T_2 - amount of capital labor time	C_4 - wage per hour of capital labor

We are dealing here with 8 types of factors. Of course, depending on the company, there may be dozens, hundreds, or even thousands of such factors of each type.

Each of these main four streams is dependent to varying degrees on the production intensity, which can generally be expressed as a function:

K_a	+	$f(p)$
fixed cost at low capacity		variable cost

We have here the most diverse combinations of these quantities, but only in one group, namely in the costs of raw materials (Q_1C_1), $k_0 = 0$, and the function f(p) takes the form of a straight line *OM*, which means that the operating cost of raw materials is proportional to production (Fig. 7).

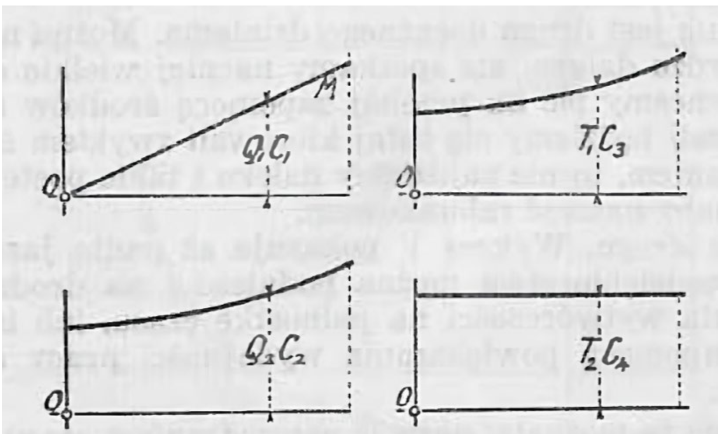


Figure 7 - 10

In all other K_0 groups, it never drops to zero, and the curves of individual costs have a similar shape to the curve of the first graph with various slopes extending to straight horizontal lines. In other words, some of them are streams of constant thickness, completely independent of whether production is small or large. We have a case where f(p) = 0.

To the latter type of costs, we can include almost all costs of the 4th group T_2C_4, i.e., capital costs.

Next, all of the above-mentioned factors in the 8th category are not independent of each other. On the contrary, there is such a close and complex relationship between many of them and it cannot be predicted in advance that reducing one of them will also reduce the total sum of operating costs.

However, by examining this relationship in more detail, we can easily see that there are many factors that, when reduced, increase others, often to such an extent that not only are no savings achieved, but on the contrary, the total operating cost increases.

This can also result in a decrease or increase in production. By delving deeper into this issue, we realize that the relationship between all the factors that make up operating costs and production is so dependent on the organic properties of the enterprise along with external factors that rational behavior through cost and time-saving measures requires great knowledge and skills to orient oneself in such a complex organism.

As an example, one can mention Taylor's 25-year study of metal processing, which ultimately comes down to finding the best way to save costs and time.

But if we possess such knowledge, then striving for the greatest profits of the enterprise leads to an inexhaustible source, because lowering the curve of operating costs and increasing production has almost no limits, as there are no limits to technical and economic progress that tend toward the highest coefficient of useful efficiency and increasing production.

Let's now consider the issue from the perspective of the factor C_3, which is the wage per unit of human labor time.

If we run an industrial enterprise and with complete knowledge of these factors, as we strive to reduce costs and increase production intensity, we will find that the factor C_3, which is the wage per hour of human labor, has the outstanding property that reducing it usually has a very negative effect on the operation of the entire enterprise and usually entails an increase in other expenses, as well as a decrease in production, that is, it yields the opposite results and ultimately reduces profits.

The principle of "*cheap but dissatisfied worker*" is directly lethal to the profits of the enterprise. If we consider only the stream of labor costs, we can easily see that reducing [hourly wages] C_3 almost always increases T_1, the number of labor hours used, and thus the benefit may be minimal or nonexistant.

However, if we also calculate the losses caused by this savings on wages in other positions:

1. increasing the amount of raw and other materials, thanks their poor handling by an unskilled, lazy, and dissatisfied worker,
2. damage to tools and machines, and above all,
3. low efficiency of the entire plant, far from the ideal standard, and therefore a loss resulting from waste of time,

only, then will we realize that when it comes to high profits of the enterprise, we should apply the opposite principle, namely "*well-paid, but first-rate and satisfied worker*."

Due to lack of time, I will not dwell on this matter any longer here, but I believe that what I have already said is enough to prove the statement that the employees' pursuit of ever-increasing wages is not at all inconsistent with high profits of the enterprise.

V. Measures to reconcile high employee wages with large company profits.

We, the technicians, have had a powerful tool for pursuing both these paths in the form of various improvements and technical methods.

Now, a new and equally powerful tool has emerged on our path, which today can confidently be said to play no less a role in the development of civilization than the machine. I mean the science of work organization.

Just as technology used to be an art and a matter of talent for only a few people before the introduction of the machine, yielding meager results, organization in the previous era, being a matter of innate talent, also produced limited outcomes. However, now that it is grounded in scientific principles, it unveils vast new horizons for progress, poised to become the next formidable lever at our disposal.

Having in our hands two such tools as technology and organization, we technicians, looking at the flowing streams of gold, can confidently say that they are sufficient for high return on investment and for such remuneration of the employee that he can enjoy all the achievements of civilization.

And now let us look at our charts from the perspective of benefits to society.

If we apply all the best technical and organizational methods to achieve the furthest benefits of for workers and capital, that is, if we go in two directions: vertically, reducing our operating costs, and horizontally, towards increased work efficiency, we will obtain a large quantity of products, each unit of which will cost us little. What does this mean? A large quantity of goods at low operating costs. So, a large supply of cheap goods, which means that here too, there is no conflict with the interests of the community, but on the contrary, it is the solution to the most vital economic interests of the entire nation, as there is a possibility of satisfying broad masses of society with increased purchasing power thanks to high employee wages. In other words, this is the only path to the wealth of the whole nation.

So, productive work of the highest quality is the magical means that can heal the greatest social wound.

A clear and deep understanding of the entire phenomenon of the flow of various values within all enterprises gives us this second strong point of support we are looking for. The third point of support is a deep sense of civic duty.

If, based on this foundation, we apply rational methods of technology and the science of work organization, we can be sure that we will solve our most important problem, because we will create the economic power of the whole nation, drawing it from all natural resources, and above all, from the greatest one, which is human labor and genius. (d. n.).

Part III

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VI. Difficulties in the way of increasing productivity in industry.

But gentlemen, this is not an easy path, on the contrary, it is very difficult, especially for us Poles.

As technicians, who are accustomed to measuring and analyzing everything, we must of course also be fully aware of all the difficulties we encounter on this path, because otherwise, these difficulties can easily lead us astray or paralyze all our efforts.

In the first part of this paper, I already pointed out some obstacles, but I believe it is necessary to further reflect on them, as this will give us the opportunity to clarify our position.

I would divide these obstacles into three categories:

1. I would include all those obstacles that every technician and organizer always encounters on their path, such as inertia of habits, i.e. conservatism, various technical obstacles, lack of material resources, imperfection of known methods, and so on.

These are all obstacles that could be called natural and that can always be overcome with good will, perseverance, technical and organizational knowledge.

In the second and third categories, I include all obstacles arising from narrow-mindedness, lack of socialization, and blind egoism of both sides concerned, that is,

2. obstacles on the part of capital owners, and
3. on the part of workers.

I will not discuss the obstacles of the first category here, but I consider it necessary to reflect a little on the remaining two.

Obstacles on the part of business owners.

First and foremost, it should be noted that the vast majority of business owners do not understand the entire mechanics of cost flows. Most of our businesses do not make cost comparisons, and those that do, use systems that give no insight into the subtlety of this mechanism, and above all, of such an immensely important and expensive factor as time, as well as the beneficial impact of productivity intensity on the final outcome.

In this regard, it could be said that entrepreneurs looked at their costs and revenues as if they were in only one plane, that is, they only saw one pair of vertical coordinates, and did not understand what would happen if production started to decline or increase.

This narrow view became even narrower due to the exaggerated concept of the power of capital held by the owners, a very weak understanding of the meaning of the coefficient of useful labor productivity, and above all, a lack of consideration for the future and only a desire for immediate profits, regardless of the paths and methods leading to them.

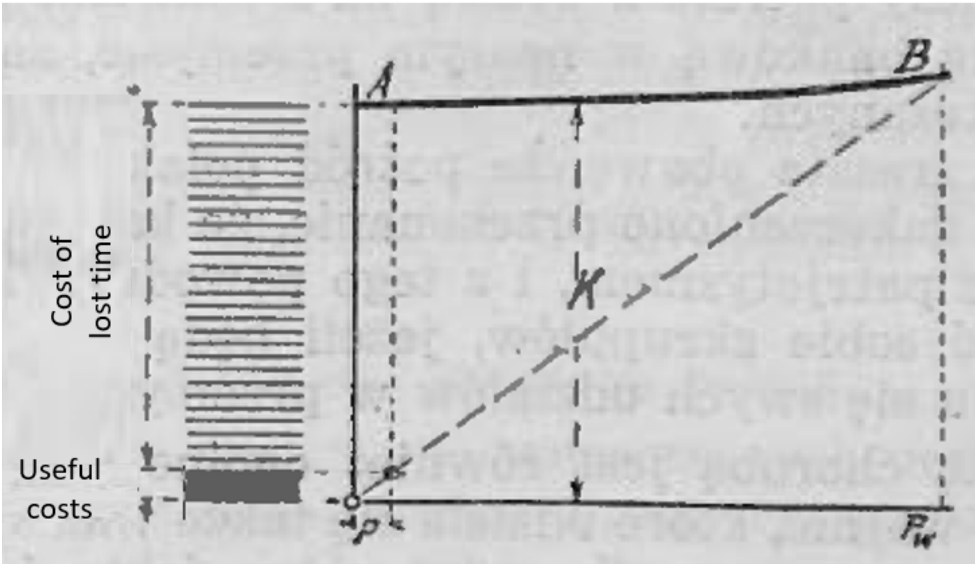


Figure 11. The ratio of lost time costs to useful costs

This narrow-mindedness often justified methods that were inconsistent with the simplest ethics and directed the entrepreneur's attention to wage labor and the squeezing of selling prices as the main sources from which the largest profits could be derived. In addition, various speculative methods were used to obtain the largest immediate profit.

As evidence of this, I could cite hundreds of different characteristic examples, which also indicate that this narrow-mindedness was not an exception but a widespread phenomenon. It is enough to mention the history of piece-rate wages, so truthfully described by Prof. [Alexander] Rothert.

Some even believed in the socialist postulate that their interests and the interests of the workers were contradictory, and that profit could only be obtained by saving on labor costs.

By emphasizing these negative aspects of employers, I by no means claim that all of them were like that.

On the contrary, there were exceptions, sometimes very prominent ones, there were people who wholeheartedly wanted to avoid constant conflict with workers and improve their well-being. Unfortunately, their efforts were usually thwarted by the narrow-mindedness of the other side and the resistance of external factors.

Generally, however, I must state that the main bulk of enterprises represented an environment in which, easily and extensively, moral-poisoning microbes proliferated, which poisoned and still poison many technicians who manage industrial enterprises, as there are many among them who spare no means to achieve easy and immediate profits. As proof, I can cite such a widespread phenomenon as the collection of so-called "commissions" from suppliers, or anywhere possible, a phenomenon that is an open secret.

There is no doubt that a technician or engineer walking the rational path and not compromising on ethics encounters great difficulties in such an environment.

Generally speaking, with very few exceptions, business owners consider this type of manager at least as dangerous to their interests as representatives of workers and political parties who openly seek to overthrow the capitalist system.

These difficulties did not diminish the moment we became an independent nation. Our rebuilding of industry is not in better condition in this regard than it was before the war, I would even say that to a certain extent, it is worse. This deterioration is due, in part, to the excessive influx of banking capital into industry, along with people who understand less about the internal workings of industrial enterprises than did the average industrialist of the past, especially since banking interests often conflict with industrial ones.

Along with the bankers, as financial managers of enterprises, come speculation and an even greater desire for immediate profits.

If we can be somewhat pleased that our banks have bought up a significant number of factories from foreign hands, especially in the former Prussian partition, as well as facilitating the launch of our industry after the war, on the other hand, we must look with concern at this phenomenon of saturation of our industry with banking, for the reasons mentioned above.

Furthermore, I fear that among Polish financiers, there is a strongly ingrained belief that capital cannot be reconciled with patriotism, and therefore, they will not hesitate to sell their shares in industry to foreign hands if they see their interest in it.

Another major problem is the general deterioration of moral standards after the war, which has also affected many technicians working in industry. Various facts indicate that some managers have no scruples, for example, when it comes to the state treasury.

Obstacles on the part of the workers

Now, the third category of obstacles, of the same type as the previous one, but from the side of workers.

It would be strange for a worker to take a higher and more rational position when the other side has such narrow horizons. In these conditions, it would be strange if the worker did not believe in the deadly theory that his interests are directly opposed to those of capital, that the capitalist mercilessly exploits him, that all wealth is the result of the worker's labor, and that he can improve his lot only through an uncompromising struggle, up to the overthrow of the other side.

I do not need to prove how great an obstacle this is for managers who want to take an evolutionary path to improve the well-being of workers, through increasing the efficiency of their work, the efficiency of machines, saving materials and natural resources, and all the achievements of technology and organization.

Convincing the worker that this is the only way to his lasting prosperity is a difficult task when the worker has long had tangible evidence that the employer usually did not follow this path. Such conviction can only be gained over time. Not through logical reasoning but through tangible facts.

However, this conservatism of the worker's beliefs would not be such a great obstacle because the worker is accustomed to looking at life through the logic of facts and simple honesty, and therefore, he can easily change his beliefs when faced with opposing facts. Unfortunately, an external factor appears here that by no means wants the worker to realize that his interests are not contrary to those of the employer. I mean here the leaders of some directions of the labor movement who ruthlessly combat any attempts to improve the welfare that do not come from their own initiative.

As evidence, consider, for example, [Ferdinand] Lassalle's book titled "Schultze-Delisch" or "Capital and Labor," which ridicules Schultze-Delisch in the most caustic way for his activity aimed at improving the welfare of workers through self-help.

Systematic attacks by socialist leaders against profit-sharing systems, which were sometimes referred to as a fig leaf to cover capitalists' indecent parts, portraying the system as one of the forms of worker exploitation by capitalists, are also a danger because of its attractive name.

I would also like to remind of the fierce opposition by socialists to the Taylor system, which aimed to organize work in such a way as to reconcile high worker wages with large capital profits. In Russia, socialists, before coming to power, referred to the Taylor system with the following sentence:

"There are three kinds of lies: lies, damned lies, and the Taylor system."

For a long time, I did not understand such a socialist position, which proclaimed above all the welfare of workers. However, my eyes were opened when, as a manager of industrial plants, I experienced for an extended period with the methods of socialist leaders.

Surprised by the workers' resistance, which almost always ended in a strike whenever I wanted to increase the wage rates on my initiative, sometimes considering them low, I once asked one of the most zealous opponents in private why he so eagerly agitated among the workers not to agree to such a beneficial change. I received the following extremely characteristic and instructive answer: "Oh! How naive you are, sir. Raises will come when we want them, but not when the director wants them."

For the leaders of this movement, their primary concern is political power, and the workers' issue is only a means to achieve this goal, so they do not hesitate to undermine the workers' welfare if it is necessary to maintain agitation, strengthen their authority, and keep control over the workers. That is why those who would like to use genuinely effective means to increase their income are considered their greatest enemies, and they fight them even more bitterly than capitalists themselves.

These factors, bringing the workers' issue to the political ground, have made it an instrument for realizing their plan. Although political parties that allegedly look after the workers' interests sometimes express the need to increase work efficiency in theory, in practice, they use methods that undermine the possibility of such improvement, which destroys the main, and actually the only source of welfare for both workers and the entire society.

I will not discuss all of these methods here, but I will point out the most important ones.

1. Socialist demand: payment only for time worked, not for useful work output.
2. Ruthless fighting against wages that encourage increased work efficiency and take into account the individual abilities of workers.
3. Strikes as the most effective remedy for improving the welfare of workers.
4. Propaganda of the idea of freedom of strikes as a cultural achievement and a democratic progress.
5. Struggle against machines and organizational methods aimed at increasing work efficiency under an absurd but very attractive slogan that increasing efficiency leads to an increase in unemployment.
6. Fighting against the idea of freedom of work.
7. Reducing the number of working hours to the same level regardless of the types and degree of difficulty of the work, and regardless of the fact that, in many cases, it leads to the spread of idleness.
8. Instilling in workers the belief that only physical labor has real value, while mental work can be considered something that can be done without. The less educated masses draw the conclusion that those engaged in intellectual work live at the expense of the worker and must be fought.

   In industrial work, such an ideology undermines the most important basis for cooperation, namely the authority of the manager and the discipline of the worker. The result is the same as if we had cut all the connections between the piston and the crankshaft in a steam engine. Instead of an atmosphere of cooperation, an atmosphere of hatred is created, in which, of course, there can be no talk of productive work. A series of violent attacks on managers, which we so often witness, usually stems from this source.
9. Using terror in its wildest forms against all those who dare to doubt the beneficial effects of these methods and try to resist them.

Any manager who wants to oppose these methods arms himself against a whole phalanx of opponents who present such managers to the working masses as the most ardent supporters of "exploiters" - capitalists, and the most dangerous because they act hypocritically.

The fight against these factors is incredibly difficult because these forces usually operate in secret and play on the worst human instincts.

I believe that this brief article is sufficient to realize the difficulties that a technician and engineer, as a manager in industrial plants, encounter on their way if they set themselves the clear goal of harmonizing the interests of workers, employers, and the whole nation, and if they are guided not by some elusive methods based on vague ideals, but by methods resulting from strict engineering calculation.

These are great obstacles, and to overcome them in the position of a manager, one must, in addition to great technical and organizational knowledge, possess extraordinary strength of character, nerves of steel, civil courage, great faith in a good cause, and a deep sense of civic duty.

But however difficult and thorny this path may be, we must walk it boldly and persistently, and this is precisely where I see the great significance of our work in social terms.

Many of the issues I have raised here belong to the category of so-called "sensitive" issues that public opinion believes should not be publicly discussed. However, this is an ostrich policy. I have a deep conviction that we, as engineers and citizens of the country, should avoid such a policy. We must clearly realize the situation in which we work.

Closing our eyes to various harmful phenomena that we encounter on our way would be far more harmful and would be the same as not paying attention to unpleasant symptoms of the machine we operate when something starts to go wrong, waiting for it to completely stop working.

After the material and moral catastrophe brought by the war, today engineers from all civilized countries are considering all these issues and searching for principles to guide their professional work in order to achieve the highest possible productivity coefficient from a general societal perspective.

Therefore, I believe that the time has come for us to take stock, to boldly face the danger, and to search for ways to combat the phenomena that destroy our work and undermine the existence of the whole society, to seek ways to heal the deep wounds that we encounter at every step in our professional work.

I believe that we will find the best ways to combat all these obstacles, precisely because science now provides us with two types of weapons: technical knowledge and scientific work organization. However, even if we use these two types of weapons in the best possible way, they will not be enough unless we add to them one more weapon in the form of a deep faith that we work for the good of the whole nation.

Conclusions

1. Considering that, under rational management of industrial enterprises, there are no fundamental contradictions between workers' pursuit of the highest wages, enterprises' pursuit of the highest return on investment, and the highest benefits for the whole nation
    a. The Congress recognizes that technicians and engineers should adopt this principle as the main basis for their professional work in industry, striving to ensure that all technical and organizational methods for managing industrial enterprises are primarily aimed at harmonizing the above-mentioned objectives with the good of the whole nation;
    b. The Congress recognizes that the only ways to achieve such harmonization are through rational reduction of the costs of production and increasing the useful productivity of human labor and all natural forces that industry uses, i.e., striving for the highest productivity.
2. Considering that our industrial plants are generally backward in terms of technical equipment, burdened with non-productive capital equipment, and almost completely lack planned and scientific organization in management and work methods,
   The Congress recognizes that there is an urgent need to:
    a. rapidly introduce modern equipment and rational technical methods of production;
    b. apply scientific methods of work organization and management.
3. Considering that knowledge of scientific work organization is still too limited in our country, the Congress recognizes:
    a. that it is an urgent need to take necessary steps to energetically disseminate and deepen this knowledge;
    b. that one of the most effective means to achieve this goal is to establish proper scientific study of work organization in higher technical educational institutions, equipped with appropriate training and research facilities for various work organization issues.
4. Considering that, in managing production work in industry, a great sense of civic duty and a great reserve of moral virtues are essential,
   The Congress recognizes:
    a. that in educating technicians and engineers, the cultivation and development of these virtues should be given top priority.
5. Considering that the best way to nurture these virtues in practical life is through the opinion of colleagues, the Congress recognizes that all associations and unions of engineers, technicians, and workers of all categories should strive to strengthen this opinion and place it at the highest level.
6. Considering that the currently prevailing erroneous concepts in the realm of workers greatly hinder and lower work efficiency, and that these erroneous concepts mainly stem from the fact that political goals often prevail in workers' unions rather than professional ones, the Congress recognizes that it is necessary for workers' unions to step down from political ground and stand solely on professional ground.
7. Considering that any stoppage of production work always harms the entire nation, the Congress recognizes:

   a. That strikes and lockouts always bring great harm, both to society as a whole and to the fighting parties, and therefore workers and employers should cease to use these means of conflict, and settle all disputes in an amicable way.
   b. The Congress recognizes that with good will on both sides, it is always possible to avoid resorting to strikes and lockouts.
   c. Therefore, the Congress recognizes that careless use of strikes and lockouts is a serious offense against the entire society.
8. Considering that the banking intervention in industrial life dating back several years often places technical and organizational principles aimed at reducing production costs on a lower priority, which should be the chief postulate of our industrial policy during the period of treasury recovery, the Congress draws attention to the importance of this matter.
9. The Congress believes that the principles aimed at reducing production costs through technological and organizational progress should be secured in governmental agreements with private manufacturers.

The Congress believes that in state-owned factories, especially those concerning national defense, cost control should be organized impeccably and should decide on all changes in the nature of the enterprise.

PRZEGLĄD TECHNICZNY

Pierwszy międzynarodowy kongres naukowej organizacji pracy

PRZEGLĄD TECHNICZNY

Harmonizacja jako jedna z głównych podstaw organizacji naukowej.

PRZEGLĄD TECHNICZNY

I Międzynarodowy kongres mechaniki technicznej

Harmonization as one of the main foundations of scientific organization (1924 Article Series)

Forward to the English edition:
In this series, Karol Adamiecki identifies the lack of coordination or "harmonization" between departments and work cells as the biggest waste in industry; contributing to idleness and underwork in some areas, while leaving the machines and workers in others overutilized and overburdened. Just as in musical harmony, the goal of the plant manager is to ensure "each sound is played at the right time, neither earlier nor later. In this regard, the role of the composer is similar to the role of the manager: both aim for harmony, the musician in terms of the harmony of the sounds, the manager in terms of the harmony of the work elements."

The article is divided into three parts, covering the following topics:

1. *Introduction and attempt at harmonizing actions: The importance of proper coordination and timing in work processes.*
2. *Cost of time: The significance of time costs in production systems, as well as the importance of level-loading.*
3. *Harmony in the selection of cells and harmony in action: The interconnectedness and interdependence of elements within a production system.*
4. *Analysis and planning of collective work using graphical methods: Introduction to the "Harmograph" visual management tool for planning and better understanding of plan versus actual.*
5. *Laws of economics as the basis of the science of organization: The article concludes by discussing the role of harmony as a fundamental law of economics, which influences work organization and efficiency.*

In addition to the theoretical aspects, Adamiecki includes case studies and outcomes from utilizing his methods of graphical analysis and harmonization. These examples provide valuable insights into the practical application of his ideas in real-world settings.

Part I

Technical Review [*Przeglad Techniczny*], 1924, Vol 62, No. 49, pp. 551-554

Works cited:
Chapman J. C.: Trade Test. Henry Holt, New York 1921. Cowdrick E. S.: Industrial History of the United States, Ronald Press Co. New York, 1923; also, Manpower in Industry. Henry Holt, New York, 1924; Fleming and Pearce: Research in Industry. Henry Holt, New York, 1924; Link H. C.: Education and Industry. The Macmillan Co, New York, 1923; also, Personnel Administration. McGraw-Hill Press Co. New York, 1923. Mann, C. R.: A study of Engineering Education. Carnegie Foundation, New York; Thompson S. E.: Underground Management in Bituminous Coal Mines, 1923: Yoakum and Yerkes, Army Mental Tests. Henry Holt, N, Y.. 1920. Other references: The Applications of Psychology to Industry; Atlantic Monthly; Bulletin of The Taylor Society; Chemical and Metallurgical Engineering; Journal of Industrial Hygiene; Psychology in Business

(Annals of The American Academy of Political and Social Science); The Psychology of Vocational Selection; Vocational Guidance.

Paper I presented at the International Congress of Scientific Organization of Labor, in Prague in 1924.

Note [original]: The text includes historical and technical terms that may require additional context for a complete understanding.

I. Introduction.

In March 1903, F.W. Taylor presented his principles and methods for the first time, stating that the fundamental issue of organizing work should be solved based on scientific principles, rather than relying solely on intuition, as it had been done previously.

Coincidentally, in February of the same year, during a lecture I gave at the Technical Society in Ekaterinoslav [Dnipro] (the center of the South Russian mining and metallurgical industry), I expressed the same idea and presented the main outline of the method of organizing collective work. This lecture was a report on my first works and research in this direction, which had started in 1895.

Since these studies later led to the establishment of a general principle based on one of the three fundamental laws of economics that guide organic nature towards the highest economy, and since this principle, when applied in practice, either by me or my colleagues, always led to a significant increase in work efficiency and savings in costs, and because this principle, as I believe, is still little known and underdeveloped, I am encouraged to present it for further development and application of the science of organization.

II. Attempt at harmonizing actions.

My research in the field of organization began with a seemingly trivial issue: I had to solve the problem of increasing the production of a small ironworks unit. The daily production of the team of workers involved in rolling thin sheet metal seemed too small to me. At first, I thought that the reason for this was the sluggishness of the workers, especially since the foremen, brought in from outside of the country and considered to be first-class specialists, saw this as the reason for the low productivity, sharply criticizing our workers. This hurt my sense of national pride, especially when upon closer observation, I realized that the workers were working diligently.

I began to study more closely and search for other causes, taking note of the time required for each individual operation with the help of a stopwatch with a second hand. The research was not easy, as I had to do it surreptitiously so that the workers would not think badly of me and harm my reputation as a young assistant to the chief engineer. Over several months, I gathered a lot of data, but I could not make sense of it until one day I came up with the idea of plotting it on charts. I immediately noticed a major cause of the large amount of time wasted due to the lack of coordination among the various operations.

I plotted my data on charts in the form of a series of parallel lines, similar to those used on the perforated paper rolls of mechanical pianos (pianolas, angelus, etc.). This chart showed several areas of congestion and large gaps, but most of all, it showed a great deal of variation. It was clear that even minor delays in some of the less significant operations would later cause significant gaps in other operations or excessive crowding. In other words, the root cause was a lack of coordination in the timing of individual movements and operations.

The factory involved in this study used two pairs of rollers and three furnaces, operated by a crew of 16 workers.

As is well known, this work involves rolling flat iron of the appropriate weight and dimensions, subject to multiple heating and rolling until the material reaches the desired dimensions. During rolling, individual pieces are rolled first singly, then doubly or quadruply, in the form of so-called "packets." Each packet thus goes through a series of alternating operations involving multiple heatings and rollings, along with a series of different additional activities such as loading into the furnaces, feeding into the rollers, arranging in packs, etc. The whole series of operations lasts from one-half to one-and-a-half hours, depending on the size and thickness of the sheets, and individual operations last from several seconds to half an hour. We have here a typical collective work of technical equipment and people.

On the graphs mentioned above, I arranged the individual main operations on the horizontal direction [x-axis], and the time scale in the vertical direction [y-axis]. The lines drawn along this scale under each operation indicated the beginning, duration, and end of the given operation.

Looking at such a graph, which in a sense is a cinematographic diagram of all activities, a lack of harmony was noticeable both in the vertical and horizontal directions. It was evident that for obtaining a high production rate, the speed of individual operations was of secondary importance, while it was starkly highlighted that the main reason for low production was the fact that individual activities rarely took place at the right time, which caused interruptions or overloads.

A similar phenomenon, albeit on a smaller scale, can be observed when several people carry a heavy load. If the movements of all these people are not mathematically consistent, according to a certain sequence, there will be an uneven distribution of the load, overloading individual people, and as a result, a lot of energy is expended with little useful outcome.

Having found this main cause of the low efficiency of the studied group of people and equipment, I naturally asked myself what production could be achieved if the lines were arranged in a strict order, consistent with the logic of the process. Since the idea of directing work according to a pre-arranged chart came to mind, like conducting an orchestra with individual instruments using sheet music, I believed that it would be better to start at a slower tempo, but harmoniously. To simplify the issue, I took the duration of each operation as a starting point, not the shortest possible, but, on the contrary, even slightly longer than average. After making several such test charts, I selected the one presented in Fig. 1.

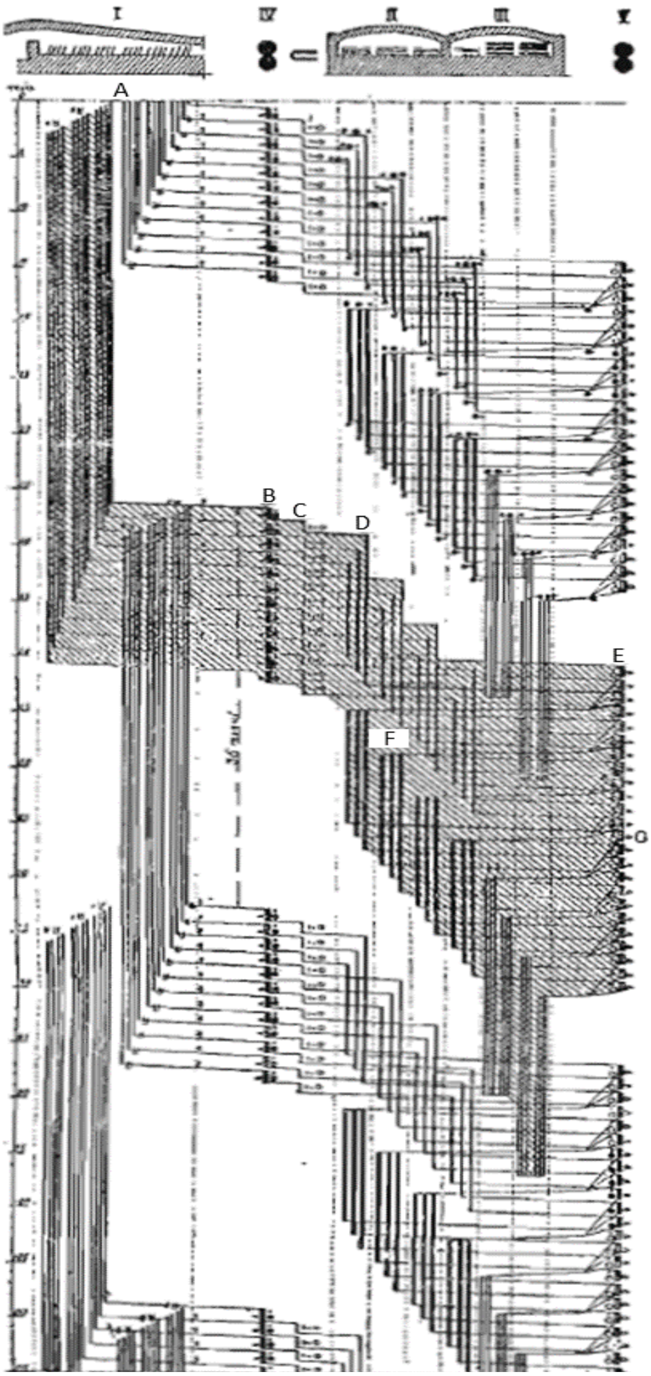


Figure 1 - Harmonograph characterizing the time consumed for individual activities

The A lines represent the time of the first heating of each packet (13 pieces) in furnace No. 1.

Line B shows the time of the first rolling on the first pair of rollers, No. IV.

Line C shows the time for bending double packs into quadruple packs.

Line D shows the time of the second heating in furnaces No. II and III.

Line E shows the time of the second rolling on the second pair of rollers, No. V.

Line F shows the duration of the third heating, and so on.

In this graph, we see the entire history of each finished pack, i.e., all the individual operations to which it is subjected during the entire process. The course of operations of one sequence is shown on the graph by slightly thicker lines. The shaded bars represent the history of a series of packs, which is referred to as a “batch.” The vertical scale, in this case, is expressed in minutes. We can see, for example, that the total time for all processes for one pack is about 90 minutes. The rate of work could be called the time intervals between one batch, or series, and another; the rate, in this case, is 36 minutes.

Of course, the spaces between the lines represent stops in the work, that is, the idling of individual machines.

A casual glance at the chart shows that it is not a graph of the highest efficiency that could be achieved from the given devices - furnaces and rolling mills; we see that the waves after each series could still be brought closer together, but only to the limit of touching the lines of the IV-V rollers, which would reduce the work rate from 36 minutes to 30 minutes.

However, I decided not to do this because, having marked the work of people with corresponding symbols on the chart, I found that some of them would be overloaded and would not have the necessary breaks, which are essential even for the lightest work. Therefore, for this reason, I gave up on the first attempt to achieve maximum production that could be obtained with the given equipment and dimensions of rolled sheets. Even so, at a rate of 36 minutes, the efficiency expressed in kilograms exceeded the ordinary average production by several multiples, that is, the introduction of such organization promised an excellent result, namely: the usual daily efficiency was 2,500 to 2,800 kg; the foremen claimed that with other, better workers, it would be possible to achieve 5,000 kg; meanwhile, my reduced chart was calculated at 10,000 kg.

Finally, I decided to make an attempt. I won't describe here the resistance I initially encountered from the workers, who felt somewhat constrained in the freedom with which they usually operated. But already on the second day, this resistance completely disappeared. Instead there was noticeable satisfaction due to less fatigue, thanks to the balanced rhythm of work and breaks, and the increased production, which had risen to 8,500 kg. I even noticed among the workers a certain kind of satisfaction, which could be compared to the satisfaction of musicians in an orchestra when they manage to play a piece in harmony and with the appropriate enthusiasm.

As we mentioned earlier, the pace of a given task could be reduced to only 30 minutes, i.e., to the limit of full utilization of time for roller No. V. But, as can be seen, furnace No. I and roller No. IV will still be far from their benchmark production, hence the obvious conclusion that for the given task, individual devices were not properly matched. From the chart, it can be seen that roller No. V is not adequate to ensure the total production capacity of roller IV and the furnaces, particularly furnace No. I. The latter being at least twice as large as required.

We see, therefore, that the comparison of this kind of collective work charts not only facilitates the planning of the arrangement of the elements of such work, but also provides clear indications as to the relative sizes of individual devices.

III. Cost of time.

By examining the losses caused by low efficiency and then looking for the relationship between cost expenditures and the quantity of products produced in a given time, I concluded that all expenses of each production can be divided into the following three categories:

1. Expenses for which time has no significance and whose amount depends solely on the quantity of products produced;
2. Expenses which, on the contrary, are completely independent of the quantity of products, flow continuously and uniformly, and during a given time period are solely dependent on the length of that period, i.e. they are proportional to the length of the previous period of time;

3. Expenses having properties intermediate between the first and second, namely those which, although they fluctuate simultaneously with the fluctuation of production, this fluctuation is not completely proportional to it, since a certain portion of such expenditures flows steadily and semi-independently of production.

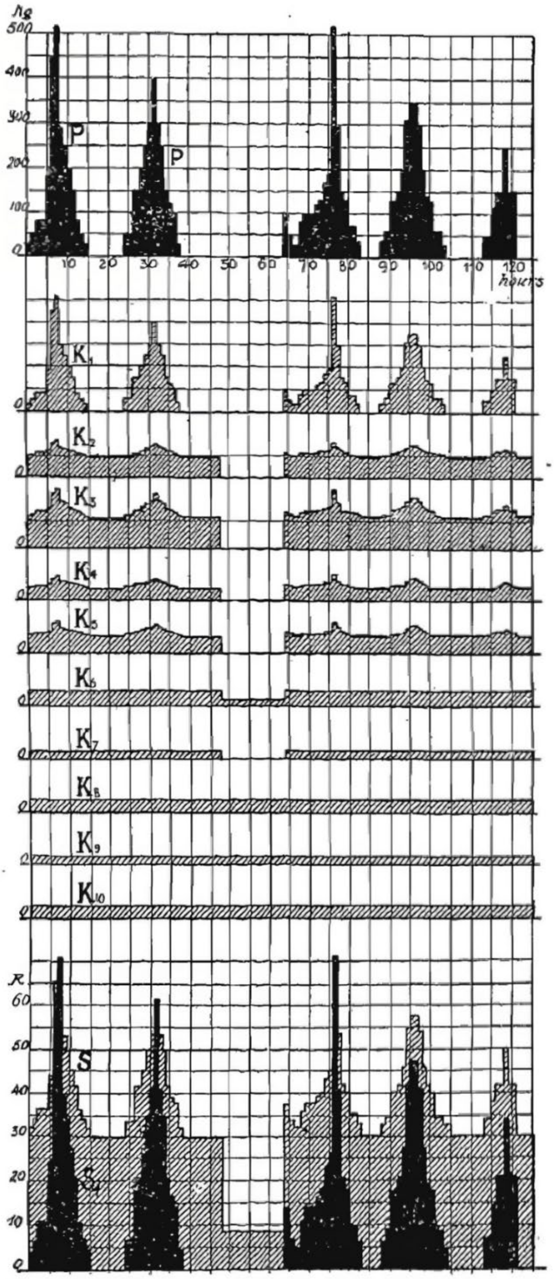


Figure 2
Production costs, reference cost, and cost of lost time.

I stated the above in a report presented at a meeting of the Association of Technicians in Warsaw in 1908 (see Technical Review [Przeglad Techniczny], from 1909).

I then cited the example of the hourly cost flow in a certain manufacturing process, graphically represented in Fig. 2. The vertical ordinates of the curve P express the actual fluctuations of production per hour, while the ordinates of the other curves K_1 to K_{10} express the individual positions of operating costs per hour as they fluctuated over time. The vertical coordinates of curve *S* represent the total costs per hour. It is obvious that each production becomes most economical when production per unit of time reaches its maximum, as then the cost of one unit of product is the cheapest, and this cost can be considered as the standard. Therefore, if production per unit of time is lower than the possible maximum, its cost will be relatively higher, and the difference between it and the standard cost will be the cost of lost time. The area covered by the cost curve *S* expresses the total actual cost for a given period; the area under the curves S_1 expresses the standard cost, and the difference between these areas expresses the cost of lost time during that period.

The presented graph of the flow of operating costs only confirms the most general theorem concerning the relationship between operating cost and productivity per unit of time, namely:

1. If productivity drops to 0, i.e. a given production workshop is idle, the cost per unit of time never drops to 0
2. If productivity per unit of time increases, the cost also increases.

Analyzing their operating costs, [accountants] express this relationship simply in the form of a graph shown in Fig. 3, i.e. they consider the total cost as if it were made up of two parts - a fixed K_0 independent of production, and a variable K_1 proportional to production; that is, they assume that the cost line per unit of time is a straight line *AB*.

However, this assumption is incorrect. The cost line is not a straight line, as shown in Fig. 3, but a curve gradually tilting upwards. I have arrived at this conclusion by a simple observation of facts. Analyzing the costs of all manufacturing plants, we can easily see that the more a given plant produces, the lower the cost per unit of production will be, but for each plant there is always a certain well-defined limit of productivity at which the cost per unit is the lowest; if this limit is exceeded, the cost per unit begins to rise again, i.e. productivity becomes less economical. In other words, there is always a certain limit of productivity beyond which overburden occurs.

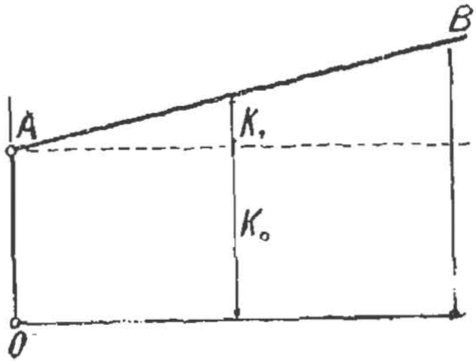


Figure 3
The relationship between operating costs and efficiency

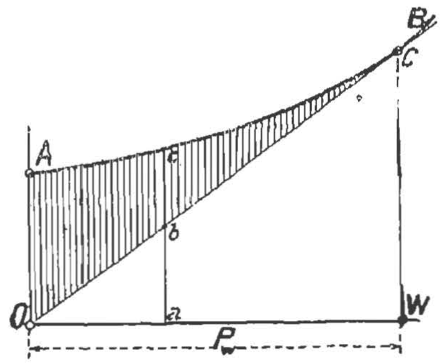


Figure 4
The proper picture of the relationship between operating costs and efficiency

If we consider expenses as the expenditure of energy and resources, we will realize that every machine, every working cell, every process, small or large, and finally every human being has this property. It is a principle of nature and we cannot imagine that such a limit does not exist for each production unit. This limit is one of the most important characteristics of each production unit.

This allows us to claim that the cost per unit of time is expressed by the upward-sloping curve *AB*. And if we draw line *OC* to this curve, starting from the origin of the coordinates, we will find the boundary point *W* beyond which the ratio of costs to production deteriorates.

Therefore, we can consider production P_W as the benchmark for a given workshop, organization, or other production unit.

Line *OC* divides total costs into two parts: *ab* and *bc*. Cost *ab* is a useful cost, while cost *bc* is the cost of wasted time.

The graph in Figure 4 is the most general characteristic of economics. Each working unit, whether consisting of a single cell, collective, living being, or machine, has its own unique characteristic. In other words, each unit has its own time price, which never drops to zero, and each has its own benchmark production, at which it operates most economically. This is an extremely important conclusion that provides us with fundamental guidelines regarding organization. (d. c. n.).

Part II

Technical Review [*Przeglad Techniczny*], 1924, Vol. 62, No. 52, pp. 579-583

IV. Harmony in the selection of cells and harmony in action.

If we consider the organization of the above-mentioned mill and its action plan, presented in Figure 1, in light of this conclusion, i.e. if we draw graphs characterizing each of the individual cells, we can easily calculate the losses resulting from faulty selection. A comparison of such graphs is shown in Figure 5.

We can clearly see here the inappropriate selection of individual apparatuses, i.e. when producing 10,000 kg, according to the given schedule, furnaces II and III and rollers V are close to their target production, while the remaining apparatuses are still largely underutilized, and the total daily loss due to this amounts to the sum of lines *a+b+c+d*. In normal unharmonized work (at a production of 2,500 kg), losses due to wasted time are expressed as the sum of lines *e+f+g+h*. By analyzing our workshop in this way, we see that losses due to wasted time may result from two reasons:

1. when individual cells are not properly selected, i.e. their target productions are not equal
2. when the action of these cells is not properly harmonized.

Therefore, the conclusion is that the best harmonization of action is only possible when the individual cells are best suited to each other, i.e. when there is harmony in the selection itself.

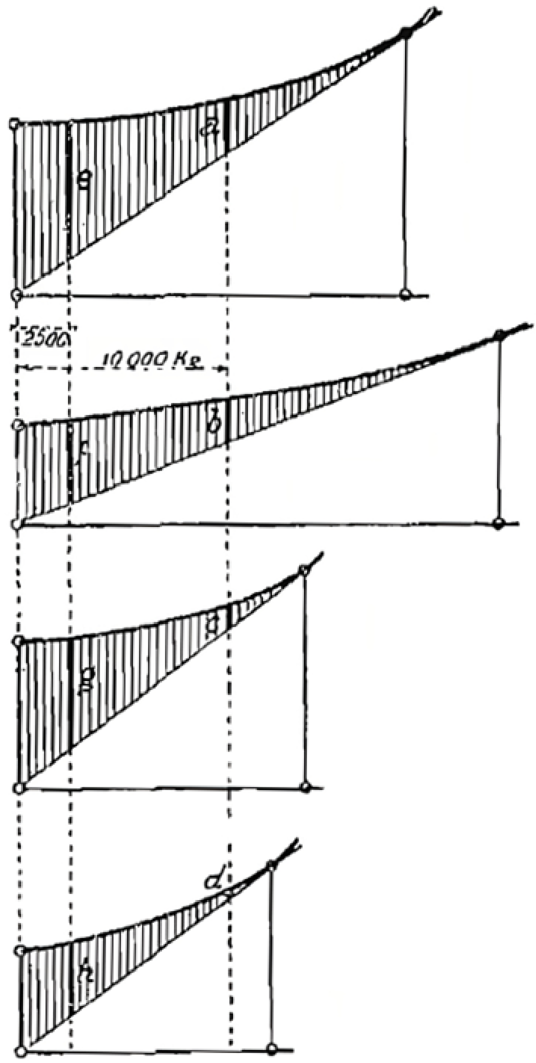


Figure 5
Graphs of own costs and losses

Since every cell of a given productive organism can always be expressed by a precise characteristic curve that shows the dependence of its costs on production (its price in time), the concept of harmony of selection ceases to be indefinite and becomes a very concrete thing. We can call a selection harmonious if the characteristic curves of all the cells are in agreement with each other, both in terms of their exemplary productions and when the sum of the verticals of all these curves is the smallest for given technical means, in other words, when each cell is economically the most perfect.

To express this idea more precisely, we can say that a given operation can be considered the most perfect if, among all the cells or devices serving the same purpose, its cost curve is the lowest, i.e., the least money flows through it per unit of time, and if this curve is as steep as possible, i.e., the cost of the last unit produced is the smallest. For example, of three cells A, B, and C in figure 6 below, C will be the most perfect.

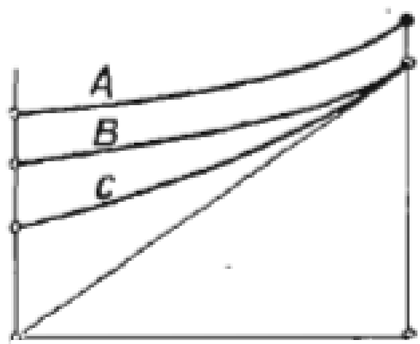


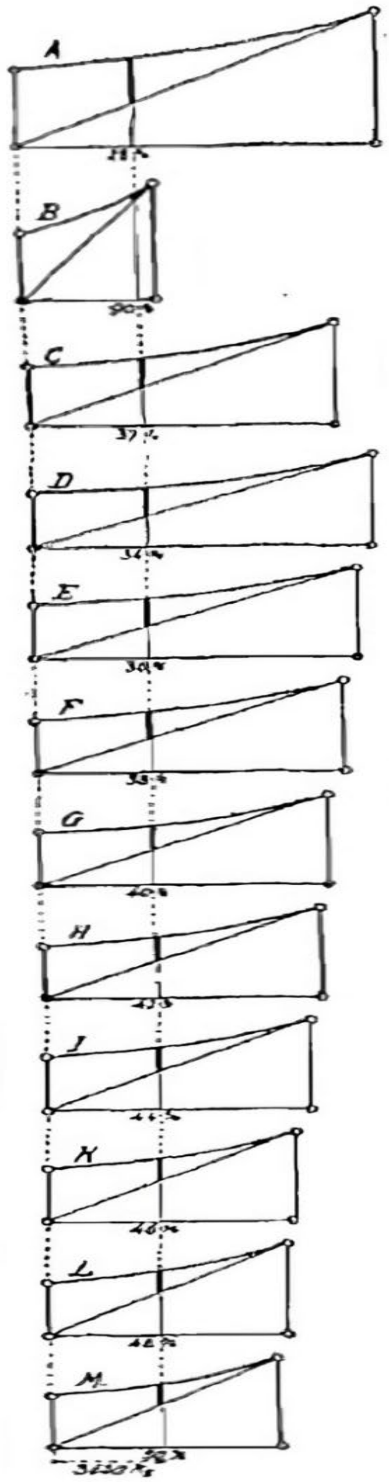
Figure 6
Comparison of several activities in terms of their efficiencies. The most perfect of them brings us closer to a straight line starting from the zero point.

Considering every workshop as an organism consisting of individual organs that work together as a collective whole, we can regard each individual organ, regardless of whether it is a machine, apparatus, tool, or person, as a kind of tap through which a certain amount of money flows per unit of time. The thickness of this stream is generally variable depending on production, and this dependence is expressed by the appropriate characteristic curve for each tap. The steepness of these curves varies and approaches straight line drawn from the zero point. The tap regulates itself more perfectly as the slope of the cost curve increases, and conversely, the closer the cost curve approaches a horizontal line, the less sensitive the tap is and the less it regulates production. Finally, we also encounter cells similar to taps, through which a constant amount of money flows per unit of time, regardless of whether the cell produces anything or not.

After all the cost items for each production unit are determined, there is only one cost item that is completely regulated automatically, and that is the cost of raw materials. However, when considering the entire workshop as a collective entity, which is like a cash register that processes money, it is noticed that it processes a stream of money whose thickness is regulated by production quantity, as shown in the cumulative chart. Therefore, when producing, the stream of money does not stop; when production increases, the stream expands gradually, but in such a way that there is always a certain ideal production limit at which the ratio of the thickness of the money stream to production is the smallest.

The ideas mentioned above include the essence of harmonizing collective work. We see that the inclusion of harmonization consists of two parts:

1. harmonizing the characteristics of the flow of costs of individual cells, and
2. harmonizing all their activities.



To solve the first problem, the main criterion is to compare the characteristics of the flow of costs, which can be expressed using the presented charts. The guiding idea for solving the second problem is the coordination of the timing of the individual activities, which can be effectively implemented using graphical methods, as shown in the example.

It should be noted that both these methods can be applied in two cases. Firstly, they can serve to examine each manufacturing workshop, investigating to what extent its processes deviate from harmony in selection and operation. Secondly, they can be used to pre-design the most perfect assembly, both in terms of selection and operation. In other words, we can compose a standard plan for the set of work cells or machines and a standard plan for their operation.

V. Analysis of collective work using graphical methods.

Using these methods to analyze various production workshops and organizations allowed me to see that most workshops, even among the most recent ones, are very far from perfection, both in terms of harmony in selection of cells and in terms of harmony in operation. The losses resulting from this are very easy to calculate.

I could provide hundreds of examples from my practice confirming the above statement, but I will only mention one example from the steel industry, in which these errors are particularly evident.

Figure 7 shows the schedule for rolling a 5 mm wire. It is an accurate average of the action of the rolling mill, which consists of a series of separate rolling machines. The image was obtained using a stopwatch. This schedule corresponds to an hourly production of 3650 units. This production was considered insufficient since the rolling mill was designed for simultaneous rolling of two wires, which could only be achieved in rare moments and only for a few seconds. The craftsmen and supplier of this rolling mill explained it as a lack of skill among the workers. However, the above schedule clearly highlights that the low production was not due to this reason, but rather due to fundamental errors in the design of the entire rolling mill and improper distribution of work between the individual rolling machines.

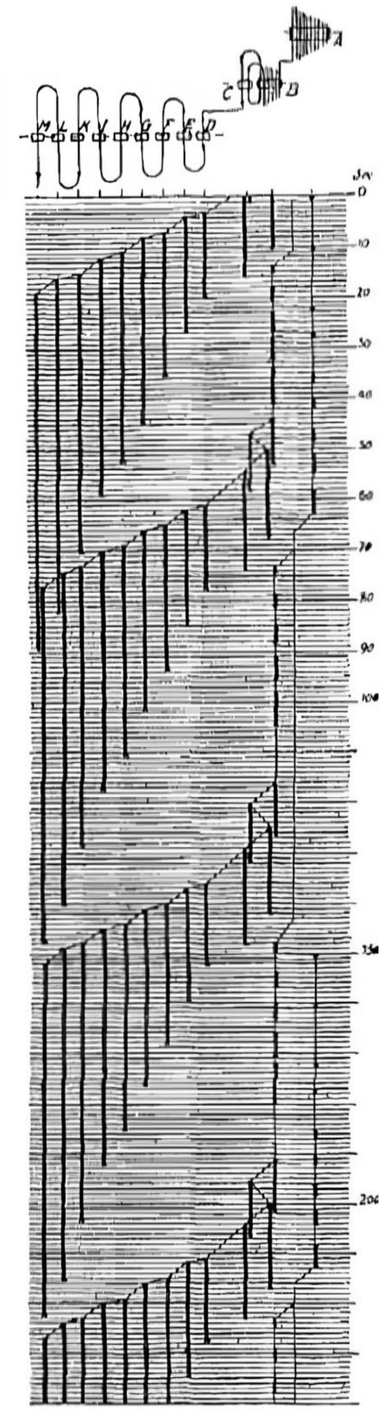


Fig. 8
Chart of a "typical" rolling mill

First and foremost, it is evident that a closer approximation of the individual waves is impossible since the operating time of the B rolling machine has already been fully utilized, and the remaining breaks could not be reduced further, even with the most highly skilled rolling machine operators. At the same time, we can see how poorly all the remaining rolling machines are utilized, especially the A rolling machine, on which the actual working time is only 28%, while the rest is idle time.

Figure 8 shows the characteristic graphs of all the individual rolling machines, produced according to the above schedule. This graph clearly shows the losses in costs resulting from time losses and the dependent relationship of these losses on the lack of harmony in the selection of individual parts and the improper division of work between them.

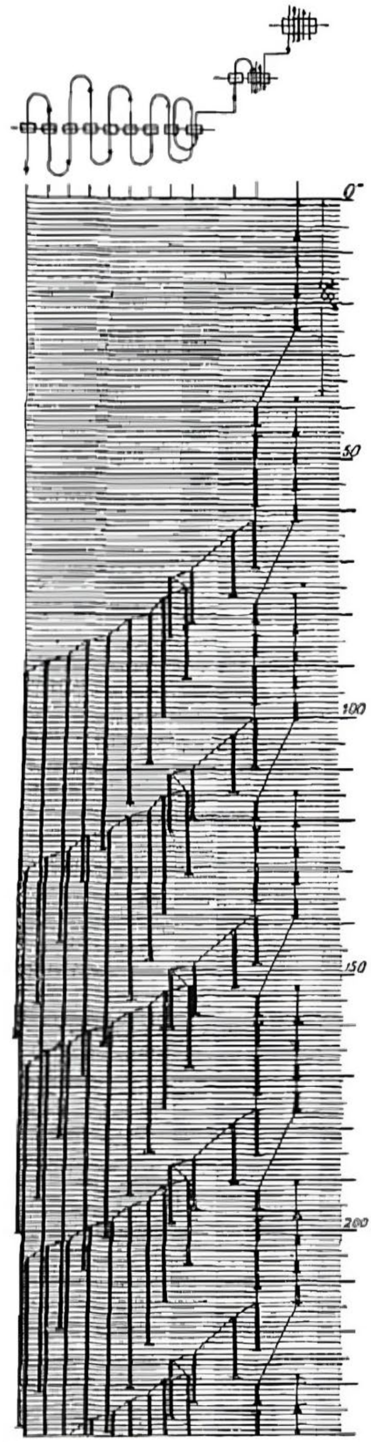


Fig. 9
Harmonogram of the new selection of rolling mills

Of course, completely eliminating losses due to idle time would be impossible without a radical change in the entire workshop's construction. This could be achieved only through the introduction of a better distribution of work but on condition of changing the raw material to wire rods of 75 kg from the blocks of 150 kg as originally intended by the rolling mill designer. Therefore, a new schedule, presented in Figure 9, was designed, which, of course, is not perfect, but the individual rolling machines were utilized far better, achieving a production rate of 6350 units per hour.

VI. Great losses due to lack of harmony.

In my personal experience with various types of collective work - including rolling mills, large-scale production, mechanical workshops, textile factories, ceramics, paper mills, and construction sites - I've encountered hundreds of examples of this kind. Such fundamental errors are frequently found, which is not surprising. Until now, in the construction and operation of manufacturing workshops, we've barely scratched the surface of harmonizing the work of individual parts. When constructing new building installations, technical knowledge was applied, yet it was often overlooked that each work cell would essentially act as a conduit for the flow of money during operation. The dependency of this flow on production per unit of time was not clearly understood. Consequently, once any factory line was installed, the organization was largely left to chance. At best, it depended on the managerial talents and routines of those in charge.

Such a situation is accurately and intelligently presented by Mr. Harrington Emerson in his *12 Principles of Efficiency*. His claim is completely valid that if in the past era we occasionally encountered extraordinary efficiency in harmonizing collective work, it was rather exceptional and only when special conditions simply forced perfect harmony, or when the intended result was impossible without perfect harmony. As a few of the rare exceptions of this kind, he cites, for example, the course of American trains called "chronometry" or shooting cannons on American warships.

In contrast to these ideas of harmony, I quote a conversation with the chief of the repair workshops, who looks at Emerson with a smile of pity, claiming that all activities in a mechanical workshop are equal and should be carried out according to plans as precise as the schedule of "chronometry" trains.

In the era of extraordinary technological development, the majority of technicians and engineers belonged to the type of the aforementioned workshop chief, while pioneers of organization such as F.W. Taylor, H. Emerson, [Frank and Lillian] Gilbreth, Gantt, and others, were exceptional. In this era, we improved details but did not cover the whole picture. We focused primarily on the design and operation of individual devices and mechanisms but did not pay sufficient attention to the proper coordination of these devices, their adaptation to working conditions, and the cost of their operation. Therefore, we often encounter workshops consisting of a whole range of devices, often themselves perfectly improved but not mutually corresponding and acting in a way analogous to hitching both racing horses and oxen to the same cart, i.e., animals of different power and character.

VII. Planning collective work - graphical method:

Everything said above leads us to the following conclusion:The arrangement of an organizational plan for each manufacturing process has the same importance as making a drawing for the construction of some mechanism, device, or structure. If in every mechanism or structure, all parts must correspond precisely to each other, then similarly, in carrying out the joint collective work of the mechanism, device, and employees, the work of each of them must correspond strictly to one another. Not only should each of them demonstrate exemplary efficiency, but the action of each of them must be so connected that the whole team also shows exemplary efficiency.

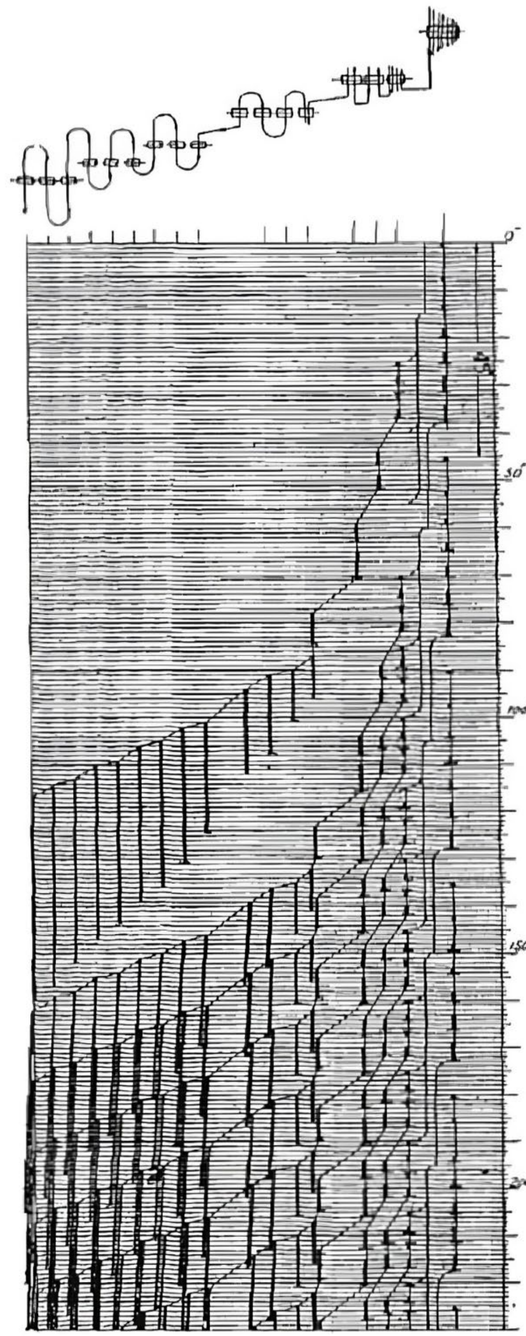


Fig. 10
Harmonogram as the basis for designing a factory

Having a clear understanding of what should be understood as the harmony of selection and operation of productive cells, the simplest logic also leads us to the conclusion that in order for a productive workshop, whether small or large, to give the highest economic result, i.e., to be able to work with the highest production at the lowest cost of labor and resources, the project of general organization should be prepared before the project of the installation itself. Only such a plan will give us strict guidelines for the equipment, the size of individual cells, the conditions of their cooperation, and their model efficiency.

However, it must be stated that if in the field of construction technology, such progress has been made that no sane engineer would ever think of starting construction without first creating a general project, specific drawings, and precise calculations, then in the field of work organization and planned operation, we are only taking the first steps when we proceed to set up productive workshops without having a detailed plan for the individual cells and the whole team. We must also carry out strict research and calculations regarding the probable costs of each cell's time and their model efficiency.

The science of organization fundamentally changes such a state of affairs, advancing as one of the most important postulates that each job should be carried out according to a plan prepared in advance and based on a thorough analysis of all work elements.

The graphic method of work harmonization presented above enables the comparison of such a plan in advance. The charts presented provide us with the main guidelines not only on how cooperating cells should be arranged to achieve the highest efficiency, but also on how such devices and cells should be selected according to their economic characteristics.

Yes, as an example of the perfect result of such a procedure, it can be noted that the wire rolling mill of one of the largest ironworks in southern Russia was designed based on a work schedule developed from the beginning. The mill was built in 1910 according to this project. Figure 10 shows this schedule and the general diagram of the mill. When compiling the schedule, simultaneous rolling of three wires was assumed. It was said several years later that the result completely confirmed this assumption - the mill produced an average of 14,800 kg per hour. The engineers who led the mill told me that they could not imagine this device working so efficiently without a properly prepared action plan, which provided many first-rate indications regarding the entire equipment, and the importance of which would not be suspected even if there was no such a clear drawing in front of their eyes showing the entire work plan of all the cells.

The examples given relate only to one area of technology, namely rolling, but of course, this method of harmonizing operations can be applied to any collective work, as the most important condition for collective work - whether it is simple or complex - to be performed most efficiently is for each activity to be carried out at its proper time, neither earlier nor later. If the movements of three blacksmiths who forge a piece of iron must be coordinated in time with an accuracy of a hundredth of a second so that the work can be done with the greatest efficiency, this principle is equally important for even the most complex work consisting of thousands of work elements and thousands of cells performing these works, regardless of the type of cooperating cells, and whether the duration of individual work and movements is measured in seconds, minutes, hours, days, weeks, or months.

Therefore, any collective work can be presented in the form of a chart, with the elements of the work of each cell arranged in a single row, for example, horizontally, and the duration of each work element indicated by lines plotted vertically on the time scale.

If we draw such a picture from nature with the help of a stopwatch, we will obtain an extremely clear means for analyzing collective work. We can precisely measure the degree of opposition, time losses, flaws in the harmony of operations, and flaws in the harmony of selecting individual cells.

Of course, this same method provides us with a means of proper harmonization. So, if we know all the elements of collective work in advance, if we know the time required to perform each task and their mutual ratio, we can use the above graphical method to design a schedule that corresponds to the model of operating efficiency. Such a schedule, along with characteristic charts, provides guidelines for the harmonious selection of cells and subsequently for the method of organizing work processes.

The main goal in creating a musical piece is to make sure that each sound is played at the right time, neither earlier nor later. In this regard, the role of the composer is similar to the role of the manager: both aim for harmony, the musician in terms of the harmony of the sounds, the manager in terms of the harmony of the work elements.

As for the selection of sounds, the science of acoustics provides numerical, mathematically precise indications regarding the choice of sounds. As for the selection of the cells performing the divided work elements, we have fundamental guidelines in the form of characteristic graphs mentioned earlier, in terms of the relationship between time, cost, and productivity for each cell.

The graphical method of harmonization that we present here does not necessarily require the collective work to belong to so-called mass production, consisting of constantly repeating actions. It can be applied equally successfully to all kinds of work, to analyze and plan the layout of the standard plan for execution.

I personally used this method many times, as I mentioned, for various construction works, including iron-concrete works. I used it in 1916 during the construction of a large iron-concrete factory building. The work was analyzed in detail beforehand, with a half-hour time interval. Due to this detailed approach, the whole construction went so fast that, for example, in carpentry work (mounting forms), some tasks were completed in half an hour, while they would have taken several hours under normal circumstances. In addition, all carpentry work was done with the help of six carpenters, instead of the 34 that were preliminarily estimated by the building specialist for iron-concrete works.

In 1915, in one of the train wagon factories, my method was used to reorganize the forging of connector hooks for wagons, and the following results were obtained: before the reorganization, a brigade of workers produced 15 hooks per day, using 2.011 kg of coke per hook. After the reorganization and the use of new furnaces whose dimensions were determined according to the schedule, the same brigade of workers was able to produce 70 hooks per day, using only 0.78 kg of coal per hook instead of coke.

I will not present many examples from my practice here, but I want to mention that a similar method was used in 1913 and 1914 to repair wagons in one of the South Russian railways. The result was a multiple increase in production in a very short time. The method was also applied in 1911 and 1912 during the construction of a complete set of equipment for a large furnace in one of the largest ironworks in southern Russia.

Considering myself, to some extent, to be the inventor of this method of analyzing collective work and planning it in advance, I must admit that it has long been used as a graphical method for determining train schedules.

Because the topic of my presentation concerns the importance of harmonization in the scientific organization of work, what I have said will be sufficient evidence that the organization in terms of the selection of personnel and their actions is one of the most important areas of this science, which, however, has been insufficiently taken into account by modern managers. (unknown date).

Part III

Technical Review [*Przeglad Techniczny*], 1924, Vol. 62, No. 53, pp. 594-595

VIII. Three laws of economics as the basis of the science of organization.

While I'm on the subject, I must address another fundamental issue, namely concerning the criticisms of many skeptics when American pioneers called their organizational methods "scientific." Many of them argue that these methods could be considered at best as an art, but not as science, because we usually consider science to be knowledge based on certain thematic axioms or laws of nature. In Europe, professor Le Chatelier first defended this issue, arguing that Taylor's system and other American pioneers of organization deserve the name of science because they use scientific methods. For a long time, I found this explanation insufficient, even though I was always deeply convinced that the science of organization deserves this name, believing that it has the right to it for other important reasons. After long reflection on this matter, I eventually arrived at what I believe to be the correct conclusion, which I would like to present to this Honorable Assembly.

Not content with Le Chatelier's defense, I posed the question: what precisely causes the methods employed by scientific organization to result in the economy of energy and resources, that is, why is the same desired outcome achieved with less effort and greater efficiency? If we always achieve better economic results by following the suggested organizational methods, it stands to reason that this occurs because these methods align with certain natural laws. These laws guide the economical use of energy and resources spontaneously, irrespective of our intention or consciousness.

Looking at the methods of what is called "scientific" organization from this perspective, I concluded that they are indeed based on such fundamental laws.

One of them is already indicated in the *report of the Committee for Administration* presented in 1912 [p 1131] at the American Society of Mechanical Engineers, of which James Mapes Dodge was president, namely the law of division of labor. This law was seen as the primary reason for the economy obtained by far-reaching division of labor into execution and management, which is most prominent in the methods of Taylor and other pioneers of scientific organization.

The law of division of labor, finally defined by Adam Smith, is the law that guides the whole living nature towards economy, and in an incredibly perfect way.

But there is another law of nature, namely the law that could be called the law of concentration or integration. Nature is also guided by this law, constantly striving for economy. Cells in performing their life functions, divide and specialize, thereby reducing the overall cost and waste of energy and resources. However, we also see that at the same time, another process takes place, namely, cells performing identical, or similar, functions, join together for common action, creating cooperation, whole organs serving a specific purpose, and thus achieving economy again.

These two laws - the division of labor and concentration - complement each other, they are closely related, so that by observing the manifestations of living nature, we see that differentiation into various functions occurs, as if in order to enable the integration of identical functions to be fully manifested, and the result of these two processes is ultimately energy and resource savings.

The English philosopher, Herbert Spencer, calls these two inseparable phenomena of living nature the general law of evolution.

Recognizing the law of concentration as the second fundamental principle of economics, associated with the law of division, we can now ask whether this law is also taken into account in the methods of scientific organization. In Taylor's system, this is quite clear, namely: by separating the executive work from the managerial thinking work, the office organizing the work combines the latter into one body. The same is true for Emerson, who proposes the creation of a staff specifically encompassing the entire organizational thinking work.

So the methods of organization also take into account the second great law of economics.

But there is also a third law of economics, namely the law of harmony, which living nature spontaneously uses in an extremely perfect way to save energy and resources. The ancient Greeks deeply felt this law, for whom both rhythm and harmony were a kind of religious cult.

Although we frequently use the word "harmony" today, we usually refer to a rather vague concept by this term, and we underestimate the importance of harmony in terms of economics. Perhaps this is because we have not yet tried to define precisely what we mean by harmony in productive work.

As far as the purely material aspect of productive work is concerned, I believe that a precise definition of the law of harmony is not difficult. Everything I have said above about harmonization explains it all too well.

Therefore, in order to achieve exemplary efficiency from an economic standpoint, we have seen that it is necessary to choose organs, or work cells, according to their complementary functions, and then these organs or cells must work together in close connection so that each action takes place in its own time.

In this definition, I see the entire economic content of the law of harmony. Understanding harmony in this way, as a fundamental law, we can easily see that this law is closely related to the first two laws of division and concentration.

If nature spontaneously and constantly tends towards division and concentration, achieving higher economic efficiency, then it is easy to see that despite this, the highest economy could not be achieved if the individual parts of the collective organism that perform divided and concentrated work were not properly matched and did not cooperate in time according to a strict plan or order.

At every step, living nature offers us vivid examples of its adherence to these three laws. It becomes easy to realize that it is precisely by obeying these laws that nature constructs its works with such astounding efficiency, to the point where we often say that nature has the ability to create something from nothing.

If we now ask ourselves whether this third law of harmony is taken into account in the methods of scientific work organization, we can certainly answer in the affirmative, because in the methods proposed by all pioneers of this new knowledge, selection and cooperation are considered the primary factors for achieving exemplary efficiency.

By putting these three laws as the main foundations on which the science of work organization is based, I do not want to be accused of trying to discover America for the second time. Undoubtedly, these laws have been widely known for a long time and are manifested in all the works and activities of modern progress, and precisely thanks to them, civilized man increasingly saves his own energy and the energy of nature. However, we must state that so far, we have been guided by these laws rather unconsciously, intuitively, and without proper understanding of their great significance, more often sporadically and chaotically, and sometimes even with some reluctance, considering the division of labor as a human misfortune.

Considering the colossal losses of time, energy, and resources that we see at every step in production work, despite the extraordinary progress of technology, and which losses Harrington Emerson so truly and glaringly highlighted in his *12 Principles of Efficiency*, we can easily convince ourselves that the main cause of this is precisely that we have not sufficiently appreciated the above three economic laws and have sinned against them at every step.

Having come to these conclusions and emphasizing the importance of the three fundamental laws of the economy of nature: division, concentration, and harmony, I dare to claim that the science of work organization has the right to be called a science not only because it uses scientific methods, as Professor Le Chatelier claims, but above all because these methods are based on these three natural laws and therefore have the right to the name of science in the highest sense of the word.

In addressing the issue of work harmonization in this presentation, I tried to draw special attention only to economic, purely material moments. I pointed out two types of harmony, namely harmony in the organization of the organism, or the harmony of selection, and harmony in action. These two types of harmony relate to all factors of collective work, i.e. machines, equipment, and people. But there is still a third type of harmony that concerns only the human factor and unfortunately cannot be captured in diagrams that facilitate harmonization. This is the harmony of the spirit, which should unite all human beings cooperating in a single collective organism, such as every production plant.

Despite the fact that the principles of spiritual harmony cannot be expressed in mathematical functions, the principles on which it is based can be precisely formulated, and the science of work organization assumes that the highest economic efficiency cannot be achieved if the principles of spiritual harmony are not fully applied.

The issue of spiritual harmony is a topic that goes beyond the scope of my presentation, so I will say only a few words about it in conclusion. When the principles of spiritual harmony are applied to the organization of human labor - for the ultimate benefit of the worker and all of humanity - the impact is profound. By striving towards the highest ideals, invoking enlightened judgment, instituting discipline rooted in superior moral motivations, and acting justly, we apply Harrington Emerson's foundational principles of efficiency to every civilized individual. In short, if we fully engage with these principles of spiritual harmony, there's no doubt that the science of work organization will become one of the most significant cultural factors in the coming era. It will ensure that work becomes a source of the greatest wealth, encompassing not just material gain but moral wealth as well.

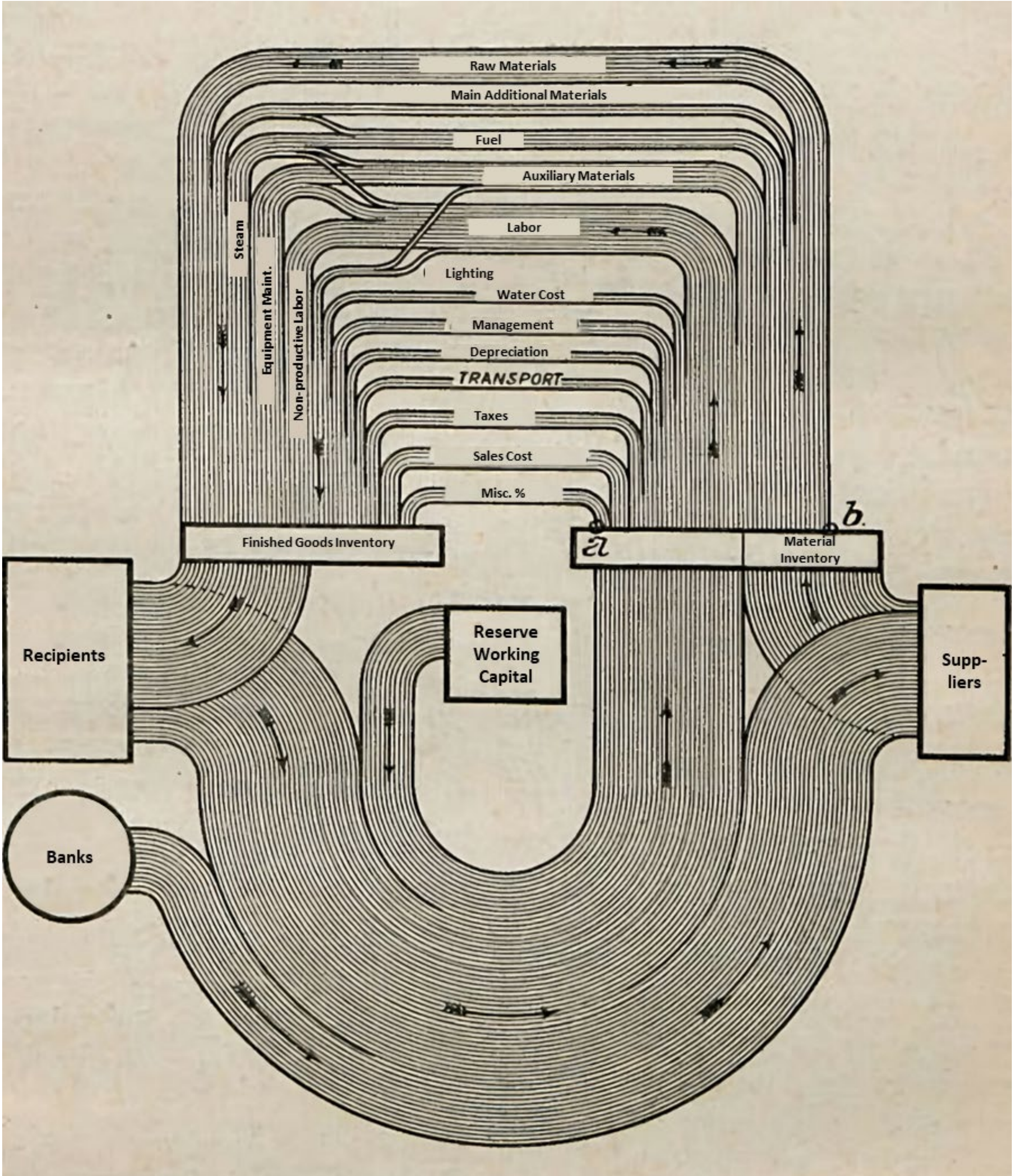

Raw Materials
Main Additional Materials
Fuel
Auxiliary Materials
Labor
Steam
Equipment Maint.
Non-productive Labor
Lighting
Water Cost
Management
Depreciation
TRANSPORT
Taxes
Sales Cost
Misc. %
Finished Goods Inventory
a
b.
Material Inventory
Recipients
Reserve Working Capital
Supp- liers
Banks

Fig. 7.

The position of an Engineer as a Manager of Manufacturing Plants (1924)

Scientific Organization of Work [*Naukowa organizacja pracy*], Warsaw, 1925, pp. 47-72

Forward to the English edition:
In this report, Karol Adamiecki addresses the role of engineers as managers in manufacturing plants, emphasizing waste reduction, proper management of resources, and achieving the greatest useful output with the least input. He presents one of the earliest examples of a Value Stream Map, which compares production costs and sales values as a visual representation of the manufacturing process.

The article cites the Waste in Industry report findings that seventy-five percent of waste is due to management's poor understanding of the system. However, it also offers solutions to these underlying issues. It describes the qualifications necessary for the role of a manager, as well as the role, position, and responsibilities of technicians when acting as managers. Adamiecki advocates for an individual who possesses extensive knowledge, experience, analytical skills, and the ability to harmonize all factors of production to achieve the greatest economic benefit for society, employees, and invested capital. He highlights the importance of the manager's intellectual and moral level, strength of character, and fair and honest behavior.

Report

In order to take a closer look at the role of an engineer and technician in managing a manufacturing plant, it is necessary to first consider the main outlines of the progress made so far in manufacturing processes from the point of view of the relationship between the input of production resources and the useful output. Then, we need to consider the main issues that arise from this for a manager.

Waste alongside the progress of manufacturing work.

The rapid development of material culture that has taken place over the past 150 years, thanks to the natural sciences and the engineering art based on them, is simply astonishing. Humans, who for many hundreds and thousands of years relied solely on the work of their muscles and the power of domestic animals, harnessed incredible amounts of natural energy during this short period. Physical work was delegated to machines, and as a result, humans ceased to be draft animals.

Small artisan workshops employing a few or several workers gave way to large industrial facilities filled with a multitude of diverse devices and machines, operated by hundreds and thousands of workers. These facilities produce enormous quantities of products that are distributed all over the world.

Thanks to technology, we have entered a new era where machines, driven by the forces of inanimate nature, have become the slaves of humans, thereby finally bringing an end to the epoch of human slavery. The amount of harnessed energy is already so great that it far exceeds human physical work. If we express this energy in units equal to the work of a single individual, we calculate, using the United States as an example, 22 such units allocated to each adult male. In other words, we can say that each adult male has the help of 22 "mechanical slaves" who assist him in his work.

Today, we use engineering and technology that our ancestors could not have dreamed of 150 years ago: we travel by railways, fly in the air, talk through radio telephones with people on the other side of the world, and so on.

All these incredible achievements are our pride. And indeed, we have much to be proud of when we look at these magnificent works of human genius.

However, unfortunately, the same methods of thinking and research that led us to these results also force us to look at things from another perspective.

There is a fundamental law of economy - the law of least effort, which governs all of nature, every living being, striving to achieve the greatest result with the least amount of effort and resources. This law also applies to humans and is the main guideline for all our technical sciences. The ultimate goal of technology is to obtain the greatest useful output with the least amount of work, energy, and all production resources. Its unattainable ideal is to convert the entire input into a useful output.

Therefore, to properly assess our magnificent achievements, which we admire so much, we need to compare them with the amount of energy and resources invested in their achievement: we need to compare the useful output with the input.

If we take even a cursory glance at things from this point of view, our excitement will cool down significantly when it turns out that the magnificent achievements are still surprisingly small compared to the input of energy and resources, and upon closer examination of this issue, we will find that in modern manufacturing processes, we encounter such waste that we have not yet come far from barbaric times in this respect.

Indeed, we have transferred our physical work to the forces of inanimate nature, taking advantage of its wealth to a degree that our ancestors could not have dreamed of. However, we squander it ruthlessly. American engineer Harrington Emerson is absolutely correct when he says that we treat the wealth of nature no less extravagantly than a young half-wit who unexpectedly received a huge inheritance. This engineer-philosopher is also not wrong in pointing out that the firefly is 15,000 times less wasteful of energy in producing its light than a human is today converting coal energy into electric light.

When the first pioneers of scientific organization pointed to the extremely low coefficient of useful efficiency in various modern branches of manufacturing work and proved that the amount of useful output could be increased several times with the same input of work and resources, they were met with great disbelief, and the belief prevailed among interested circles that waste only occurred in certain individual cases. However, recent studies by the American Engineering Council collected in the work *Waste in Industry* confirm on a large scale that waste is not an exceptional phenomenon but a widespread one. The figures obtained in such studies are striking.

The American Engineering Council has done a great job in bringing to light the fact that even in such a magnificent industry as the American one, only 35% to 50% of the total input of work and production resources is converted into useful output, and the rest goes to waste.

If in American industry, which uses machines and rational organization to such an extent as no other industry in the world, we encounter such great waste, then what can we say about our manufacturing work?

The studies by the American Engineering Council, demonstrating this state of affairs, would give rise to sad reflections and doubts about modern progress if they did not also indicate ways to remedy the situation. Thus, we see first and foremost that the research commission, summing up the losses and deriving the coefficient of useful efficiency, compared it not with an unattainable ideal standard but with a standard already achieved at the current state of technology and organization science. This gives hope that, although the losses are enormous, they can be eliminated if existing and effective measures are applied.

The second significant advantage of the work *Waste in Industry*, which elevates it to the rank of the most outstanding engineering works in recent times, is the identification of factors upon which the elimination of waste depends and the indication of the importance of these factors. The statement that nearly three-quarters of waste elimination depends on administration and organization is somewhat sensational news, especially for those who focus solely on technology or routine and underestimate the importance of these factors.

Upon closer examination of the causes of the large losses we encounter in all areas of manufacturing work, it is easy to see that the main source of this state of affairs stems from the fact that, in the past, when we had powerful means and achievements of technology at our disposal, we paid too little attention to the most important principle: "the greatest useful output with the least input." We were on the path to the greatest output without regard to the means by which we would achieve it. Having the ease of obtaining great results, we did not pay attention to the input of production resources.

I do not deny that in some branches, we tried to achieve the highest coefficient of useful efficiency: the entire history of engine development, for example, shows how meticulously we studied energy flow balances and made various inventions to save even one-tenth of a percent of the energy input. Similar efforts in improvements can also be observed in many technological processes and in the work of individual machines or devices. However, we must admit that most often this was an improvement in technical details, without encompassing the entirety of production processes. So far, we have predominantly been technicians-specialists with little or almost no orientation in the phenomena of manufacturing from an economic perspective; we have not even been able to accurately measure the values that flow through a manufacturing plant and compare the total useful output with the input.

Another important cause of the wastefulness so far was that, in the past, the matter of organization was not based on strict knowledge and scientific principles, but was almost exclusively left to the innate talents and routines of managers. Until recently, it was even believed that organization was an art that could not be captured by general principles that everyone could follow. This belief was quite similar to the view that prevailed widely about 150 years ago regarding technology; at that time, technology was also considered an art that could not be captured by scientific principles and that only innate talent and tradition passed from father to son could achieve anything.

Today, however, we already see clearly that basing technical methods on scientific principles has brought about the astonishing progress that we are witnessing. Now, organization is also at a similar turning point. Over the past twenty years, organizational methods have been based on scientific principles, and the results already achieved open up new, distant horizons for progress in eliminating the enormous losses in human labor, natural energy, and other means of production.

If we consider the low coefficient of useful efficiency of the past epoch as an era of plundering exploitation of natural resources to some extent, we are now entering a new period in which rational use of these resources will be the main indicator of progress, thanks to technology and organization based on scientific principles.

Main management issues and guidelines for solving them.

If we now look at the technical and economic issues encountered in all areas of manufacturing work and consider that all these issues must be resolved in accordance with the most important economic principle mentioned above, we will see that the engineer's task as a manager of manufacturing workshops covers a much broader scope than before. To perform this task, we must move beyond the narrow confines of pure technology and take control of all economic and social processes that take place in such a complex organism as every modern manufacturing plant.

From an economic point of view, all these processes, expressed in monetary units, ultimately boil down to two main streams, namely

1. expenditure, or the costs of producing a certain quantity of product, and
2. income, as the sum obtained from the sale of this product.

Regulating these two basic flows is the main task of a manufacturing plant manager, and the main guideline in this regulation is the principle of obtaining the greatest useful output with the least input of production resources. This task is not easy when we have to deal with a highly complex network of phenomena that are interdependent and dependent on various external influences.

However, thanks to modern research, we already know the main laws that govern the two streams mentioned above and that provide us with clear points of support for solving the most important economic issues concerning the management of the production process.

1. One of these laws expresses the relationship between the quantity of the product produced, its operating cost (expenditure), and time;
2. the second expresses the relationship between the quantity of the product, its sales value (income), and time.

As for the first relationship, it can be represented by the graph in Fig. 1, if we plot production (*p*) performed in a unit of time on the horizontal axis (*OX*), and the cost (*K*) of that production on the vertical axis. In this way, we obtain a very characteristic cost curve (*AB*) in a unit of time:

1) it is a curve that continuously rises upwards as production in a unit of time increases,
2) the starting point (*A*) always lies above point (*O*), which means the cost in a unit of time never falls to zero when the plant does not produce anything,
3) the curve (*AB*) is concave upwards, as for each production unit, there is only one optimal production (*pw*) at which the ratio, i.e., the cost per unit of product, is the lowest.

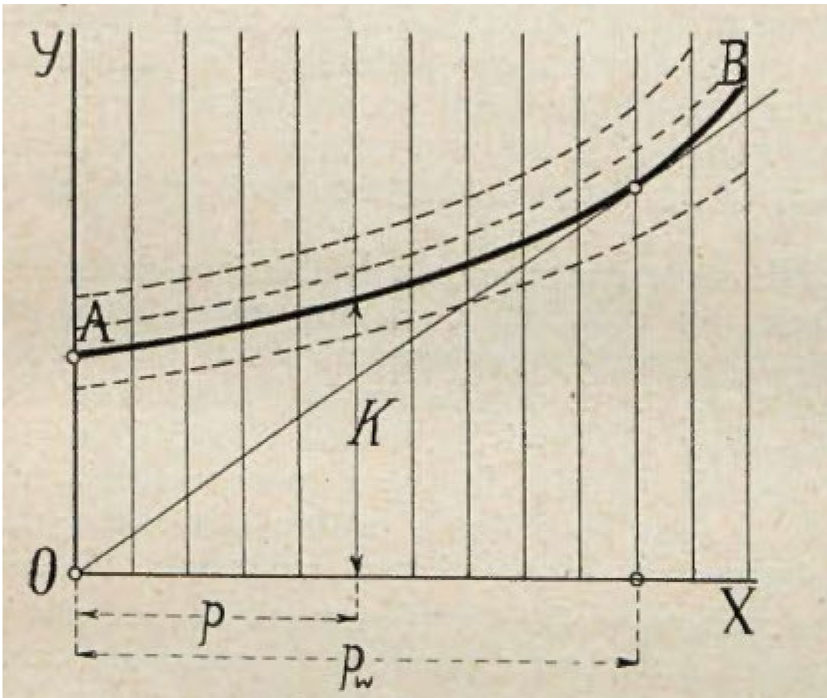


Fig. 1

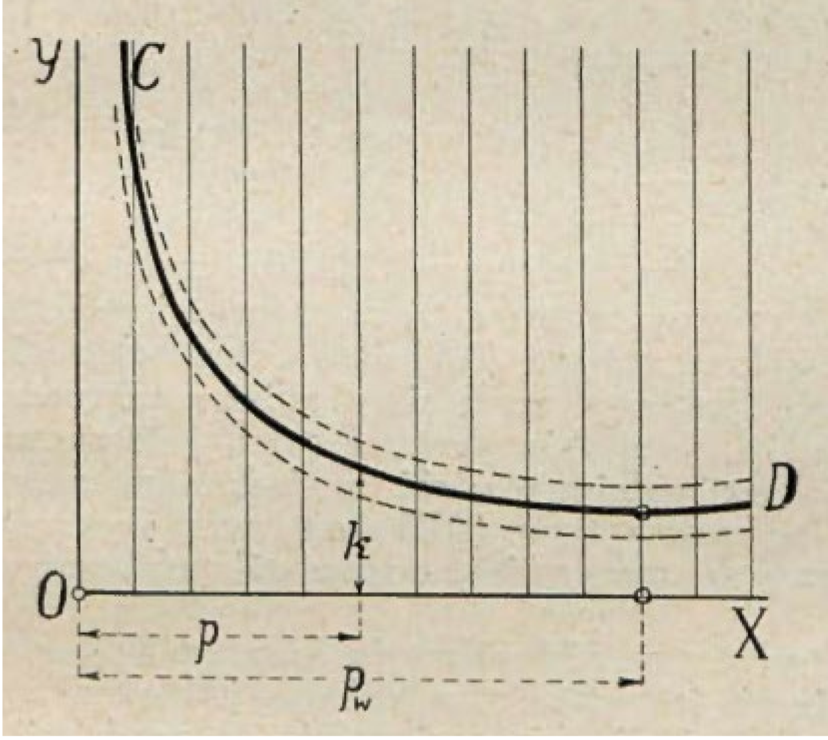


Fig. 2

The above graph is a fundamental characteristic of every production unit, in other words, it is the price of its time, assuming that when production (*p*) fluctuates, all other factors and conditions on which expenditure (*K*) also depends, such as the prices of materials, their quality, working conditions, the condition of equipment, machines, etc., remain the same.

If all these factors and conditions start to change, the cost curve in a unit of time (*AB*) changes its position, inclination, and curvature accordingly, but given equal conditions, it never loses the three previously indicated characteristic properties and has a strictly defined position and curvature.

The graph shown in Fig. 2 results from the previous graph, namely: the ordinates $k = K/P$ of the curve (*CD*) express the cost per unit of the product at different productions in a unit of time. The curve (*CD*) is somewhat distorted hyperbola and shows that the cost per unit of product decreases rapidly as production in a unit of time increases and reaches its minimum at the optimal production *Pw*.

With changing conditions, i.e., the change in the position of the curve (*AB*), the curve (*CD*) also lowers or raises.

For a more detailed explanation of the relationship between production, its costs, and time, as well as the many significant conclusions that can be derived from this relationship, I direct the reader to my articles in Przegląd Techniczny (No. 41-44 from 1923 and No. 49, 52, and 53 from 1924). At present, I must limit myself to the above remarks, especially since I am only concerned with providing a general characterization of the issues related to managing a production facility.

However, for further argumentation, it is necessary to emphasize that the law of cost flow in a unit of time, expressed by the curve *AB*, applies not only to the total sum of costs flowing through the entire production complex but also to all the constituent cost streams flowing through each work cell, which make up the entire workshop as a collective organism. Thus, each individual cell of the factory has its operating cost curve similar to curve (*AB*), meaning that a certain cost stream flows through each of them in a unit of time, which is also influenced by changes in material prices, working conditions of the cell, its condition, and so on. The total cost of the entire factory in a unit of time, expressed by a curve of type (*AB*), is the sum of the characteristic graphs of all individual cells of the factory.

Considering all cost items of production from the point of view of their type, we encounter only one item whose stream flows proportionally to production, regardless of the organ through which it flows, namely the cost of raw material. This cost is therefore expressed in our system by a straight line (*OB*) starting from point (*O*) in Fig. 3. All other cost items either flow constantly, independent of production volume, or grow not entirely proportionally to it and do not drop to zero when production in a unit of time is equal to zero. In any case, the sum of all cost items, whether flowing through the entire production organism or its individual organs in a unit of time, always varies according to a certain characteristic curve (*AB*), as indicated earlier.

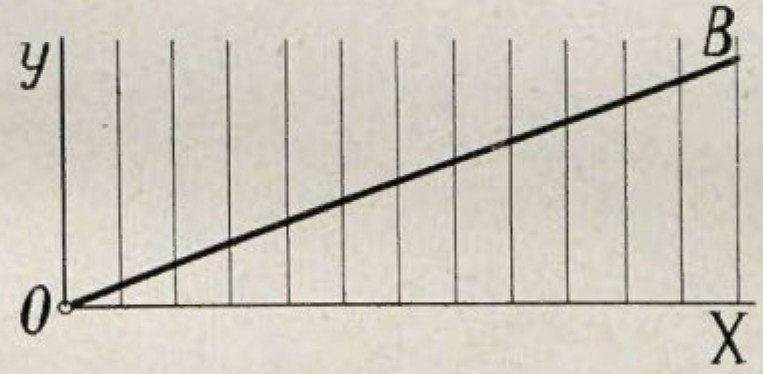


Fig 3.

As for the relationship between production, its sales value, and time, this relationship can also be expressed graphically in a similar way as we expressed the relationship between production, its manufacturing cost, and time. In Figs. 4 and 5, this relationship is presented. The curve of the product's sales value, contrary to the cost curve, always starts from point (*0*) because if we do not produce anything, the sales value is obviously equal to zero. If the price (*c*) of the product unit is constant (Fig. 5), the total sales value (Fig. 4) is expressed by the ordinates of the straight line (OS_1). However, this is usually an exceptional case and occurs only when there is a constant balance between supply and demand, regardless of whether we release a small or large quantity of the product to the market.

Most often, however, as we release an increasing quantity of the product for sale in a unit of time, or as the market becomes saturated, the price of the product unit gradually decreases (see Fig. 5), and the curve of the total sales value, bending downward, takes the form of (*OS*), and at a certain production level (*OG*), the value reaches its maximum [Σg] (limit value).

We will not delve further into the value curve here, as for the purposes of this report, we only need a few remarks concerning this curve. The reader will find more details on this subject in the extremely valuable book "Zarys ekonomji politycznej" (Outline of Political Economy) by Prof. Z. Straszewicz.

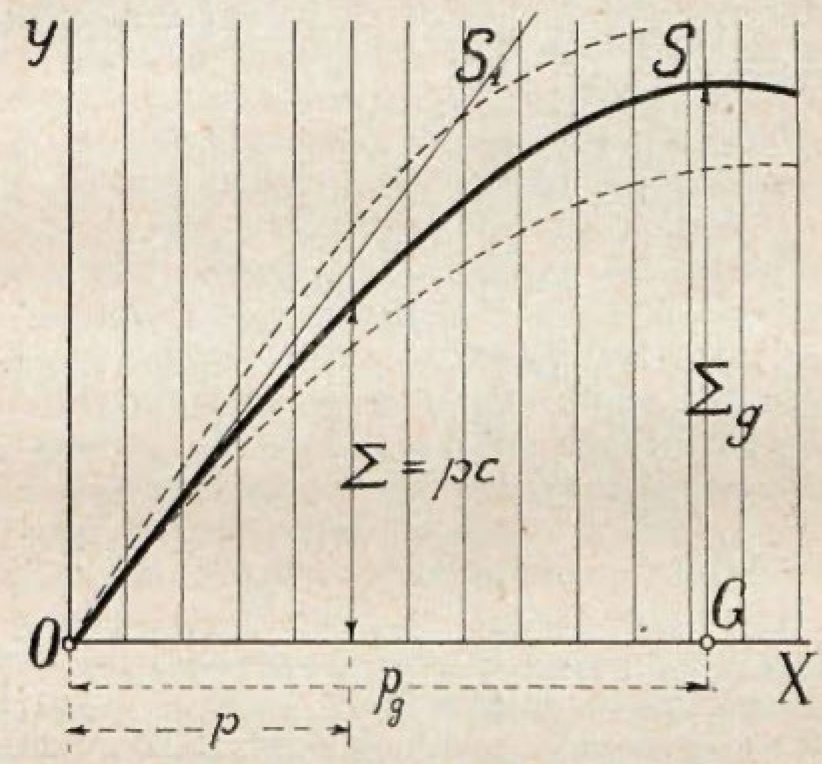


Fig. 4.

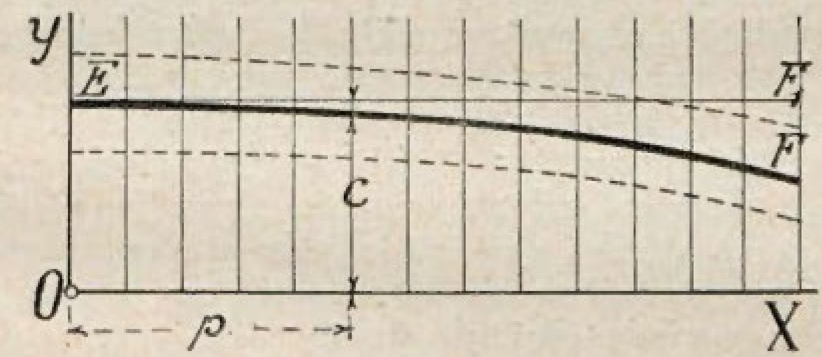


Fig. 5.

We have just mentioned that the law of supply and demand is the reason for the gradual decrease in the price of a product unit when increasing production, but due to the same law and varying levels of competition, the price of a product unit can increase or decrease even with the same production level of a given production facility. This means that the price curve (*EF*) can rise or fall, as shown by the dotted lines in Fig. 5. The total sales value curve (*OS*) can deviate in one direction or the other, pivoting around point (O*).* (At the same time, the curvature of this curve and the limit value may change).

With normal economic development, we most often encounter a decline in product prices, and for this reason, we can say that the sales value curve of the product generally has a tendency to tilt downwards.

If we draw the manufacturing cost curve and the sales value curve on the same scale, we can superimpose one onto the other, thereby obtaining a single general graph of expenditure and income, which gives us a clear understanding of the flows of various values that take place in a production facility. Fig. 6.

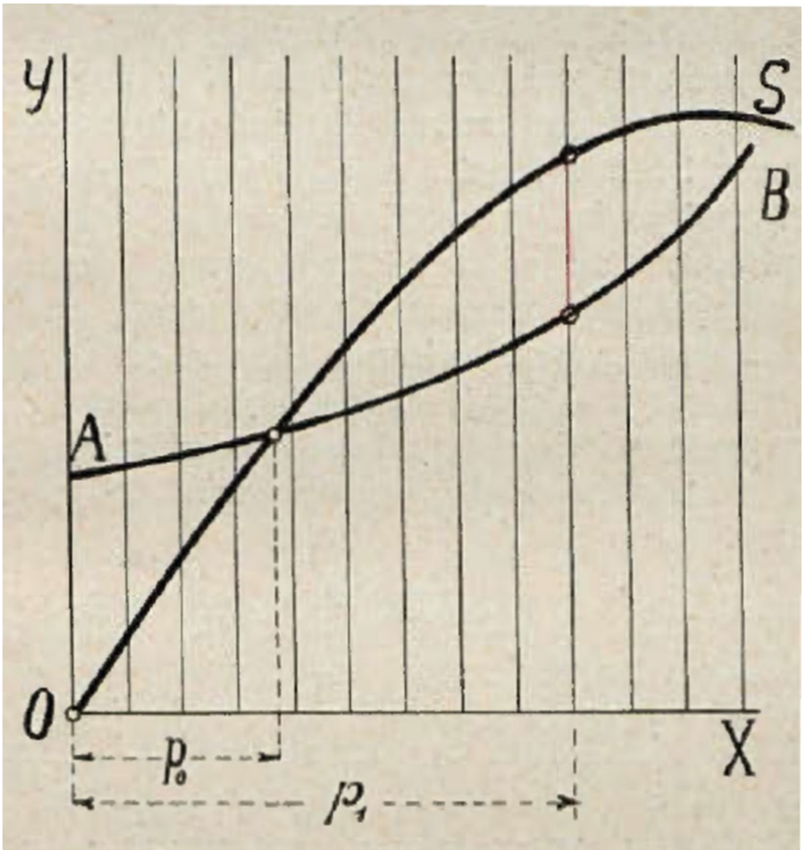


Fig 6.

A closer examination of this graph leads us to a series of extremely important conclusions related to the issues that a manager of a production facility encounters.

The scope of this report does not allow for a detailed consideration of all these conclusions. However, we must point out a few of them to at least present an outline of the general technical and organizational tasks.

First and foremost, the issue of profits stands out. We can see from the graph above that profits can be discussed only when the manufacturing cost curve and the sales value curve intersect, and if the production per unit of time exceeds a certain minimum (*p0*). Otherwise, the enterprise incurs losses.

This minimum production could be called the “first critical production.”

Curves (*AB*) and (*OS*) are independent of each other, and they can also fall and rise independently. With such fluctuations, it is very easy for an enterprise that generates profits at a certain level of production to turn into one that incurs losses, and vice versa.

If we look at the curves expressing the law of expenditure and income for each production facility and consider that these curves continuously change their curvatures, positions, and inclinations depending on the changes in internal and external conditions of the company, and that we arrive at the discovery of these curves and their understanding through simple observation of facts and logic, then the whole theory of Marx about surplus value, or profit, and all his conclusions, appear before our eyes as one big folly. It is hard to believe that such a concept could have arisen in the human mind, and even more so that so many people subscribed to it. I would argue that in the history of human intellectual development, it is a kind of stain, darker than the worst superstitions, because it has fueled conflict under the guise of progress.

If we look at a production facility from the perspective of the highest return on investment, the expenditure and income chart (Fig. 6) clearly shows the paths to follow to achieve the highest profit. Since the sales value curve, as we have already mentioned, usually has a tendency to tilt downwards, and this phenomenon does not depend on our will, there are only two ways left for us to achieve the highest profits: lowering our operating costs, i.e., lowering curve (*AB*), and increasing production to the limit (*p1*), at which the difference between the ordinates of curve (*OS*) and curve (*AB*) is the greatest.

From the chart, we can easily notice that such a policy of the plant manager also leads to satisfying the most important interests of the buyer of the manufactured product, as the low unit cost allows for a reduction in the selling price, and the increase in production, i.e., supply, allows it to be purchased by more people.

So, we see that there is no fundamental contradiction between the interests of capital invested in the manufacturing plant and the interests of the consumer, as long as the manager properly understands the laws governing the flow of expenses and revenues and follows the above-mentioned paths to achieve the highest profits (reducing production costs and increasing production).

But looking at the chart, we notice that increasing profits by increasing production has its limit at the point when curves (*AB*) and (*OS*) are farthest apart.

We could call the production (p_1) corresponding to this second point the “second critical production.” If we exceed this last point, the total profit will begin to decrease - the price per unit of production will fall faster and faster, and after exceeding the marginal value (market saturation), demand may decrease so much that a crisis eventually occurs - when further increasing production begins to bring losses. We will always reach such a crisis if we increase production too quickly without taking into account the pace of market purchasing power development and not exploiting all possibilities of reducing cost curves. However, if we gradually increase production and simultaneously lower our operating cost curves and influence the expansion of the sales market with appropriate sales price reduction policies, then despite the decrease in the sales value curve, the point of the greatest distance between both of these curves will move to the right; in other words, such an increase in production will no longer cause a decrease in profits or a crisis resulting from excess production compared to demand.

Someone could object here that such a conclusion is a theoretical assumption that could fail in practice - however, whoever has carefully read [Henry] Ford's insights will be convinced that he adheres to precisely such a policy in managing his plants and has practically proven on a large scale that it is the right policy that can always reconcile the highest profit with the greatest interest of the consumer.

But analyzing production costs as a function of production and time leads us to a third extremely important conclusion concerning the remuneration and interests of workers. Since the total cost (K) consists of a whole series of items, including labor, i.e., the amount paid to workers employed in the enterprise, one might superficially conclude that reducing production costs directly leads to the necessity of lowering wages; however, a deeper examination of the dependencies between the individual cost streams and production leads us to the opposite conclusion, namely, that increasing wages, reducing working hours, and generally improving working conditions can be fully reconciled with lowering the total sum of production costs and increasing production per unit of time, as long as various technical and organizational improvements aimed at saving energy, materials, and time are applied appropriately. Although progress in the field of technology is already significant, we do not yet see an end, and technical sciences continue to open up new fields for progress; organizational science is only taking its first steps and opens up immense horizons for us in the field of eliminating waste. Therefore, when looking for ways to reduce costs and increase production, we will always find inexhaustible means in technology and organization, and we do not need to resort to lowering wages or worsening working conditions. On the contrary, even rational wage increases and improvements in working conditions can, in many cases, directly contribute to lowering operating costs and increasing production.

Due to lack of time, we cannot go into a more detailed analysis of this issue here; we will only say that a detailed consideration of all the factors on which the cost flows depend - strict engineering accounting with a pencil in hand, without resorting to various humanitarian considerations - ultimately leads us to the assertion that there is no contradiction between the interests of workers, high return on capital, and the interests of consumers, as long as we know the whole mechanics of expense flow and can rationally regulate these flows.

The chart in Fig. 6 shows the general law governing these flows. If we wanted to graphically represent the total balance of flow at a given production per unit of time, we could present it in the form of a chart shown in Fig. 7, namely, if we draw production costs and sales values in the form of streams, the width of which we will take equal to the ordinates obtained from the chart in Fig. 6 at a given production. Thus, in the example provided in figure 7, the width of the total cost stream (*ab*) is equal to cost (*K*) at a given production (*p*).

The width of the streams in the upper half of the chart consists of a whole series of streams and rivulets representing different cost values.

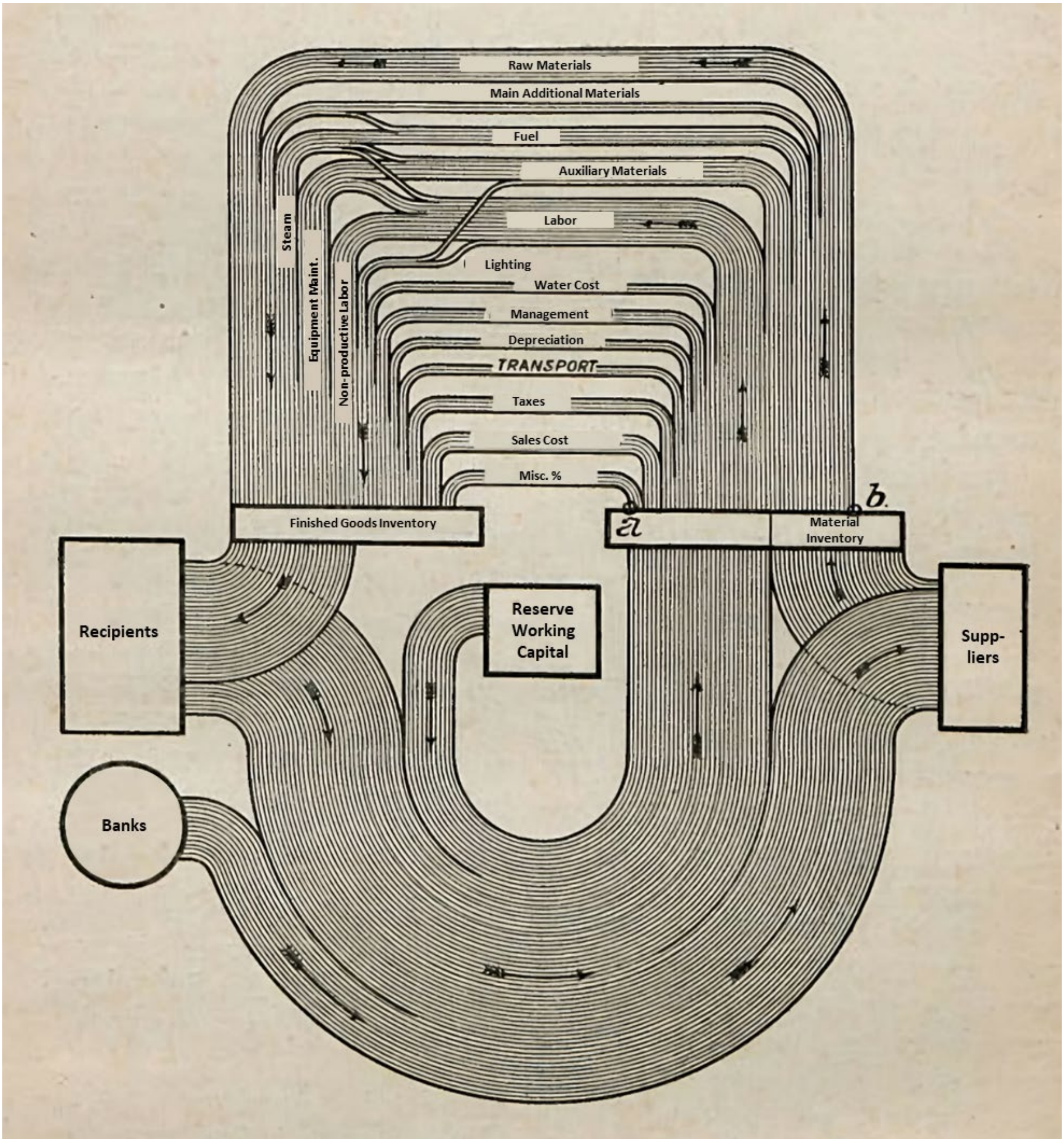


Fig. 7.

Fig. 7 [“Value Stream Map”]

The lower half of the chart represents revenue. But the inflow of money for the sold product does not go synchronously with the expenditure on production in a given unit of time. In a given month, for example, not all the products produced may be sent to buyers (with a portion stored temporarily in the warehouse). Payments from recipients may also arrive for products sent in previous months. The same can be true for deliveries: in a given month, a greater or lesser amount of materials may arrive than were used in that same month for manufacturing, and the payment for the supplied materials may relate to previous deliveries. In other words, we can encounter the most diverse thicknesses of inflows and outflows on the chart.

But the expenditure needed for production cannot wait – the thickness of the cost stream must be covered in a given month, otherwise it would result in a halt in manufacturing. This lack of synchronicity in flows applies not only to the main outflow and inflow streams of money. We can easily notice this in almost all the individual streams throughout the entire cycle. Therefore, we must have some additional accumulators that would take on the excess inflow or cover the deficit in case of a decrease in inflow. Such accumulators are:

- stocks of finished goods and materials,
- reserve working capital, or
- various credit institutions such as banks, etc.

The chart in Fig. 7 presents a general picture of expenditure and income processes taking place in every manufacturing establishment and is a graphical balance of the entire circulation of value in a certain unit of time, e.g., a month, and at a given production (*p*) executed during that month and the various exchanges the establishment had with outside parties during that time.

If we express the streams in general sums, we will get a fairly simple picture indicating that we are dealing with a circulatory process. However, the more we delve into the details of this process, the more we will realize that it is highly complex.

Each of the main streams consists of numerous smaller ones, expressing either the flows through various individual organs that make up the entire productive organism, or expressing individual expenditure or income positions, e.g., material costs, sales values of individual products, acquisition costs of various means of production, inflows and outflows of money from buyers and to suppliers, etc.

All these streams and rivulets generally do not flow synchronously among themselves and not synchronously with production, although each of them is more or less dependent on it and flows according to its own characteristic chart (*AB*).

This circulatory process reminds us of blood circulation in a living organism. All the more so because the width of the streams is not constant, but variable, they depend on one another and on various internal and external influences.

All these streams and rivulets constantly pulsate, and they are interconnected in an incredibly subtle way. If we start to influence any of them, it will affect the entire flow. Some streams have a property that if we start to expand them, other streams will also expand automatically in various proportions or, conversely, narrow down automatically, and so on.

In a word, we are dealing with an organism in which highly complex and subtle economic processes take place, and which a manager must direct. Of course, this task is not easy. It requires extensive knowledge and experience to not only orient oneself in such an immensely complex web of technical, commercial, financial, and economic issues, but also to be able to regulate the flows with the thousands of knobs and faucets from all the streams to achieve the highest useful efficiency coefficient.

If we compare this circulatory flow (balance) with other similar processes we have thoroughly scientifically studied and can manage efficiently, e.g., if we compare it with energy balances in converting fuel heat into mechanical and electrical energy, or cycles of various technological processes, we come to realize the intricate complexity of the entire manufacturing process expressed in monetary terms, and its comparative lack of extensive study.

We must admit that while we have made significant progress in some technical aspects of this process, in others related to the economic side and coordinating everything into a perfectly functioning whole, we are only taking the first steps. Undoubtedly, we will only be able to manage a manufacturing plant effectively when we scrutinize all its processes with the same precision that we've applied to studying energy transformations in engines or various reactions in technological processes.

Our current position in dealing with the immense complexity of economic phenomena in today's manufacturing plants is analogous to that of an engineer operating a steam engine, but to whom the complex energy transformations occurring within it are a complete mystery.

So, the task is not easy, but there is no doubt that we are quickly approaching rational solutions. We have already found the two aforementioned laws governing the flows of expenditure and income, expressing their dependence on production and time, and the science of organization is expanding ever wider, starting from the organization of sequential tasks for a single worker and now applying scientific methods to the organization of all production and economic processes in industrial facilities.

Qualifications necessary to perform the role of a manager.

From this brief overview, we can see how extensive knowledge and experience a manager should have in order to meet the challenge. The operation of the entire organism depends not only on its internal structure but also on many variable external conditions – commercial, financial, economic – necessitating a thorough understanding and ability to navigate these conditions to find the optimal solution for each unique situation.

If we then consider that this entire manufacturing organism is composed not only of machinery and devices, but also of people, who form a kind of collective nervous system that directs the entire organism, and who are incredibly subtle machines with not only physical but also a vast array of spiritual properties and interests, we will understand how challenging and responsible the task of a manager is, whether directing the entire industrial plant or its individual parts.

Who can meet such a challenge?

To this question, we can answer that only someone who:

1. has sufficient knowledge and experience, and is able to:
2. analyze in the finest detail the entire intricate web of phenomena,
3. discover the laws governing them, and properly utilize these laws,
4. apply scientific methods to eliminate all unnecessary waste,
5. consider the properties and needs of employees, and
6. coordinate all factors towards the three most important goals, namely:
    a. the greatest economic benefit for the whole society,
    b. the greatest benefit for the employees, and
    c. the highest profit from the invested capital.

Today, there is a widespread belief that the person who has the right to be the overall manager of an industrial plant is primarily the person who invested money in it, the owner. However, owning a property does not imply the ability to manage it, especially an industrial enterprise. If it were only about the interests of the owner, about receiving personal profits from the invested capital, then obviously nobody would need to worry about whether the owner-manager has the necessary qualifications or not, even if they were completely illiterate. But every manufacturing plant is essentially a specialized organ fulfilling some economic functions of the entire nation. This is a point that all industrialists acknowledge, particularly when they're advocating for their interests or seeking privileges or assistance from the government and society.

Therefore, society cannot afford to be indifferent as to whether the owner of a manufacturing plant is qualified as a manager. Incompetent management can lead to significant harm, not only to the enterprise's employees, but also to society as a whole. Today, many people who still believe in the omnipotence of capital find it challenging to accept the idea that capital is not the primary driving force. They struggle with the concept that mere ownership does not automatically entitle them to independently manage the enterprise.

It is worth quoting the following statement by [Henry] Ford:

> *"The employer is just a person, just like his workers. He has the right to maintain his position only as much as he can fulfill it. If he can steer his enterprise, then he fits his position, otherwise, he has no more qualifications than a newborn baby."*

So, if we look at things impartially, we must answer our question that the mere title of ownership is not a sufficient qualification to manage an industrial plant. And if we start examining the existing relationships, we can easily see that a significant number of owners of manufacturing plants do not have sufficient knowledge, experience, or other qualifications for management.

Engineer as a manager of manufacturing plants

For some time now, there have been claims for workers to take managerial positions in industrial plants, primarily from some leaders of the labor movement who have turned the workers' cause into a tool of politics. The average worker, possessing a fair amount of common sense, would typically hesitate to take charge of such complex affairs that require knowledge they do not possess. Of course, some of them might aspire to the position of a director or workshop manager, but mere desire cannot replace the necessary qualifications, and such experiments can only lead to the ruin of manufacturing plants, as has been broadly tested in Bolshevik Russia. There is no doubt that among workers, there are occasionally talents so outstanding that they could successfully hold official positions. However, this should not be generalized to all.

Merchants and financiers often claim to be best suited to manage manufacturing plants. But this only proves that people who meddle in affairs they don't fully understand can be found everywhere. While a deep understanding of commercial and financial matters is essential, it only constitutes one part of the necessary qualifications. Among merchants and financiers, of course, there are individuals capable of embracing the entirety of the required qualifications, but these are rare exceptions, and generally, outdated prejudices still dominate these spheres, such as among merchants—the belief that the whole art of trade lies in buying as cheaply as possible and selling as expensively as possible—and among financiers—the belief that money is the entire economic power and that manufacturing plants exist solely to extract money, before which all other considerations and objectives must yield. Members of these two groups hold a deep conviction that industry and commerce cannot be guided by social or national considerations because they weaken their economic power. They have equated these considerations with the always devastating effect of charity, a legend many people unfortunately believe.

Since management positions in manufacturing plants are most often occupied by people with technical education of various levels, the question arises whether technicians and engineers have sufficient qualifications to solve all the above-mentioned management-related issues. To this question, we must also answer negatively and state that among today's technicians and engineers, there is still a small percentage of people who can cope with such a great task. Generally, we have more than enough preparation for solving technical problems; but our knowledge in the commercial, financial, and economic fields is insufficient, and above all, we do not have training in organization itself.

Despite this, we can confidently assert that the methods of rigorous mathematical and realistic thinking in which technicians are best trained, and which have already produced such great results, provide a guarantee that it is technicians, rather than anyone else, who will best solve the tasks related to managing manufacturing plants after expanding their knowledge in other fields.

However, analyzing the issues related to production processes, we see that among them there are many issues of another category, which cannot be solved by knowledge and professional experience alone, and for which we can find the key only in individual and social ethics.

Therefore, the manager of a manufacturing plant should possess outstanding virtues in this category.

If we want to apply for a production managerial role, we must understand that the widest professional knowledge will be greatly flawed if it is not accompanied by an equally high socialization of the manager. A person lacking these virtues should not take on managerial roles, because instead of contributing to progress, they can easily become a social pest.

Role, position, and responsibilities of a technician as a manager.

We must finally get rid of certain prejudices that have also penetrated some technical minds, particularly that there is a fundamental contradiction between the interests of workers and the interests of capital, as this prejudice obscures the mind and eliminates any basis for the logical thinking required in solving every economic issue.

If this fallacy of conflicting interests were true, then we technicians would have no choice but to roll up our sleeves and join the fight on one side or the other, using all our technical knowledge as a means of combating the other side. It would be more logical than putting our creative work between two fiercely fighting sides, watching helplessly as it is destroyed, and constantly receiving painful blows from both sides.

Today, knowing that there is no such contradiction and having reached this conclusion not only through theoretical analysis but also through practical experience, as Ford has done for example, we must abandon our passive and narrow position and, having expanded our knowledge, take on higher positions in production management. We must occupy an unoccupied position and roll up our sleeves, not to fight opponents, but to harmonize all pertinent factors and forces and, in this way, eliminate incredible waste, converting it into wealth for everyone.

Harrington Emerson's statement that if we could only turn a fraction of our current losses in energy, human labor, materials, and time into useful results, all humanity would be living in prosperity, is the most realistic truth, and not merely an impossible idealistic dream. Proof of the realization of this claim is not only Ford's activity but also the striking fact that all those nations that currently work better and more effectively, eliminate losses in the use of labor, natural resources, and live in greater prosperity than nations that cannot.

Harrington Emerson also puts forward another claim, that one of the most important principles of efficiency is fair and honest behavior. An truth as old as the world, but we has so forgotten about it that those who remind us of it are often called eccentrics. Such an eccentric is Ford and many of those American activists who have made the greatest fortunes. It seems that the time is coming when man, having tried all means to avoid this truth, will have to return to it as one of the most important foundations of modern economy.

It seems to me that everything said above is enough to define qualifications and shed light on the position a manager of production facilities should occupy. But for his work to be effective, he must rely on some higher moral authority, which would be respected. Such authority can only be created by associations dedicated to a more altruistic vision. American engineers have already started this by uniting in one federation with the motto of serving society and all humanity. They are currently planning to create such a federation of engineers from all over the world.

This level of focus is essential not only because it fosters authority, which is needed to override various detrimental biases and narrow views that lead to wastage of labor and productive resources. It is also needed to cultivate a sense of higher civic responsibilities among its members, which primarily lie on the person directing the manufacturing work.

Our main organizational task is to harmonize all factors of production for cooperation, not for struggle. This task would not be so difficult if today's employers and workers stood at a higher level of culture and if the deeply rooted prejudice that their interests are contradictory and that only through extreme selfishness, without considering general social interests and the interests of the other party, can they achieve the highest results for themselves.

To achieve the desired results under such conditions, the manager-engineer must develop not only purely professional but also general cultural activities - he must therefore support all legitimate demands of both sides, while also opposing demands that would hinder cooperation or impede the application of technical and organizational achievements aimed at eliminating waste and increasing efficiency.

For effective development of such activities, it is necessary to create a third force that both sides of the conflict would have to reckon with - we must therefore have a sense that in our efforts to remove these obstacles, the opinion of an altruistic association, as a representative of the interests of the whole society, stands behind us.

When we take such a position, we will be able to effectively counteract the encountered obstacles, for example, if an employee makes a demand contrary to the proper functioning of the production organism, hindering its development and limiting technical and organizational improvements. If an employee seeks to improve their well-being by demanding higher wages and better working conditions, while supporting these legitimate demands, we will have to veto them if they want to achieve them immediately, without considering all other conditions and economic possibilities, as we are not miracle workers who can instantly implement technical and organizational improvements and change the streams of income and expenditure to cover the increased labor costs without causing a rise in the cost of production, which is always dangerous for the workers themselves.

We must energetically oppose the false ideology of workers that they can raise their own well-being through increasing wages without increasing productivity and wasting time in all its forms.

We must energetically oppose the factors destroying the discipline of collective work, as it is one of the most important foundations of organization and cooperation.

We must also actively intervene and veto any obstructions that may arise from the business owner. For instance, should the owner view their enterprise solely through the lens of personal and immediate gains - intending to boost profits by reducing worker wages or worsening working conditions, or prioritizing short-term earnings over long-term sustainability by neglecting equipment maintenance, technical enhancements, and ongoing organizational progress. It's problematic if a considerable portion of the profits isn't reinvested in the enterprise for improvements and financial fortification against potential crises.

We must also intervene if the business owner views the manufacturing plant as a platform for various speculative activities and aims to introduce policies that encourage such speculation. We must oppose their intentions if they believe that the optimal strategy to boost profits involves increasing the selling price and forming cartels to achieve this objective.

We will have to intervene if the entrepreneur sets up production plants for purely speculative purposes or without having a clear idea of the sales market, thus contributing to the triggering of crises and so on.

Finally, understanding our managerial position in the economic life of the entire nation, we will have to veto if the government or legislative bodies, interfering in industrial or workers' affairs, wanted to introduce regulations even in the best faith, but not in accordance with economic laws or that could hinder the development of technology and organization in industrial bodies. We must veto if the government, for political reasons, will adhere to the policy of "taking into account the current mood" and thus unwittingly help the harmful violation of fundamental economic rights or the reduction of work efficiency, of which we have numerous examples since the beginning of the rebirth of our statehood.

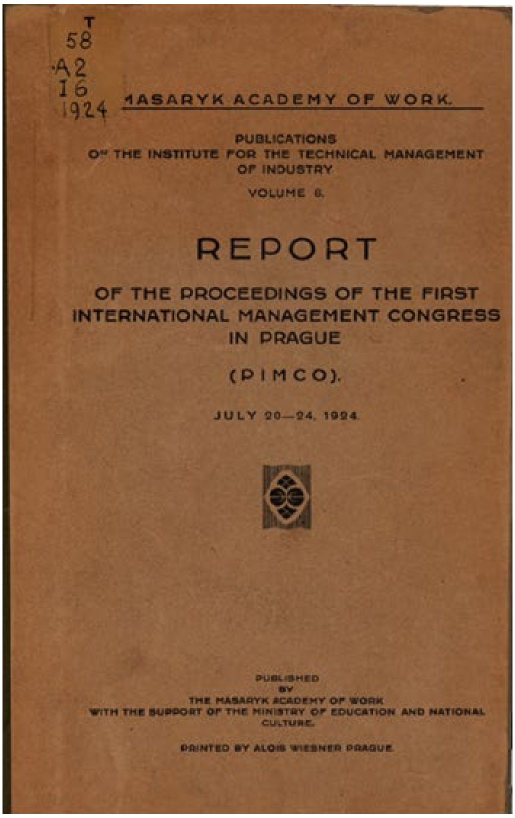
But pointing to the numerous duties that arise from the position we must take as plant managers; I would not like to be misunderstood. Saying that mainly among technicians and engineers, there may be people who can best solve issues related to the management of manufacturing work, I do not claim that this should be a reason for giving them special rights or privileges in this regard. Giving such privileges would distort the whole matter and would lead to the harmful path of caste and regulation of activity, which cannot be regulated.

The position of managerial manufacturing work, requiring great knowledge, experience, and highly developed sense of citizenship, as well as outstanding personal qualities, cannot be achieved through any privileges. Such a position is achieved only through the actual possession of all personal qualifications and demonstrating proficiency through action.

If I claim that there is also a need for a certain collective force, it is not at all for the defense of the material interests of the members of the association or for taking a militant position, as is the case today in all professional associations, but to raise the civic culture of its members and create a higher authority that would stand guard over the interests of the entire society and fulfill its functions with the help of its impartial opinion.

Lastly, when I argue that the managers of manufacturing operations must counteract and eliminate hurdles that impede the harmonization of all forces and factors of production, undermine work efficiency, and contribute to waste, it's important to clarify what this entails. This does not involve meddling in economic affairs via various commands, prohibitions, rules, privileges, or similar forms of top-down regulation. Rather, it involves actions and adaptations of existing economic relationships that prevent such obstacles from arising in the first place. However, we must acknowledge that these hurdles and resistances cannot be eradicated immediately, as they primarily stem from deeply entrenched aspects of our general cultural state and cannot be removed simply through artificial regulation or forceful methods. Elevating our cultural level is key. One of the most effective ways a manager can influence and counter these obstacles is by maintaining a high intellectual and moral standard and demonstrating strong character. It's undeniable that these qualities in a manager exert a positive and remedial effect on the entire environment.

In conclusion, the advent of organizational science—a field that pervades all sectors of the economy and conducts an all-encompassing analysis of its phenomena—unveils a substantial civilizational task for technicians and engineers eyeing managerial roles. This endeavor may pose challenges, but the immense honor and prestige it offers is undeniable.



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REPORT

OF THE PROCEEDINGS OF THE FIRST INTERNATIONAL MANAGEMENT CONGRESS IN PRAGUE

(PIMCO).

JULY 20—24, 1924.

PUBLISHED BY
THE MASARYK ACADEMY OF WORK
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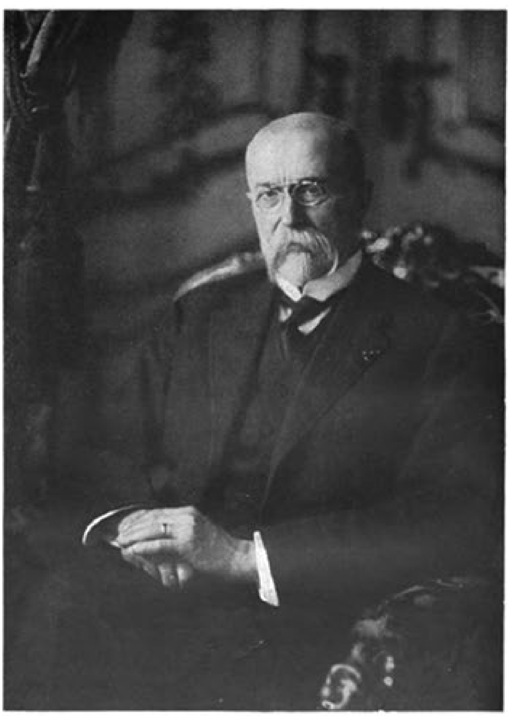
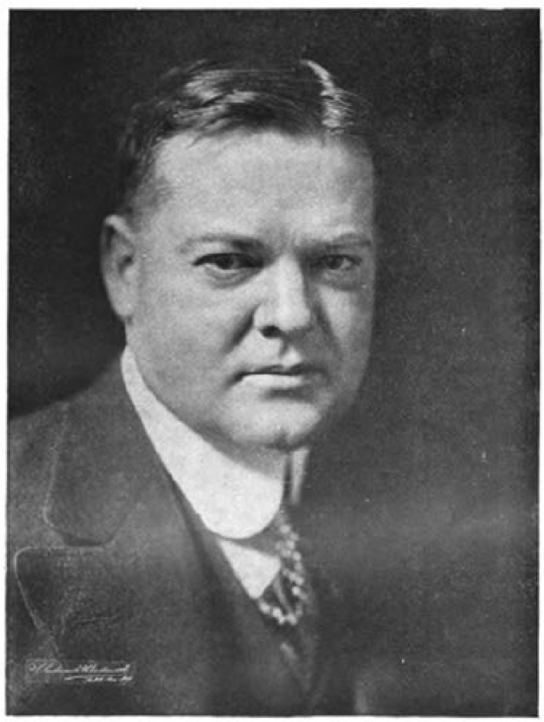


T. G. Masaryk.



Herbert Hoover

PIMCO (Proceedings of the first International Management Congress) in Prague. July 20-24, 1924

The Institute for the Technical Management of Industry Masyryk Academy of Work, Prague, 1925

Forward to the English edition

The inaugural session of the International Management Congress in Prague (PIMCO) was a landmark event, drawing more than 500 delegates from around the world. This gathering served as the international debut of Karol Adamiecki's paper on Harmonization, amplifying his recognition outside of Europe, notably amongst peers from the United States and Japan. The International Management Congresses paved the way for Adamiecki, alongside Herbert Hoover and Jan Masaryk (son of Czech President, Tomáš), to co-found the International Committee of Scientific Management (CIOS, Comité International de l'Organisation Scientifique) in 1926.

The Congress was organized at the request of the Masaryk Academy of Work (Czechoslovakia) with a joint committee comprised of the following associations from the United States:

- *The American Management Association*
- *The Management Division of the American Society of Mechanical Engineers*
- *The National Association of Cost Accountants*
- *The Society of Industrial Engineers*
- *The Taylor Society (including M. Cooke, F. Gilbreth*, L. Gilbreth, HS Person, and LW Wallace)*

The meeting centered on several key aspects of management science, organized into five main groups:

1. *General Group: Nature and Principles, Human Factors, General conditions (Harmony, worker participation, wages, profits).*
2. *Elimination of waste, standardization, and simplification in industry*
3. *Scientific management in the coal and transportation industries*
4. *Scientific management in Public Administration*
5. *Training (of workers, Higher education and technical training of manager and engineers)*

In addition to the presentation of his paper, which is already included in its entirety these collected works, Adamiecki made a few additional remarks which we include here in the original English.

**Frank Gilbreth, though instrumental in organizing the conference, tragically passed away shortly before it commenced. The first day of the Congress concluded with a memorial service in his honor.*

P43:
Professor of Engineering Karol Adamiecki spoke in Polish and French as follows:

Ladies and Gentlemen ,
In the name of the technical high schools in Warsaw and the Association of Engineers and the League of Work I have the honour to greet you, Mr. Chairman, and all the participants in this congress.

We are convinced that this congress is contributing in a great measure to the co-ordination of the efforts of the scientists of all the civilised nations.

We Poles consider this congress as particularly important because there are represented in it the emancipated peoples, that is, the peoples of the Little Entente and the Poles, who with youthful ardour rejoice in their rebirth. We are happy to see how considerable is the participation of the distinguished representatives of the United States in which country has arisen the science of productive work. As far as the cult of work is concerned the United States act as an example for all the nations of the world.

We Poles very warmly greet the American representatives because we regard them as the bearers of the idea of productive work in the name of the loftiest moral ends.

We are of opinion therefore that the initiative of the valiant Czechoslovak nation, in summoning this congress and in inviting to it so many eminent men of action, is praiseworthy in the highest degree.

Finally I express the wish that the labours of all the participants of the congress may prove very fruitful in the field of international work for the good of mankind.

P 56
Prof. K. Adamiecki's (Warsaw) paper was read by Mr. Stan. Łubieński. As same has subsequently been printed, we refer to it below.

In this paper there is embodied the result of 28 years of labour on the part of Mr. Adamiecki in the field of scientific management. A report dealing with the principles of scientific management of work had first been published by Mr. K. Adamiecki as far back as 1903, a month before Taylor's first publication appeared, a fact which will no doubt be of interest to the American members of the Congress.

The leading idea of these principles is the harmonious collective work which is dependent on the following two principles:

1. The principle of harmonious selection of working units destined to cooperate (structural harmony).
2. The principle of harmonious cooperation (active functional harmony)

As a practical solution for the application of these two principles Mr. K. Adamiecki devised the following graphic methods:

1. A graphic method showing the time used.
2. A special method for the harmonization of the operations of individual working units.

This latter graphic method makes the harmonization of collective work very similar to the harmonization of musical units in music.

Mr. K. Adamiecki and some of his followers have, ever since 1903, often made use of these principles and graphic methods with a good result as regards increase in output.

It is to be expected that these achievements will greatly contribute to the development of the "Scientific Management Science".

Apart from what precedes, Mr. Adamiecki expresses the view that the following three natural laws are to be considered the chief principles of scientific management:

1. The law of the division of labour;
2. The law of concentration;
3. The law of harmony.

He comes to the conclusion that only such methods may be called scientific as are founded on the above mentioned three laws.

I.

OTWARCIE ZJAZDU

A.

PRZEMÓWIENIE PROF. K. ADAMIECKIEGO, przewodniczącego Komitetu Organizacyjnego Zjazdu.

Panie Marszałku, Panowie Ministrowie, Panie i Panowie.

Komitet Organizacyjny dzisiejszego Zjazdu uważa za konieczne przedewszystkiem wyjaśnić w kilku słowach powód zwołania Zjazdu i jego cel. Dlatego jest niezbędnem przytoczenie kilku dat historycznych.

Sprawa oparcia organizacji procesów wytwarzania na podstawach naukowych zaczęła kiełkować już dawno wśród techników i inżynierów Polskich. Pierwsze prace na tem polu rozpoczęły się około 1895 r.; w sali tej już 16 lat temu odezwał się pierwszy głos, a więc w parę lat potem, kiedy w Stanach Zjednoczonych Ameryki Północnej F. W. Taylor, H. Emerson, F. B. Gilbreth, H. L. Gantt rzucili pierwsze myśli o naukowej organizacji.

W 1915 r., podczas wojny, kiedy w społeczeństwie naszem spodziewano się już, że naród nasz odzyska wolność, technicy i inżynierowie polscy w tem Stowarzyszeniu odbyli kilkanaście narad, zastanawiając się nad bogactwami i warunkami przyrodzonymi, które nasz kraj posiada, jako podstawami przyszłego samodzielnego bytu gospodarczego naszego narodu.

Ze wszystkich tych rozważań wyłoniła się jedna zasadnicza myśl, a mianowicie: wszyscy wtedy przyszliśmy do wniosku, że, jakkolwiek posiadamy wielkie bogactwa leżące w ziemi, i mamy pomyślne warunki rozwoju, jednak wszystkie te bogactwa nie dadzą nam podstawy bytu jako

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Opening of the 1st Congress on Polish Scientific Organization of Work. (Dec 6-8, 1924)

Source: Naukowa Organizacja Pracy. The first congress Polish 1924. Warsaw, 1925, pp. 1-5

Forward for the English edition:
The Scientific Society of Organization and Management [Towarzystwa Naukowego Organizacji i Kierownictwa] (TNOiK), was founded on April 20, 1925 as the Institute of Scientific Organization (INO) at the Museum of Industry and Agriculture in Warsaw, one of the world's first professional management organizations, through a merging of 15 circles of scientific work and technician associations in Poland. This executive committee convened the 1st Polish Congress of Scientific Organization on December 6-8, 1924 with the approximately 500 people participating.

Karol Adamiecki was elected the first Director of the INO and performed this function continuously until his death on May 16, 1933. Through this organization, in 1926, he established the monthly Przegląd Organizacja (Organizational Review) – one of the oldest periodicals in the world today.

Source: http://www.tnoik.org

I. OPENING OF THE CONGRESS

SPEECH BY PROF. K. ADAMIECKI,
Chairman of the Congress Organizing Committee.

Mr. Marshal, Ministers, Ladies and Gentlemen,

The Organizing Committee of today's Congress considers it necessary, first of all, to clarify in a few words the reason for convening the Congress and its purpose. Therefore, it is essential to cite a few historical dates.

The issue of basing the organization of production processes on scientific foundations began to emerge long ago among Polish technicians and engineers. The first works in this field started around 1895; in this hall, the first voice was heard 16 years ago, which means a few years later when, in the United States of America, F.W. Taylor, H. Emerson, F.B. Gilbreth, H.L. Gantt introduced the first thoughts on scientific organization.

In 1915, during the war, when our society expected that our nation would regain its freedom, Polish technicians and engineers held several meetings in this Association, contemplating the natural resources and conditions our country possesses as the basis for the future independent economic existence of our nation.

From all these considerations, one fundamental idea emerged, namely: at that time, we all came to the conclusion that, although we have great wealth lying in the earth and favorable conditions for development, all these riches will not provide us with a basis for existence as an independent nation if we do not reach for the most important source – **efficient and well-organized labor.**

Unfortunately, our nation, due to either its unfortunate history or deeply rooted harmful habits, did not get used to considering work as the most important foundation of prosperity, but rather considered it a misfortune. Therefore, among technicians and engineers, the idea of drawing the attention of the entire nation to this great and inexhaustible source of wealth emerged, by creating the League of Labor, which would promote the idea of efficient work.

This idea was proposed by engineer Piotr Drzewiecki. In 1919, when we regained our independence, thanks to his efforts and activities, such an association was established. The League of Labor, besides propagating the idea itself, also took the initiative to establish a scientific institution called the Institute of Labor Organization, which would indicate the paths to rational organization.

Unfortunately, having regained our freedom, our nation began to seek the paths to prosperity in other fields. We started experiments that were inconsistent with the most elementary laws of economics. Despite frequently extolling the virtues of "work", it appears that no one has seriously considered its implications. Calls for increasing labor productivity were generally understood as calls for excessive, even more oppressive work for employees. Our nation was more inclined to participate in politics than to engage in work. In the whirlwind of partisan politics, we opted to assign blame to the left or right for our deteriorating economic situation, rather than acknowledge the glaring truth that, that **there is no prosperity without efficient work.**

The ideals of the League of Labor mostly did not resonate, and the project of the Institute of Labor Organization fell due to lack of support.

However, among technicians and engineers, this idea continued to develop and strengthen and just last year, this movement saw a significant revival. In September, a delegate of the Association of Polish Technicians and Merchants in America arrived with a special mission to stir up our society in this regard. Our compatriots from America, hearing what was happening here and comparing the sad state of affairs with the extraordinary acceleration of work in America, sent a special memorandum to all Polish technical associations, scientific institutions, social associations, and the Government, calling for attention to the new methods of organizing production in America and offering their help in establishing relations with American engineers. At the same time, Mr. St. Łubieński, the delegate, brought an assurance from the Federated American Engineering Society that they were ready to help us transplant these methods to Poland.

It is significant that initially, **only technical spheres** responded to this appeal. In the Association of Technicians in Warsaw, a Committee was immediately formed **to implement** the American proposals, and after the lecture on November 30, 1923, by engineer J. Kannegeisser on the

importance of the scientific organization of labor, the Circle of Organization Engineers was formed, which took the matter upon itself.
Thanks to the influence of the Warsaw Circle and the lively interest of technical spheres throughout the country, 14 provincial circles were established within a few months, within various technical associations.

You will find a detailed description of the history of this movement and the activities of these associations in the Bulletin we published for this Congress.

But I must emphasize an important moment that has recently significantly stimulated interest in the matter of scientific organization, not only of technical spheres but also of production and government spheres, namely the July International Congress in Prague on the scientific organization of labor.

This Congress was important to us for two reasons:

1) The Polish delegation had the opportunity to see for themselves the great work accomplished by Czechoslovak engineers in creating the Masaryk Academy of Labor, and how quickly the Czechoslovak nation is moving forward, thanks to the understanding of the importance of scientific organization for increasing labor productivity.
2) We had the opportunity to personally connect with the most prominent American engineers who promised us their help. You will also find the details of this matter in the aforementioned Bulletin.

The 15 Circles of Organization Engineers, which were formed at such a rapid pace and which currently have over 350 members, require quick unification and the development of a program for further joint activities. It is precisely for this purpose that the Organizing Committee decided to convene members of all Circles. However, since many issues that we wish to discuss are of great importance and concern the entire Polish community, we have allowed ourselves to invite all interested parties.

Here is the reason and purpose of today's Congress.

The numerous guests gathered here are undoubtedly proof that the importance of the scientific organization is already widely understood in our country, which gives us engineers courage and faith that our work and efforts will finally bring tangible benefits, especially if colleagues from other professions join our activities.

Opening today's Congress, I have the honor, on behalf of the Organizing Committee, to welcome all our distinguished and respected guests and all colleagues from the Circles of Organization Engineers who have come in such large numbers.

At the same time, I have the honor to welcome the Envoy of the Czechoslovak Republic, who has graced our Congress with his presence and to express our gratitude for the extremely hospitable reception our delegation received in Prague during the International Congress, organized by the Masaryk Academy of Labor.

In order to organize the Congress's proceedings, the Organizing Committee allows itself to propose to the esteemed Assembly:

To elect as the President of the Congress, engineer Piotr Drzewiecki, our first pioneer of the idea of efficient work and a highly deserving activist in the field of technical and social work.

To invite to the Honorary Presidium:

Dr. Józef Joteyko, a distinguished activist in the field of scientific research in physiology and psychology of work, as well as experimental psychology, to which we engineers turn to find guidance on how to deal with the human machine.

- Prof. Karol Skotnicki, Rector of Warsaw University of Technology.
- Prof. Dr. Karol Wątorek, Rector of Lviv Polytechnic.
- Prof. Dr. Jan Krause, Rector of the Academy of Mining.
- Prof. Piotr Sosnowski, Rector of the Main School of Rural Economy.
- Prof. Piotr Kasperski, Rector of the Higher School of Commerce.
- Colonel Konstanty Haller, Commander of the Officer Engineering School.
- Jan Zagleniczny, a distinguished industrialist, president of the Supreme Council of Sugar Industry Associations, who was the first to show generous support for the goals set by our Circle in the field of scientific organization.
- Władysław Kiślański, the doyen of Polish industrialists and engineers.
- Prof. Ignacy Radziszewski, president of the Association of Polish Technicians in Warsaw.
- Prof. Stanisław Rybicki, president of the Permanent Delegation of Polish Technical Associations.
- Engineer Edward Wagner, President of the Łódź Technical Association, a deserving figure in the field of technical and social work.

For the direct management of the Congress's proceedings, the Organizing Committee proposes to invite chairpersons, deputies, and secretaries of plenary sessions:

Saturday, December 6:
- Chairperson: MP Engineer Juljan Sykała (Warsaw).
- Deputy: Engineer Eugeniusz Górkiewicz (Katowice).
- Secretary: Engineer Władysław Łoziński (Warsaw).

Sunday, December 7, morning session:
- Chairperson: Engineer Stanisław Raźniewski (Dąbrowa).
- Deputy: Engineer Zygmunt Rytel (Warsaw).
- Secretary: Engineer Józef Jakobi (Sosnowiec).

Afternoon session:

- Chairperson: Engineer Teofil Wdziękoński (Bydgoszcz).
- Deputy: Engineer Teofil Ryngman (Warsaw).
- Secretary: Engineer Władysław Kozłowski (Warsaw).

Monday, December 8:

- Chairperson: Prof. Edwin Hauswald (Lviv).
- Deputy: Engineer Jan Wojciechowski (Warsaw).
- Secretary: Engineer Walerjan Janota (Dąbrowa).

For the main Secretary of the Congress, the Organizing Committee proposes Stanisław Łubieński.

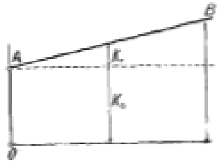
All the above proposals were unanimously accepted.

twórczy idzie biegiem jałowym, to koszt na jednostkę czasu nigdy nie spada do 0.

2) jeżeli wydajność na jednostkę czasu wzrasta, to koszt również wzrasta.

Badający koszta własne, zależność tą wyrażają zwykle w postaci wykresu pokazanego na rys. 3, czyli rozpatrują całkowitą sumę kosztów, jak gdyby składającą się z 2 części, — jednej stałej K_0 niezależnej od produkcji, drugiej K_1 — proporcjonalnej do produkcji; czyli zakładają, że linja kosztów na jednostkę czasu jest linją prostą AB.

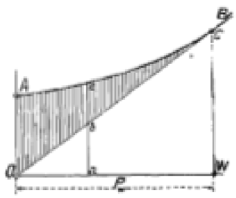
Założenie to jest jednak niesłuszne. Linja kosztów **nie jest linją prostą, lecz krzywą wychylającą się stopniowo ku górze**, jak to wskazuje rys. 3. Do twierdzenia tego doprowadza mnie prosta obserwacja faktów rzeczywistych. Analizując koszty wszelkich zakładów wytwórczych, łatwo możemy się przekonać, że im więcej dany zakład produkuje, tem koszt na jednostkę wytwórczości będzie mniejszy, ale dla każdego zakładu **istnieje zawsze pewna ściśle określona granica wydajności**, przy której koszt na jednostkę jest najmniejszy; jeżeli ta granica zostanie przekroczona, to koszt na jednostkę zaczyna znów wzrastać, czyli wytwórczość staje się znów mniej ekonomiczną. Innemi słowy, **istnieje zawsze pewna granica wytwórczości, poza którą następuje przeciążenie.**



Rys. 3. Zależność kosztów własnych od wydajności.

Jeżeli będziemy rozpatrywali rozchód jako nakład energji i środków, to przekonamy się, że właściwość tą ma każda maszyna, każdy organ pracujący, każdy warsztat, mały czy duży, wreszcie każdy człowiek. Jest to zasadniczem prawem przyrody i nie możemy sobie nawet wyobrazić, aby taka granica nie istniała dla każdej jednostki wytwórczej. **Granica ta jest właśnie jedną z najważniejszych charakterystyk każdej jednostki wytwóczej.**

Upoważnia nas to do twierdzenia, że rozchód na jednostkę czasu wyraża się krzywą AB, wychylającą się ku górze. I jeżeli do tej krzywej przeprowadzimy styczną OC, wychodzącą z początku spółrzędnych, to znajdziemy ten punkt graniczny W, poza którym stosunek kosztów do produkcji znów się pogarsza. **Produkcję P_w możemy więc uważać za wzorcową** dla danego warsztatu, organu, czy innej jednostki wytwórczej.



Rys. 4. Właściwy obraz zależności kosztów własnych od wydajności.

Styczna OC dzieli koszty całkowite na 2 części: ab i bc. Koszt ab jest kosztem użytecznym, koszt bc jest kosztem straconego czasu.

Wykres na rys. 4 **jest najogólniejszą charakterystyką ekonomiczną.** Każda jednostka pracująca, czy to składająca się z jednego organu, czy zbiorowa, czy będzie to istota żywa, czy maszyna, **ma swoją i tylko sobie właściwą taką charakterystykę.** Słowem, każda ma swoją cenę czasu, która nigdy nie spada do zera i każda ma swoją wzorcową produkcję, przy której działa najekonomiczniej.

Jest to wniosek **niezmiernie ważny**, dający nam zasadnicze wskazówki, dotyczące organizacji. (*d. c. n.*).

Uwagi w sprawie założenia Instytutu Organizacji Pracy.

Analizując niezmiernie złożony splot przyczyn opłakanego stanu ekonomicznego naszego kraju, drożyzny i ciężkiej sytuacji finansowej, dochodzimy zawsze do głównej praprzyczyny, mianowicie: niezmiernie niskiej sprawności naszej pracy.

Zjawisko to przejawia się na wszelkich polach pracy wytwórczej prawie bez wyjątku: mała wydajność pracy jest chorobą, która toczy wszystkie nasze warstwy społeczne, zacząwszy od pracownika, zajętego pracą umysłową, a kończąc na pracowniku, który pracuje fizycznie. Małą sprawnością odznaczają się również wszystkie procesy techniczne i gospodarcze naszych warsztatów wytwórczych, zacząwszy od małych rzemieślniczych a kończąc na wielkich zakładach przemysłowych. Jest to główne źródło wszystkich wskazanych nieszczęść, a wszystkie prawie niedomagania organizmu gospodarczego, które od kilku lat staramy się usunąć, są tylko objawami tej głównej i najistotniejszej choroby, której oczywiście nie usuniemy, lecząc objawy a nie samą chorobę.

Wskutek małej sprawności, trwonimy niezmierne ilości bogactw przyrodzonych, w które kraj nasz obfituje; wkładamy wielką ilość pracy, otrzymując tylko znikomą ilość skutku użytecznego. Straty te są tak olbrzymie, że gdybyśmy tylko choć niewielką cząstkę tego straconego nakładu pracy i środków wytwórczych potrafili zamienić na wynik użyteczny, to dobrobyt całego narodu podniósłby się do wysokości, przekraczającej najśmielsze nasze marzenia.

Prawdę tę zrozumiały wszystkie narody zachodnie i po klęskach wojennych z całą świadomością dążą do racjonalnego wykorzystania bogactw przyrodzonych i do usuwania marnotrawstwa w pracy, widząc w tem nietylko środek zbawienny pokrycia niesłychanych strat spowodowanych wojną, ale również główną podstawę przyszłej kultury i dobrobytu.

Dzisiaj oczy całego kulturalnego zachodu zwracają się nietylko do nauk przyrodniczych i technicznych, które mając na celu wykorzystanie sił i bogactw przyrody na pożytek człowieka, dały w ciągu ostatnich 150-ciu lat tak olbrzymie wyniki, ale przedewszystkiem ku nowej nauce, która zjawiła się przed dwudziestu paru laty, mianowicie nauce organizacji.

Nauka organizacji pracy nietylko wskazuje źródła i przyczyny dotychczasowego marnotrawstwa, ale daje również metody jego usunięcia, a więc wskazuje, w jaki sposób można otrzymać większy wynik użyteczny przy mniejszym nakładzie pracy i środków. Ze zjawieniem się jej kończy się era niszczenia wielkich źródeł energji, pracy i bogactw przyrodzonych dla otrzymania małego wyniku użytecznego, a rozpoczyna się nowa era wielkiego wyniku użytecznego, a małego nakładu pracy i środków.

Jak każda nowa idea napotyka zawsze opór w konserwatyźmie umysłu ludzkiego, tak również i nauka organizacji została przyjęta z początku z niedowierzaniem, a nawet spotkała się z ostrą krytyką, ale to trwało niedługo, gdyż wyniki były zbyt jaskrawe, a prawdy głoszone przez pierwszych pionierów tej nauki tak głębokie i proste, że szybko utorowały sobie drogę do wielu umysłów.

Szczególnie ostre zarzuty podnosiły się przeciwko tej części nauki organizacji, która bezpośrednio dotyczy podniesienia sprawności pracy ludzkiej. Twierdzono więc, że tak zwany system Taylora prowadzi wprost do przeciążenia i wyniszczenia organizmu pracownika, gdy tymczasem w systemie tym chodzi o coś wręcz przeciwnego, mianowicie o wysoką sprawność, czyli o usunięcie strat w nakładzie pracy, a zwiększenie wyniku użytecznego. Warto tu przytoczyć bardzo charakterystyczny przykład dla tych, co jeszcze wątpią o tem.

Kilka lat temu została wydelegowana komisja przez Instytut hygieny społecznej w Paryżu do zbadania wyników osiągniętych w fabryce prochu w Ripault we Francji, gdzie

Remarks on the Establishment of the Institute of Labor Organization (1924)

Technical Review [*Przegląd Techniczny*], 1924, Vol. 62, No. 49, pp. 554-556

Forward to the English edition:
In this article, Karol Adamiecki delves into the state of Poland's economy, identifying low work efficiency as its primary ailment. Drawing inspiration from Western nations that have harnessed the science of organization to boost productivity and minimize waste, he highlights the considerable benefits of such an approach along with illustrative examples in Europe, such as in the Ripault gunpowder factory in France. For Poland to realize these benefits, Adamiecki proposes the establishment of the Institute of Work Organization (TNOiK), introduced in the previous chapter.

Upon analyzing the complex mix of causes behind the dismal state of our national economy, high prices, and the dire state of our public finances, we invariably arrive at the main underlying cause: the extraordinarily low efficiency of our work.

This phenomenon is evident in almost all fields of productive work without exception: low labor efficiency is a disease that affects all our social strata, starting with the intellectual worker and ending with the physical laborer. Our technical and economic processes in our production workshops, from small craftsmen to large industrial establishments, are also marked by low efficiency. This is the main source of all the indicated misfortunes, and almost all the shortcomings of the economic organism, which we have been trying to eliminate for several years, are just symptoms of this main and most essential disease, which we will not remove by treating symptoms rather than the disease itself.

Due to the low efficiency, we squander vast amounts of the natural resources that our country is abundant in; we expend substantial effort only to yield a minuscule amount of beneficial outcome. These losses are so colossal that if we could convert only a small fraction of the lost effort and productive means into a useful outcome, the welfare of our nation would rise to a height exceeding our wildest dreams.

All Western nations understood this truth, and after the wartime disasters, with full awareness, they strove for the rational utilization of natural wealth and the elimination of waste in work, seeing not only a means to compensate for the enormous losses caused by war but also the main basis for future culture and prosperity.

Today, the eyes of the entire industrialized West are not only turned towards the natural and technical sciences, which have aimed to harness the wealth and energy of nature for human benefit with remarkable success over the past 150 years. Increasingly, attention is being directed towards a new discipline that emerged some two decades ago: the science of organization.

The science of labor organization not only indicates the sources and causes of the previous waste but also provides methods for its elimination, thus showing how to achieve greater useful results with less labor and resources. With its emergence, the era of depleting large resources of energy, labor, and natural wealth for meager returns is ending, and we are entering a new era characterized by increased productivity combined with significantly reduced labor requirements.

Like every new idea, the science of organization initially encountered resistance due to the conservatism of the human mind. It was initially met with disbelief, even harsh criticism. However, this phase did not last long, as the results were too glaring, and the truths espoused its early pioneers so profound and straightforward that they quickly paved their way into our collective consciousness.

Especially harsh criticism was directed toward the area organizational science pertaining to the improvement of human work efficiency. It was argued that the so-called Taylor system leads directly to overwork and the physical exhaustion of the worker, however in truth, the goal is quite the opposite, namely high efficiency, with increased productive output made possible through the reduction of wasted effort. It is worthwhile to recount a particularly illustrative example for those who remain skeptical.

A few years ago, a commission was delegated by the Social Hygiene Institute in Paris to investigate the results achieved in the Ripault gunpowder factory in France, where the work in one of the divisions was organized according to the Taylor system. The Institute delegated this commission under pressure from the leaders of the workers' party, who claimed that the workers in this factory were exploited and overloaded with work.

Long and very thorough research has shown that during the four months after reorganizing work (from January to May 1917) the following results were obtained:

1. The average productivity increased from 10.5 kg to 31 kg per worker per hour
2. The average monthly salary increased from 185 francs to 260

The number of working hours was reduced from 9.5 to 8.5 per day.

4. The number of days missed due to illness or not showing up for work decreased by 50%.
5. Health examinations and inspections showed that the overall condition improved, and no signs of overwork were noticed.

The figures mentioned above speak for themselves, and this example is not an isolated case. When scientific methods of work organization are applied rationally, we consistently see similar positive results, which is hardly surprising. Indeed, it would be a calamitous contradiction if the pursuit of science was aimed at maximizing productivity at the expense of depleting the energy inherent in human labor.

In the United States, where this science was born, it was nurtured by the brightest technical minds and has been so extensively refined that it has since spread to the whole world. If the United States was able to create a powerful army equipped with advanced technical means during the six years of war, it was undoubtedly due to the innate organizational sense of Americans supported by new scientific work organization methods.

After the war, when the need for compensation for material and cultural losses became urgent in America, Herbert Hoover led the movement to revive work efficiency using scientific methods. Almost all European countries have followed the same path. The development of the science of organization and its application to industrial work has been recognized as a primary necessity and finds support from various social strata and governments.

In France, prominent scientists, statesmen, industrialists, and engineers are making strong efforts not to fall behind. A series of labor research laboratories are expanding their activities. This movement is gaining increasing support. The same can be seen in Belgium, England, Italy, and other European countries. Even in Russia, the Soviet government is embracing scientific organization like a lifebuoy. Despite its inevitable collapse if work efficiency is not improved, it tries to organize work in industrial enterprises on scientific grounds. These efforts are relatively ineffective as work and science cannot be forced, but they are still very significant.

Particular attention should be paid to the movement that has developed in Czechoslovakia in this regard. The Czech worker, hardened by long years of work, has a keen sense of reality and instinctively feels that wealth and prosperity can be achieved only through work. That is why, after gaining independence, Czechoslovakia quickly achieved balance, turned away from the false slogans of subversion, and embarked on the path shown by its practical and far-sighted leaders.

Organization of Work:

As a result of the attention drawn to the Czechoslovak government and industrial sectors by the Czech embassy in the United States on the great importance of the science of work organization, which was developing so powerfully in America, President Masaryk took the initiative and, offering a million Czech crowns, laid the foundation for an institution whose main goal is to develop and spread the knowledge of efficient work.

Thanks to this initiative, which aimed at improving efficiency to aid in the recovery of the economy of Czechoslovakia, work was begun in earnest. Quickly, the Masaryk Academy of Work was established, which united all the most prominent Czech scientists and technicians, and the government, industry, and broad social sectors came forward with material support. They sought professional help from the American Federation of Engineers, which, in line with its main principle of serving all humanity, willingly provides its knowledge and moral support.

Observing this renaissance movement unfolding in the civilized world, the contrast with our country's situation in this regard becomes glaringly obvious. Though we're starting to sober up to the challenge and, as previously mentioned, calls for improved work efficiency and rational organization are becoming more frequent, we have yet to make any decisive strides in this direction. The only progress that can be noted is that when in 1919 a few people conceived the idea of creating the Institute of Work Organization, it was a voice crying in the wilderness; today, however, it has already gained some recognition, especially among engineers. The issue has already found such a lively resonance that at all technical conferences held in recent years, unanimous resolutions have been adopted demanding the cultivation and dissemination of the science of organization - and as a result of the departure of Polish technicians to America, several clubs have been established throughout the country, specializing in this matter (The Role of Organization Engineers).

It is also very comforting that among manufacturers, the issue of scientific organization has already gained quite broad interest along with the recognition of the need for reorganization of production systems based on scientific principles.

But it is finally time to move from intentions to actions. The matter is pressing, especially in the face of the economic crisis that has manifested itself throughout the country after the stabilization of our currency. One of the first steps that our society and production sectors must take and not skimp on resources is the establishment of the Institute of Work Organization, modeled on many such institutions already established abroad, which would be the center for cultivating the science of organization and disseminating its methods to all areas of our work.

This institution should primarily be based on the self-help of the production sectors, but the government should not be indifferent to it, especially since after the stabilization of the currency, the entire economic policy should be focused on raising productivity. In addition to this, the Institute of Work Organization can contribute significantly to improving the organization of state administration bodies, which, unfortunately, are still an example of poor work efficiency.

Scope of activities, tasks, and structure of the Institute of Work Organization

Reaching the conclusion that establishing the Institute of Work Organization is one of the first steps to be taken on the path to improving work efficiency and healing our economic life, the following questions arise: what should be the scope of activities of such an institution, what tasks should it undertake, what structure should it have, etc.?

In response to these questions, various program proposals for the Institute could be put forward. However, all proposals of this kind should primarily focus on practical applications. Therefore, the program should primarily take into account scientific research on the most important and current issues in the field of production and work, aiming at finding methods of organization that are easy to apply in practice. The Institute should avoid purely theoretical research or at least not place it at the forefront, so as not to become an institution too detached from life. One of the most important tasks of the Institute should be to provide advice and practical guidance in the field of organization, aimed at eliminating waste and increasing efficiency.

The best way to create the program for the Institute is to draw on the patterns of similar institutions that have already been established abroad. However, caution must be exercised and blind imitation avoided; when setting up such a program, it must be adapted to our conditions, taking into account our strengths and resources available.

Having studied the matter for a extended period of time and followed the progress of organization science and its applications, as well as familiarizing myself with some foreign institutions of this kind, I have developed a general project for the Institute's program, which I consider the most appropriate under our circumstances. A brief outline of this program is as follows:

The Labor Organization Institute is a public utility scientific institution whose goal is to promote and develop the science of organization and its applications, aiming to identify the best methods of achieving the highest efficiency in the use of materials, natural energy, time, and human labor.

To achieve its goals, the Institute brings together the most prominent scientific and technical minds working in the field of organization and carries out the following activities:

1. Conducts systematic scientific research on economic conditions and factors related to industry, agriculture, crafts, trade, and other branches of professional work, as well as examining the causes of losses in production means and reduced labor productivity;
2. Based on this research and the principles of organization science, develops methods and action plans aimed at eliminating losses, increasing efficiency, and reducing production costs;
3. Studies human working conditions from the perspective of physiology, psychology, and hygiene, in order to adapt these conditions to the requirements of the human body, select appropriate technical equipment and tools, choose suitable people for a given profession, and establish work methods that ensure the highest efficiency while maintaining the worker's strength and health;
4. Studies physical and mental characteristics, along with human abilities, to provide guidance on career selection;
5. Studies the issue of remuneration for work to establish pay systems best suited to given working conditions and professions, encouraging efficient work;
6. Provides advice on all matters related to organization and control of production processes, management, and increasing work efficiency based on scientific principles.
7. Conducting studies on the development of organization science, physiology, and experimental psychology in their application to professional work;
8. Disseminating knowledge in the aforementioned fields through lectures, readings, demonstrations, practical exercises, and publications in the form of books, magazines, etc.;
9. Maintaining constant relations with professional and scientific institutions, industrial enterprises, agriculture, offices, etc., which can contribute to solving the aforementioned tasks or applying the results of the Institute's work;
10. Presenting proposals and projects to state authorities and local governments aimed at improving the economic efficiency of the entire country and individual production sectors;
11. Maintaining correspondence and exchanging works with foreign institutions.

Regarding the internal organization, the Institute, as a body composed of the most distinguished professionals working in the field of organization, should be an entirely autonomous institution in terms of its scientific and practical activities. The Institute's affairs should be managed by a board elected from among its members, structured in such a way that the Institute's director would head it and could independently handle some matters. In this way, the positive aspects of the collegial system could be exploited while avoiding its drawbacks by ensuring agile and prompt action of the leading individual.

Since the Institute aims for the general benefit of society and would be mainly founded with private funds, it should be subject to the control of a special body (curatorship) in terms of finances, management, and the general direction of its activities. This body would consist of representatives from the productive sectors providing funds for the establishment and operation of the Institute, representatives of some related institutions and associations, and representatives of interested government bodies.

Concerning the initial scale of the Institute, I believe it would be a significant mistake to establish it on a large scale. The essence and strength of such an institution lie primarily in the people working there, not in technical equipment, laboratories, or rich scientific resources. It is essential to remember that Poland has a negligible number of professionals in the field of organization. At the beginning of the work, even on a small scale, the lack of people will pose a serious difficulty, and there will be a need to train younger professionals abroad. For these reasons, I think that when establishing the Institute, it should be limited initially to the necessary minimum and gradually expand its activities as professional forces and material resources increase, part of which the Institute itself should obtain from fees for advice and practical work (Report on participation in courses held in Berlin).

Prof. K. Adamiecki

*Note for the English edition: this article was reprinted nearly verbatim in Institute of Work Organization [Instytut Organizacji Pracy]. Warsaw, 1925, pp. 3-15

willing to help and ready to serve the distant Country of their fathers; they are however discouraged by the carelessness in public affairs" (Quotation from a letter of the Chairman of the Association of Polish Engineers of America).

It was not until quite lately, thanks to the energy of several local personalities and a flow in of new forces from Poland, who succeeded to prove the effectiveness of work carried on by the engineering circles in order to bring about an industrial regeneration of Poland, that an increase of interest in the purposes of the initiators of the Association of Polish Engineers of America has become noticeable. The news of the foundation in Poland of a number of scientific management circles conveyed to America by engineer Stan. Borkowski has served as a dicisive factor in accelerating that movement. A report made by eng. Borkowski in March in Detroit has brought about the foundation of a Scientific Management Circle in Detroit, which circle has in a short time developed a very lively activity (See report in No. 4—5 of this Journal).

Although the Association of Polish Engineers of America has emanated from the Association of Polish Engineers and Architects in Detroit, yet it is quite a new institution. Its aim is a general representation of Polish Engineers of America but it will certainly succeed in persuading other specialists to work. The constitution is up to the level of large American Associations and it is intended to become associated with the Federated American Engineering Societies.

As to the aims and the importance of the newly formed Society our readers will be best informed from its Declaration, the report of eng. S. Borkowski and the following articles. On our part we can add that the editors of the Review of Management will do their utmost to help the Association of Polish Engineers of America in the prosecution of their aims.

In order to start this action we have decided to specially dedicate this copy to the works sent to us by our colleagues from America, in order to accentuate that their declaration has found among us a ready response and that we believe in the success of the work undertaken by the Association of Polish Engineers of America.

We are sure the flow of the new science of management, so important as it is, will now come to us from America in a wider stream, thanks to the assistance offered to us by our compatriots from their new great Country.

We consider the foundation of the Association of Polish Engineers of America as the beginning of a new era in their work, which will certainly bring glory to the name of Poland; this collective and harmonious work directed to the ideals of universal welfare, so dear to every American and every Pole, will certainly be most fruitful.

May God help you, American Colleagues!

Editors,
The Review of Management.

POMOC Z AMERYKI.

JEDNYM z najważniejszych środków do wypełnienia zadań Instytutu Naukowej Organizacji jest nawiązanie stosunków z zagranicą, a przedewszystkiem z Ameryką, jako głównym źródłem nowej wiedzy, której rozpowszechnianie w Polsce jest zadaniem Instytutu.

Trzeba przyznać, że zwracając się w tym kierunku mieliśmy pewne obawy, czy te stosunki uda się łatwo nawiązać. Sądziliśmy, że zbyt wielka przestrzeń dzieli nas od Amerykan, którzy dosyć mają własnych zagadnień do rozwiązywania, aby mieli troszczyć się naszemi potrzebami. Jednakże nasze obawy okazały się całkiem płonne, wszyscy bowiem najwybitniejsi pionierzy i działacze amerykańscy na polu naukowej organizacji, do których zwróciliśmy się, okazali nam wielką życzliwość i wyrazili wprost niezwykłą gotowość otwarcia nam wszystkich źródeł, z których moglibyśmy korzystać przy wypełnianiu wszystkich zadań.

Nasze zabiegi w kierunku Ameryki znalazły niezwłoczny i niezmiernie żywy oddźwięk. A więc p. *L. W. Wallace* w imieniu Amerykańskiej Rady Inżynierskiej wyraża gotowość ułatwiania praktycznych studjów inżynierom i technikom Polakom w zakładach amerykańskich, pan *Morris*

Help from America (1926 Article)

Organization Review [*Przegląd Organizacji*], 1926, Issue 1, No. 7, pp. 214-217
[*Originally Published in Polish and English*]

Forward to the English edition
In his role as the director of the newly-established Polish Institute of Work Organization, or INO (now known as TNOiK), Karol Adamiecki emphasizes the crucial role of support from significant American figures in scientific management to offer support. Distinguished individuals such as Harlow S. Person (President of the Taylor Society), Harrington Emerson, Lillian Gilbreth, and engineer (and future US President) Herbert Hoover - revered in Poland for his humanitarian efforts and his influential "Waste in Industry" Report - eagerly extended their expertise and resources to aid the institute's mission.

Reprinted here as it appeared in the original English translation.

The relation with countries abroad, and especially with America — the main source of the new science of management, the promotion of which in Poland is the first aim of our Institute — constitutes one of the most important means of activity.

We must admit that we were anxious as to whether the relation would be easy to begin. We thought that America was too far away from us to expect her to care for our problems when she herself has many of them to solve. Our fears, however, proved to be unfounded, as all the most prominent American pioneers in the field of scientific management, whom we approached, have shown us their friendly attitude and expressed an unusually warm willingness to assist us to benefit from all the sources which could prove of interest to us in the prosecution of our aims.

Our steps have found an immediate and ready response. Mr. L.W. Wallace, in the name of the American Engineering Council, expresses its readiness to facilitate Polish engineers' practical studies in American industrial concerns; Mr. Morris Llewellyn Cooke collects a library on scientific management which he offers to our Institute; Mr. Robert Kent, Prof. Joseph W. Roe, Prof. J.P. Jordan, Mr. Sanford E. Thompson, Mr. H.S. Person, and Mrs. Lillian M. Gilbreth are sending us a lot of information concerning American literary works; thanks to their cooperation, the Institute obtains free of any charge the copyright privilege for the publication of a number of American works; the venerable Harrington Emerson promises to send us his courses by correspondence, Mr. Wallace Clark offers us a number of his works and presents in the name of Secretary H. Hoover a complete collection of publications of the Division of Simplified Practice, expressing at the same time his readiness to supply our Review with his valuable works.

We must strongly emphasize the fact that the friendly attitude which our American friends are showing our Institute is not only the expression of the usual international courtesy; it has much deeper reasons, two of which are especially obvious.

A genuine cordiality and readiness to serve others are innate features of a true American, while his common sense is strongly tied in with his high idealism and altruism. Having in a practical way gained the conviction that the coupling of these two qualities, apparently excluding each other, is of immense importance in the general progress, the American does not only preach that work for the entire nation and humanity should be the aim of all civilized men but acts accordingly. The second reason is beyond doubt the special sentiment felt by America toward Poland, the chief source of this sentiment being the memory of our heroes who fought at the side of America for her independence 150 years ago. Mr. Piotr Drzewiecki has felt it on many occasions during his last trip through the United States.

It is for these reasons that we consider the help shown to us by the named personalities as exceedingly valuable; it certainly comes from a true and real friendship and is an obvious confirmation that our Institute will have a lasting and efficient support in the prosecution of its aims.

We are today announced of new support, from a still nearer quarter — from the Association of Polish Engineers of America. It is most comforting news which we are welcoming all the more warmly, as our Countrymen intend to open to us the greatest source of wealth — the creative contribution of the American thought.

The following Declaration of the Association of Polish Engineers of America and the abundant correspondence received from them by our Institute clearly show that the collective assistance of Polish Engineers of America will be of the greatest importance in the work of the Institute. Our Colleagues from America point out that the extent of their assistance will depend on the response their endeavors will find in our Country.

As regards the Institute for Scientific Management [INO, now TNOiK] in Warsaw, we consider it our pleasant duty to affirm that the endeavors of the Association of Polish Engineers of America will find a close collaboration.

The plans of the newly established Association are very wide; it is their intention to enter into close contact with similar technical associations and scientific institutions in Poland and to become a representation of the Polish engineering world in America — to use the expression — a sort of a technical and industrial legation.

We think it is a very fortunate idea which deserves strong support. The United States of America has attained such an amazing technical and industrial progress that they are today attracting the attention of the whole world, and all the nations are eager to enter into close contact with America in order to acquaint themselves with its methods of work and economical life. Interested parties from a number of countries consider it a necessity, and their governments try to support the scientific and technical relationship with the United States. Germany and Czechoslovakia have done the most in that direction. The Czechoslovakian Government keeps a special attaché at the Washington legation — an engineer, whose duty is to keep up a close relationship with the American engineering world.

We have had quite lately an opportunity to see the positive results of such steps.

We think Poland has not so many successes to record in that direction. It is true that one often hears of representatives of various social groups going to the United States; however, these trips are not made to study the technical and industrial progress but are in most cases undertaken with the object of securing financial help from Poles residing in America. Such trips are usually failures, as American Poles are generally discouraged with the disorder reigning in Poland.

The help offered by the Association of Polish Engineers of America to our own engineering and scientific institutions is an opportunity which we must not neglect on any account. Mutual benefits may be so numerous and large that we have no doubt the Declaration of the Association of Polish Engineers of America will meet with the fullest appreciation of our people, while the interested parties will try to immediately contact this extremely important organization.

Prof. K. Adamiecki,
Manager, Institute for Scientific Management in Warsaw.

POSTĘPY W ZASTOSOWANIU METOD NAUKOWEJ ORGANIZACJI W ZAGŁĘBIU DĄBROWSKIEM I KATOWICKIEM.

Les progrès dans l'application des methodes de l'organisation scientifique dans les bassins de Dombrowa et Katowice.

Napisał prof. K Adamiecki.

PODCZAS wycieczki do Zagłębia Dąbrowskiego i Katowickiego, którą odbyłem razem z p. Wallace Clark'iem w sierpniu b. r., miałem możność bliższego zapoznania się z postępami w zastosowaniu metod naukowej organizacji, jakie tam osiągnięto w niektórych przedsiębiorstwach przemysłowych. Jakkolwiek są to dopiero początki, to jednak wyniki są już tak widoczne i obiecujące, że zasługują na szczególne wyróżnienie.

Wycieczka trwała zbyt krótko, aby dać możność zebrania wielu szczegółowych danych, które niewątpliwie zainteresowałyby czytelników „Przeglądu Organizacji", na razie przeto ograniczę się tylko do podania krótkiego kronikarskiego zarysu prac już dokonanych lub rozpoczętych, zaznaczając, że czytelnicy będą wkrótce mieli możność szczegółowego zapoznania się z niektóremi z tych niezmiernie ciekawych prac, gdyż ich autorzy obiecali podać nam wyczerpujące referaty.

Wśród zakładów, które stanowczo weszły już na drogę naukowych metod organizacji, należy przedewszystkiem wymienić: Kopalnię węgla „Grodziec II", Hutę Pokoju, Hutę Bismarcka, zakłady Fitzner i Gamper w Sosnowcu i Kopalnie rudy ks. Donnersmarka w Tarnowskich Górach. Pozatem poważne prace w tym kierunku rozpoczęto na kopalni „Król" (Tow. Skarboferm) w Królewskiej Hucie, kopalni „Kazimierz" Warszawskiego Towarzystwa, oraz na kopalni „Dembińsko" Tow. Zjednoczonych Hut Królewska i Laura.

KOPALNIA GRODZIEC II.

Kierownikiem technicznym tego przedsiębiorstwa jest inż. Stanisław Rażniewski, jeden z najbardziej przekonanych wyznawców naukowej organizacji wśród górników polskich. W Nr. 1 „Przeglądu Organizacji" umieszczony został artykuł p. Rażniewskiego, dotyczący organizacji przewozu drzewa. Jest to jedno z pierwszych zastosowań zasady harmonizacji na kopalni Grodziec II i bodaj czy nie pierwszy krok w zastosowaniu naukowej organizacji w całem Zagłębiu Dąbrowskiem .

Inż. Rażniewski, zachęcony dodatniemi wynikami, osiągniętemi przy tej tak bardzo ważnej dla kopalni robocie, utworzył przy zarządzie kopalni specjalny organ — biuro organizacji, którego celem jest badanie wszystkich robót i procesów kopalnianych i zestawianie projektów organizacyjnych. Poniżej zamieszczony wykaz prac wskazuje jak wielką rolę odgrywa już ten organ w zarządzaniu kopalnią.

1. *Reorganizacja roboty w tartaku.* Była to pierwsza próba organizacji, przeprowadzona na kopalni Grodziec II w maju r. z. Po przeprowadzeniu równoległego chronometrażu zestawiono harmonogram i podług niego skoordynowano wszystkie roboty. W ciągu paru tygodni dzienna produkcja tartaku podniosła się dwukrotnie.

2. *Przewóz drzewa do kopalni.* Szczegóły tej pracy czytelnik znajdzie, jak już wspomnieliśmy, w Nr. 1 „Przeglądu Organizacji".

Należy tu zaznaczyć, że poza wynikiem bezpośrednim, w postaci znacznego podniesienia wydajności, dwie te prace dały drugi niezmiernie ważny wynik, a mianowicie, dały zarządowi cały szereg wskazówek zasadniczych w jaki sposób należy prowadzić dalsze prace organizacyjne. Ustalono więc przedewszystkiem, że organizacja wogóle powinna być wprowadzana stopniowo — etapami. Najpierw skoordynowanie poszczególnych czynności, czyli harmonizacja bez zmiany w sposobie ich wykonania i bez zmiany w urządzeniach technicznych, a potem dopiero dalsze etapy organizacji — badanie szczegółów i ich ulepszanie, — czyli, jak mówi p. Rażniewski, najpierw harmonizacja, a potem dopiero tayloryzacja.

Takie ujęcie sprawy należy uważać za bardzo szczęśliwe, jest to bowiem jedyna prawidłowa droga, po której dążyć powinien każdy organizator. Każdy proces, chociażby najprostszy,

Progress in the application of methods of scientific organization in Zagłębie Dąbrowskie and Katowice (1926 Article)

Organization Review [*Przegląd Organizacji*], 1926, Issue 1, No. 6, pp. 190-193

Forward to the English edition:
In this article, Karol Adamiecki introduces an early manifestation of the improvement cycle in the form of a four-step process:

1. *Analysis,*
2. *Planning,*
3. *Execution, and*
4. *Control.*

Readers familiar with "Total Productive Maintenance" (TPM) will recognize in early attempts to apply scientific management principles to mining cart repairs, which involved optimizing tasks through grouping by general characteristics, conducting time studies, planning repairs and materials, all leading to a measurable increase in efficiency.

Addressing the high failure rate of organizational transformations, Adamiecki emphasizes the importance of a staged approach, breaking down organizational issues into individual components and addressing each with a gradual progression from broader to more detailed issues. Drawing from his observations at Grodziec II mine, and Huta Pokoj ironworks, the largest plant of its type in interwar Poland, Adamiecki shares successful examples of organizational transformation, highlighting the key strategies and approaches employed by their leaders, demonstrating how this simple yet effective method can make all the difference.

Introduction

During a trip to the Dąbrowa Basin and Katowice area, which I took with Mr. [Henry] Wallace Clark [*collaborator of Frederick Taylor and Henry Gantt*] in August last year, I had the opportunity to become more familiar with the progress in the application of scientific organization methods that have been achieved in some industrial enterprises there. Although these are just the beginnings, the results are already so visible and promising that they deserve special recognition.

The trip was too short to allow for the collection of many detailed data that would undoubtedly interest the readers of *Organization Review*, so for now, I will limit myself to providing a brief chronological outline of the work already initiated or completed, noting that readers will soon have the opportunity to become familiar with some of these extremely interesting works in detail, as their authors have promised to provide us with comprehensive reports.

Among the establishments that have decisively entered the path of scientific organization methods, the following should be mentioned first and foremost: "Grodziec II" coal mine, Pokój Steelworks, Bismarck Steelworks, Fitzner and Gamper factories in Sosnowiec, and the Prince Donnersmarck ore mines in Tarnowskie Góry. In addition, significant work in this direction has begun at the "Król" mine (Skarboferm Company) in Królewska Huta, "Kazimierz" mine of the Warsaw Company, and at the "Dembinsko" mine of the United Steelworks Królewska and Laura Company.

Grodziec II Mine

The technical director of this enterprise is engineer Stanisław Raźniewski, one of the most convinced followers of scientific organization among Polish miners. In issue No. 1 of *Organization Review*, an article by Mr. Raźniewski was published, concerning the organization of timber transportation. This is one of the first applications of the harmonization principle at the Grodziec II mine and perhaps the first step in implementing scientific organization throughout the entire Dąbrowa Basin.

Engineer Rażniewski, encouraged by the positive results achieved in this very important work for the mine, established a special body at the mine management - an organization office, the purpose of which is to examine all mining work and processes and compile organizational projects. The chart below of the work shows what a significant role this body already plays in the mine management.

1) Reorganization of work at the sawmill. This was the first attempt at organization carried out at the Grodziec II mine in May of the same year. After conducting a parallel time-study, a schedule was created, and according to it, all work was coordinated. Within a few weeks, the daily production of the sawmill doubled.
2) Transport of timber to the mine. Readers will find the details of this work, as we have already mentioned, in issue No. 1 of *Organization Review*.

It should be noted that besides the direct result, in the form of a significant increase in efficiency, these two works provided a second, extremely important result, namely, they provided the management with a whole series of fundamental guidelines on how to conduct further organizational work. It was determined, first and foremost, that the organization should be introduced gradually - in stages. First, the coordination of individual activities, i.e., harmonization without changing the way they are performed and without changes in technical equipment, and only then further stages of organization - detailed examination and improvement, - that is, as Mr. Rażniewski says, “first harmonization, and then Taylorization.”

This approach to the matter should be considered very fortunate, as it is the only correct path that every organizer should pursue. Every process, even the simplest one, consists of many details and individual issues. All of these issues must be properly resolved for the organization of the entire process to be brought to perfection. However, examining and resolving all the details requires a lot of time and considerable research effort - sometimes even years. Thus, a fundamental question arises: should we wait to improve the organization until all the details are examined, i.e., postpone the practical application to the distant future, or introduce improvements immediately as soon as a single detail is examined? But this also will not speed up the matter, as all the details of a given process are interconnected and mutually dependent. Starting with the improvement of the organization's details may even sometimes cause confusion and difficulties due to this very dependence.

So how should we proceed to reach the goal in the simplest way?

The only answer to this question is to proceed in stages. The organization issue of each process should be broken down into individual issues, adhering to the principle of gradually transitioning from issues encompassing the entire process to increasingly more detailed ones. We must go through a whole series of stages, from rough processing to the final, most delicate processing, if we may express it that way. We must proceed in the same way as when spinning a thread from tangled wool fleece - first comb it thinly and loosely, and then gradually, more densely.

Having divided the entire organization issue in this way, we achieve results gradually, and when going through each stage, we must grasp the entire cycle of organization each time:

1. Analysis,
2. Planning,
3. Execution, and
4. Control.

This very principle of gradual progress has been adopted at the Grodziec II mine as the main guideline for all organizational reforms. Reaching this principle during the first organizational attempts mentioned above should be considered a very important tangible result for the further development of the scientific organization's application at the Grodziec mine.

The accurate realization of this immensely important principle by Mr. Engineer Rażniewski and his closest collaborators provides a complete guarantee that the organizational work they have started will bear great fruit. This work was started in the spring of the same year, and currently, a significant increase in efficiency has already been achieved in many important areas of mining work during the first stage.

In addition to the above-mentioned works, the following tasks have already been completed or are in progress:

3) Sand delivery for backfilling. In this important work for the exploitation of the mine operating with a fluid backfill system, efficiency has increased more than twice after organizing the entire transportation using schedules.
4) Repair of mining carts. This is a very interesting example due to the fact that we are dealing with a great variety of tasks that are difficult to predict in advance. It is a widespread belief that due to this reason, the application of scientific organizational methods to repair work is impossible. The approach taken at the discussed mine completely refutes this belief.

   As a starting point, the completely correct assumption was adopted that despite the great diversity of damages and tasks encountered here, they can always be divided into groups distinguished by some general characteristics, and to which certain general working methods can be applied. After establishing such groups, conducting time measurements for individual groups of works and determining the average execution time was no longer a major challenge.

As with all works, the principle of organizing the overall repair of carts was adopted here first, without improving the details for the time being. Thanks to the proper coordination, according to a certain plan of serial repairs, preparation of materials and tools in advance, the efficiency of this work has increased on average by one and a half times.

5) Miner's work in a coal tunnel. Although this work is difficult to grasp for analysis and organization due to the variety of conditions, a significant result has been achieved here over time. The average efficiency has increased by over 100%.

In addition to these works, in which such significant progress has already been made, the organization office gradually extends its research work to an increasing number of tasks. Currently, the following works are in progress:

6) Construction of backfill dams. For these works, studies were conducted and an organization plan was established, according to which an 80% increase in efficiency is expected.
7) Inspection of the insulation of electrical cables. Studies were conducted and a plan was established. A 100% increase in efficiency is expected.
8) Tunnel wall construction. Studies are being conducted.
9) Concrete tunneling. This work is also in the research stage.
10) Tunnel lining. Under investigation.
11) Installation of backfill pipes. Under investigation.
12) Miner's work in a stone tunnel. Under investigation.
13) Miner's work with machine cutters in pillars and tunnels. Under investigation.
14) In addition, Gantt charts were used for control in many tasks.

As can be seen from the above list, the team at the Grodziec II mine is fully immersed in the organizational work there and has already covered a significant range of tasks. It is particularly important to emphasize that each organizational improvement is introduced only on the basis of very thorough and comprehensive research, and with great caution, which is undoubtedly the main reason that the results achieved are permanent and do not cause any difficulties for the workers, who soon realize that their work is made easier and lighter. In addition, as the work is established according to the new plan, workers receive bonuses.

In general, it can be said that the application of scientific organizational methods at the Grodziec II mine is exemplary, which should be primarily attributed to the fact that the mine's management is fully convinced of the new methods, deeply understands their significance, and acts gradually.

It is also important to emphasize the enthusiasm and interest of the entire staff of the organization office, led by engineer Skowronek, in their organizational work.

There is no doubt that under these conditions, the progress of applying scientific organization at the Grodziec II mine is entirely guaranteed.

Finally, I must state that the results achieved at this mine in such a short time are a clear proof of how much can be accomplished with the goodwill, energy, and enthusiasm of the managers, as well as the fact that with a thorough understanding of the basic principles and leading ideas, there is no need to resort to specialist organizational consultants invited from outside.

When I expressed this belief to Mr. Rażniewski, he replied that in this particular case, the publications of the Institute of Scientific Organization and the ideas disseminated by it played a significant role, and that he himself and all his subordinate management staff are trying to deeply understand and implement these ideas in practice. If this is indeed the case, I must say that these seeds have fallen on fertile ground and will undoubtedly yield the desired fruits.

Huta Pokoj Plant (Friedenshütte).

These plants are perhaps the largest ironworks in Upper Silesia. They are currently under complete Polish management. This management, with general director Dr. Gliick at the helm, recognized the importance of organization based on scientific methods and decisively embarked on this path since last year.

Particular interest in this matter is shown here by the main technical director, engineer Artur Wauer, a highly experienced metallurgist, which is an essential circumstance, as true and rapid progress can be expected only when the main manager has belief in, and understanding of, the new methods.

This circumstance should be attributed to the fact that significant results were achieved, and a whole series of research works initiated, in some departments at Huta Pokoj within a relatively period short time.

The fundamental step towards rational organization in Huta Pokoj was the establishment of a kind of staff next to the main technical director. This staff consists of:

- organization department,
- statistics and production control department,
- heat management department,
- refractory materials and lubricants research department.

All these departments have the task of conducting scientific studies and preparing improvement projects, which, after approval by the technical director, are put into action.

The organization research department was entrusted to a young engineer, Mr. Stefan Majda, a former student of the Warsaw University of Technology, who is fulfilling his task with great interest and knowledge of the subject. I must admit that reviewing his work gave me great satisfaction, as he is my student; he is currently very successful in implementing the principles acquired during his theoretical studies at the University of Technology.

As for the work done by this department, the following should be mentioned:

1) After conducting a detailed time-study of material delivery in the Martin-type steelworks and appropriate organizational changes, the time of one cycle (charge) for each furnace was reduced from 6 hours to 5 hours and 15 minutes. At the same time, the number of workers decreased from 363 to 303, and the labor cost in the steelworks decreased by 14%. The number of locomotives for material delivery was reduced from four to two.
2) Similar studies were conducted for the supply of materials to the blast furnace. Regulating this issue resulted in an increase in blast furnace production from 170 to 200 tons per day.
3) The studies conducted in the rolling mills deserve special attention. In these studies, a complete system of schedules was used, which greatly aided both the timing of rolling processes and the compilation of new plans. After reorganizing according to these plans, the efficiency of the rolling mills significantly increased, namely:
    a) in the rail rolling mill, time utilization increased from 53% to 94%;
    b) in the profile rolling mill, time utilization increased from 50% to 82%;
    c) the efficiency of the thin sheet rolling mill increased by 14 to 40%.
4) Very detailed studies were conducted on the fabrication of various rail car components: wheel rims, axles, wheels, and axle assemblies. These studies showed that significant savings in raw materials and machine tool utilization can be achieved in this department when work is organized according to the plan which is currently under development.
5) The organization department is also conducting a very detailed study on wage systems that would best suit local conditions and properly encourage workers to increase work efficiency.

Overall, it is a pleasure to report that organizational work in Huta Pokoj has already made significant progress and will undoubtedly continue to expand and deepen, as the management is fully convinced of its great importance.

(To be continued).

UWAGI W SPRAWIE KOSZTÓW WŁASNYCH WYTWARZANIA.

Quelques remarques sur le prix de revient.

Prof. K. Adamiecki.

Artykuł niniejszy napisany był w początku grudnia 1926 r., t. j. przed wydaniem rozporządzenia o utworzeniu Biura Badania Cen i Komisji Ankietowej.

1. POTRZEBA NORMALIZACJI METOD OBLICZANIA KOSZTÓW WŁASNYCH.

Obliczanie kosztów własnych wytwarzania różnych produktów do niedawna należało przeważnie do zakresu czynności, wykonywanych przez buchalterów i miało głównie na celu osiągnięcie cyfr, potrzebnych do orjentowania się przy sprzedaży produktu. Chodziło więc albo o obliczenie przypuszczalnych wydatków, jakie pociągnie za sobą wyprodukowanie jakiegoś zamierzonego wyrobu w celu ustalenia ceny, po jakiej będzie można go sprzedać, albo o zestawienie wszystkich wydatków już poniesionych przy fabrykacji danego produktu, aby sprawdzić czy na nim osiąga się zyski czy straty. W tym drugim wypadku obliczanie kosztów własnych miało również poniekąd na celu zestawienie ogólnego obrazu wydatków, z którego możnaby ocenić stopień doskonałości gospodarki wewnętrznej przedsiębiorstwa i znaleźć wskazówki, co należy przedsiębrać, aby produkt wypadł możliwie najtaniej.

Jeżeli zadamy sobie pytanie, czy dotychczasowe systemy obliczania kosztów własnych odpowiadają temu ostatniemu celowi, to, niestety, musimy stwierdzić, że większość z nich w bardzo słabej mierze odzwierciadlała stan ekonomiczny procesów fabrykacji, a bardzo często nawet go zaciemniała. Innemi słowy, ten najważniejszy cel, któremu przedewszystkiem powinno służyć obliczanie kosztów własnych, był i jest jeszcze prawie zupełnie zaniedbany.

Przyczyna takiego stanu rzeczy leży głównie w tem, że zestawianiem sprawozdań, dotyczących kosztów własnych, zajmowali się przeważnie buchalterzy, którzy naogół nie znają bliżej wszystkich właściwości procesów produkcji i dążą do różnych uproszczeń w obliczeniach, uzasadnionych li tylko względami buchalteryjnemi. Zresztą mieli głównie na oku otrzymanie cyfr sumarycznych, „*wystarczających*" do określania cen sprzedażnych produktów oraz ogólnych zysków lub strat.

Ale może ten ostatni cel był osiągany w zadowalniającej mierze? Na to pytanie musimy również odpowiedzieć, że dotychczasowe systemy obliczania kosztów własnych w znacznym stopniu chybiają celu po pierwsze dlatego, że przy podziale tak zwanych kosztów ogólnych na poszczególne wyroby używa się sposobów tak prymitywnych i nie odpowiadających istocie rzeczy, że otrzymuje się wyniki często zupełnie błędne, a powtóre, że w samym celu tkwi zasadnicze złudzenie, cena sprzedażna bowiem nie wynika z kosztu własnego, jak to wielu ludziom się zdaje.

Trzeba więc stwierdzić, że tak ważna sprawa dla kierownictwa przedsiębiorstwem, jak obliczanie kosztów własnych nie była i nie jest jeszcze racjonalnie rozwiązana.

Taki stan rzeczy mógł jednak przetrwać tylko dopóty, dopóki w kierowaniu przedsiębiorstwami przemysłowemi opierano się na metodach empirycznych i liczono głównie na talenty organizatorskie kierowników, którzy zwykle nie zdawali sobie nawet sprawy z potrzeby ścisłej kontroli.

Kierownik jednak, który chce iść świadomie po drodze postępu i nie liczy na szczęśliwy przypadek, lecz chce opierać się na racjonalnych metodach organizacji, nie może iść po omacku. Musi więc ciągle mieć przed oczami jasną i dokładną charakterystykę ekonomiczną wszystkich procesów przedsiębiorstwa i widzieć wyraźnie skutki zastosowanych metod, aby móc kierować temi procesami najbardziej ekonomicznie.

Dla niego porównywanie kosztów własnych z cenami sprzedażnemi produktu ma znaczenie tylko pobudki do obniżania kosztów, ale nie stanowi głównego celu obliczania kosztów własnych. Jemu chodzi przedewszystkiem o obraz cyfrowy, charakteryzujący strumienie wydatków, przepływających przez jego warsztat.

Z chwilą więc gdy zarządzanie zakładem wytwórczym zaczęto opierać o podstawy naukowe, zestawienie takiej charakterystyki stało się

Remarks on the Issue of Operating Costs in Production (1927)

Organization Review *[Przegląd Organizacji],* 1927, Issue 2, No. 1, pp. 2-15

Forward to the English edition:
In this comprehensive article, divided into three parts, Karol Adamiecki delves into traditional cost accounting practices, explores the often-misunderstood dynamics of price determination, and critiques misguided attempts at price regulation. The first section dissects the limitations of traditional cost accounting systems, which fail to accurately represent the economics of the manufacturing process, largely due to accountants' lack of familiarity with production specifics.

Moving onto Part II, the article challenges the prevailing belief that product prices are determined simply by calculating operating costs and adding a profit margin. Using the example of three hypothetical factories, the author elaborates, through formulas and graphs, how varying market conditions, differing factory investment decisions, production capacity, and competitive dynamics influence price determination, emphasizing the necessity of a firm understanding of the law of supply and demand. The final section critiques efforts to regulate prices. He analogizes ignorance of the law of supply and demand to misunderstanding the law of gravity - with both, ignorance can lead to unfortunate outcomes, but this is not the fault of the laws themselves. Advocating for a more effective approach, Adamiecki recommends a select group well-versed in these economic principles, akin to the American Engineering Society and its influential 1921 Waste in Industry report.

Forward to the original:
This article was written at the beginning of December 1926, i.e. before the issuance of the regulation on the establishment of the Bureau for Price Research and the Inquiry Commission.

I. The Need for Standardization of Methods for Calculating Operating Costs

Until recently, the calculation of the operating costs for the manufacture of various products was primarily a task performed by accountants. The main aim was to obtain figures necessary for selling the product. This goal was either to estimate potential expenses associated with producing a planned product, thereby determining its sale price, or to compile all production expenses already incurred to evaluate whether it generated a profit or loss. In the latter case, calculating operating costs also aimed to provide a comprehensive overview of expenses. This could be used to assess the efficiency of the company's internal economy and to identify what actions should be taken to minimize the product cost.

However, if we question whether the current systems for calculating operating costs align with this ultimate goal, we must unfortunately admit that most of these systems only faintly reflect the economic conditions of the manufacturing processes, and they often obscure them. In other words, this crucial goal, which should be the primary focus of the operating cost calculation, has been, and continues to be, largely neglected.

The main reason for this situation is that the preparation of reports on operating costs has primarily been the responsibility of accountants. These individuals generally lack a deep understanding of the specific characteristics of production processes and often simplify calculations for the sake of convenience, using justifications grounded in accounting principles. They are mainly focused on obtaining aggregate figures that are “sufficient” for determining product selling prices and for assessing overall profits or losses.

One might wonder if this goal has been achieved satisfactorily already. In response to this, we must assert that current systems for calculating operating costs significantly miss the mark. Firstly, this is because the methods used to distribute so-called operating costs across individual products are primitive and do not truly reflect the nature of these costs, which often leads to completely incorrect results. Secondly, there's a fundamental misconception embedded in the goal itself, as many people falsely believe that the selling price directly arises from operating costs.

Therefore, it must be stated that such an important aspect of company management, like the calculation of operating costs, has not been and still isn't addressed rationally.

This state of affairs could only persist in an era when industrial leaders relied on empirical methods and primarily depended on the organizational talents of managers, who were largely unaware of the requirements for rigorous manufacturing controls.

However, managers who consciously embark on a path of continuous improvement, relying on rational organizational methods instead of mere luck, cannot operate in the dark. They must have a clear and accurate economic characterization of all enterprise processes, and fully understand the effects of their applied methods to manage these processes in the most economical way.

For them, comparing operating costs with the selling prices of the product only serves as a stimulus for reducing costs, but it is not the main goal of calculating operating costs. Their primary interest lies in a numerical depiction that characterizes the expenditure streams flowing through their workshop.

Therefore, as soon as industrial management began to be based on scientific principles, compiling such a characterization became an urgent and indispensable need. For a company manager, it is as much a necessity as having a complete set of various measurement and signaling devices on the captain's bridge of a modern sea vessel. These devices help the captain to understand both the state of all the on-board equipment as well as the position of the ship and guide him on what needs to be done to sail in the desired direction.

Since the main goal of all branches of technology and management methods is to achieve a product with a minimum expenditure of manufacturing resources, that is, the lowest possible operating cost, one could generally say that the ratio of the total cost to the quantity of product obtained is precisely this economic characteristic — the main indicator of the degree of perfection of the technical and organizational means applied to a given manufacturing process.

However, the overall sum of costs and its relation to production does not provide a comprehensive enough picture. Managers cannot be satisfied with merely establishing the amount of expenses. They also need to know what these expenses depend on and to what extent in order to apply appropriate remedial measures. The level of expenditure is influenced by a wide array of factors, ranging from those entirely dependent on technical and organizational procedures to those completely independent of them.

Therefore, if cost calculation is to guide management towards actions that can achieve the most cost-effective use of manufacturing resources, the total cost must be broken down into categories. These categories should be arranged in such a way as to distinctly reveal the level of influence each factor has, whether it's entirely within the control of internal operational management, partially influenced by these procedures, or completely external to them.

From this simple consideration, we can conclude that the classification of expenses constituting the operating cost cannot be arbitrary or based solely on accounting requirements, but must result from the nature of the production processes themselves and the type of factors that influence the size of expenditures.

Taking into account:
1. that we always deal with a large number of factors on which various operating cost categories depend,
2. that many of these positions are closely related, so that changing one of them may automatically and significantly change others,
3. that many of the factors influencing the operating cost are interdependent,
4. that various cost categories depend on the intensity of production to varying degrees, and,
5. that many expenses flow asynchronously with production, meaning that a certain expenditure made at a certain moment may pertain to a manufacturing process executed much later, makes it clear that the matter of grouping different streams of operating costs to reflect the internal state of the production workshop and provide guidance on how to manage it is not as simple as it might seem.

Given that the total sum of operating costs is a function dependent on a great number of variable factors and, furthermore, it is a highly complex function, we can say a priori that only after familiarizing ourselves with the main properties of this function will we find clues on how to combine individual cost items into groups that will give us the desired characteristic.

As we have already mentioned above, current systems of classification of different cost items mostly do not provide managers with an adequate picture from which they could draw rational conclusions for managing the enterprise.

As a result, because these systems are typically arbitrary and empirical, when we want to draw conclusions from compilations of operating costs based on these systems, concerning the evaluation of either technical economy or applied management methods, we encounter significant doubts at every step, and it is even quite easy to derive completely false conclusions.

We could cite a whole series of examples of disastrous consequences when managers, relying on the figures obtained from the calculations of their operating costs, decided on some fatal technical or organizational procedure.

Be that as it may, it can generally be stated that the majority of existing systems for the classification of operating costs and their distribution among individual products are such that they allow, at most, to determine the size of this or that position, but do not provide the possibility of drawing any precise conclusions regarding the causes affecting that size.

When it comes to comparing either individual cost categories or their fluctuations, due to the reasons mentioned and because the classification systems in different establishments are very diverse, we can, at most, compare the costs of the same establishment from different periods. However, when it comes to comparing the operating costs of different establishments producing the same products, the comparison becomes mostly impossible.

Finally, when we come to comparing the operating costs of a production unit without considering a whole range of factors, especially the degree of the establishment's workload at a given moment, we can go completely astray. The operating cost of a production unit in the same establishment can be significantly higher during a period of good management and low purchase prices compared to the operating cost during a period when savings were not considered, and purchase prices were high. Drawing any justified conclusions becomes even more difficult when we want to compare the operating cost of a production unit from two different establishments.

However, the current circumstances are gradually improving. While in the past, technicians paid little attention to the calculation of operating costs, recently they have been increasingly involved and are trying to solve the issue rationally.

Particularly in America, there is lively activity in this regard. They have even created a special association (National Association of Cost Accountants) dedicated to studying methods of calculating operating costs and standardizing them in various industrial sectors. In Germany, engineering circles have also been dealing with this matter very diligently for several years. A commission of distinguished experts has been established, which has already published several valuable works in this field.

Research on the classification of operating costs and methods of their distribution appears in print more and more often and the various proposed systems are gradually moving in the right direction. However, the issue itself is not yet definitively resolved, as the existing studies are either one-sided, focusing only on individual industrial sectors, or in many proposed systems, the influence of earlier empirical classification methods can still be seen.

The issue of establishing rational methods of calculating costs, therefore, requires further study and comprehensive examination, as well as the collective work of many experts, since the general course of production processes varies significantly in different industries, and thus, the methods of calculating operating costs cannot be determined according to a single rigid template.

Recognizing the urgent need for such collective research, the Institute of Scientific Organization intends to establish a special commission soon, which would deal with the collection of materials, their comprehensive examination, and the determination of rational methods for compiling operating costs, adapted to different industries.

Assuming that this intention will soon be realized, I believe it would be useful to make some general observations on how to approach this issue.

1. First and foremost, the normalization of methods for calculating operating costs should not be understood as merely standardizing classification systems for each particular industry, without considering certain general and inviolable principles, independent of this or that type of manufacturing or product.

   It is often heard that the courses of production processes in different industries vary so significantly, for example, machine production is so different from brick production, coal mining, or the transportation industry, that the systems for calculating operating costs must be completely different and cannot have anything in common.

   However, this opinion is unjustified, as despite significant differences in the details of the flow of expenses in these processes, there are certain general characteristics that can and should be captured in a general characterization expressed in the main outlines of the expenditure classification, which can also vary significantly in details, depending on the type of production process.

   Therefore, I believe that determining the main common guidelines for the normalization of methods for calculating operating costs is of great importance.

   When such guidelines or general principles are established, normalization will be significantly facilitated with the continued development of these principles in application to individual branches of industry.

2. The normalization of methods for calculating operating costs can be significantly facilitated by appropriately grouping various productions according to the similarity of the production flows. Then, adhering to the general established principles, several or a dozen methods differing in details can be determined for these groups.

   The general method of calculating operating costs, established for a certain group, can be successfully applied to any production within that group, even if the subject of the production is completely different. For example, I believe that a rational method of calculating operating costs in metallurgy will also be suitable for the spinning industry.

If necessary, one can resort to subgroups, introducing appropriate changes in the methods without violating general principles or guidelines adopted in a given group.

In this way, the issue of normalization will be not only significantly facilitated but also the uniformity of the overall system will be maintained.

3. The classification of various cost items should primarily aim to characterize the operation of the work cells and departments that make up a given manufacturing workshop, highlight individual processes, and the factors that influence the height of expenses. In other words, individual expenditures should be grouped in such a way that they primarily reflect the essential state of technique and organization in the manufacturing workshop.

4. Various simplifications in the classification of costs, aiming to ostensibly facilitate the division of costs among individual products of a given workshop, should be considered secondary matters. This is because the very economic characteristic that the operating cost is supposed to express could easily be compromised. The issue of dividing costs among individual products will not only be unaffected by this, but on the contrary, it will be simplified, because only with a rational classification based on economic characteristics are the simplest and most accurate guidelines for the division of costs among different products obtained. Furthermore, this division will be more precise and consistent with actual observations.

5. The methods of calculating operating costs should include the principle of calculating the costs of consumed time. I have already drawn attention to the necessity of introducing this item in the article "Graphical method of organizing work in a rolling mill", published in *Technical Review* in 1909. Although this proposition might have seemed too bold and challenging to implement back then, today, after many applications of scientific organization, which has greatly emphasized the significance of time-saving, the idea of calculating the cost of wasted time has completely matured, evidenced by the fact that Americans have already started to introduce the costs of lost time into their operating costs.

   Establishing this issue on rational grounds will not encounter significant difficulties if the fundamental law of dependence between the total investment of production resources and production per unit of time, presented in the main outlines in my earlier reports (*The social significance of an engineer's work in industry*. "Technical Review" 1923, No. 41, 42, 43, 44.; *Harmonization as one of the main foundations of scientific organization*. "Technical Review" 1924, No. 49, 52, 53; *The position of an engineer as a manager of production facilities*. Paper from the 1st Congress of Polish Scientific Organization 1924.), is taken as the starting point.

6. When determining methods for calculating operating costs, one should strive to ensure that, in parallel with actual costs, standard costs resulting from an established organizational plan are calculated. If this idea, raised by Emerson in his work "Efficiency"

(1912), is incorporated into a system that is easy to apply in practice, then the operating cost, as a report on the operation of the entire enterprise organism, will become the main and essential compass for navigating the highly intricate network of production processes.

7. Since the comparison of costs can be made only over an extended period (e.g., monthly), this deprives the manager of such an important means of orientation throughout this period and may cause a delay in making an important decision against unnecessary losses. Therefore, the system for calculating operating costs should be complemented by a statistical system highlighting daily fluctuations of major expense categories, production, and time consumption.

   Therefore, along with establishing the standard operating cost calculations, methods of factory statistics should also be established, mutually complementing each other.

8. For the compilation of operating costs and for statistics, standard graphical methods should be established, with the help of which data could be presented in the form of charts in parallel with numerical data, which would significantly facilitate orientation in all the most important details.

9. Finally, when establishing methods for calculating operating costs, it is necessary to adopt the principle of the greatest possible simplicity and compliance with the requirements of general accounting.

II. Operating Cost and the Sale Price of the Product

Among managers of industrial and commercial enterprises, as well as consumers, there is a widespread belief that the selling price of production and trade items results directly and exclusively from operating costs and a certain arbitrary amount that the manufacturer or intermediary adds as their profit. Therefore, the selling price of the product will be higher the higher its operating cost and the larger the percentage of profit the manufacturer or intermediary adds.

Based on this assumption, the manufacturer calculates the operating cost of a unit of the product as accurately as possible, adds a percentage that seems reasonable to them, and believes that they have established the price at which the buyer should agree.

The buyer, on the other hand, is convinced that if they have to pay a high price for a product, it is because the manufacturer or intermediary has too high operating costs and, above all, adds too high a percentage for profit. The buyer explains the high price, or expensiveness, either due to the manufacturer's inability to produce cheaply or their greed for achieving the highest possible "usurious" profits. This conviction is so deeply rooted that almost all buyers believe they are subject to constant exploitation and are reluctant to believe that a manufacturer could ever suffer losses, especially when selling a product at high prices.

The typical manufacturer, when facing losses, are convinced that they have added too small a percentage to their operating costs when calculating their selling price or that they made a mistake when calculating these costs to their disadvantage. They are also inclined to blame the buyer, who they believe does not understand their difficult situation.

Against this backdrop, mutual bitterness arises, especially during periods of inflation when the consumer has to pay dearly for the products they purchase, and yet the manufacturer still incurs losses despite selling their product at a high price.

It is quite understandable that the average buyer explains the emergence of prices and the reasons for inflation in this way, as the basic laws of economics are still little known among the general public. Moreover, it should be added that even in the minds of some economists, absurd theories regarding value, price, and profits continue to circulate. These theories, for example, claim that the price is the cost of labor plus the entrepreneur's profit (Marx's theory) or the operating cost plus the entrepreneur's profit in general (Valois, Economie nouvelle).

It is a bit more difficult to understand why there are many manufacturers who hold similar beliefs. One would expect that manufacturers, constantly and directly dealing with economic phenomena, should already understand the fundamental law of supply and demand, which directly and inexorably governs product prices. However strange this phenomenon may be, it also stems from the fact that there are generally few manufacturers who are aware of the basic laws of economics.

Regardless, the belief in the superstition that selling prices depend directly and exclusively on the will of manufacturers and intermediaries is so widespread that statements refuting this superstition still find very little audience and usually encounter the opinion that the law of supply and demand is a beautiful theory, but one that practice routinely disregards. Even the most glaring facts do not convince people that the opposite is true; they do not see that, despite various "practical" attempts to raise prices to save themselves from losses, these losses still occur. Despite the struggle against inflation undertaken by buyers or guardian authorities, prices rise or fall independently of all these efforts and even generally increase under their influence.

As the assertion that there is no functional relationship between the unit cost of a product and its selling price – one that would allow us to determine the price if we know the cost – may seem paradoxical to many readers, I will therefore endeavor to prove this based on the law of dependence existing between the total sum of operating costs, production, and time.

If we denote by K the total operating cost of production p during time t or in its unit, the relationship between K and p can be expressed by the algebraic equation:

$$K = K_o + a\,p + f(p)$$

Where

K_o is the cost per unit of time when production $p = 0$, *a* is a certain constant coefficient of increasing costs K_1,

f(p) is a function increasing as p increases, with this increase being more than proportional, and when $p = 0$, the function *f(p)* is also equal to zero.

The values K_0 *(a)* and the expression of the function *f(p)* are always precisely determined if we assume that all factors on which they depend remain unchanged, that is, that production takes place under the same conditions, for example, that the prices for purchasing materials and labor remain the same, the methods of manufacturing and equipment do not change, etc.

The above dependence can be easily expressed by a curve, plotting production *p* on the x-axis and operating cost K_1 on the y-axis.

The curve *AB*, expressing this dependence, will have the appearance shown in Fig. 1.

The fact that each manufacturing workshop always has only one best production *pw*, at which the operating cost per unit of product is the lowest (i.e., $(K_w / p_w) = min$), causes the curve *AB* to always have a downward-facing convex side.

In several of my previous papers, I have presented evidence that the relationship between the total operating cost per unit of time and production is always expressed in this way and not otherwise, so I will not repeat this evidence here.

From this dependence, it follows that the operating cost of a product unit

$$\frac{K}{P} = \frac{Ka}{p} = a + \frac{f(p)}{p}$$

is graphically expressed by the curve *CD*.

This curve is similar to a hyperbola, as it asymptotically approaches the y-axis. When $p = 0$, the operating cost of a product unit becomes infinitely large.

In our further considerations, we can assume, without any detriment to the main conclusions, that the curve *AB* is a straight line, especially since the curvature between points *A* and *W* is so small that in practice, within these limits, we can consider it as a straight line. Then, the curve *CD* can also be considered a hyperbola within these limits.

To prove our statement, let us first assume that those who claim that the selling price of a product unit should be equal to the sum of its operating cost plus a certain percentage considered as a fair profit are correct.

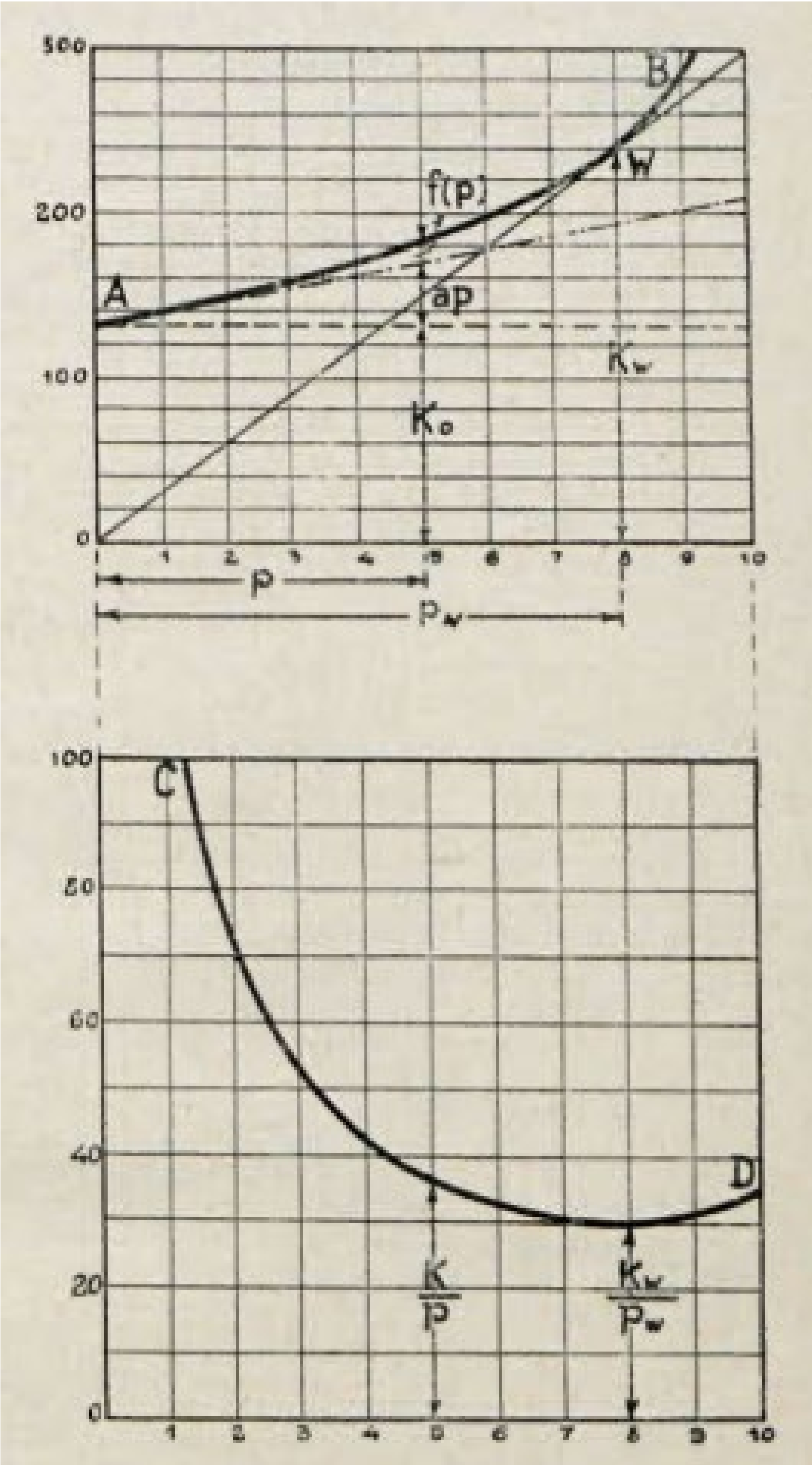


Fig. 1.

Let us assume that both the buyer and the manufacturer want to be completely loyal to each other and agree on the arguments presented by both sides. The buyer, therefore, agrees with the manufacturer's arguments, who would like his capital to always be equally interest-bearing at a moderate percentage, for example, 12%.

In other words, the buyer agrees to pay for a unit of the product only at a price that would cover the operating cost and a certain additional amount, which in total would yield the indicated interest rate on capital.

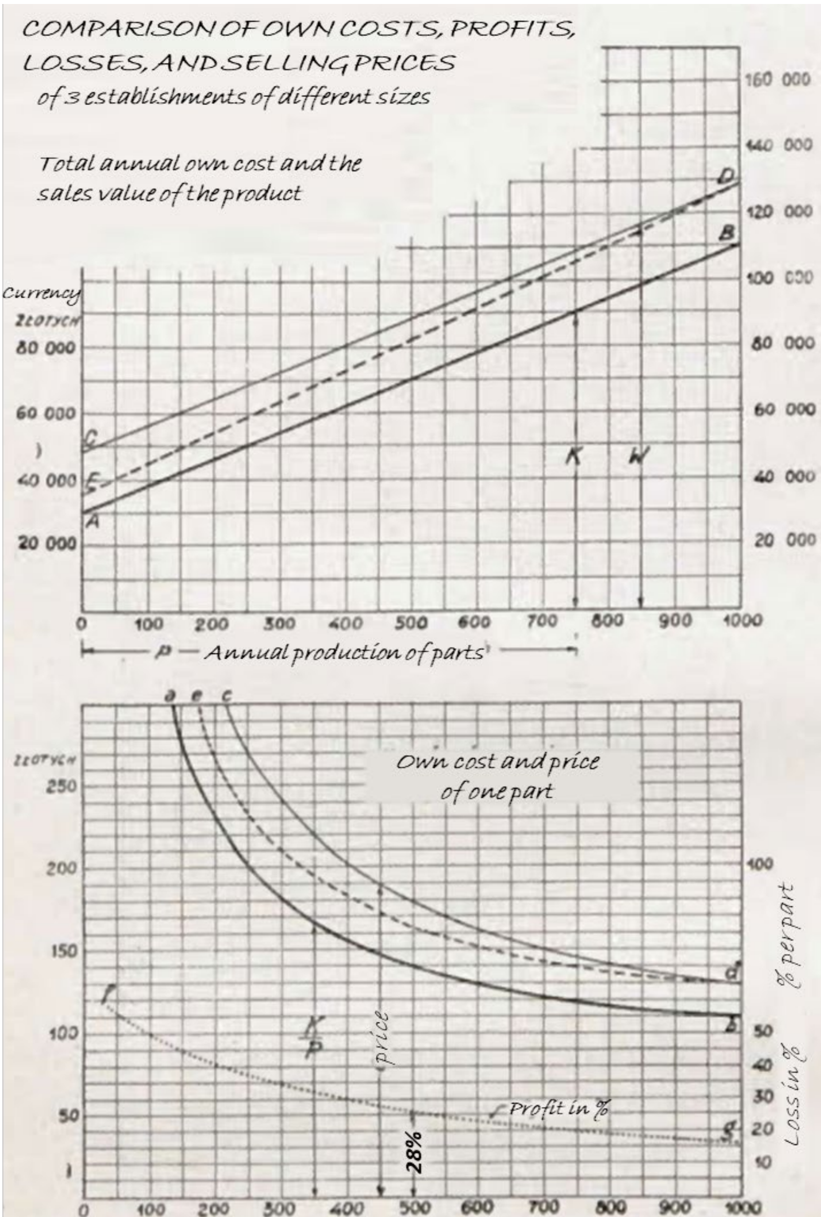


Fig. 2.

Then, in our diagram in Fig. 2, the total sales value for the manufacturer is expressed by the ordinates of the straight line *CD* parallel to the straight line *AB*, whose ordinates express the total operating costs, and for the buyer, the price per product unit is expressed by the ordinates of the hyperbola *cd*.

From the graph, it is clear that this ideal will last only as long as the manufacturer produces the full amount of product that his workshop is capable of. However, when he starts producing less for any reason, the buyer will have to pay increasingly more for each unit of the product, with the price rising faster as production decreases.

If both parties agreed on a fixed interest rate on the invested capital of 150,000 zł, for example, 12%, which, according to our graph, results in a 16.4% addition to the operating cost of each product unit at full production, then when production is halved, the manufacturer will have to add not 16.4% but 28% to the operating cost of each product unit to achieve the same 12% return on capital. This means that not only will the price increase, but the rate of addition must also be increased. This rate of addition is expressed by curve *fg*.

Obviously, in such an agreement, all the risk falls on the buyer.

We will not achieve better results if we establish a fixed percentage addition to the operating cost of each product unit. Then, as production decreases, the product price will increase, not as fast, but in any case, the price curve will be expressed by the hyperbola *de*, and the total sales value will be expressed by the straight line *DE*.

The interest rate on the capital invested in the business will decrease slightly, but it will not help the buyer much, who is forced to pay more for the product as production decreases.

The buyer will have to accept the increasing price of the product even if the manufacturer completely renounces profits and sells his product according to his operating costs. But of course, even then, the buyer will eventually say "enough - I cannot pay a price that increases infinitely" and guarantee the coverage of the manufacturer's operating costs when his production drops to zero.

We see, then, that there is no key dependent on operating costs, by which one could calculate the selling price and which would secure the interests of the buyer and allow the manufacturer to always achieve profits, regardless of whether the production is small or large.

Such a key could be imagined if production per unit of time were always constant. But this can only happen accidentally when we are dealing with a single buyer who always needs the same quantity of a certain product and a single manufacturer who always produces the same amount of the product. However, even in this case, the price will change due to changing production conditions and the prices of the means of production at which the manufacturer acquires them.

For the buyer, it is primarily important that the price does not exceed their purchasing power and, in general, that it decreases. Moreover, they are not at all interested in the manufacturer's operating cost or whether the manufacturer gains or loses at a given price. Despite any sympathies for this or that manufacturer or intermediary, the buyer will always turn to the one who offers a lower price and better conditions.

Now let's imagine two manufacturers, (X) and (Y), with completely identical workshops. Suppose that the manufacturer is very conscientious and calculates the price strictly according to their operating cost per unit of product with a minimal percentage for profit, e.g., 10%, but is in a situation where their workshop, for reasons beyond their control, produces only one-third of what it could produce. The other manufacturer, having an absolutely identical workshop but currently developing three-quarters of its production capacity, also calculates the selling price according to their operating costs but adds a significantly higher percentage for profit, e.g., 30%. Despite this, they will be much cheaper than the first one. In Fig. 3, the difference is clear. The straight line *AB* represents the total operating cost of both workshops at different productions, while the curve *ab* expresses the operating cost of the product unit. Under the assumed conditions, the price offered by manufacturer (X) is 76, and by manufacturer (Y) is 48.

Of course, the buyer will go to the second one, and will think that the first one is a profiteer. If a third manufacturer (Z) appears who has a much better and larger workshop (straight line *CD* and curve *cd*) and makes every effort to develop full production, they can offer a price of 34, which is one and a half times greater than their operating costs, and yet still be significantly cheaper than their competitors.

If the buyer believes that the selling price should be equal to the operating costs plus a "fair" profit, they will consider this third manufacturer to be very conscientious, and the first two to be price gougers to be avoided, and even persecuted with the help of various official bodies fighting price gouging.

The first two manufacturers will be inclined to assume that the third manufacturer either cannot calculate their operating costs or, assuming they are competing unfairly, will also think that it would be good to place them under the supervision of the authorities.

However, as we can see, all these opinions are completely wrong and only arise because the people expressing them do not understand the aforementioned law of dependency of operating costs on production over time and assume that the manufacturer can set the price by starting from the figure of operating costs and adding any percentage for profit. Above all, they do not understand the relentless law of supply and demand.

Various remedial measures that address effects rather than causes continually emerge based on these naïve concepts. These measures include regulations on price controls, checks on operating costs, and initiatives aimed at combating high prices and speculation, among others.

One could look indifferently at all these ineffective measures if they were cheap and harmless. However, on the contrary, they are very costly, and while sometimes bringing temporary, apparent relief, they always cause great devastation to economic progress. They also cause significant confusion and lower the level of ethics within society.

From what we have said above, it is clear that the buyers set the highest limit of the price, simply because they will stop buying when the seller offers a price that is too high. On the other hand, the lowest limit will be set by the seller who will still consider it advantageous for themselves, provided the buyer does not find a cheaper source. In other words, the price will be higher the greater the demand and the lower the supply and vice versa.

If we can say that there is some dependency between the operating cost and the selling price, it is only by understanding the limits within which the price may fluctuate without loss to the enterprise. These limits are set precisely by the operating cost (the point where the demand curve intersects the curve of the operating cost of the product unit).

Although this matter is very interesting, we will not discuss it here at this time, so as not to go beyond the scope of this article. Instead, we refer readers to Chapter III of "Outline of Political Economy" by Prof. Zygmunt Straszewicz, 1924.

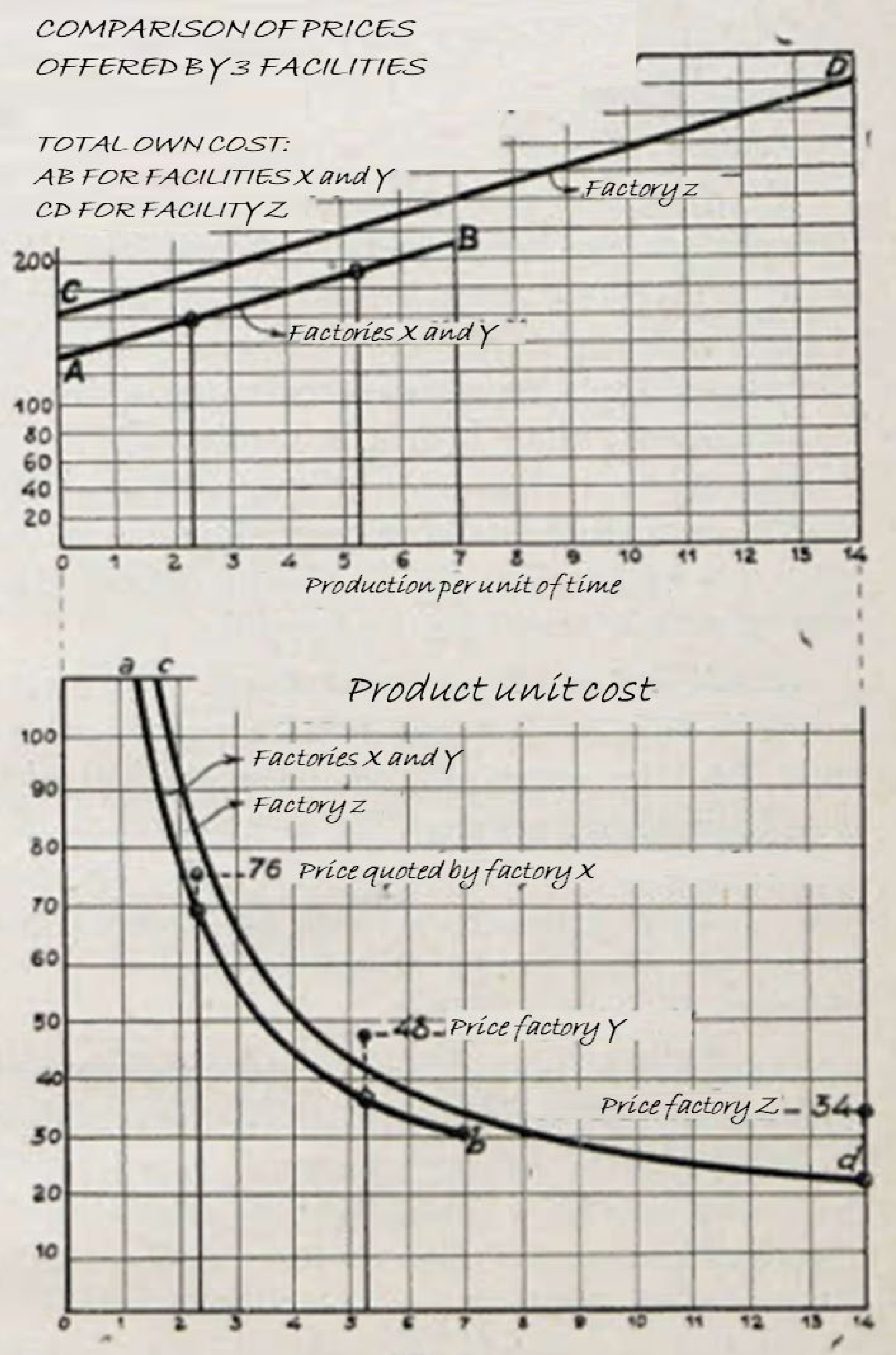

COMPARISON OF PRICES
OFFERED BY 3 FACILITIES
TOTAL OWN COST:
AB FOR FACILITIES X and Y
CD FOR FACILITY Z
Factory Z
Factories X and Y
A
B
C
D
200
100
80
60
40
20
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Production per unit of time
Product unit cost
a
c
Factories X and Y
Factory Z
76 Price quoted by factory X
48 Price factory Y
Price factory Z 34
b
d
100
90
80
70
60
50
40
30
20
10

Fig. 3.

The price level is determined by this law automatically and completely independently of the level of operating production costs. No artificial means or agreements, based on any small or large addition to operating costs, calculated for profit, will help. There is no sense in regulating what regulates itself automatically.

If the effects of the law of supply and demand bother someone, it is better if they get to know this law accurately, adapt to it, and make proper use of it, as complaining will not help here, just as complaining about the law of gravity, which, when properly understood and applied, can bring great benefits instead of misfortune.

If the manufacturer finally understands that only supply and demand and the factors that influence them regulate prices, then, in order to have profits instead of losses, they must adapt their operating costs to the price, and not be deceived by the erroneous theory of price calculated by adding a moderate percentage to their operating costs.

I believe that the above considerations and calculations are sufficient to prove the our initial proposition and may contribute to dispelling the widespread belief in the false theory that the price of products arises from the operating cost and the addition for profit.

As we can see, the formation of prices is not as simple as this naïve theory claims. The level of prices is directly governed by the law of supply and demand, and indirectly by a whole range of factors that influence the increase or decrease of supply and demand. Therefore, if we wanted to regulate prices, we would first have to understand the laws of dependency existing between all these factors and supply and demand, and only then, by influencing this or that factor, could we achieve the desired result.

But understanding these laws in their entirety is still a song not yet written, so we cannot begin to regulate such a complex phenomenon with various crude methods directed at the effects, rather than the causes, most of which bring about the opposite effect.

I will not delve into this issue here, as in this case, we are only concerned with explaining the lack of functional dependence between the selling price and the operating cost of the product.

The absence of the indicated functional dependency does not mean that a manufacturer, when setting a price, does not need to calculate their operating costs and can merely make an estimate based on intuition. This would be a grave misunderstanding. In fact, the lack of dependency leads to the opposite conclusion: the manufacturer should calculate their operating costs with even greater precision to fully comprehend the financial implications for the business at a given price, a price which is determined by external factors, regardless of their own intentions.

Such a calculation of operating costs should not only be accurate, but also extremely detailed, enabling easy navigation through necessary technical and organizational improvements, so as to better adapt the business to the prevailing conditions.

In this context, the graphical method can prove invaluable - the use of charts illustrating the relationship between operating costs and production per unit of time can greatly aid such orientation.

For example, the conditions in which industrial plants compete with each other with fluctuating selling prices and different degrees of market demand, I believe it would be helpful to construct a chart comparing the operating costs of three plants of different sizes producing the same product.

Let's assume that we have three industrial plants, whose total operating cost and operating cost per unit of production are presented in Fig. 4.

The annual operating cost *K* at different production sizes is expressed by the ordinates

straight line I	*A*	for the smallest plant (A), capable of producing a maximum of 250 units of product;
straight line II	*B*	for the medium-sized plant (B), capable of producing up to 500 units of the same product annually;
straight line III	*C*	for the largest plant (C) with a maximum production of 1,000 units.

We assume that these plants are completely identical in terms of the quality of their equipment and administration, and work under the same conditions, with the same prices of materials and workers, etc., differing only in terms of their size, i.e., in terms of their invested capital.

Let's assume that these plants have the following invested capital:

plant (A) .... 55,000 złotys
plant (B) ... 77,000 złotys
plant (C) ... 120,000 złotys

These capital investments will not, of course, be proportional to production, so the invested capital of plant (B) will be less than double that of (A), and the capital of plant (C) will be less than double that of plant (B).

Similarly, their fixed operating costs O I, O II, O III will be less than proportionally larger from one another.

Since these plants work under the same conditions, the lines I A, II B, III C will be parallel to each other.

The chart clearly shows the differences in the operating costs per unit of product in each of these plants.

If they operate at full capacity, the operating cost of one piece of the product
in plant (A) is 150 zł.
in plant (B) is 130 zł.
in plant (C) is 110 zł.

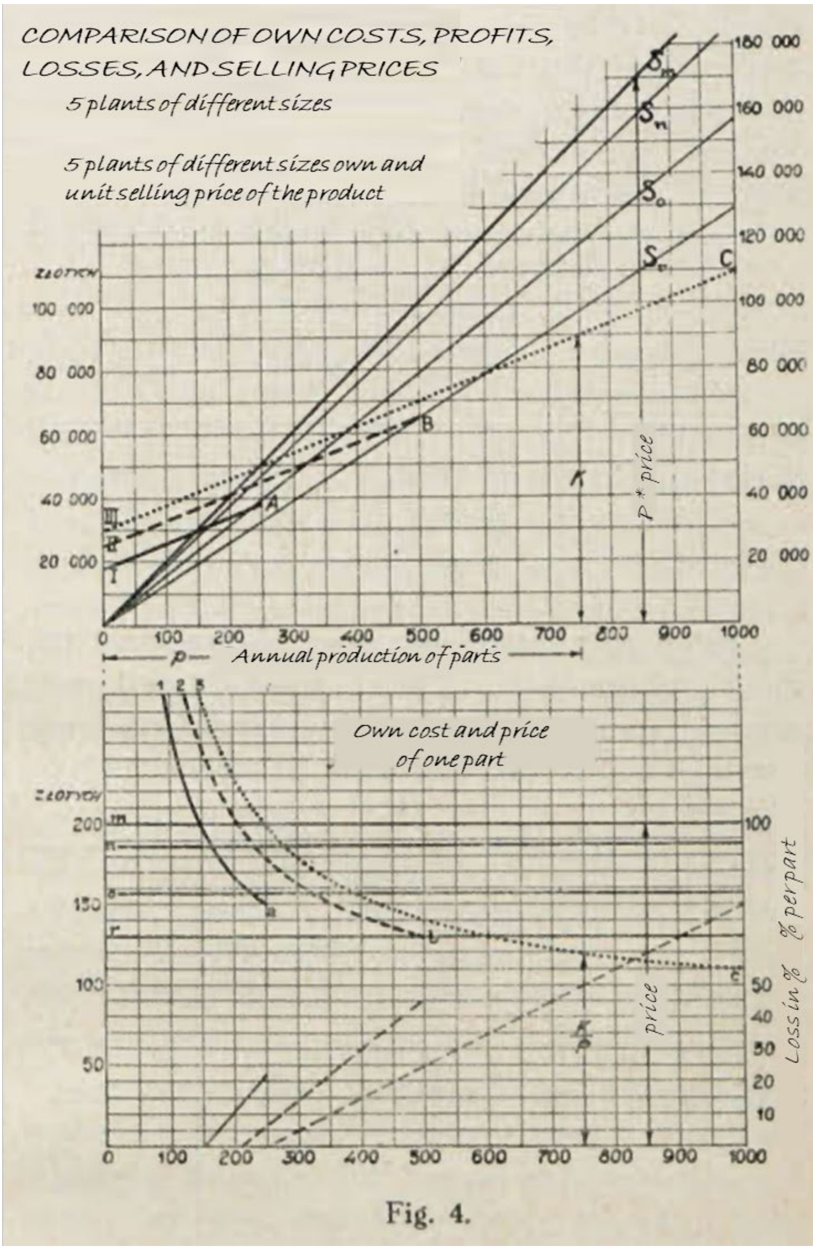


Fig. 4.

Since these plants have the same market and release completely identical products, the selling price per unit will inevitably be the same for all of them.

Each of them can calculate the price as they wish, with a higher or lower addition to their operating costs; ultimately, the buyer will decide, who will primarily go to the one who sets the lowest price and determines the supply-to-demand ratio at a given moment. If demand starts to decrease, all three plants will have to reduce their selling prices equally.

Let's consider on the chart how the profits or losses of plants A, B, and C appear at different selling prices.

Suppose the price has reached level *m* of 200 złotys per unit, and the demand is so high that all plants will operate at full capacity; then the total annual sales value will be expressed by the ordinates of the line OS_m, and the result will be:

Plant	Total annual profit or loss (zl.)	Profit expressed as a % of the invested capital	Profit or loss per unit (zl.)
Plant A	12,000	22.50%	50
Plant B	35,000	44.50%	70
Plant C	90,000	75%	90

If the selling price drops significantly and stands at the level r = 130 zł., which means that the total annual sales value is expressed by the ordinates of the line OS_r, and the plants will operate at full capacity, then:

Plant	Total annual profit or loss (zl.)	Profit expressed as a % of the invested capital	Profit or loss per unit (zl.)
Plant A	-6,000	-10.9%	-20
Plant B	0	0.0%	0
Plant C	20,000	16.6%	20

In the same manner, we can consider the outcomes at all intermediate prices. It is easy to visualize the effects of different prices for each plant by adjusting the corresponding lines on the graph that express the selling price. Similarly, we can grasp the total sales value by observing the inclination of the *OS* lines.

For example, the price *r* = 130 zł. is still profitable for plant (C) as long as it exceeds production of 610 units, plant (B) at all possible production levels for it would have losses until production drops below 500 units, at which point losses drop to 0. Plant (A) will always have losses at this price.

If the overall market demand falls below 250 units annually for plant (C), even at the high price of *m* = 200 złotys, the production will always result in losses, while plants (A) and (B) can still have profits, but below 200 units, plant (B) will have losses, and plant (A) will still have profits until the demand falls below 150 units.

We will not delve into the various, very interesting conclusions that suggest themselves when considering this chart in terms of profits, losses, return on capital at different fluctuations in production, selling prices, and various critical points - each reader can derive them from the chart themselves.

But in any case, we must emphasize what this chart highlights especially vividly, namely that profit is not solely the result of high prices and that the producer cannot arbitrarily set the selling price, as many people think, and even if they could, they would never eliminate the critical points of production that, if not exceeded, will always result in losses even at the highest price. This is because the lines *OS* originate from point *O*, and the lines I A, II B, etc., always originate from points above *O*.

In comparing the three plants, we assumed that they are similarly equipped and operate under the same and unchanging conditions, and therefore, the cost lines I A, II B, III C are constantly unchanged. However, we never encounter such cases in actual practice. Even if we found plants completely identical in terms of equipment and internal management, the purchase prices of materials, labor, and external conditions that affect the operating cost are constantly changing and differ for each plant. Therefore, we deal with lines of total operating costs that either rise or fall, and to make accurate comparisons and draw conclusions about profits and losses, we need to consider not only fluctuations in selling prices and production but also the variability of cost charts themselves.

Taking all this into account, as well as the countless variations between individual manufacturing plants, we must concede that the investigation and comparison of operating costs and deriving impartial conclusions is a highly complex task, even when using the graphical method. This complexity is further amplified when we consider that, in the real world, costs per unit of time do not follow straight lines like I A, etc., but rather unique curves that would need to be plotted each time.

III. Attempts to Regulate Prices

Having examined the calculation of operational production costs and the development of selling prices in previous discussions, we're naturally driven to conclusions about various artificial means of price regulation, which for years have been implemented under the broader umbrella of combating inflation.

As I have already said, all these methods do not and cannot yield any positive results, because the law of supply and demand is a law, not a theory conceived in human minds that can be overturned. However, the result achieved is similar to that achieved by Don Quixote in his fight against windmills. The key difference being that while his struggle resulted solely in his own personal injuries, the impact of this fight significantly hampers the economic vitality of the entire nation, ultimately leading to widespread impoverishment and even greater inflation.

This battle with windmills, however, continues unabated; the spirit of Don Quixote seems to be immortal. Advocates of the fight, having realized that attacks on high prices, allegedly resulting from excessive profits, do not help, now turn to the other "component" of the price - the operating costs.

Voices are growing louder in favor of having authorities investigate manufacturers' operational costs in an effort to pinpoint the perpetrators and bring them under control. This may involve defining a fair profit margin percentage and enforcing adherence to it by manufacturers. Supporters of this idea are particularly inspired by the belief that they are striking at the central hidden bastion of inflation. As operational costs are often guarded by manufacturers as their most significant trade secret, many suspect that this secrecy primarily serves to conceal excessive profits.

Recently, this idea has become so popular that a project to create a special government commission to investigate operating costs has emerged and is being implemented. Thus, a large "cannon" has been created, consisting, supposedly for impartiality, of representatives of all interested spheres, including government, industrialists, workers, experts, technicians, and accountants!

The entire endeavor will, of course, be very expensive. Nevertheless, one could not be against it if the cost, even a very large one, would pay off if the true causes of the high cost of living were found and innovative ways to remove them were discovered. However, the current setup and prejudiced proposition of the commission is problematic. Instead of promoting beneficial outcomes, it is likely to do more harm than good.

The examination of the internal costs could bring substantial benefits if carried out for the following purposes:

1. The internal cost may concern the buyer, the entire society, and the government only indirectly, for example, from the perspective of our industry's competition with foreign countries. In this regard, explaining the average operating costs of the most important industrial products and the conditions influencing the main categories compared to those abroad would be very desirable. It would give the government guidance on the overall economic policy, the use of measures facilitating the development and efficiency of our industry, and the removal of obstacles that hinder this development.

   Gathering such data is an important matter, but there is no need to create a special and large commission when the relevant existing bodies of the Ministry of Industry and Trade can do this, which, if necessary, could appoint several specialists.

2. Society may be equally invested in assessing operating costs from the perspective of perfecting their calculation methods, just as it values the application of optimal techniques and resources in production, fostering sustainable industrial development. This is because the use of irrational production controls, such as inaccurately calculated operating costs, is as equally undesirable as the employment of flawed tools and outdated production methodologies.

   Approaching the examination of operating costs from this angle, the formation of a large, specialized body akin to the aforementioned government commission would be unnecessary. This is not a concern that falls within the jurisdiction of government authorities or the representatives of any party or social class. This challenge, being fundamentally a technical-scientific one, should be addressed by the appropriate technical and scientific institutions. As I mentioned in the first chapter, the Institute of Scientific Organization has already begun tackling this issue.

3. Finally, there is another issue related to operating costs that may concern everyone, namely the unnecessary loss of production resources - materials, energy, human labor, and time.

> The examination of these losses and their causes would undoubtedly be beneficial, as it would indicate the main paths to follow in order to achieve higher manufacturing productivity. Such studies were conducted several years ago by the American Engineering Council in several industries in the United States, bringing undeniable benefits to the industry in serving as a stimulus to eliminate waste.

However, such studies cannot be conducted by a commission composed of incompetent representatives of various social strata and government spheres, but by a body consisting of impartial top-notch experts, predominantly in the field of organization, - a body similar to the one created by the American Engineering Council for this purpose.

Such a body would not even need to examine operating costs but only the expenses of production resources, expressed in quantitative units, and production. The examination of operating costs for this purpose, given the current irrational methods of calculation and due to the fluctuation of material and labor costs, would only obscure the matter.

By publishing a translation of the work of the aforementioned American Engineering Council titled "Waste in Industry" at the beginning of last year, the Institute aimed to stimulate such studies in our country. Since such studies are entirely in the Institute's program, it even took the initiative to begin similar studies in our own printing industry several months ago. The Institute of Scientific Organization, wishing to expand these studies on a larger scale, appealed to the government and industrial circles for support in February of last year.

In considering the examination of operating costs, one must ultimately conclude that this is an important matter, and the studies can bring significant benefits if they are conducted only *from the perspectives discussed above and by the appropriate professional forces.*

If the research were to be conducted with the aim of finding a means to regulate prices, it can be predicted in advance that they will completely miss the target. Instead of creating a heavy and costly apparatus in the form of the aforementioned government commission, it would be far more useful and cheaper to gather several dozen people from various proposed spheres and buy them books (especially for the initiators of the commission) dealing with the law of supply and demand and require that they familiarize themselves with the topic and start looking for the causes of high prices where they actually lie, as well as influence the relevant spheres, which still seem to believe that with various improvised experiments, the citizens' welfare can be increased. For my part, I would recommend the aforementioned "Outline of Political Economy" by Prof. Straszewicz as such a book. Some supporters of the creation of such a commission believe that if the research does not lead to the discovery of means to regulate prices, at least the flaws in technical management and systems of industrial administration will be clarified. This is complete naivety.

To determine whether this prediction is accurate, one must first ask whether, given the current state of operating cost calculation and factory accounting methods, we can expect to find figures from which we could derive sufficiently clear and accurate numerical characteristics on which unbiased conclusions could be based, whether regarding technical management or the degree of perfection of administration.

To answer this question, one can only respond in the negative. The first reason being, a significant majority of industrial establishments do not calculate monthly operating costs for their products at all. Instead, they are content with an annual statement from the general accounting department where all expenses are combined in a lump sum. Secondly, those establishments that do compile detailed monthly operating cost summaries do so according to classifications that are so varied and allocate costs to individual products in such empirical ways, these summaries cannot even be compared with each other. Most importantly, none of the existing cost reports provide figures that offer insights into the degree of utilization of the facility at any given moment, or its intensity of production, either in its entirety or in its individual parts. Therefore, we are lacking data that is essential for making any comparisons or drawing any conclusions.

Thus, the present situation is entirely hopeless, even if it were just about revealing the conditions under which individual establishments operate. However, if the initiators and supporters of the aforementioned commission to examine costs believe that they will find sufficient material for comparison and impartial conclusions, they will be thoroughly disappointed. They will realize that they have attempted to square the circle, that is, undertake a task that cannot be solved. Moreover, when it comes to regulating prices, there is no need for a solution, as this is automatically resolved by the law of supply and demand.

Is it worth creating an exceedingly costly apparatus for such a hopeless goal, which not only will not help, but will introduce even greater confusion into economic relations? There is no doubt that immersing oneself in a sea of barely understandable numbers will offer a broad scope for drawing false and biased conclusions. These conclusions might be convenient for juggling in the realm of partisan politics, but they have nothing to do with the welfare of the state.

Remarks on the issue of operating costs

PRZEGLĄD ORGANIZACJI

MIESIĘCZNIK POŚWIĘCONY SPRAWOM ORGANIZACJI I ADMINISTRACJI ŻYCIA GOSPODARCZEGO

ORGAN INSTYTUTU NAUKOWEJ ORGANIZACJI

ROK II WARSZAWA, PAŹDZIERNIK 1927 Nr 10

GENERAŁ WILLIAM CROZIER.

Na zaproszenie Instytutu Naukowej Organizacji w tych dniach przyjeżdża do Warszawy gen. W. Crozier, współtowarzysz pracy Taylora i wielki przyjaciel Polski. Wybitne zasługi na polu wprowadzania metod naukowej organizacji w armji amerykańskiej stawiają go w rzędzie najzasłużeńszych pionierów tej nauki. Redakcja Przeglądu Organizacji, pragnąc zaznajomić czytelników z działalnością gen. Crozier zamieszcza poniżej krótki rys biograficzny, dotyczący jego prac i zasług na tem polu.

Redakcja z radością wita przyjazd gen. Crozier, widząc w tem jedno z dalszych ważnych ogniw w zacieśnieniu serdecznych stosunków nawiązanych z naszymi przyjaciółmi amerykańskimi, którzy nie pomijają żadnej sposobności, aby pomóc nam w zaszczepianiu i rozpowszechnianiu naukowej organizacji w Polsce.

REDAKCJA.

Gen. WILLIAM CROZIER.

„Najwcześniejszem wspomnieniem mojej młodości jest wspaniały pomnik Kościuszki, stojący przed szkołą wojskową w West Point, którą ukończyłem. Pomnik ten wpoił we mnie miłość dla wielkiego bohatera oraz poczucie wdzięczności dla narodu polskiego".

„To też aczkolwiek miło mi jest słyszeć z ust profesora Adamieckiego, że my Amerykanie przydaliśmy się Polsce, jednak nie widzę w tem żadnej zasługi. Jest to tylko częściowe spłacenie długu wdzięczności przez naród amerykański wobec ojczyzny Kościuszki i Pułaskiego — bojowników o wolność ludu amerykańskiego".

(Z przemówienia do delegacji polskiej na III Międzynarodowym Kongresie N. O. w Rzymie dnia 8.IX.27).

Z NAZWISKIEM gen. Crozier łączy się wprowadzenie Naukowej Organizacji do administracji wojskowej. Był on pierwszym, który zastosował idee Taylora do amerykańskiego przemysłu wojennego i osiągnął tak doskonałe wyniki, że niewątpliwie prace jego przyczyniły się w dużej mierze do usprawnienia armji amerykańskiej, której organizacja wzbudziła podziw podczas wojny światowej i przyczyniła się do zwycięstwa.

W początkach swego rozwoju naukowa organizacja spotkała się z energicznym sprzeciwem ze strony związków robotniczych, które w niej widziały jedynie środek do dalszego wyzysku robotnika. Kampanja ta była tak zacięta, że zasługi gen. Crozier należy specjalnie podkreślić,

General William Crozier [Scientific Management in Government] (1927)

Organization Review *[Przegląd Organizacji*], 1927, Issue 2, No. 10, pp. 355-364

Forward to the English edition:

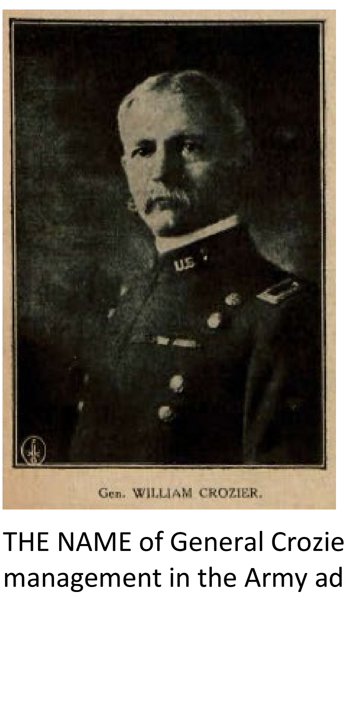
General Crozier was a pioneering figure in the realm of scientific management, with significant influence in the US, Europe, China, and Japan. This article serves as an introduction to General Crozier's visit to Poland in 1927 and provides modern readers with valuable insights into the development and challenges of scientific management during its early years. The article highlights General Crozier's collaboration with Frederick Taylor, the progress made in implementing Taylor's methods in a government institution, and the obstacles facing widespread adoption.

**The article was originally published in English and Polish and is presented here without alteration.*

Forward to the original:

General William Crozier, an associate of celebrated Taylor and a great friend of Poland is coming within the next few days to Warsaw upon the invitation of the Institute for Scientific Management. Eminent merits in the field of scientific management and its application in the United States Army place General Crozier among the most prominent pioneers of that science. In order to acquaint our readers with his accomplishments we are giving below a short biography, illustrating his work and merits in that field. We are happy to welcome General Crozier and consider his visit as a further step towards the strengthening of the pleasant relations with our American friends, who do not miss a single opportunity to show us their courteous assistance in propagating the principles of scientific management in Poland.

THE EDITORS.



Gen. WILLIAM CROZIER.

My earliest recollection from my youth is the magnificent monument of Kościuszko standing in front of the Military Academy at West Point of which I am a graduate. This monument has instilled in me a profound love for that great hero and a feeling of gratitude towards the Polish nation.

And although I am pleased to hear from Professor Adamiecki that we Americans have been useful to Poland, yet I do not see any merit - It is only a partly repayment of our debt of gratitude to the Country of Kościuszko and Pułaski, who fought for the freedom of the American nation."

THE NAME of General Crozier is closely connected with the introduction of scientific management in the Army administration. He was the first to apply the practice of Taylor principles and ideas to the manufacturing establishments of the Ordnance Department; the splendid results obtained have contributed to a large extent to the effectiveness of the United States Army, the organization of which has aroused the admiration of the whole world during the war and assured the ultimate victory.

In the first stage of its development, scientific management has met with a strong opposition on the part of labor unions, considering it as another means of exploiting the workers. The stubbornness of the campaign makes General Crozier's merits still greater, and in spite of all the difficulties he succeeded, thanks to his unfailing energy and determination, to overcome the obstacles and reach the aim in view.

It was one of the first collisions in the history of scientific management and was to a certain extent brough about by the initiative of Major F.E. Hobbs, commanding officer of the arsenal at Rock Island, who on his own responsibility attempted to introduce time-studies. It was somewhat premature, as neither the equipment nor machines or tools were standardized at the said arsenal and as a consequence the attempts to establish standards of work have caused serious criticism and attacks.

General Crozier, who at the time was Chief of Ordnance, tried to soften the incident; being very much interested in the Taylor System he did not wish it to cause unnecessary and harmful struggles. He therefore tried to slow down the introduction of the new methods until such time as his studies of the existing conditions are ended.

One of the features of the new system, which caused the greatest attacks of labor unions, was the time-study. General Crozier's opinion on time-studies is best illustrated by his following statement:

> *"Time-studies give the most accurate measure for determining the proper amount of work which can be done without undue fatigue, while the bonus wage system connected thereto makes it possible to assure the workers proper pay for the work done. The two features of the new system taken together increase the earnings of the capable worker without decreasing them in the case of a worker whose capabilities are lower."*

General Crozier's attitude toward the workers is not narrow or partial; he understands the situation of the worker thoroughly which is plainly seen from the following statement:

> *"In principle I approve of the organization of labor. I do not think, in our imperfect human relations, anyone is in a position to secure for himself consideration, or even justice, unless he has some power. For persons of small individual influence, such as the great class of employees in general, the only way in which power can be secured is through combination for common action. But scientific management does not interfere with labor's ideals, on the contrary it transfers the gravity center from an individual and often wrong valuation of work to an accurate measuring of same, unaffected by*

personal inclination, and therefore it assures the attainment of the ideal of fairness and justice."

The above statement is sufficient illustration of the broadmindedness of General Crozier in respect of the Taylor system and its relation to labor. The results obtained through the application of time-studies are thoroughly confirming the above. A comparison of the savings made by the State in the work of the arsenal before and after the application of time-studies shows a marked decrease in the cost per unit, a large part of these gains however has been paid to the workers as a bonus.

As far back as in 1906 General Crozier went on to suggest that in addition to himself the commanding officers of the Watertown and Watervliet arsenals visit Taylor with the purpose of discussing scientific management; unfortunately his departure for Cuba in connection with the hostilities made it impossible. Not before 1909 could General Crozier give more of his time to these problems. He visited the Link Belt and Tabor plants and has also seen Taylor at Boxly and from that time onwards he becomes a close collaborator of Taylor.

We might appraise here one of the features of General Crozier's character – his cautiousness in respect of all new theories, which he always subjected to the most minute study. Yet his caution in embarking on a new enterprise was always fully equaled by the firmness with which he stuck to it, once he made up his mind as to its rightness.

To realize his plans General Crozier had to act with the greatest caution; he was well aware of the influence of a certain group of Congressmen (influenced by their electors – in a great part government employees), who tried to bring a pressure to bear on the Secretary of War against scientific management. That was why he considered that to have positive results in hand, was the best argument he could present in this respect.

In order to secure some of these results, General Crozier resolved to make a beginning with and test of the Taylor System at the Watertown Arsenal. The choice of this arsenal was dictated by Taylor himself as having little work of a repetitive nature and therefore relying entirely upon the day-work wage system.

The principal manufactures at Watertown were seacoast-gun carriages. Writing to General Crozier, Colonel CB Wheeler, then commanding officer at Watertown, said: "The adoption of the Taylor System by the Ordnance Department and its introduction at this arsenal, where the necessity for it is most urgent, will mark one of the greatest strides in advance in the organization of our Army."

In order to carry out this plan at the Watertown arsenal General Crozier engaged C. Barth, one of the most prominent collaborators of Taylor. The results of the reorganization were so encouraging, that in his Report to the Secretary of War in 1911 General Crozier gave the best testimony of the methods of scientific management and their application to the war industry.

The Report is most interesting, it is also the first official Report, containing such a favorable opinion on the Taylor System. General Crozier writes as follows:

> *"We have systematized the method of putting work into the shops, so that orders for manufacture now go from the office to the shops with the most complete arrangement and supply of drawings, specifications, bills of material, lists of parts etc., so that the foremen are relieved from much of the semi-clerical and other office work which they used to have to do, and for which they are not well qualified and cannot attend to without a neglect of other more appropriate duties.*
>
> *"We have systematized the work of planning the course of component parts of the structures to be manufactured through the shops of the arsenal, so that this course shall be regular and orderly, and the work shall at no time be held up through the lack of some component which is not at hand when needed. We have thus avoided wasteful effects which arise through congestion of work at particular machines or the idleness of other machines or workmen."*

The Report is too long for full reproduction here; it will be interesting however to note some of the figures. In the case of the 6-inch gun carriages, the cost of the direct labor was reduced from $10,239 to $6,949, while that of the other shop expenses from $10,263 to $8,956. As to the workmen it is most significant that 153 men have during one year earned $6,938 more than what they earned before the Taylor System.

In view of the successful results obtained at the Watertown Arsenal, General Crozier decided to assemble at that arsenal a board, which included the commanding officers of other arsenals, for the purpose of determining what can be introduced in these arsenals out of the experience gained. In order to settle the question of time-studies he decided to invite the cooperation of Dwight V. Merrick, who had received his training at the Bethlehem and Link-Belt plants under the supervision of Taylor.

Rock Island was the next arsenal to which General Crozier resolved to extend the Taylor methods. This step however has met with a strong resistance on the part of labor unions. The Association of Machinists issued a circular calling the workmen to a determined fight against the system, while their leaders conducted a stubborn agitation and spread false information; they felt that the Taylor System, one of the principles of which was that of cooperation, tends to abolish the principle of fight, which is easy to spread by means of hatred and demagogical phraseology and which constituted the foundation of their authority.

The fight has moved on to the Congress, where the labor leaders found support among some of the Congressmen. A Committee has been named to investigate the matter. The stubbornness of the quarters opposing scientific management went so far as to suggest a law, whereby the application of the Taylor System in government enterprises would be prohibited.

Although the Committee was zealous to protect the well-being of the employees and sympathized with their leaders yet if failed to find any ground to base condemnation of the Taylor System; this result was due to the strained efforts on the part of Taylor's adherents to defend scientific management and especially to the determined attitude of General Crozier, who was convinced that there were large benefits to be drawn by the State and the workmen themselves from the new methods of work and was energetically parrying off all unfounded attacks. The authority enjoyed by the great organizer of the only government establishment which was in a position to successfully compete with privately owned industry, has had its influence on the formation of the public opinion.

The labor leaders however would not surrender; they continued their agitation and several years later, having gained a temporary majority at the Congress they caused at the beginning of 1915 some restrictions to be passed in the army and navy appropriation bills, which hindered to a certain extent the application of scientific management. In spite of these restrictions the development of scientific management in the American industry became so rapid and brought about such astounding results, that the labor leaders such as the present President of the American Federation of Labor Mr. William Green do not miss any opportunities to state that the welfare of the working men depends on the strict cooperation between employers and workers and through the application of scientific management methods.

The firm and wise attitude of General Crozier in his organization work has gained him full sympathy of Taylor, who speaks of him in high words of appreciation. Being specially interested in the efficiency of work of government offices, Taylor points out in his *Government Efficiency* paper in 1911 the splendid organization of the Ordnance Department headed by General Crozier as compared with other government enterprises.

General Crozier created a new type of ordnance officer in his Ordnance Department, more suited for industrial work than for pure military duties. That is how Taylor describes General Crozier's system of training officers for the Ordnance Department:

> *"In this department, the officers are selected from the line of the army by competitive examination and they enter this department expecting to devote their lives to industrial problems rather than to military ones; thus the mental attitude of these officers differs entirely form that of ordinary officers. Their ambitions lie toward promoting efficiency in manufacture. The present organization of this department offers an ideal opportunity for the selection of men well suited to their work. At the end of three or four years the young officers are obliged to go back to the line of the army for a year's work, and unless they have made good in their work as manufacturers or designers they are not taken back into the Ordnance Department. And on the other hand, if they themselves find that they are unfitted for work of this character, they can voluntarily go back to the line.*

"This insures the gradual selection of men specially suited to manufacturing duties and this primarily accounts for the fact that the work of the Ordnance Department, with General Crozier at its head, represents the only case in which government shops are able to successfully compete with corresponding manufacturing companies in civillife as far as costs and quality is concerned."

A new and important phase of General Crozier's activity in the field of scientific management begins with the entering of the United States into the War. As the huge government orders for arms and ammunition were distributed among the arsenals and various private plants, it was most difficult to have a clear picture of the progress of their execution. The orders grew from hundreds to millions and consequently the ordinary methods of control of such quantities and of the time required for their manufacture have become insufficient.

Having thoroughly acquainted himself with the methods of HL Gantt – a well-known organizer and a close collaborator of Taylor – General Crozier invited him in 1917 in the capacity of industrial adviser to the Frankford Arsenal and immediately after the declaration of war to the Ordnance Department at Washington.

The problems of control which stood before the Ordnance Department and which seemed to be insurmountable have been satisfactorily solved by means of the Gantt Charts. This method of control, the main feature of which is the comparison between promises and performances, had been established in the Frankford Arsenal before the war was declared. This system General Crozier began to extend throughout the Ordnance Department as soon as America entered the war. The system of Gantt charts giving at any moment the actual progress made was a great help in managing the Ordnance Department and enabled its Chief to see at all times how each of his subordinates was performing the work assigned to him.

And here again has General Crozier met with serious difficulties. In his last book *Organizing for Work*, Gantt throws some light on the matter and his words explain to a certain extent the nature of these difficulties. He points out that the leading positions at Washington were occupied during the war by men, who knew how to raise the money needed, but could not transform it into fighting power – food and clothing, weapons and ammunition. That accounts for the fact that the actual state was totally different from what has been proposed and those in authority not only discouraged all efforts to show comparison between their promises and their performances, but actually forbade such comparisons to be made.

According to the words of Gantt

"alone among those in authority at that time General Crozier reorganized the important principle that authority and responsibility for performance must be centered in the same individual and organized his Department on that basis. He perfectly understood the importance of high efficiency which must be stimulated continuously and that for this end comparisons and records showing at all times the progress of work are essential."

It is evident from Gantt's description that the system has not been agreeable to those in authority and some hidden forces, who did their utmost to keep the discrepancies in the deliveries from coming to light, which would surely happen had the General's system of control been introduced in its full extent. And this probably was the reason of General Crozier's retirement from his position in 1917.

The report of Dean Herman Schneider of the University of Cincinnati who was called at the end of 1917 to the Ordnance Department to investigate the matter, throws some light on the organization work of General Crozier. Dean Schneider writes as follows:

> *"Each production section has production and progress chart systems. These charts give a picture of the progress of the whole Ordnance program including lags and the causes therefor. Combined in one office and kept to date they show the requirements as to workers, as well as to materials, transportation, machinery, and all the other factors, which make or break the program. These charts, developed and introduced by Gantt, are effectively contributing to the systematization of management. With a plan and charts of this sort the Ordnance Department is in a position to state at any time its immediate and probably future needs in men, materials, transportation, and equipment. On the basis of the said charts the whole of the program of war production can move with fair uniformity, without disastrous competition or dishonesty in deliveries."*

Unfortunately the method developed by General Crozier has been abandoned by his successors, which in view of the reasons quoted above, is best proof of its perfection.

Upon leaving the active service General Crozier devoted much of his time and work to scientific management and is now one of its most active promoters.

General Crozier spent the last three years outside America. While in Japan he had a very interesting lecture on the application of the Taylor System in war work and has to a great extent contributed to the creation of the Japanese Institute of Scientific Management. In China General Crozier had an accident and was obliged to stay a longer time in Pekin.

In September last General Crozier took part in the Rome International Congress of Scientific Management. He has not only shown much sympathy to our delegation, but has also given proof of it by readily accepting the invitation to visit Poland in order to acquaint himself with the progress made in the field of scientific management and to enter into a closer touch with our Country. The arrival of General Crozier is expected at the end of the month.

PRZEGLĄD ORGANIZACJI

MIESIĘCZNIK POŚWIĘCONY SPRAWOM ORGANIZACJI I ADMINISTRACJI ŻYCIA GOSPODARCZEGO

ORGAN INSTYTUTU NAUKOWEJ ORGANIZACJI

ROK II | WARSZAWA, LISTOPAD 1927 | Nr 11

NADZWYCZAJCZAJNE POSIEDZENIE CZŁONKÓW INSTYTUTU NAUKOWEJ ORGANIZACJI W WARSZAWIE

DNIA 28.X.1927 R.

W dniu 28 października r. b. odbyło się w Auli Politechniki Warszawskiej z okazji przyjazdu do Polski gen. Crozier nadzwyczajne posiedzenie członków Instytutu. W zebraniu, które zaszczycił swą obecnością Pan Prezydent Rzeczypospolitej, wzięło udział zgórą 500 osób — przedstawicieli rządu, wojskowości, sfer naukowych, przemysłowych i technicznych. Po przemówieniu wstępnem przewodniczącego Rady Instytutu, prof. K. Adamieckiego, Generał William Crozier wygłosił odczyt o zastosowaniu systemu Taylora w Departamencie Uzbrojenia armji amerykańskiej.

Pragnąc zaznajomić czytelników z przebiegiem tego niezmiernie ważnego dla Instytutu zebrania, podajemy przemówienia w całości.

PRZEMÓWIENIE PROF. K. ADAMIECKIEGO.

Panie Prezydencie Rzeczypospolitej, Panie Generale, Panie i Panowie.

Jako przewodniczący Rady Instytutu Naukowej Organizacji mam zaszczyt otworzyć ogólne nadzwyczajne posiedzenie Instytutu.

Posiedzenie dzisiejsze jest wyjątkowo uroczyste i stanowi ważny fakt w rozwoju prac naszego Instytutu, a to z następujących powodów:

Pierwszym powodem jest obecność Pana Prezydenta Rzeczypospolitej. Jego zainteresowanie napawa nas wielką radością i dodaje szczególnie silnego bodźca do dalszej twórczej pracy.

Drugim powodem uroczystości jest przybycie na dzisiejsze zebranie naszego szczerego przyjaciela, pana generała Williama Crozier, jednego z najwybitniejszych przedstawicieli narodu amerykańskiego.

Wreszcie trzecim powodem uroczystego nastroju jest liczny udział dostojnych gości ze wszystkich działów pracy państwowej, sfer naukowych i gospodarczych. Jest to dowodem, że prace, dokonywane przez nasz Instytut, są uznawane za ważne przez kierowników wszystkich dziedzin życia naszego kraju.

Otwierając to tak uroczyste zebranie, pozwolę więc sobie przedewszystkiem, w imieniu wszystkich członków Instytutu, złożyć gorące podziękowanie wszystkim dostojnym naszym gościom, że raczyli wziąć w niem udział i że w ten sposób dali dowód swego żywego zainteresowania się pracami naszej młodej instytucji.

Wypełniając następnie pierwszy punkt programu, uważam za swój obowiązek wypowiedzieć w kilku słowach, jakie są cele naszego Instytutu i pod jakiem hasłem prowadzimy nasze prace.

Moi Panowie.

Pan Marszałek Piłsudski wypowiedział wkrótce po wojnie następujące znamienne słowa:

„Skończył się wyścig krwi, teraz trzeba przystąpić do wyścigu pracy".

W zdaniu tem mieści się cały program dla naszego narodu. Każdy Polak powinien nietylko rozumieć, ale i odczuwać, iż jest niezbitą i oczywistą prawdą, że jeżeli w tym wyścigu pozostaniemy w tyle, to nie możemy nawet marzyć o utrwaleniu naszego bytu państwowego i narodowego.

Extraordinary meeting of the members of the Institute of Scientific Organization in Warsaw on October 28, 1927

Organization Review *[Przegląd Organizacji],* 1927, Issue 2, No. 11, pp. 403-413

Forward to the English edition:

This article features General Crozier's lecture in its entirety, bookended by Adamiecki's introduction and closing remarks. The lecture delves into the historical background, implications, and impact of the Taylor system, or scientific management, on American industry. Furthermore, it explores the political intricacies of introducing this system into public institutions, and highlights the challenges faced in its quest for widespread acceptance.

General Crozier emphasizes the paramount importance of fostering cooperation between workers and employers, advocating this as a key driver of industrial prosperity, encouraging both employers and labor leaders to recognize and embrace its benefits. Furthermore, he cautions against the pitfalls of relying on inexperienced practitioners and stresses the importance of careful and gradual implementation.

Forward [original]:

On October 28th of the this year, an extraordinary meeting of the members of the Institute was held in the Hall of the Warsaw University of Technology on the occasion of the arrival of General Crozier to Poland. The meeting, which was honored by the presence of the President of the Republic, was attended by over 500 people - representatives of the government, the military, scientific, industrial and technical circles. After the introductory speech of the Chairman of the Institute Council, Prof. K. Adamiecki, General William Crozier delivered a lecture on the application of the Taylor system in the US Army’s Ordinance Department.

To acquaint readers with the course of this extremely important meeting for the Institute, we present the speeches in their entirety.

Speech by Professor Karol Adamiecki

Mr. President of the Republic, General, Ladies and Gentlemen.

As the Chairman of the Scientific Organization Institute Council [INO, today TNOiK], I have the honor to open this extraordinary meeting of the Institute.

Today’s meeting is exceptionally solemn and constitutes an important fact in the development of our Institute, for the following reasons:

The first reason is the presence of the President of the Republic. His interest fills us with great joy and adds a particularly strong stimulus to further creative work.

The second reason for the solemnity is the arrival of our sincere friend, General William Crozier, one of the most outstanding representatives of the American nation, to today’s meeting.

Finally, the third reason for the solemn mood is the numerous participants of distinguished guests from all fields of state work, scientific, and economic circles. This is evidence that the work carried out by our Institute is recognized as important by the leaders of all fields in our country.

Opening this solemn meeting, let me first of all, on behalf of all members of the Institute, express our warm thanks to all our distinguished guests for taking part in it and thus giving evidence of their lively interest in the work of our young institution.

Fulfilling the first item on the program, I consider it my duty to say a few words about the aims of our Institute and under what slogan we conduct our work.

Gentlemen,
Marshal Pilsudski spoke the following significant words shortly after the war:

“The race of bloodshed is over, now we must enter the race of work.”

This sentence contains the whole program for our nation. Every Pole should not only understand, but also feel, and it is an undeniable and obvious truth that if we remain behind in this race, we cannot even dream of consolidating our state and national existence.

However, two things must be distinguished in work: its cost and its productive output.

One can labor intensively, toil until the last breath, and yet achieve only a modest output. Our focus should not be on sheer exertion, but on productive work—work that delivers substantial output with minimal effort.

Therefore, when we talk about the “race of work,” we must understand that it means achieving the greatest possible result with the best use of labor and available natural resources.

In other words, we need to know how to work. Only such a nation—one that can work with high efficiency and therefore, is able to convert the majority of its total labor capacity into useful output—will not lag behind. Such a nation will represent a valuable and essential part of the family of civilized nations.

However, the ability to work efficiently is no simple task; quite the contrary, it is immensely challenging. To accomplish this, we must arm ourselves with the full arsenal of science and knowledge. Most importantly, we must understand and apply the science of organization across all fields. This new discipline, born just 30 years ago in America, has undoubtedly contributed significantly to the astonishing progress currently being made by the Americans. It's worth noting that while the science of organization initially developed relatively slowly and struggled to penetrate European thought processes, its development and application have been progressing at a rapid pace in recent times. A vivid example of this is the recent Third International Congress on Scientific Organization, which was held in Rome in September of last year.

Nearly 1,300 people from all over the world took part in it, and over 160 papers were presented, indicating significant progress in achieving high efficiency ratios not only in human work but also in the use of all production resources, thanks to the methods provided by the science of organization.

Today, it can be said without exaggeration that the idea is increasingly entrenched in the consciousness of civilized nations that the science of organization is a powerful lever that opens up new, immeasurable horizons of progress and that the nation that best understands and applies it will lead all others.

It would be like breaking down open doors to prove to this splendid audience how important it is for this science to penetrate as quickly and deeply as possible into all strata of our nation.

However, we are pleased to acknowledge that this process, thankfully, has already begun in our country.

This is evident not only in the great interest in new work methods but also in the number of significant results achieved through the application of these methods.

The aim of our Institute, which was founded less than 3 years ago, is to accelerate this process by disseminating and implanting this new science in all fields of our country's productive work, helping and stimulating all organs that make up the entire state and social organism to use rational work methods.

I will not speak here about the Institute's previous achievements, but I must say, on behalf of all colleagues working at the Institute, that we work with enthusiasm and faith, that our efforts are beneficial, and that we contribute to winning the "race of work."

We work with a deep conviction that we are building the most important parts of the foundation for a lasting social and national existence.

Our motto is "the well-being of all strata of our nation and all of humanity," and the means to this end is science, whose first postulate is *the cooperation, collaboration, and harmony of all production factors*. A science that proclaims that the prosperity and happiness of the nation can only be achieved through the cooperation of forces, not through their opposition or struggle.

Characteristics of General Crozier.

Since our dear guest, General Crozier, has expressed his readiness to present us with his conclusions regarding the results of his long and extremely fruitful work in the field of the application of scientific organization, let me welcome him wholeheartedly on behalf of all those gathered here and say a few more words about his venerable person.

When the results of Frederick W. Taylor's work became famous in 1906-1908, General Crozier, as the head of the US Army's Ordnance Department, was one of the first to become interested in Taylor's methods.

General Crozier is not quick-tempered by nature, has a very critical mind, and must thoroughly understand the advantages of a subject to become its supporter.

This is precisely the attitude he showed towards the Taylor system. When, after a long study and trial, he became convinced that the proposed management methods could produce excellent results, he became their ardent supporter, persistent propagator, and uncompromising defender after cautious criticism.

As a highly experienced administrator and deep connoisseur of psychology and human nature, General Crozier understood perfectly well that such radical reforms, to which the organization based on scientific foundations aspires, could only be introduced gradually. Therefore, he began to introduce the Taylor system into American arsenals very cautiously.

Caution was also necessary because at that time American labor unions, or rather their leaders, were waging a very fierce fight against the Taylor system.

The principles proclaimed by Taylor, that there is no fundamental conflict of interest between workers and employers, that the well-being of workers can be achieved only through the cooperation of both sides, not through struggle, that limiting the productivity of workers is primarily harmful to themselves, and that a more capable and efficient worker should earn more than a less capable and less efficient worker, were, in the opinion of the then labor leaders, heresies that should be fought with all their might.

Labor unions also opposed the Taylor system, using all means at their disposal. Many union leaders spread the most false opinions about the Taylor system, which became so widespread that although they have already subsided in America, to this day, various activists in Europe, acting on behalf of workers, believe or knowingly spread absurd opinions about this system.

The matter of introducing the principles of scientific organization was more difficult in this case because it concerned military factories, that is, government institutions, which were very willingly interfered with by incompetent factors dealing with politics, and even demagogy, and taking advantage of the privilege of being members of legislative bodies.

General Crozier, wanting to raise military production to a flourishing state, had an extremely difficult task when, in addition to overcoming essential and bureaucratic difficulties, he had to defend a good cause against various attacks by unions and politicians for years. He was never an opponent of labor unions, on the contrary, he considered them to be very useful institutions for workers, which he cared for constantly and sincerely. Therefore, when he realized that the Taylor system was precisely leading to the prosperity of workers, he defended it with even greater persistence despite the great hardships he had to endure. He achieved great results.

General Crozier achieved extremely important outcomes during the war when, as head of the Ordnance Department, he had to direct the huge industrial machine responsible for supplying the American army with the required equipment.

The transparent control system he introduced is truly admirable, which allowed him to immediately orient himself to all details and efficiently manage the entire industrial machine. The inventor of this system was H.L. Gantt, whom General Crozier then appointed as his collaborator.

If the American nation was able to mobilize a huge army equipped with state-of-the-art technical means within a few months, which amazed the whole world while tipping the scales of victory in favor of the Allies, it was not because this nation has great material resources, but because it has people who were able to transform these resources into means of defense and combat so quickly and efficiently for a good cause, and above all, because it has such leaders as General Crozier.

His work in the field of development and application of scientific organization to military issues is of great importance and it can be said that in this field he is the first pioneer.

But General Crozier’s work is important not only for military purposes, scientific organization methods are common to all fields, and the manner of their application, which was guided by General Crozier, should be emulated by all those who envision the future of the nation based on the competition of efficient work.

However, a brief description of General Crozier would be incomplete if I did not repeat here a few words that he spoke to our delegation at the Congress in Rome.

When we thanked the members of the American delegation for the help and support they showed to our Institute, General Crozier replied as follows:

> *"The earliest memory of my youth is the magnificent monument of Kosciuszko, standing in front of the military school in West Point, which I graduated from. This monument instilled in me a love for the great hero and a sense of gratitude to the Polish nation.*
>
> *Therefore, although I am pleased to hear that we, Americans, have been useful to Poland, I do not see any merit in it. This is only a partial repayment of the debt of gratitude by the American nation to the homeland of Kosciuszko and Pulaski - fighters for the freedom of the American people."*

Before proceeding to the next item on the agenda, I must declare on behalf of the members and the Council of the Scientific Organization Institute that in recognition of the great and important work done in the field of scientific organization, General William Crozier was unanimously elected as a member of our Institute. I am happy that it fell to my lot to inform the General of this election and to ask him to accept the dignity.

Speech by General Crozier

Application of the Taylor System to Armories in the United States of America
(Lecture by Gen. W. Crozier).

Gentlemen,
As the esteemed Chairman kindly noted, if I can interest you for a moment in the subject of scientific organization in industrial plants, it may be only because I will try to cite something from the experience of the Technical Department of the United States Government, in which I had the opportunity to introduce the system commonly called the Taylor system.

I was the head of American army armament and the director of the Ordinance Department from 1901 to 1918, and in that position, I had six armories under my management, employing several thousand workers. These facilities produced cannons, small arms, ammunition, and other types of armaments for the army and, to some extent, for the navy.

The industrial methods we used fully corresponded to the methods commonly used at that time, and we must note that the level of efficiency and savings we achieved was not lower than in private enterprises.

I was well acquainted with these methods, as I observed them for 20 years as a junior officer in the Ordinance Department. Therefore, when I had the opportunity to become familiar with Taylor's work, in which he criticized conventional methods and presented the principles he called the new science of management, I was able to assess their importance and decided to test his system in the Ordinance Department.

After several conferences held with Taylor and several trials conducted under his direction in one of the manufacturing arsenals, I hired one of his assistants to introduce the Taylor system to the armory in Watertown, Massachusetts, as a laboratory test to verify both the advantages of this system and our ability to use it properly when applied to government work.

The main product of the Watertown arsenal was bases for coastal artillery cannons. The reason I chose this particular production line was the similarity of cannon base production to production in typical industrial plants, such as machine tool manufacturing. The armory consisted of a pattern shop, foundry, forge, mechanical workshops, and an experimental laboratory, which allowed for the testing and application of new methods in basic mechanical production operations.

After two years of experience, we were able to draw some concrete conclusions. As for the materials used in production, we found that purchases were made with a better awareness of deadlines and required quantities, thus avoiding downtime due to a lack of necessary items and unnecessary immobilization of capital due to premature material purchases, which we had previously encountered constantly.

Materials were more accurately tailored to the tasks for which they were needed, and we could more precisely calculate the cost of materials in relation to various tasks for which they were required from the warehouse and presumably used. Inventorying materials in the warehouse became much easier, more accurate, and more continuous as a result of closer control, constantly comparing the quantities of materials in the warehouse with the quantities provided by accounting.

As for the progress of work through the workshops, we largely eliminated the phenomenon of idle machines waiting for work they would be needed for later but had not yet reached them, while overloading other machines due to a poorly arranged program, resulting in an accumulation of work.

We avoided the losses that arise from a lack of employment of highly paid workers who gathered, waiting for an overworked foreman to assign work for them and their machines.

Thanks to these and other improvements in management, increased machine efficiency, and improvements in processes based on scientific research, we found that workshop work was carried out and completed more quickly. We could more accurately predict in advance the deadlines by which work should be completed and achieved all other positive results that flow from skillful and reasonable planning of worker employment throughout the year at the arsenal.

From the above results, it is clear that the new working methods at the arsenal significantly reduced in-house costs.

Methods of accurately calculating in-house costs, which before the application of the Taylor system were somewhat a pride of the Ordinance Department, showed that a reduction in the cost of our products by 20 to 40% was not uncommon with these new working methods, and that in several cases, savings were so great that we did not want to show them in order not to arouse suspicion that our cost calculation system was flawed, or that the previous efficiency was exceptionally low.

And yet this cost reduction did not result from a reduction in workers' wages. On the contrary, earnings increased beyond the previously known norm. It should be noted that the nature of the work in the Watertown armory was such that the repetition of tasks was a rare phenomenon, and therefore the piecework payment system had not previously been applied there. Therefore, it was necessary to examine and calculate the majority of tasks performed by workers in order to determine a wage scale that would adequately reward the appropriate level of efficiency. For this reason, the number of people involved in time-based tasks, which could be compensated according to the new scale, could increase relatively slowly and as experience was gained in applying new methods in calculating the time needed for both determining the appropriate wage and performing individual tasks. After about two years, more than 40% of the total number of workers employed in the armory performed tasks that were calculated based on time measurement. Relevant data showed that the earnings of these workers increased by an average of 26% above the usual daily wages they had received before.

I will not explain the details of warehouse management, workshop organization, work planning, time charting, machine improvements, tool standardization, process studies, worker instruction, and motivation and engagement, which led to the more important results mentioned above.

There is not enough time for all of this, and there are relevant works and sources in the literature that are better than mine.

I would just like, as a public official, to testify to the results achieved in the field of public administration, thanks to the methods that seem to interest you gentlemen. However, from the details, some generalizations emerge, considering which we can understand and evaluate what exactly in the Taylor system constitutes a new era for industry and determine which principles of this method are entirely new and how they differ from the old ways.

These principles can be divided into certain groups, namely principles directly related to the worker and the efforts expected from them, and principles related to the incentives that should encourage them to perform these tasks, followed by a group of principles that have nothing directly to do with the worker but relate to general administration.

The principle of precise planning in advance of each job in all its details comes to the fore, such as planning work in the Watertown armory in the manufacture of 10 or 12 bases for 8-inch coastal guns. The question arises, what is actually new about this? After all, every workshop owner has been devising ways to perform new tasks since the beginning of industry; and indeed, this is the case. However, we know how this usually happens.

When the order for production is issued, the execution only begins when the relevant production department is available and the relevant material is accepted for processing, only when the appropriate machines are released from the previous job. However, all this is done without paying due attention to the need to maintain the continuity of work or taking into account breaks caused by a lack of material or other components, not yet ready for use in the further course of work. All this is associated with the risk of faulty placement and possibly loss of parts that cannot be used at the proper time or improper use of material issued from the warehouse for some work, which was left somewhere in the workshop, waiting for the machine on which it is to be processed; however, the machine is still busy processing parts from previous, not yet completed, orders.

The distribution of work in the workshop was traditionally entrusted to the foreman, who himself had to plan the work and assign machines for its execution. He must coordinate these machines accordingly and arrange the best order of work on each, often having a very vague idea of the times when individual machines will complete their current tasks and having very scarce information about the sequence and urgency of work dumped into his workshop without prior detailed planning.

There is a great variety of deficiencies associated with the lack of a planning system; however, the moment these deficiencies become too great to tolerate, the usual preventive measure is to change the foreman or seek a superhuman to take over the function in which the alleged fault was established. No one, however, thought of revising the entire system until Taylor convinced us that in such a case, it is necessary to create a special work organization department whose task is to develop the order of production from the moment of receiving the raw material until the shipment of the finished product and the development of time schedules needed for each component part on its way from department to department and from machine to machine, in such a way that there are no delays at any stage of work due to a part not being ready yet and that there are no problems with the accumulation of the same or different jobs that collide with each other on machines, not according to a pre-arranged plan. These time schedules should be collected in a work progress report in such a way that each person managing a particular job is informed in advance of their participation in the overall set of activities.

Taylor showed us that it is worth devoting a certain amount of space in the office and a certain number of staff to carry out planning activities. This does entail some increase in the company's overhead costs, but a properly established and functioning planning department undoubtedly pays off handsomely.

Although someone might argue that by emphasizing planning activities in industry, Taylor did not introduce a new principle, but only transformed the procedure according to an already recognized principle; one must admit, however, that this transformation was so significant that it became almost revolutionary and created a new era in the development of manufacturing.

As for the group of principles directly related to the worker, we were amazed by Taylor's claim that very few workers, even with high skill and extensive experience, know the best ways to perform the work that is their specialty. The reason for this is that workers almost never deal with or very rarely address the issue of the speed at which their work can be done. Since they were never encouraged to increase their productivity, they did not develop a habit or ability to save time in the sequence or other details of their work, which they know well and could master. The second reason is that certain elements of work are entirely beyond the knowledge of the worker and are known only to people with technical education. In metal cutting, for example, daily adjustments of speed, feed, and depth of cut require the best results to be obtained through knowledge of the strength of transmission belts, the durability of machine gears, the physical properties of the workpiece being processed, and the tool used, as well as the most economical amount of time in which the cutting tool will become dull to such a degree that it will require re-sharpening. A small number of these elements fall within the competence of the worker; in order for all of them to be used to the best effect in a given job, an examination should be conducted by someone competent who will be guided by the motive of ensuring the greatest speed corresponding to the appropriate quality and avoiding excessive fatigue. The results of these studies are then compiled into a set of instructions handed over to the worker, which the latter follows.

At this point, we encounter another group of principles directly related to the worker: namely, principles concerning the incentives that should be offered to them in order to persuade them to follow instructions accurately and intelligently, as well as to motivate them to perform their best efforts in fulfilling their tasks. There was a general belief among employers that the regular wages, generally applicable in a given locality, were entirely sufficient to achieve this goal. We all know employers, even prominent ones, who say that paying wages corresponding to the level in a given locality, or the amounts paid by others, entitles them to demand the best efforts from workers, and that lower performance than expected indicates a lack of conscientiousness on the part of the workers. Taylor tells these gentlemen that they have no right to demand anything like that. He argues that for the remuneration generally accepted in a given locality, employers have the right to demand only the efforts for which wages were established, which is far from the highest productivity. It is now worthwhile to briefly examine the circumstances in which the wage scale in a given locality arises.

So far, no one has established a satisfactory basis on which wages should be based. This means that in a group of successful enterprises, thanks to the joint efforts of workers and capital, no one has determined the proper share of success on the one hand for workers in the form of wages, and on the other hand for invested capital in the form of interest and profit. Each side tried to get as much for itself as possible against the aspirations of the other side, and there was an insurmountable temptation for each side to give the other as little as possible. The final result depended on bargaining skills, agility, combat ability, and endurance; in this process, workers were given no incentive to make honest, intelligent efforts. Even when payment was demanded proportionally to performance, such as with piecework wages, the mentality of employers was so focused on aggressive and insincere bargaining and the sales process that when piecework rates significantly exceeded established daily rates, piecework earnings were cut and brought back to the previous low level. As a result, piecework wages were heavily discredited in workers' circles, and the deliberate lowering of productivity by workers was a completely understandable defense against these abuses.

I mention these facts not as something new, as they are well known to all employers at the helm of large industrial establishments, but I draw attention to them to show how impossible it was to assume that under such an unsatisfactory arrangement of forces, the highest productivity could be expected from workers. In fact, no one knew what could be achieved by the best efforts, as no one performed them; on the contrary, they were hindered, concealed, and disguised, making it impossible to utilize and adequately evaluate these efforts. Workers, indeed, knew much more than anyone else about the possibilities in their work, but even they did not know what sincere and sensibly directed efforts could bring from an average worker, as they had no experience in this direction. If we now consider the general experience, as well as the experience of industrial enterprises and the wage scale as a result of this experience, we must admit that this scale corresponds to the current productivity of workers and the mutual relationship between capital and labor.

Into this hostile and unsatisfactory atmosphere, Taylor stepped in, first and foremost, scientifically determining the proper amount of work that a skilled worker should perform with due diligence on a task appropriately prepared for him without unnecessary fatigue, but with the expenditure of efforts that would enable him to have a higher standard of living and greater satisfaction. Secondly, he established the principle that for such performance, the worker should receive not the remuneration that was sufficient for the lower-grade work performed by him, nor the remuneration 5 or 10 percent higher, which was often the subject of pitiful strikes, but 20, 30, 40, 50 or even more percent. Taylor showed through scientific methods that without raising remuneration within the above limits, there is absolutely no possibility for a group of workers to provide their employers with the services they are capable of. He showed employers and managers, with whom he usually had the most difficulties, that these high workers' wages and the 200% increase in production are not extraordinary, and that the ultimate result was higher wages and a significantly reduced cost of the product.

Taylor did not emphasize any particular system by which increased remuneration for strictly defined work was to be determined. At the Watertown Arsenal, we initiated a bonus system, while in other arsenals we used a simple piecework system, and also recognized the advantages of the differential piecework system and the premium system, among others. As for the profit-sharing system, Taylor had some doubts as it required a better understanding of the company's financial matters than the knowledge usually possessed by workers, and because this system, among others, deferred remuneration for efforts so far that it significantly reduced the value of the incentive. However, in all systems, he stressed the need for a scientific determination of the basis of remuneration to enable management to maintain this system continuously from the moment it was announced and implemented. This is essential in order to gain the trust of workers. The easiest means of determining this remuneration was the most characteristic feature of Taylor's system, namely time study.

I will not take up time describing time study, which you gentlemen undoubtedly know. However, I would like to emphasize the need for proper technique in implementing the principles of scientific management. Mere recognition of the importance of these principles does not yet justify their application by so-called "efficiency engineers," just as understanding the value of sanitary facilities, hygiene, and preventive measures does not make a layman an experienced doctor. We had some experience in this direction in America.

About 16 years ago, one of the main railway networks in the United States appealed to the Interstate Commerce Commission, which it was subject to in some respects, for permission to raise freight rates on the grounds that the existing rates were not sufficient to enable the company to achieve appropriate profits. This request was opposed by the Shippers' Association, as a result of which the above case was referred to the aforementioned Commission.

The Shippers' Association had as its main advisor, Mr. Brandeis, who now holds the position of a Supreme Court judge, and who at that time was a lawyer in Boston and knew about our activities in the field of scientific organization at the Watertown Arsenal, located in the suburbs of that city. Mr. Brandeis argued that there was no need to raise railway rates and astonished the whole country with a statement that the railways could save $300,000 a day if they improved their operations according to the principles of scientific organization. Such a radical statement, made during a noisy dispute, immediately attracted the attention of the press, resulting in a large number of newspapers and trade publications teeming with articles about scientific management in general, and Taylor's system in particular. As a result, Taylor's name, as well as the more important principles of his science, became very popular.

The rate increase requested by the railway was not granted, and interest in the matter ceased. However, the importance of the case itself contributed to the publicity of scientific organization and created a demand for details about it; at the same time, it gave room for action to self-proclaimed organizers, people with little knowledge of industry, many of whom were genuinely committed to new ideas but lacked sufficient painstaking training in analysis, experience, and drawing conclusions, thanks to which Taylor's system achieved such high practical value and was used by him and his students. Some of these people took positions in industrial establishments, where lack of knowledge often led to costly mistakes in practical execution and led to dissatisfaction of workers or management, whose psychology required extraordinary caution in introducing methods sometimes entirely new. The disappointment resulting from these errors had a negative impact on the opinion of the new system and diminished the benefits in terms of publicity and sympathy it had gained thanks to the railway case.

In order to achieve rapid benefits from the principles of scientific management, teaching by experienced experts is essential; the same applies to any other art and science. Otherwise, progress will be marked by the same slowness that characterizes the "trial and error" method compared to the method of following competent advice.

It will be interesting to familiarize oneself with the political aspect of introducing scientific organization into state-owned institutions in the United States. In a country like yours and mine, everything that closely concerns the life of the nation, such as employment systems and workers' remuneration, must have its political aspect; these difficulties may, perhaps, be avoided by anticipating and learning from the experiences of others. This political aspect was something completely unknown to Taylor. He believed that his system would find its way into private industry, as managers could not resist the opportunity to benefit from the increased profits the system brought, and workers in every enterprise would be satisfied with the increase in earnings and improved working conditions. However, labor unions were apprehensive. They did not believe in the sustainability of high wages received by workers in establishments where Taylor's system was applied; they feared that once efficiency benchmarks were introduced, the high level of those wages would be lowered. They were also concerned about the negative impact of the mutual trust that began to develop between employees and employers on workers' solidarity and the situation of trade unions. In any case, in none of these enterprises did conditions justify strikes, nor did it appear that an attempt to call a strike by labor leaders would succeed; Taylor was convinced that it would never be otherwise. Therefore, he ceased to deal with labor unions as something he should bother with, but he was not hostile to them and did not object to workers belonging to them.

However, when it came to a state-owned industrial establishment, the conditions were somewhat different. These establishments are not run for profit, and although all managers are responsible for the operation of these establishments and would like to see them working as economically as possible, the savings that make the difference between large and small profits or between profit and loss are not as decisive a factor as in private establishments. Political considerations come into play here. The legislative body, which allocates funds for the maintenance of state-owned industrial establishments and has the right to determine in general terms how these funds are to be used, manages the state property of the Republic. The most important consideration for the members of this body is their election to a certain position and re-election after their term expires; therefore, they are very sensitive to any influence from organized groups of their voters, which may have an impact on the number of electoral votes. A representative to the United States Congress, therefore, seeks the favor of the Women's Christian Union, the Loyalist Legion, or the Religious Mission Board; no representative would want to risk displeasing labor unions. Such "misfortune" could not be compensated by economical management of government industry. Therefore, when I informed the leaders of the trade unions that I was not afraid of their incitement to strikes in the arsenals, that I could outbid them in winning the sympathy of the workers, and that I was able to replace the strikers faster than they could empty these positions, they resorted to political weapons that cannot be used in disputes in private industry and attacked the Congress in Washington with complaints about the "oppressive Taylor system" and requests for legislation prohibiting the use of this system in arsenals and other state-owned industrial establishments.

I won't bore you with the story of the struggle that took place in various congressional committees for and against the proposed laws, although I could cite many interesting and amusing details. The savings achieved in manufacturing in the Ordinance Department had already had some influence on Congress, although perhaps not in all points in the direction desired by our Department. For example, they debunked the widely-held belief that private industrialists could produce cheaper for the government than state-owned enterprises and still have additional profits. As a result, certain congressional committees responsible for handling credit allocations increased those credits for weapons and ammunition with the proviso that they would only be used for armament production and not for purchases or production in private factories until all armament facilities were fully utilized. I was unable to change this decision by stating that it would be unwise to deprive private industrialists of the experience in the manufacture of weapons and ammunition, which might be needed in the event of war. We witnessed a strange phenomenon, namely, some congressional committees demanded the greatest possible use of savings achieved in the armaments industry, while other committees supported the ban on the methods that had led to these savings.

The battle within Congress ended in a partial ban. Timekeeping was prohibited, as well as bonus systems. However, the government's legal department decided that this ban did not apply to the piece-rate system. As for the prohibition on timekeeping, local legislation eventually lifted it. By then, we had enough experience to determine average times for various tasks without conducting studies.

This congressional agitation contributed to the enormous publicity of the Taylor system, which, combined with the previous railway case, only helped to expand this science and its beneficial effects. Personally, I avoided discussing these matters for two years, trying to thoroughly test the system in our armaments industry, as I did not want my appearance to create new difficulties. Later, however, in my annual report, I described all the experiences.

I obtained and demonstrated numerically the savings in production and the impact of the system on workers' earnings within the Ordinance Department. Government reports are usually not widely read, but this report was printed, and the information it contained was helpful to those directly interested in the subject. The purpose of the report was to expand these principles, which official publications do not always achieve. The continuity of experience in institutions where Taylor's principles were introduced, either partially or completely, slowly convinced members of Congress that Taylor's views were true – that the worker is entitled to a greater share in the increased production that resulted from their constantly increasing efforts better directed than under the old methods. Finally, the experience of the World War, which so clearly highlighted the colossal production achieved by workers who genuinely strived to create, and the high wages honestly earned and honestly paid for these increased efforts – was the best educational process.

The opposition of workers' unions has disappeared. Prominent union leaders came forward with a public statement to their followers that workers must be paid in proportion to their productivity instead of, as before, within the framework of pay for time worked. Such resolutions are now a characteristic feature of the annual meetings of the Labor Federation. We can state that the principles of scientific organization have completely triumphed in the United States.[emphasis original]

It turned out that, like all other loud innovations, Taylor's principles had broader possibilities than could be predicted.

The human mind is too limited to foresee the limits of good things. The support that new ideas received from American industry and workers exceeded Taylor's expectations. He rather only counted on arousing some attention of the workers to obtain bonuses and that the performance of work, planned by others, helps the worker in their tasks and increases their productivity. (Previously, there was a system of one worker spying on another regarding productivity, which, of course, created an unpleasant atmosphere).

However, experience is needed to utilize the entire stock of useful ideas and resources that appear if all working forces can be drawn into work with a common idea and a deep understanding of management principles, understanding that the success of the enterprise is their own success and that their cooperation in achieving it is always beneficial to them.

This idea of cooperation is probably the greatest of all the reasons for the current industrial prosperity of America. [emphasis original]

Although it is difficult to predict how far these possibilities will go and what results we will ultimately achieve, it can be said that Taylor was a pioneer and creator of it all.

Final Speech by Prof. K. Adamiecki

Undoubtedly, I will be the spokesman for all those present if I thank General Crozier in the strongest terms for his full of deep thoughts and magnificent lecture.

In my introductory speech, I said that today’s meeting is a very important stage in the work of our Institute. After listening to the General’s lecture, I must repeat this with even greater emphasis, for I am convinced that General Crozier’s words will sink deeply into our minds.

Undoubtedly, they will add a new stimulus to all those who are eagerly trying to apply the principles of scientific organization with greater energy and perseverance in paving the way for a good cause.

The General’s words will deepen the proper understanding of the Taylor system, especially among younger technicians and engineers. They will stimulate reluctant employers to consider whether it would not be worthwhile to become acquainted with the new system of management, instead of stubbornly adhering to the old one. Attention should be drawn to those employers and managers who would like to embark on the path of scientific organization, that this should be done very cautiously and gradually, and above all, that they should guard against various dilettantes who call themselves “organization engineers”.

These words will draw the attention of workers and employers to the fact that they should work hand in hand, not fight, and that this is the only way to achieve prosperity.

Finally, perhaps they will stimulate some labor leaders to consider whether it is worth spreading false information about the Taylor system and scientific organization, as this position is doomed to failure from the outset, and whether it would not be worth taking a more sensible position, as American labor leaders have already done.

Once again, thanking General Crozier, I close the meeting.

PRZEGLĄD ORGANIZACJI

MIESIĘCZNIK POŚWIĘCONY SPRAWOM ORGANIZACJI I ADMINISTRACJI ŻYCIA GOSPODARCZEGO
ORGAN INSTYTUTU NAUKOWEJ ORGANIZACJI

ROK II WARSZAWA, MAJ 1927 Nr 5

KONTROLA JAKO ZASADA NAUKOWEJ ORGANIZACJI.

Le contrôle comme principe de l'organisation scientifique.

Prof. K. ADAMIECKI.

Z POŚRÓD czterech głównych faz (zasad) naukowej organizacji: analizy, planu, wykonania i kontroli ta ostatnia uważana jest zwykle za mniej ważną. Często słyszy się zdanie, że jeżeli analiza i plan były przeprowadzone należycie, a wykonanie doszło już do pewnej doskonałości, to kontrola traci swoje znaczenie, a nawet, że staje się zbyteczna.

Jest to pogląd całkowicie niesłuszny i jest pewnego rodzaju wskazówką, że wypowiadający go nie zdają sobie jasno sprawy ze znaczenia podstawowych zasad naukowej organizacji i ścislego między niemi związku.

Kontrola wykonania jest zasadą nienaruszalną i zawsze niezbędną, niezależnie od stopnia doskonałości zastosowania pierwszych trzech zasad.

Możemy łatwo przekonać się o tem jeżeli zastanowimy się nad głównemi zadaniami, jakie ma spełniać kontrola.

PIERWSZE ZADANIE KONTROLI.

Pierwszem zadaniem kontroli jest sprawdzanie, czy wykonanie zgadza się z planem, czyli wzorcem, który został ustalony na podstawie analizy; kontrola musi przytem wykazać stopień odchylenia wykonania od wzorca.

Z tak postawionego zadania kontroli zdawałoby się napozór, że jej znaczenie zmniejsza się w miarę tego, jak wykonanie staje się coraz doskonalsze i zbliża się do wzorca. Nie trzeba jednak zapominać, że doskonałość wykonania jest w znacznym stopniu wynikiem ciągłego porównywania z wzorcem czyli kontroli. Możnaby powiedzieć, że kontrola odgrywa rolę barjer, które nakierowują wykonanie ku postawionemu wzorcowi.

Nie możemy sobie wprost wyobrazić, aby wykonanie mogło zgodzić się z postawionym sobie planem-wzorcem, gdybyśmy go nie sprawdzali nieustannie. Bez takiej kontroli (nakierowujących barjer) bylibyśmy w położeniu człowieka, który obmyślił i wytknął sobie najlepszą drogę dojścia do jakiegoś punktu, ale wstąpiwszy na nią zamknął oczy, lub pozbył się innych z pięciu swoich zmysłów, innemi słowy pozbył się swoich najważniejszych i tak czułych środków kontroli. Oczywiście szanse kroczenia po tej drodze zmalałyby tak dalece, że człowiek ten tylko przypadkiem doszedłby do celu.

To sprawdzanie konieczne jest na całej drodze. W miarę zbliżania się do wzorca mamy wprawdzie do czynienia z mniejszemi odchyleniami, ale musimy je sprawdzać i mierzyć aż do samego końca drogi, jeżeli chcemy, aby wykonanie zgodziło się ostatecznie z wzorcem.

Widzimy więc że kontrola wykonania jest nieuniknioną konsekwencją postawienia sobie planu — wzorcowego i nie może być uważana za drugorzędną zasadę naukowej organizacji, którą możnaby osłabić lub pominąć jako coś, co komplikuje lub podraża proces wykonania.

Kontrola, jako środek porównawczy wykonania z planem i wskazujący wielkość odchyleń, jest bezpośrednio związana z planem i całkowicie od niego zależną. Im plan jest więcej szczegółowy i ściślejszy, tem kontrola musi być bardziej szczegółowa i bardziej ścisła.

Harrington Emerson, mówiąc o kontroli (sprawozdaniu), jako o jednej ze swoich dwunastu zasad wydajności, podkreśla ze szczególnem na-

Control as a Principle of Scientific Organization (1927)

Organization Review *[Przegląd Organizacji],* 1927, Issue. 2, No. 5, pp. 187-192

Forward to the English edition:
In this article, Adamiecki revisits the "cycle of organization" consisting of analysis, planning, execution, and control. Here, "control" is defined not in terms of authority, but rather akin to the scientific oversight of an experiment, coupled with subsequent analysis of any deviations from the ideal "Plan-Standard." This approach allows for continuous improvement, as the operations of the factory incrementally align with the specified Plan through each iteration. While traditional organizations often employ some form of visual management, these are typically centered around results. In contrast, scientific organizations leverage visual management tools like Gantt charts or harmonographs to unearth hidden inefficiencies, paving the way for further analysis and optimization.

AMONG the four main phases (principles) of scientific organization:

1. analysis,
2. planning,
3. execution, and
4. control,

the latter is often considered the least important. One often hears the opinion that if the analysis and plan were properly conducted, and the execution has already reached a certain level of perfection, then control loses its significance, and even becomes redundant.

This view is completely unjustified and is a kind of indication that the person expressing it is not clearly aware of the importance of the basic principles of scientific organization and the close relationship between them. Control of execution is an inviolable and always indispensable principle, regardless of the degree of perfection of the application of the first three.

This becomes apparent when we better understand the main tasks that control is expected to fulfill.

The First Task of Control

The first task of control is to check whether the execution is in accordance with the plan, that is, with the standard that was established based on the analysis; control must demonstrate the degree of deviation of the execution from the standard.

With such a defined task of control, it would seem at first glance that its importance decreases as the execution becomes more and more perfect and approaches the standard. However, one should not forget that the perfection of execution is to a large extent the result of continuous comparison with the standard, i.e., control. One could say that control plays the role of guardrails that guide execution towards the established standard.

We simply cannot imagine execution aligning with the set Plan-Standard without constant verification. Without such control (guardrails), we would find ourselves in the position of a person who has plotted the best path to a particular point, but having embarked on it, closes his eyes, or forsakes his other senses, in other words, loses his most essential and sensitive means of control. Of course, his chances of staying on this path would decrease so drastically that he would reach his goal only by accident.

This verification is necessary all along the way. As we approach the standard, we do indeed deal with smaller deviations, but we must check and measure them until the very end of the journey if we want the execution to ultimately align with the standard.

Therefore, we see that control of execution is an inevitable consequence of setting a plan-standard and cannot be considered a secondary principle of scientific organization, which could be weakened or omitted as something that complicates or increases the cost of the execution process.

Control, as a means of comparing execution with the plan and indicating the magnitude of deviations, is directly related to the plan and entirely dependent on it. The more detailed and precise the plan, the more detailed and precise the control must be. Harrington Emerson, speaking of control (reporting) as one of his twelve principles of efficiency, emphasizes with particular emphasis that it must be:

1) accurate,
2) sufficient,
3) continuous (unceasing), and
4) immediate.

There could be no better and more straightforward definition of the most important virtues of effective control. The lack of any of them, or their lesser perfection, significantly weakens the value and effectiveness of control.

There should be a certain balance between these advantages. The effectiveness of control may suffer, for example, if continuity or immediacy of control is reduced due to excessive precision.

One should also not go too far in reducing the accuracy of control for the sake of continuity or immediacy. In addition, the degree of these advantages should be adapted to the importance of the controlled factor - it would be unreasonable to apply very high precision where it does not have much significance, or, for example, to strive for excessive continuity of control if a given factor can be checked only periodically without detriment to its effectiveness.

Finally, control, in line with the main goal of scientific organization - achieving the greatest useful result with the least expenditure of resources - should not be too complex and costly. It should always be remembered that control is a means, not an end. If one can talk about the redundancy or reduction of control, it is only referring to its unnecessary excess, never the principle of control itself.

For the first task of control to be carried out in the simplest and most effective way, control should take into account the importance of the factors that are subject to it. In this regard, when establishing a general control program and all its details, one should be guided by a method similar to the one used in analysis, namely: one should list all the factors that may affect the outcome of execution and its deviation from the established standard, then rank these factors according to their importance (influence), and finally determine control methods for each factor in such a way that they possess the indicated advantages to a greater extent as the factor becomes more important.

By following this path, one can expect that the entire control apparatus will be sufficiently accurate, adequate, continuous, and immediate, while not being overloaded with too costly details.

Second Task of Control

Control, as a principle of scientific organization, besides the task of checking deviations in execution from the established plan-standard, has another extremely important goal, namely, indicating the causes of these deviations. By fulfilling this goal, control not only gives us guidance on what to undertake to align execution with the plan but also plays the role of a repeated analysis of factors and conditions upon which the allocation of productive resources and useful results depend; thus, we verify not only the execution itself but also the result and analysis on the basis of which the plan was established.

During control, new factors and conditions that were not foreseen in the analysis may emerge, or the extent of influence of factors that were deliberately omitted in the analysis as less important to the task may be revealed. Control, therefore, provides us with new, more precise guidelines, allowing us to establish a subsequent, more perfect execution plan.

Thus, the conducted control-analysis becomes the beginning of the next, more perfect cycle of organizational phases: the second, more perfect plan-standard, the second, more perfect execution, and the second, more perfect control. The latter, again fulfilling the role of a new analysis, gives rise to the third cycle of organization and so on.

We can see that control is an indispensable step in improving the organization, acting as a key, revealing ever more distant horizons of progress and a means of establishing successive improved plan-standards.

Being such an essential link in the entire chain of gradual improvements in the organization, control cannot be removed or weakened, as this would be equivalent to stalling progress in productive processes.

Control in Traditional versus Scientific Organizations

The essence of the reports used by control as the fourth phase of the organization differs fundamentally from those of ordinary control. In the latter, we deal with data and figures showing only the actual state, whereas in the reports used by control in a scientific organization, we always have double data and figures, some expressing the actual state and others expressing the standard state.

Data verifying the actual state, by themselves, do not yet provide us with a sufficient basis for judging the degree of execution perfection if we have nothing to compare them with.

We can draw conclusions from this data only when we compare them with other figures, for example, expressing the previous state or analogous figures related to other productive systems. However, such a comparison will have very little value because the figures we compare the actual state with do not have the character of standards. We can indeed say whether the state is improving or deteriorating or whether a given system works better than another, but we cannot say at what level it is in comparison to the perfect standard state; and although it may happen that it is significantly better compared to the previous state, it may still be far from what it should be. In a word, since in ordinary organization we do not set strict plan-standards, when controlling execution, we do not have a constant basis for comparison, and the results of such control are very relative and generally provide little benefit.

The situation is entirely different when we operate according to an established plan-standard, that is, guided by the principles of scientific organization. Then, during the control of execution, next to each figure expressing the actual state, we always have a second standard figure expressing the state accepted as ideal. Comparing these figures provides an accurate basis for judging the degree of execution perfection.

Only this kind of control is justified and constitutes an essential stimulus for progress, as it directs execution towards the set goal, i.e., the standard. This is such a fundamental feature of control applied in scientific organization that if we do not encounter standard figures in statistical reports, even the most detailed ones, we can immediately say that a given organization has not yet emerged from the stage of ordinary organization.

Measure of Deviation in Execution from the Standard (Efficiency)

Having to deal with two quantities: one representing the actual state and the other the standard state, we can express the deviation in the form of the difference between these quantities or their ratio. The latter method is better, as it provides an idea of the degree of deviation.

Since, in the course of proceeding according to the principles of scientific organization, we always have in view a standard (standard plan, standard execution method, standard production, standard expenses, standard time) to which we strive and with which we compare the actual state, it becomes necessary to establish a name for the above ratio. Americans call this ratio "efficiency."

Among all the expressions in the Polish language that convey related concepts, such as productivity, efficiency, effectiveness, the term "wydajność" (efficiency) seems most appropriate for defining the discussed ratio.

Although this term is often used in a different sense, for example, sometimes referring to production in a unit of time, it is most commonly used to define a ratio expressing a certain degree of perfection, e.g., the efficiency of ore is called the ratio of the amount of metal obtained to a given amount of ore. The use of the term "efficiency" to denote the standard ratio (degree of perfection) is also supported by the fact that it has become established in Polish literature on scientific organization.

In order to standardize comparisons, it has been decided to express efficiency in percentages by multiplying the fraction representing this ratio by 100.

However, to avoid misunderstandings and standardize the concept of efficiency, an important reservation must be made regarding this fraction.

All the quantities representing the actual state, in relation to standard quantities, can be divided into two types, namely those that increase when approaching the standard and those that decrease when approaching their standard. The first type includes all quantities expressing the useful result, i.e., production, which should generally be as large as possible to approach the standard. The second type includes quantities expressing the expenditure of productive means, which should be as small as possible to approach the standard.

In the first case, to express the efficiency of a given factor, we should take the ratio of the actual size to the standard size, namely we write:

Efficiency = (actual size / standard size) * 100

For example, if the actual production is 40 units and the standard is 120 units, the production efficiency will be (40/125) * 100 = 32%.

In the second case, we should take the inverse ratio, namely we write:

Efficiency = (standard size / actual size) * 100

For example, if 80 units of material were used and the standard amount was 60 units, the material efficiency would be (60/80) * 100 = 75%, if 50 units of material were used, its efficiency would be (60/50) * 100 = 120%, and we would then say that the material efficiency is 120 percent, meaning that its consumption is 20% higher than expected.

Similarly, when it comes to expressing time efficiency, we must take the ratio of standard time to actual time, as we always strive to reduce time in pursuit of perfection. Therefore, if 18 hours were used to perform a certain task, and the standard time was:

(10/18)*100 = 55.5%

Having established the concept of efficiency, we can generally say that the task of control is to check and examine the efficiency of all relevant factors.

Starting on the Path to Scientific Organization

People interested in scientific organization and wanting to apply its principles in practice often ask the question: where to begin? Scientific analysis, as the first phase of organization, requires lengthy, meticulous, and sometimes costly research, which discourages many people, especially since visible improvements can only be expected after an extended period of time.

However, this task can be significantly facilitated if it is divided into a series of gradual stages. Since rational control, as we have already mentioned, plays to some extent the role of analysis and provides guidance for improvements, the introduction of such control can be the first stage from which to start if we want to enter the path of applying scientific organization methods.

But control, as we have seen, must be based on standards. The question arises, what standards should be set during the first preliminary period in improving the organization? The answer to this question is straightforward. Unable to establish such standards with the help of detailed scientific analysis, we can initially set approximate standards based on the best previous results and approximate calculations.

If we then measure deviations from these standards during the execution, control and identify the causes of deviations by gradually removing the most important ones, and complementing control with increasingly detailed analysis, we will be able to set higher standards and thus progress step by step in improving the organization.

This approach is particularly recommended when it comes to improving an existing organization rather than creating a new one, which is most often the case in practice. This path does not require immediate large-scale reforms, which usually encounter significant difficulties, and it aligns with one of the most important principles of scientific organization, namely, the gradual implementation of the intended plan as the inertia of the participants' habits is overcome and new habits are established.

Another advantage of such an evolutionary development of the organization is that during rationally established control, factors and conditions affecting the outcome become clearly visible, making it easier to identify which ones have the most significant impact and therefore which ones should be primarily influenced to achieve the best results.

As an example, I will cite the approach to production control that I proposed in 1907 [*likely an unpublished description of his work with a factory, or from an article missing from bibliographies at the time of this publication -ed.*], which can serve as an illustration of the above-mentioned observations.

Although this example concerns the production of rolling mills, the method adopted here can be applied to almost all manufacturing processes, and therefore, I believe that citing this example will not be without benefit.

In daily production reports for rolling mills, the usual practice is to provide the quantity of rolled product and indicate its type and dimensions, as shown in columns (a) and (b) of Figure 1.

These figures indicate that production fluctuations in individual shifts were significant. These fluctuations largely depend on the dimensions of the rolled iron, but generally, it is not possible to conclude from similar statistics whether production is satisfactory or not. There is a lack of data to compare with the achieved production.

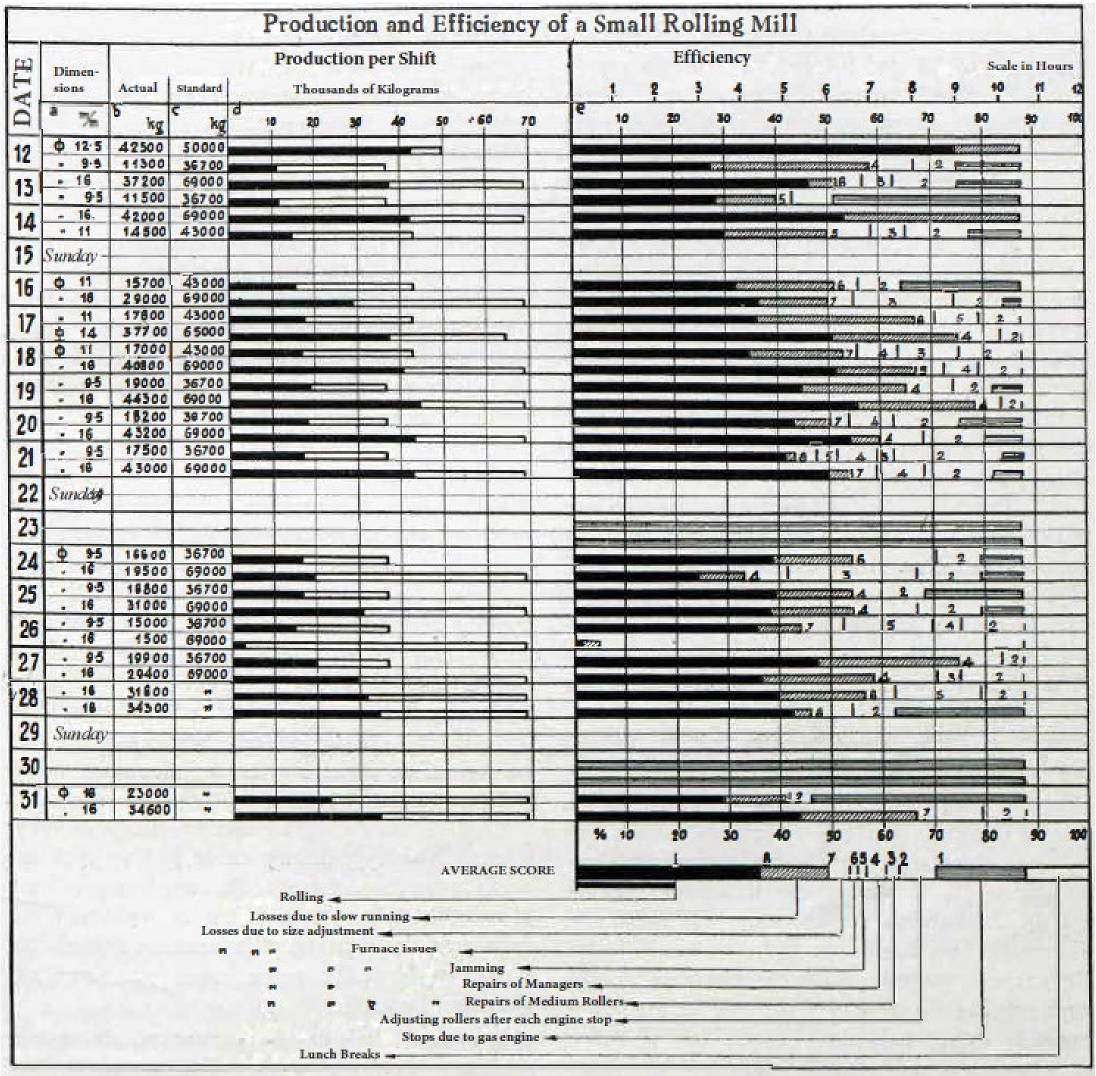


Fig. 1.

To remedy this, the production from a whole series of previous periods was examined, and the highest productions already achieved during a 12-hour shift for each specific type (profile) of iron were adopted as the standard. These productions are listed in column (c).

Next, in order to find the causes of deviations from the standard production, all breaks in rolling were recorded with an accuracy of five minutes, while simultaneously noting the main reasons for these breaks.

In other words, the first step in introducing rational control was taken.

In column (d), the actual and standard production is presented graphically in the form of horizontal thick lines. The difference in length of each pair of these lines clearly indicates the magnitude of deviation from the standard in each individual shift.

To obtain an even clearer picture, in column (c), the production efficiency, i.e., the ratio of actual production to the standard, is expressed graphically in percentage terms. The length of the black lines represents this efficiency.

Since the total length of the scale of this chart can also be considered as the length of one shift, i.e., 12 hours, dividing it into 12 parts allowed marking the length of various observed breaks in rolling on the chart. These breaks were combined into seven major groups, marked with numbers 1 to 7. In addition, there were lunch breaks, which averaged about 1.5 hours. The time of all these breaks combined with the rolling time equal to the length of the black lines did not, however, fill the entire 12 hours. The missing time segments are marked diagonally and marked with the number (8).

This means that the actual running time of the rolling mill was longer than the black lines indicate, specifically, longer by the length of the segments marked with the number (8). But this time was not used efficiently, so the segments (8) can be considered as time losses due to either too slow rolling or various minor breaks in work that were not recorded in the reports.

The chart compiled in this way clearly highlights the magnitude of deviations from the standard production and their main causes.

The average production efficiency (33%) and its losses during the given period are shown at the bottom of the chart. For example, we see that the most significant losses are due to the gas engine driving the rolling mill (losses 1 and 2). Although the identification of this fact for the rolling mill manager was not new, as the stagnation due to constant engine repairs was too obvious even without such detailed time control, putting them into numbers, and especially the graphical representation, provided a clear picture of all shortcomings of the workshop and prompted the management to embark on a path of organizational improvements.

The most significant efficiency losses due to the engine driving the rolling mill could not be eliminated immediately, as it required a complete reconstruction of the rolling mill.

These losses resulted only from a fundamental flaw in the installation. The designer who designed this rolling mill apparently had no idea of the working conditions in the mill and, focusing solely on utilizing blast furnace gases, applied a gas engine (1500 HP) that is not suitable for directly driving a rolling mill at all. In this case, we have a striking example of the unfortunately too frequently encountered errors in the design and installation of industrial workshops, which cause significant losses simply because many designers are prone to introducing various technical improvements without properly examining whether the given working conditions allow it.

The production control captured in the above manner, in addition to drawing attention to a series of organizational issues, stimulated further, even more detailed, investigations of the rolling process itself. Parallel chronometry of the rolling mill provided a series of charts that allowed the assembly of standard schedules. These schedules showed that the production standards taken as the best from the previous statistics are still far from those that could be achieved if various organizational improvements were introduced, and rolling took place according to the mentioned schedules.

When calculating the production efficiency for the cited several-week period according to these new standards, it turned out that it averaged only 18%. This figure in this case demonstrates how large a field for improvements in organization were revealed through the initiation of rational control.

In conclusion, it should be noted that the graphical method of efficiency control presented in column (e) has also been adopted in America. Specifically, Gantt based his own charts on it, which today constitute one of the best ways to control production processes.

> The director should receive only summarized and standardized reports containing all characteristic elements of management; these summaries should be carefully examined by an assistant before they reach the director. F. W. TAYLOR.

PRZEGLĄD ORGANIZACJI

MIESIĘCZNIK POŚWIĘCONY SPRAWOM ORGANIZACJI I ADMINISTRACJI ŻYCIA GOSPODARCZEGO
ORGAN INSTYTUTU NAUKOWEJ ORGANIZACJI

ROK II WARSZAWA, KWIECIEŃ 1927 Nr 4

STOSUNKI Z AMERYKĄ.

Relations avec les Etats-Unis.

DZIĘKI korzystnym konjunkturom powojennym, Stany Zjednoczone mogły w bardzo szerokim zakresie wprowadzić u siebie w przemyśle i handlu nowoczesne metody organizacji, które nadzwyczaj korzystnie wpłynęły na rozwój życia gospodarczego Ameryki i pozwoliły jej zająć naczelne miejsce wśród wszystkich cywilizowanych narodów świata. Ta wyraźna wyższość Ameryki sprawia, że wszystkie narody europejskie starają się dziś przejąć od niej umiejętność organizowania życia gospodarczego, poznać zasady i metody pracy, aby przez zastosowanie ich do warunków ojczystych postawić swój własny dom na racjonalnych podstawach i podnieść ogólny poziom życia i dobrobytu obywateli.

Konieczność utrzymywania ścisłego kontaktu z Ameryką i śledzenia za jej szybkiemi postępami zrozumiały wszystkie kraje; nie wszystkie jednak z należytą energją wykorzystują te możliwości, jakie daje bezinteresowność Amerykan w udzielaniu pomocy i poparcia innym. Nieskoordynowana akcja, a szczególnie przy braku poparcia ze strony sfer rządowych, przynieść może jedynie połowiczne korzyści, gdy tymczesem akcja ta właściwie zorganizowana, może być bardzo owocna. Jako dowód tego może posłużyć fakt, że Niemcy, dzięki zabiegliwie i umiejętnie podjętym staraniom, zdołały umieścić w jednej tylko szkole Forda zgórą 100 inżynierów, którzy kształcą się w nowoczesnych metodach organizacji przy masowej produkcji. Rząd czechosłowacki dwukrotnie delegował do Ameryki inż. St. Szpaczka, który nawiązał bezpośredni, ścisły kontakt ze sferami inżynierskiemi i umożliwił praktyczne studja kilkunastu inżynierom w tychże zakładach Forda. Po kilkoletnich studjach ludzie ci powrócą do swych krajów z nowemi zasobami wiedzy praktycznej, zahartowani w pracy, a przedewszystkiem ożywieni duchem amerykańskim, którego najpotężniejszą cechą jest stałe, wytrwałe dążenie do postępu, poprzez wszystkie przeszkody, jakie stają na drodze; ludzie ci staną do własnych warsztatów pracy i korzystając z wielkiego doświadczenia Ameryki i nabytych umiejętności, przyspieszą tempo życia gospodarczego na drodze do dobrobytu we własnych krajach.

Niestety w Polsce w zakresie tym robi się niewiele, choć wprowadzenie nowej energji do naszego słabego organizmu państwowego w okresie konsolidacji gospodarczej, jaki obecnie przeżywamy, a szczególnie wbec szybkich postępów innych krajów, jest poprostu nakazem chwili. Dążąc do usprawnienia naszego życia gospodarczego i rozumiejąc, że szeroka wymiana myśli i prac z dziedziny naukowej organizacji ułatwi urzeczywistnienie tego celu, Instytut Naukowej Organizacji, od początku swego istnienia rozpoczął nawiązywać stosunki z zagranicą, a przedewszystkiem z kolebką tej nowej dziedziny wiedzy — z Ameryką. Dzięki szczerej życzliwości kilku najwybitniejszych działaczy na polu naukowej organizacji, Instytut nasz nawiązał z pokrewnemi instytucjami w Ameryce bliski kontakt, który w krótkim czasie przerodził się w szczerą przyjaźń.

Na łamach „Przeglądu Organizacji" pisaliśmy już niejednokrotnie o Amerykańskiej Radzie Inżynierskiej, która w osobie jej sekretarza, inż. L. W. Wallace'a udzieliła Instytutowi daleko idącego poparcia w sprawie ułatwienia naszym młodym inżynierom praktycznych studjów w amerykańskich zakładach przemysłowych. Pisaliśmy również o niezwykle serdecznym i bezinteresownym stosunku do nas tak wybitnych

Relations with America (1927)

Organization Review *(Przegląd Organizacji)* 1927, Vol. 2, no. 4, p. 143.

Forward to the English edition:
In this article, Karol Adamiecki asserts that America's advanced organizational methods in industry and trade have allowed it to become a global leader, inspiring European nations to adopt similar practices for improving their economies. He highlights the diligent efforts of Germany and Czechoslovakia in learning and implementing American organizational methods and contrasts this with Poland's limited progress. The second half of the text serves as a letter of appreciation for, and a description of, the support the Institute of Scientific Organization (INO, today TNOiK) has received from America, particularly with the American Engineering Council, the Taylor Society, as well as several notable individuals such as Harrington Emerson, Lillian Gilbreth, H.S. Person, and Morris L. Cooke. Included is a list of the significant contribution of the comprehensive collection of scientific organization literature sent from the Taylor Society, which includes a note to handle with care so as keep in order the instructional routing cards from the Tabor Manufacturing Company.

THANKS to the favorable post-war economic conditions, the United States was able to widely implement modern organizational methods in industry and trade, which had a remarkably positive impact on the development of America's economy and allowed it to take the leading place among all industrialized nations of the world. This clear superiority of America has led all European nations to try to adopt from it the ability to organize economic life, to learn the principles and methods of work, in order to apply them to their own conditions, to build their own house on rational foundations, and to raise the general standard of living and welfare of the citizens.

The need to maintain close contact with America and to keep up with its rapid progress is understood by all countries, yet not all pursue these opportunities with appropriate enthusiasm, despite the generosity of Americans in providing assistance and support to others. Uncoordinated action, especially in the absence of government support, can only bring partial benefits, while well-organized action can be very fruitful. As proof of this, the fact that Germany, thanks to its diligent and skillful efforts, was able to place 100 engineers in just one Ford school, who are learning modern organizational methods in mass production. The Czechoslovak government twice delegated Engineer St. Szpaczek to America, who established direct, close contact with the engineering circles and facilitated practical studies for several engineers in the same Ford factories. After several years of study, these people will return to their countries with new resources of practical knowledge, hardened by work, and above all invigorated by the American spirit, whose most powerful feature is constant, persistent pursuit of progress, through all obstacles that stand in the way. These people will stand at their own workstations, and using America's great experience and unparalleled skills, they will accelerate the pace of economic life on the path to prosperity in their own countries.

Unfortunately, little is done in this area in Poland, although the introduction of new energy into our weak state system during the period of economic consolidation that we are currently experiencing, especially in the face of rapid progress in other countries, is simply a mandate of the moment. Striving to improve our economy, and understanding that broad exchange of thoughts and work in the field of scientific organization, will facilitate the realization of this goal, the Institute of Scientific Organization [INO, today TNOiK], from the beginning of its existence, began to establish relations abroad, and primarily with the cradle of this new field of knowledge - America. Thanks to the sincere goodwill of several of the most distinguished activists in the field of scientific organization, our Institute has established close contact with similar institutions in America, which in a short time has transformed into sincere friendship.

In the pages of the *Organization Review*, we have written more than once about the American Engineering Council, which, through its secretary, L. W. Wallace, provided the Institute with far-reaching support in facilitating practical studies for our young engineers in American industrial plants. We also wrote about the extremely warm and selfless attitude towards us of such distinguished individuals as Harrington Emerson, R. T. Kent, Wallace Clark, Ms. Lillian M. Gilbreth, Prof. J. W. Roe, and others. Recently, as a result of the publication in *Organization Review* of a series of serious articles in the field of practical application of the principles of scientific organization in Polish industry, we were contacted by the editor of one of the most serious American magazines (*Manufacturing Industries*), a distinguished activist in the field of scientific organization, L. P. Alford. He requested permission to reprint these articles in English and offered us free use of his materials. We are in constant contact with Mr. Alford, which undoubtedly will push forward the work of the Institute.

Morris L. Cooke
Pres. Taylor Society

We must also acknowledge with great appreciation the friendly stance taken by the most serious of American associations dealing with scientific organization - namely, the "Taylor Society", with its president, Mr. Morris L. Cooke, and director, H. S. Person, at the helm. These gentlemen deeply felt the wish of their mentor - Taylor, expressed in a letter to Prof. H. Le Chatelier: "I only wish for my ideas to spread", and besides promoting the science of organization and supporting all its manifestations in their own country, they show moral, and even material help to all those younger institutions that strive towards a common goal.

The most eloquent proof of this selfless and valuable help offered to our Institute by the Taylor Society is the gift of a collection of books in the field of scientific organization. This collection includes several dozen of the most distinguished works in this field (we provide a detailed list at the end of this), as well as an immensely valuable document in the form of a complete set of instructional cards from the "Tabor Manufacturing Company", in which Taylor conducted his historical research and for the first time formulated and implemented his principles of organization.

Dear Professor,
We have sent books collected by us for the Institute of Scientific Organization. One of the packages contains a complete set of instructional cards from Tabor Manufacturing Company, identical to the set offered to the Masaryk Academy of Labor. This is the third set released so far from the Tabor Manufacturing Company. The first one was offered during the war to the French government, to facilitate the scientific organization of French machine factories. I consider this set to be an extraordinarily valuable specimen. Once you familiarize yourself with it, you will agree that I am right to stress the need to handle it carefully so as not to change the order of the many cards it contains. Familiarizing oneself with the manufacturing process according to these instructional cards is in itself a good lesson in Taylor's techniques.

At the same time, I am enclosing a list of the books sent; I have marked their titles in my own card file, so that I can complete the Institute's collection as this field of our activity develops. I hope that these books will contribute to the development of scientific organization in Poland.

Assuming that you and your colleagues will be glad to have Taylor's own handwriting, I am sending one of his letters from my private collection. Expressing my appreciation for your wise management of the movement of scientific organization in Poland, I remain...

-M.L. Cooke.

The motives and incentives that guided the donors emerge from the letter of the director of the Taylor Society, Mr. H.S. Person, to Professor K. Adamiecki, dated January 28, 1927. From this letter, selflessness clearly shines through, the love of the goal they strive for, faith in its power, and a sincere desire to help the Institute, in which they see a worthy propagator of Taylor's principles. Due to the importance of the ideas contained in this letter, we quote its content in full.

H.S. Person
Director of the Taylor Society

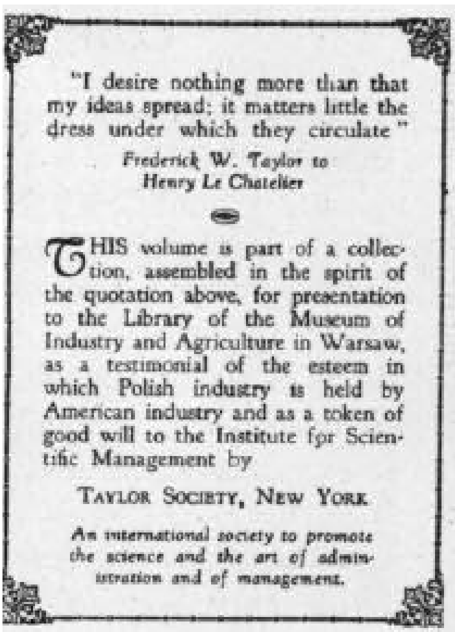
Respected Sir,
The President, Mr. M.L. Cooke, along with the directors of the Taylor Society, wishes to convey to you and the Institute's Council thanks for the words of gratitude expressed on the occasion of donating a collection of books to the Institute's library in the field of scientific organization.

We understand well that distance is not an obstacle to cooperation in fulfilling common goals and we will be happy if we can assist in your work for the benefit of your organization, even if only in a small scope.

We hope that in a short time this collection of books will become what we call a "working collection," accessible to all who wish to work, and it will be read, analyzed, and discussed; that it will become common property of all students studying organization.

We believe that you will continue to be inspired by the spirit of Taylor, who was one of our great scholars, although his laboratory was a factory, and the data he used were known facts, collected on the basis of experience, known - when they were discovered by him.

Taylor's main principle is that no issue of scientific organization is too trivial to not deserve meticulous investigation. In every study, he primarily sought information from literature in all available languages, evaluated every sentence, and only then began deep, usually experimental research to determine facts and discover laws, taking into account the specific conditions in which his question arose. Taylor took advantage of the experiences and conclusions of others, but he never relied on these conclusions if they were not completely certain; he had to delve into everything himself.


"I desire nothing more than that my ideas spread; it matters little the dress under which they circulate"
Frederick W. Taylor to Henry Le Chatelier

THIS volume is part of a collection, assembled in the spirit of the quotation above, for presentation to the Library of the Museum of Industry and Agriculture in Warsaw, as a testimonial of the esteem in which Polish industry is held by American industry and as a token of good will to the Institute for Scientific Management by

TAYLOR SOCIETY, NEW YORK

An international society to promote the science and the art of administration and of management.

Taylor's second fundamental principle was that every discovered truth should be accessible to all and be expressed in the principles and methods of organization for the common good. Scientific Organization - it is a collection of fundamental truths that he discovered and formulated; Taylor's system is a set of actions by which these truths are made available for general use. He believed that the principles are universal, but the actions must be adapted to the conditions each time. We hope that you will be able to successfully acquaint your compatriots with Taylor's principles and, through the examination of his system, develop a system that suits the conditions in the Polish industry.

-W.S. Person

This immense goodwill allows us to hope that at any moment we can expect sincere support from our friends in America, and we probably do not need to add how far this support can be fruitful for the Institute's further work.

As can be seen from the above, the "road to America" has already been paved by the Institute; the further fate of the initiated action depends on joining it and coordinating the activity of all those factors that see one of the ways to improve our economic life in establishing and rationally using relations with America.

GIFT OF THE "TAYLOR SOCIETY".

LIST OF BOOKS DONATED BY THE TAYLOR SOCIETY TO THE INSTITUTE OF SCIENTIFIC ORGANIZATION

1. F.W. Taylor. "A Piece Rate System."
2. F.W. Taylor. "Notes on Belting."
3. F.W. Taylor. "Shop Management."

4. F.W. Taylor. "On the Art of Cutting Metals."
5. F.W. Taylor. "The Principles of Scientific Management."
6. F. W. Taylor and S. E. Thompson. "Concrete - Plain and Reinforced."
7. F.W. Taylor and S. E. Thompson. "Concrete Costs."
8. F.W. Taylor. "Success - A Lecture to Young Men Entering Business."
9. H.L. Gantt. "Training Workmen in Habits of Industry and Cooperation."
10. H.L. Gantt. "Interstate Commerce Commission - Docket No. 3400 - Re Investigation Proposed Advances in Freight by Carriers in Official Classification Territory - Brief on Behalf of Traffic Committee of Commercial Organizations of the Atlantic Seaboard - Louis D. Brandeis - Counsel."
11. F.W. Taylor. "Principles of Scientific Factory Organization - Metallurgy Review." (Translation)
12. Eleanor B. Cooke. "Preface to the French Edition of the Principles of Scientific Management - by Frederick W. Taylor." (Translation)
13. F.W. Taylor. "Principles of Scientific Business Management." (Translated by H. J. Hendrikse)
14. F.W. Taylor. "Principles of Scientific Management." (Japanese Edition)
15. F.W. Taylor. "Rational Workshop Management - According to Taylor System - Stockholm - Swedish Industrial Association."
16. F.W. Taylor. "On the Art of Metal Cutting." (Russian Edition - A.W. Pankin - Petrograd)
17. William Kent. "Investigating an Industry."
18. "Congressional Record. Sixty-Third Congress Feb. 23. 1915 - Hearing before Senate Committee in re Taylor System."
19. "Commission on Industrial Relations Final Report - Washington D. C. 1915."
20. F.B. Copley. "Frederick W. Taylor." (Vol. 1)
21. F.B. Copley. "Frederick W. Taylor." (Vol. 2)
23. T.W. Taylor. "In Memory of F. W. Taylor - Two Appreciations - James Mapes Dodge and Morris Llewellyn Cooke."
24. F.W. Taylor. "The Principles of Scientific Business Management." (German Edition by R. Roesler)
25. "Dartmouth College. Tuck School Conference Scientific Management."
26. "Chief of Ordnance. U. S. Report of the Chief of Ordnance to the Secretary of War - 1912."
27. A.S.M.E. "The Present State of the Art of Industrial Management - Majority Report of Subcommittee on Administration - 1912."
28. H.P. Kendall. "Scientific Management - An Address."
29. F.W. Taylor. "Scientific Management Defined."
30. F.W. Taylor. "The So-Called Taylor System." (German Edition)
31. Wilhelm Wirz. "Taylor's Operating System."
32. Frank Gilbreth. "The Study of Motion." (Russian Edition - A. W. Pankin - Petrograd)
33. H.L. Gantt. "Contemporaneous Systems of Wages and Selection of Workmen in Connection with the Profit of Enterprises."
34. M.L. Cooke. "Business Methods in Municipal Works."
35. Morris L. Cooke. "Scientific Management of the Public Business."
36. Morris L. Cooke. "Casual and Chronic Unemployment."

37. Morris L. Cooke. "The Spirit and Social Significance of Scientific Management."
38. S.E. Thompson, William O. Lichtner, Hall, Kepele, and Henry J. Guild. "Development of Scientific Method of Management in a Manufacturing Plant."
39. Morris L. Cooke. "Who is Boss in Your Shop?"
40. Morris L. Cooke. "True Cost-Finding - What it Can Do for the Railroads."
41. Morris L. Cooke. "An All-American Basis for Industry."
42. Morris L. Cooke. "Will Labor Make the Next Move?"
43. Morris L. Cooke. "On the Organization of an Engineering Society."
44. Morris L. Cooke. "Unemployment Scores."
45. "The Annals (American Academy of Political and Social Science). Personnel and Employment Problems in Industrial Management - May, 1916 - Editor - Meyer Bloomfield and Jos. H. Willits."
46. Horace B. Drury. "Labor and Production."
47. Boyd Fisher. "How to Reduce Labor Turnover."
48. Leonard C. Wason. "The Problems of the Contractor."
49. Rudolf Roesler. "The Criminal Liability of the Organs of Joint-Stock Companies." (German Edition)
50. "The Annals (American Academy of Political and Social Science). Modern Manufacturing - Sept. 1919 - M. L. Cooke, Editor."
51. "The Annals (American Academy of Political and Social Science). Science ~ Modern Industry - May, 1925 - Jos. H. Willits."
52. "International Labour Office. Enquiry into Production - Introductory Memorandum."
53. William Green. "Address before Taylor Society, Dec. 3. 1925."
54. Dwight V. Merrick. "Time Studies as a Basis for Rate Setting."
55. Harrington Emerson. "The Twelve Principles of Efficiency."
56. Dexter S. Kimball. "Principles of Industrial Organization."
57. Charles Day. "Industrial Plants - Their Arrangement and Construction."
58. William Kent. "Investigating an Industrial Plant." (Warsaw Edition)
59. Richard H. Landsburgh. "Industrial Management."
60. William O. Lichtner, "Time Study and Job Analysis."
61. William O. Lichtner, "Planned Control in Manufacturing."
62. Hugo Diemer. "Business Management-Manuals 33 and 34."
63. Hugo Diemer. "Business Management-Manuals 35 and 36."
64. Hugo Diemer. "Business Management-Manuals 37 and 38."
65. Hugo Diemer. "Business Management - Manuals 39 and 40."
66. Geo. D. Babcock. "The Taylor System in Franklin Management."
67. "New York Public Library. Scientific Management - A List of References in the New York Public Library - Compiled by Walter Vail Brown-1917."
68. Herbert Hoover. "Business Cycles and Unemployment - Report and Recommendations of a Committee of the President's Conference on Unemployment."
69. Edward D. Jones. "The Administration of Industrial Enterprises."
70. "Federated American Engineering Societies. Committee on Elimination of Waste in Industry - 'Waste in Industry'."
71. H.P. Dutton. "Factory Management."
72. Morris L. Cooke. "Our Cities Awake."

73. D.L. Hoopingarner. "Labor Relations in Industry."
74. H. Feldman. "The Regularization of Employment."
75. William Henry Lellingwell. "Office Management."
76. S. Roland Hall. "The Handbook of Sales Management."
77. Edward Eyre Hunt. "Scientific Management Since Taylor - A Collection of Authoritative Papers - Published by Edward Eyre Hunt."
78. Edward Eyre Hunt. "Conferences, Committees, Conventions and How to Run Them."
79. C. E. Knoeppel. "Installing Efficiency Methods."
80. Carle M. Bigelow. "Installing Management in Woodworking Plants."
81. Henry H. Farquhar. "Factory Storekeeping."
82. Henry Ford. "My Life and Work."
83. P.F. Walker. "Management Engineering."
84. John A. Fitch. "Review of F. B. Copley's Frederick W. Taylor - Machinists Monthly Journal April, 1925."
85. "Dilesa Sociale. Rome, Italy - Probierni del Lavoro - (F. W. Taylor, The Scientific Organization)." (Italian)
86. Stuart Chase. "The Tragedy of Waste."
87. C. Charter Harrison. "Cost Accounting to Aid Production."
88. Frederick A. Parkhurst. "Applied Methods of Scientific Management."
89. F.B. Copley. "Frederick W. Taylor Revolutionist."
90. C. Bertrand Thompson. "The Literature of Scientific Management."
91. Anne R. McGuire. "Bibliography of Executive Ability, Leadership and Management (Mimeographed) (Dept. of Commerce)."
92. "Exhibit - Route File (Complete Set of Instruction Cards). For 18" X 24" X 4" Plain Jarring Machine M 18 X 24 X 4" J P - As Manufactured by Tabor Manufacturing Co., Phila. Pa."

PRZEGLĄD ORGANIZACJI
MIESIĘCZNIK POŚWIĘCONY SPRAWOM ORGANIZACJI I ADMINISTRACJI ŻYCIA GOSPODARCZEGO
ORGAN INSTYTUTU NAUKOWEJ ORGANIZACJI
ROK IV WARSZAWA, MAJ 1929 Nr 5

KRÓTKI ZARYS HISTORJI ROZWOJU NAUKOWEJ ORGANIZACJI W POLSCE NA TLE JEJ ROZWOJU W INNYCH KRAJACH.

Aperçu historique de l'organisation scientifique en Pologne relativement au développement de l'organisation scientifique dans les autres pays.

Prof. KAROL ADAMIECKI.

JEŻELI zastanowimy się nad przyczynami olbrzymiego postępu techniki, przemysłu i wogóle kultury materjalnej narodów ucywilizowanych w ciągu ostatnich 150 lat, to niewątpliwie za najważniejszą z nich musimy uznać wspaniały rozkwit wiedzy przyrodniczej w tymże okresie. Zastosowanie praktyczne tej wiedzy sprawiło, iż człowiek osiągnął tak wielkie zdobycze, o jakich nie marzył nawet w ciągu wielu wieków poprzednich.

Ale zkolei zjawia się pytanie, dlaczego nastąpił tak szybki i nadzwyczajny rozkwit wiedzy przyrodniczej? Odpowiedź nie jest trudna: dlatego, iż przekonano się, że prawa kierujące zjawiskami można odkryć nie drogą spekulacyj umysłowych, lecz drogą bezpośrednich i ścisłych obserwacyj zjawisk, a zwłaszcza że została ustalona ścisła metoda doświadczalna badania — metoda odkrywania zależności między przyczynami i skutkami, czyli praw rządzących zjawiskami w przyrodzie.

Tylko dzięki zastosowaniu tej metody, która jedynie ma prawo na miano naukowej, poznanie przyrody mogło dojść do tak dalekich granic i mógł nastąpić tak wielki postęp w wykorzystaniu jej bogactw, jakiego jesteśmy świadkami.

Z postępu tego nie należy jednak sądzić, że naukowa metoda doświadczalna objęła już wszystkie dziedziny wiedzy i działalności ludzkiej. Nawet w działalności technicznej i gospodarczej są jeszcze dziedziny, w których empiryzm, postępowanie poomacku podług zgóry powziętych kruchych teoryj i hipotez nie ustąpiły jeszcze, a niekiedy odgrywają jeszcze główną rolę. W każdym razie można powiedzieć, że wszędzie tam, gdzie metoda naukowa zdążyła dotrzeć, okazała się kluczem, który otworzył drogę do wielkiego postępu, jak również, że olbrzymi rozwój wiedzy technicznej i jej zastosowań niewątpliwie trzeba przypisać temu, że wiele jej gałęzi zostało już opartych o badania metodą naukową.

Ten triumfalny pochód nauki doświadczalnej długi czas nie dosięgał jednej z najważniejszych dziedzin działalności gospodarczej, a mianowicie, zarządzania rozumianego w najobszerniejszem znaczeniu, jako organizowanie wszystkich środków i czynników wytwórczych. Doniedawna panował tu całkowicie empiryzm i sposoby postępowania, oparte na tradycji i organizatorskich talentach poszczególnych kierowników.

W miarę rozwoju życia gospodarczego sposoby zarządzania udoskonalały się wprawdzie drogą systematyzacji nabytego doświadczenia, ale głęboko było zakorzenione przekonanie, że zagadnienia zarządzania lub wogóle organizacji pracy należą do zakresu sztuki, a nie nauki.

Pierwszy i stanowczy wyłom w tych pojęciach został zrobiony w 1903 roku, gdy amerykański inżynier Fryderyk Winslow Taylor wydał swą książkę „Zarządzanie warsztatem wytwórczym" (Shop Management). Prace swoje na tem polu rozpoczął on około 1883 r., gdy pełnił funkcję inżyniera w zakładach Midvale Steel Co (1878–1890).

Prace Taylora mają epokowe znaczenie nietylko dla nowoczesnego przemysłu, ale i dla wszystkich dziedzin działalności gospodarczej. On jest założycielem i ojcem nauki, która dziś

A brief outline of the history of the scientific development of an organization in Poland against the background of its development in other countries. (1929)

Organization Review [*Przegląd Organizacji*], 1929, Issue 4, No. 5, pp. 151-162

Forward to the English edition

This outline provides an overview of the development of scientific management, from its birth in the United States to its rapid growth in Europe and Poland. Adamiecki discusses the initial challenges faced in the United States, such as resistance from trade unions and political opposition, before highlighting the spread of Taylor's scientific management ideas across the Atlantic and into Europe.

In the final section of the article, we learn the details of the development of scientific organization in Europe, particularly in Poland, where it had become a leader in the field, overcoming initial obstacles and embracing the principles of scientific organization for improved industrial efficiency and labor productivity. A particularly noteworthy fact is that most successful organizational transformations began with the principle of harmonization, focusing on the interplay between various elements in the work process, before moving on to improving the individual work processes.

[Introduction]

If we reflect upon the reasons for the colossal advancement in technology, industry, and material culture of industrialized nations over the last 150 years, undoubtedly the most significant is the remarkable blossoming of natural science knowledge during this period. The practical application of which has allowed humanity to achieve such feats that people could not have even dreamed in the preceding centuries.

But, in turn, the question arises: why has there been such a rapid and extraordinary flourishing of natural science knowledge? The answer is not difficult: it happened because we realized that the laws guiding phenomena can be discovered not through speculative thinking, but through direct and precise observations. Notably, a rigorous experimental method of investigation has been established - a method for uncovering the relationships between causes and effects, or the laws governing the natural world.

Only through the application of this method, which alone has the right to be called scientific, could our knowledge of nature reach such distant boundaries, and such great progress in utilizing its riches, as we witness today.

However, we shouldn't presume that the scientific experimental method has been applied to all areas of knowledge and human activity. In fact, within technical and economic spheres, there exist realms where empiricism and the use of tentative methods based on fragile theories and hypotheses still persist, sometimes playing a significant role. Nevertheless, it's evident that wherever the scientific method has managed to permeate, it has served as the key to unlocking tremendous progress. The vast expansion of technical knowledge and its applications can undeniably be credited to the incorporation of scientific research methods in many of its branches.

This triumphant march of experimental science did not reach one of the most important fields of economic activity for a long time, namely, management as understood in the broadest sense, that is, as the organization of all production resources and factors. Until recently, empiricism and methods based on tradition and the organizational talents of individual managers completely dominated this field.

As economic life developed, management methods improved through the systematization of acquired experience, but the deeply rooted belief was that management issues or, in general, work organization, belonged to the realm of art, not science.

[Birth of Scientific Management]

The first and decisive breakthrough in these concepts was made in 1903 when the American engineer Frederick Winslow Taylor published his book *Shop Management*. He began his work in this field around 1883 when he was an engineer at Midvale Steel Co (1878-1890).

Taylor's work has epoch-making significance not only for modern industry but also for all fields of economic activity. He is the founder and father of the science that is now rapidly developing in the United States under the name of “scientific management,” and in European countries under the name of “scientific work organization” or more broadly – “scientific organization.”

To better highlight the picture of this movement in Poland, I believe it is necessary to first recall several dates and facts concerning the development of scientific organization in the United States and other countries.

Although Taylor presented his paper "Notes on Beltings" in 1893 and a paper on piece-rate pay (*A Piece-Rate System*) in 1895, which are closely related to his work on management principles, they are only fragments that shed weak light on his main ideas. These ideas are fully revealed only in the aforementioned *Shop Management*. Therefore, one can say that 1903 is the date from which a fundamental breakthrough in the understanding of management and organization began.

The scientific approach to these issues is Taylor's exclusive merit and forms the main foundation of his system. It is very interesting that Taylor himself never brought this fundamental moment to the forefront, and even in his next book, which he published in 1911 and titled, at the request and influence of his friends: *Principles of Scientific Management*, he did not explain the scientific nature of these principles.

This gave rise to accusations from various scientists for some time that Taylor and his followers abused the term "science." Taylor never adequately responded to these accusations because he considered the method he applied in his research to be so natural and based on common sense that he himself seemed to be unaware that it was, in fact, the scientific method.

This dispute would have lasted quite a long time if it had not been ultimately resolved by Professor Henry Le Chatelier, who immediately discovered the purest scientific method in Taylor's research and pointed out that this is the foundation of his system.

However, Taylor did not limit himself to introducing the scientific method to organizational issues. Here is what his biographer Frank B. Copley writes about this matter in his extremely interesting two-volume work: *Frederick W. Taylor, Father of Scientific Management*:

> *"Although everything indicates that Taylor secured his place in history mainly due to the application of the scientific method to his work in the field of organization, it would be a serious mistake to assume that his lasting contribution is limited only to this."*

> *"When Taylor realized that scientific principles and methods are of great importance because they contain the philosophy, spirit, and life, he also acknowledged that a system is needed to implement them. Possessing great practical sense along with theoretical knowledge, Taylor, even when the principles were still acting on him as more or less unconscious stimuli, developed ways of action and mechanisms for applying them in life, and finally coordinated them so well that he created a uniform, logical, and very flexible system."*

However, Taylor did not have the gift of expressing his thoughts, often emphasizing the details of his system too strongly and not emphasizing the guiding ideas it was based on enough, especially the scientific experimental method he followed, which Professor Henry Le Chatelier brilliantly elucidated.

This weak aspect of Taylor's writings is undoubtedly the reason why most people, after reading his works, do not grasp the guiding idea. But there is another reason, perhaps far more important, namely that many people, even among scholars, do not have a clear understanding of the essence of the scientific method, and therefore notice various details or principles captured in the system in his works, but do not understand the source from which they originate.

Regarding this misunderstanding, prominent American economist Irving Fisher makes very characteristic remarks (*Bulletin of the Taylor Society*):

> *"I have just recently read a critique of scientific organization by one of the scholars who thoroughly read Taylor's works, and yet he completely failed to grasp their guiding idea."*

And further, after asking what the essence of scientific organization is, he writes:
According to Taylor, the main features of scientific organization are the following:

- *Time-motion studies to perform a particular task in the proper way.*
- *Functional or divided management and its superiority over the old-fashioned single-master management.*

- *Standardization of tools, equipment, tasks, and worker movements for each type of work.*
- *Establishment of a planning office.*
- *Instruction cards for workers.*
- *The idea of task assignments along with bonuses for successful completion, and so on (Principles of scientific organization, pp. 129-130).*
- *However, those who seek the soul of scientific organization in the above principles or classifications are like people who wish to discover the spirit of religion in a particular ritual. We will not find the great secret of scientific organization here.*
- *Certain methods of action or devices may express the difference between two non-scientific systems, but the difference between Taylor's system and any other lies in the fact that his methods were not whims of imagination but the results of painstaking scientific research.*
- *Huxley, the great apostle of science, used to say that a man of science must have a fanatical belief in truth and humbly acknowledge facts and their consequences.*
- *Taylor was animated by such a spirit, and history will bestow immortal glory upon him as the first man to introduce this subtle scientific spirit, which reigned only in universities and scientific laboratories, into the realm of industrial organization.*

The above words are one of the best descriptions of Taylor's work and the reasons why the most essential basis of this work struggles to penetrate human minds.

However, it must be admitted that none of the numerous commentators and propagators of Taylor's principles have precisely explained the essence of the spirit of science from which his entire work stems.

As we have already mentioned, only Professor Henry Le Chatelier not only noticed the scientific spirit in Taylor's work but also brilliantly defined what experimental science is, indicated that its aim is to discover the laws governing phenomena, explained precisely what the scientific method is, through which these laws can be discovered, and finally demonstrated with extraordinary clarity that Taylor based his entire system on these very assumptions (*See Philosophy of Taylor's System by H. Le Chatelier, published by the Institute of Scientific Organization [in Polish], 1926*).

If the assessment of Taylorism by Prof. Le Chatelier had appeared immediately after the publication of Taylor's works, it would undoubtedly have contributed significantly to the proper and rapid understanding of Taylor's ideas and would have silenced many attacks that Taylor's system faced for a long time from those who misunderstood it or deliberately misinterpreted some of its principles.

Unfortunately, Prof. Le Chatelier became acquainted with Taylor's works on organization only in 1911, and although he became an apostle of Taylor's system from that moment, as he expressed himself, the series of articles he wrote on this subject appeared only in France and for a long time did not find a proper response in other countries.

In any case, Prof. Le Chatelier's commentaries on Taylor's principles are of immense importance, and they will play a significant role in the history of the development of scientific organization, as they are the key to properly understanding these principles.

[Proliferation of Taylor’s Scientific Management in the US]

Until the end of 1910, Taylor's principles were relatively unknown in the United States, except for a few industrial plants where Taylor himself or his collaborators tried to organize production on new principles; the broader business community showed little interest in them.

However, this state of affairs changed abruptly as a result of the 1910 appearance of Louis D. Brandeis, a prominent lawyer from Boston, who opposed the increase of railway tariffs demanded by the Railroad and Iron Companies, who were claiming that such an increase was necessary to cover the deficits that the railways were incurring.

Brandeis argued that the railways could make significant profits without raising tariffs if they managed their economy rationally, and above all, if they applied scientific organization according to Taylor's principles.

Brandeis' energetic intervention led to the creation of a special investigative commission by the Interstate Commerce Commission in Washington. After several months of investigation, the Commission ruled against the increase in railway tariffs. Although the Commission did not advocate the wider introduction of scientific organization, as it believed that these principles were still in the experimental stage, public opinion became highly interested in Taylor's system, which the press gave such great publicity that Taylor even feared that it would harm the cause by giving rise to various opportunistic organizers and charlatans who would discredit the seriously started work.

And indeed, his predictions were correct, as soon after the United States became swarming with various "efficiency engineers" who undoubtedly did more harm than good.

[Diffusion of Taylor’s Ideas outside of the United States]

However, disregarding the harmful activities of these pseudo-Taylorists, it must be acknowledged that the publicity given at that time contributed to a great extent to the widespread interest in Taylor's works not only in the United States but also worldwide.

Proof of this is that soon afterward, Taylor's works were translated (between 1911 and 1913) into French, German, Danish, Swedish, Polish, Russian, Latvian, Italian, Spanish, Japanese, and Chinese. From that time on, there is an abundance of books on the subject of management and organization in the literature of the United States, and several journals dedicated specifically to this subject begin to emerge.

However, it should not be assumed that all of this literature can be classified as scientific organization; among it, there is a relatively small number of works that have real scientific value.

On this matter, Prof. H. Le Chatelier, in the introduction to the Polish edition, says with complete justification:

> *"We encounter numerous descriptions of organization and administration in the literature. The proposed models may be good, but they may also be bad. Everyone organizes in their own way and declares the superiority of their methods, but they do not attempt to provide scientific proof of their value. This is undoubtedly material that can give the reader useful tips, but it has nothing to do with scientific organization (Taylorism)."*

At the same time as the great interest in Taylor's work emerged in the United States in 1910-1911, a fierce campaign began against Taylor's system by labor union leaders and various politicians. At that time, American labor unions fought against increasing production and labor efficiency, believing it would lead to unemployment. In addition, as a result of the unfortunate experience of the fatal and short-sighted policy of the majority of industrialists lowering piecework rates as labor efficiency increased, they could not understand Taylor's basic ideas and were firmly convinced that Taylor's system was a new means of worker exploitation. The majority of union leaders considered Taylor's claim that there is no conflict between the interests of workers and employers, and that high wages can be reconciled with low production costs, as mere hypocrisy. Those who professed the idea of class struggle and suspected that Taylor was right, attacked with even greater fierceness, as the victory of the idea of cooperation could completely undermine the ground on which they based their activities.

The struggle was extremely difficult, as the other side, the employers, did not understand Taylor's ideas and generally treated his claims about high wages, low production costs, and the principle of cooperation with dismissive skepticism. Finally, numerous unsuccessful attempts by various "efficiency engineers" masquerading as scientific organization experts were eagerly seized upon by Taylor's opponents as a weapon against him.

This struggle reached its climax in January 1915 when, under the influence of demagogic speeches by labor leaders, some members of Congress and the Senate caused Congress to adopt the army and navy budget with an amendment stating that none of the approved funds could be used as compensation for time study (timekeeping) or as a bonus to the worker's regular wages in military establishments.

For Taylor, this was a painful moral blow, which, as his biographer says, undoubtedly contributed to undermining his already weakened health and thus hastened his death, which occurred in March 1915.

However, labor union leaders did not enjoy their victory for long, as soon after, sound American judgment began to prevail to such an extent that even Samuel Gompers, president of the American Federation of Labor and Taylor's fiercest opponent, admitted before the end of the war in 1918 that Taylor's ideas must triumph.

Indeed, soon after the war, there was such a change in the mentality of workers and in the views of American industrialists that the current president of the Federation of Labor Unions, William Green, asserts at every opportunity that the idea of cooperation, shared interests between workers and employers, high wages, and high efficiency is now the main basis for the prosperity of American industry and the well-being of workers.

It should be noted that this change was largely influenced by the activities of the Association for the Promotion of Scientific Organization (later called the "Taylor Society"), founded in 1911 by Taylor's closest collaborators and friends, who, after his death, redoubled their efforts to promote his ideas.

At the initiative of this Association, a joint conference with W. Green and other prominent labor union leaders was held in March 1925. Subsequent conferences further reconciled their views to the extent that today, American labor unions themselves support the introduction of scientific organization.

[1911 through 1913: Development of Scientific Organization in Europe]

As I mentioned earlier, Taylor's work stirred minds around the world, leading to the propagation of his principles and attempts to apply them in practice in many countries. The publicity given to these principles in the United States in 1910 resonated in Europe, so much so that the years 1911-1913 can be considered the beginning of the development of scientific organization on European soil.

Although Professor Henry Le Chatelier has been continuously pointing out the importance of Taylor's work in various fields of productive labor in France since 1911, it must be admitted that among European countries, the new principles of organization most interested the Germans.

The ground was prepared to some extent here. Highly regarded technical universities, a rapidly developing industry with ambitions to surpass the entire world, extremely active numerous engineering associations imbued with the spirit of progress, and numerous research laboratories supported by the government and industry created an atmosphere in which all new ideas and inventions in the technical and economic fields were eagerly absorbed, imitated, or developed.

If, based on the extensive German literature on Taylor's system and organization in general, one can say that the Germans understood the mechanism rather than the spirit of Taylor's scientific work, it must be admitted that they were the first in Europe to try to apply this mechanism to practical life.

In 1913, the Association of German Engineers (V.D.I.) invited James Mapes Dodge, director of Link-Belt Co, who, with Taylor's participation, introduced his system to the organization, to its annual congress in Leipzig. This congress was devoted almost exclusively to discussing modern methods of organization, especially Taylor's principles, and resonated strongly among all spheres of German engineering and industry. Thanks to the interest of the scientific community, scientific organization quickly penetrated German higher technical schools, facilitated by the fact that organization and administration of industrial plants had long been the subject of lectures in many of them.

After the war, this movement continued to gain momentum throughout Germany, especially since the government spared no resources to support it. This government, understanding that increasing labor efficiency, improving workshops, and lowering production costs are among the most powerful means to Germany's economic revival, created a central state institution: the Reich Board of Trustees for Economic Efficiency (*Reichskuratorium für Wirtschaftlichkeit}*, whose task is to support and coordinate numerous institutions and committees scattered throughout Germany aimed at rationalizing economic life in all areas.

As for the development of specific methods of organization and their practical application, progress in Germany is proceeding at a rapid pace, and it can be said that in this regard, Germany has advanced the furthest among all European countries.

Although the situation is somewhat worse in other countries, it must be acknowledged that this movement is gaining momentum.

In France, the voice of Professor H. Le Chatelier did not find a significant response for some time, but during the war, interest grew considerably, especially when the French Ministry of War took steps to establish planning offices according to Taylor's principles in the factories under its administration; Clemenceau issued a circular urging all directors of these factories to familiarize themselves with these principles.

In 1922, an association was established under the name "Conférence de l'Organisation Française," whose task is to promote and develop scientific organization in France.

Around the same time, the "Comité Michelin" was formed under the leadership of Prof. H. Le Chatelier. The committee's task is to organize special courses in scientific organization and train mainly graduates of higher technical schools in this field. The committee was initiated by the Michelin brothers, owners of the well-known rubber factory in Clermont-Ferrand, who also cover all the costs of the committee's activities.

In 1924, the first French Congress of Scientific Organization took place in Paris, followed by the second in 1925. Both congresses demonstrated that the movement in the field of organization in France is developing very successfully.

After the war, significant interest in scientific organization can be observed in almost all European countries, which was largely due to the realization that the only certain way to rebuild the devastated economies is through diligent and efficient work.

This realization has become most firmly established in engineering circles, and in all countries, centers have been created to develop the science of organization and apply it to practical life, primarily on the initiative of these circles. Such centers, in the form of either special associations or institutional research laboratories, have emerged in recent years in Belgium, Switzerland, Italy, Spain, and so on.

But particular attention should be paid to the movement in Czechoslovakia that emerged immediately after the war. The Czech nation, tempered by work through long centuries, has a deep sense of reality and instinctively feels that the foundation of wealth and prosperity can be achieved solely through hard work. Thus, having regained its independence, it quickly came to balance and entered the path indicated by its practical and far-sighted leaders.

During the war, Czechoslovak engineers and economists began to propagate the need to create a higher technical and economic institution aimed at supporting technical and economic sciences and introducing the best methods of utilizing natural resources and human labor. With the proclamation of independence at the end of 1918, this group formed the Technical-Economic Union (Technicko-Hospodarska Jednota) and began publishing the journal "Nova Prace," which called for the establishment of an Academy of Labor in line with the idea once expressed by Masaryk in his writings.

This idea soon found resonance, especially when the Czechoslovak Embassy in the United States began drawing the attention of the Czechoslovak government and industrial sectors to the development of scientific organization in the United States.

At the end of December 1919, President Masaryk, having at his disposal a million crowns collected by Czech emigrants in America, donated them as a fund for the establishment of the planned institution, which was named Masaryk Academy of Labor.

The matter proceeded quickly, the relevant law was passed in parliament, and by spring 1920, the Academy was opened. It was the first institution of its kind in Europe, and its scientific and research work covers all branches of Czechoslovakia's economy, with a focus on issues in the field of scientific organization of labor.

The Masaryk Academy of Labor, bringing together the most outstanding scientific, technical, industrial, and commercial forces of Czechoslovakia, develops very active work and has undoubtedly become the main center from which the initiative to apply the methods of scientific organization to all areas of productive labor emanates. In this regard, it is undeniable that Czechoslovakia is making such great progress that it confidently stands among the leading European countries.

[Scientific Management in Poland]

Having provided a brief outline of the history of the development of scientific organization in the United States and the major European countries, it is necessary to consider how this issue is presented in Poland.

Reaching back to the earliest manifestations of this movement, it should be recalled that in 1903, I presented a paper at a meeting of the Russian Technical Society in Yekaterinoslav [*Dnipro*] on the organization of work in rolling mills. This paper reported the results of research and work in this direction, which I began in 1896 in the metallurgical plants "Huta Bankowa" in Dąbrowa Górnicza. This work led me to establish general principles of collective work, which I called the principles of harmonization, as well as the graphical method of planning collective work. The general approach to these issues and their solutions is almost entirely consistent with the basic postulates of Taylor's system.

The above paper was later presented at a meeting of the Association of Technicians in Warsaw and printed in Technical Review (*Przegląd Techniczny*) in 1909. Although this work did not initially arouse much interest in the country and it can be said that only a few individuals understood its deeper meaning, the idea, once introduced, did not disappear but gradually developed over time. A series of applications of the principle of harmonization, carried out both by the author himself and by several of his followers, fully confirmed and proved that this principle is one of the most fundamental in the organization of production factors.

The works of Taylor, which, as already mentioned, attracted worldwide interest mainly after 1910, also stirred minds in Poland, but to a lesser extent than in Western European countries and even in Russia. This, of course, was due to the suppression of national life by foreign invaders. As for intellectual life in the technical field, its main centers - higher education institutions, with the exception of Galicia [*geographic region spanning what is now southeastern Poland and western Ukraine]*, did not exist as Polish institutions in the other parts of the country. A significant number of engineering forces were scattered all over the world, and technical and engineering associations in the country barely survived. Thus, it is not surprising that in Poland there was no ground on which Taylor's ideas could easily take root and develop.

Only in Galicia, or more precisely in Lviv, where there was a Polish polytechnic, was there an environment in which these ideas could find a livelier resonance. This indeed happened, especially since the ground was to some extent prepared, as in 1905, Professor Edwin Hauswald began lectures at the Lviv Polytechnic under the title "Organization and Management of Enterprises." In addition, the Lviv Polytechnic Society at that time was actively interested in the issues of organization. Prof. Hauswald, following the progress of literature, did not fail to draw attention to Taylor's system in those lectures.

Earlier, in 1903, engineer Aleksander Rothert became interested in Taylor's works. Later, after becoming a professor at the Lviv Polytechnic, he emphasized the important aspects of Taylor's system in his lectures. In 1908, he wrote an article about wage systems in *Lviv Technical Journal (Czasopismo Techniczne Lwowskie*), which was closely related to Taylor's system. Shortly after, Prof. Rothert expanded his studies on wages and published separate brochures in Polish and German.

This work, as a comprehensive approach to the issue of wages in relation to scientific organization, is the first of its kind in the literature on the subject.
In 1913, Taylor's book "Principles of Scientific Management" was published in Polish, translated by engineer H. Mierzejewski.

However, all these efforts did not initially stimulate widespread interest. They can be seen as the first seeds sown, destined to bear fruit in the future once a broader understanding of the importance of labor productivity took hold.

The first significant manifestation of such understanding was a series of conferences at the Association of Technicians in Warsaw in 1915 on the subject of natural resources and economic forces in the future united Poland. In almost all of the several dozen papers, one general idea emerged: although we possess great natural wealth and will have favorable development conditions after unification, all this will not provide us with a basis for existence as an independent nation if we do not reach the most important source - efficient and well-organized labor.

The years of war and its disasters, however, did not favor the penetration of this fundamental economic truth into broader society. When the revival of the Polish state finally occurred at the end of 1918, a new negative factor appeared, common to all European countries that had gone through war disasters, namely, revolutionary slogans promising prosperity to the broad masses of workers not through efficient work, but through social upheavals. These slogans were all the more dangerous because, unfortunately, our nation, due to either its unfortunate history or ingrained habits, was not very inclined to consider work as the most important basis for prosperity.

Therefore, in technical and engineering circles, the idea emerged that first and foremost, the promotion of efficient work should be prioritized. To implement this idea, under the initiative of engineer Piotr Drzewiecki, the "Work League" Association was founded in April 1919. At the same time, the author of this article proposed the establishment of the Institute of Scientific Organization as a center aimed at cultivating this science and stimulating the application of its methods in practice.

Unfortunately, our nation, having regained its freedom, preferred to engage in politics rather than work. We began to experiment in ways that contradicted the most elementary economic laws. Indeed, people often extolled "work," but no one seriously thought about it. In partisan fervor, we preferred to seek culprits for the worsening economic situation on both sides, rather than face the obvious truth that there is no prosperity without efficient work.

The outreach of the Work League did not find a broader resonance, and in the so-called leftist circles, calls for increased labor productivity and for ceasing to consider strikes as the only universal remedy for resolving workers' issues were even seen as encouraging excessive, even more oppressive work.

Under these conditions, the Institute of Scientific Organization, which was founded by a small group of well-intentioned people, did not find support and had to be closed after a few months.

However, at that time, the understanding of the need for this science had matured enough in scientific and technical circles that at the Warsaw University of Technology, which was reorganized by Polish scientific forces shortly after the Russians left the country, lectures on scientific organization were introduced in the fall of 1919, under the initiative of the late Professor Zygmunt Straszewicz, and the undersigned was appointed to deliver them. Similar lectures also began at the Main School of Rural Economy and the Wawelberg and Rotwand

Mechanical School. Unfortunately, this did not last long, as soon the war with the Bolsheviks broke out, which for a whole year immobilized all higher education institutions in Poland.

When, at the end of 1921, the Department of Scientific Organization was established at the Mechanical Faculty of the Warsaw University of Technology, and the undersigned was appointed to it, the lectures were resumed in the autumn of 1922. It should be noted that in terms of granting scientific organization accreditation in higher education institutions, Poland has gone the furthest among all European universities, as so far, no other technical institution in Europe, except the Warsaw University of Technology, has such a department. This science seeps into the minds of students through subjects such as the organization of industrial enterprises or various technologies, depending on how the respective professors understand Taylor's principles. It must be admitted that there are still few who find the scientific spirit in them to the extent that Professor H. Le Chatelier did, while most understand them as characterized by the aforementioned economist Irving Fisher.

Although the matter of wider interest, initiated in 1909, has not yet yielded results, the idea has not only survived but has been increasingly reinforced among engineering circles. Therefore, when in the autumn of 1923, the Association of Technicians in Warsaw received a call from the Association of Polish Technicians in America to pay attention to scientific organization, a special Scientific Organization Circle was established.

As a result of the influence of this Circle, several similar circles were formed within a few months at various provincial engineering associations. Soon, a new significant factor appeared that greatly stimulated interest in the matter of scientific organization, not only in technical circles but also among the broader Polish public - namely, the 1st International Congress of Scientific Organization, which took place in July 1924 in Prague.

This congress was important to us for several reasons. Firstly, the Polish Delegation had the opportunity to see for themselves the great work the Czechs had accomplished in creating the Masaryk Academy of Labor and how quickly the Czechoslovak nation was moving forward, thanks to understanding the importance of raising labor productivity. Secondly, they had the opportunity for personal contact and establishing very friendly relations with the American delegation, consisting of the most prominent pioneers of scientific organization in the United States. Finally, this congress undoubtedly stirred our national ambition and increased the energy of those who set themselves the task of introducing scientific organization in Poland.

Indeed, this movement soon gained significant momentum. The Warsaw Circle organized the 1st Polish Congress of Scientific Organization, which took place in Warsaw at the beginning of December 1924. The large number of participants and the topics of discussion showed that the awareness of the need to improve efficiency through organization based on scientific principles had already reached deep into Polish society, and even that serious work had begun in the direction of practical application.

It should also be noted that at that time, this interest began to manifest itself at almost all technical conferences and meetings.

As a result of the 1st Congress, all Circles were united into one organization with an Executive Committee at the helm, which primarily embarked on a publishing campaign, made possible thanks to subsidies received from several industrial institutions, especially from the Sugar Industry Association, which was one of the first to recognize the importance of scientific organization for our economic life.

However, the most important result of this movement was the establishment of the Institute of Scientific Organization (INO, Instytut Organizacji Naukowej). The initiators of this institution, who were unable to realize this project in 1919, took up the idea again in November 1924 and this time, thanks to the financial support of some industrial institutions and the lively interest of broader society, led to the establishment of the Institute of Scientific Organization as an autonomous institution at the Museum of Industry and Agriculture in Warsaw in April 1925.

Since interest in scientific organization began to manifest itself in agricultural circles as well, an Agricultural Section was established at the Institute from its very inception.

The representatives of various organizations joined the Institute's Board of Curators as a supervisory body, including the Academy of Technical Sciences, the Main School of Rural Economy, the Higher School of Commerce, the Polish Committee for Standardization, the aforementioned Executive Committee of the Scientific Organization Circles, the Labor League, the Central Union of Polish Industry, Mining, Trade and Finance, the Union of Agricultural Organizations, the Central Craftsmen's Association, the Museum of Industry and Agriculture, and the Ministries of Labor and Social Welfare, Military Affairs, Education, Industry and Trade, Agriculture, and Communications. This clearly demonstrates the great interest of broad social strata in this matter.

The goals and tasks of the Institute are indicated in the first paragraph of the Statute, which reads:

> *"The Institute of Scientific Organization is a public-use scientific institution whose aim is to promote, support, and develop scientific organization, with the task of identifying the best methods to achieve the highest efficiency in the utilization of materials, mechanisms and devices, natural energy, time, and human labor."*

As for its internal organization, the Institute is to some extent on the level of an Academy, as according to paragraph four of the Statute: "members of the Institute can be appointed from among individuals who have distinguished themselves with outstanding scientific or practical work in the field of labor organization and improvement of production processes."
From the moment of its establishment, the Institute became the center of the entire movement in this field in Poland. Its activity is developing very successfully, expanding into ever-wider circles. Gradually, special sections and commissions are being created, dealing with the issues of organization in specific areas of economic life. Currently, there are already sections such as: agriculture, administration and office, household management, chemistry, commission for standardization of methods for calculating operating costs, a lecture commission, editorial

committee, and an advisory commission on organization. In addition, the Institute has a laboratory for studying motion in work, combined with a cinematographic laboratory for producing films for teaching organization.

The Institute's activity is particularly lively in the publishing field. At the beginning of 1926, it took over the entire book publishing campaign from the Executive Committee of the Association of Scientific Organizations and can now boast the publication of several first-class works on scientific organization. In addition to books, it consistently publishes three magazines: the monthly *Organizational Review (*Przegląd Organizacj), the bimonthly *Organization of Work in Agriculture (Organizacja Pracy w Rolnictwie)*, and the monthly *Household Organization* (Organizacja Gospodarstwa Domowego).

An important part of the Institute's work is the lectures organized throughout the year. These lectures are conducted as closed cycles ranging from 40 to 80 hours and cover groups of subjects from general principles of organization and applications to specific areas of work and production. The attendance at these lectures is so high that the Institute, due to a lack of appropriate premises and a sufficient number of lecturers, cannot keep up with the rapidly increasing demand.

As there was a need to train specialists in scientific organization, the Institute, in addition to the above-mentioned lectures, decided to organize special seminar studies with practical exercises for a limited number of people who already have the appropriate theoretical and practical preparation.

In general, it can be said that the activity of the Institute is developing so successfully that it not only has caught up with analogous institutions abroad but has even surpassed some of them, and many significant initiatives in the field of applying scientific organization methods in various branches of Polish industry and administration are undoubtedly due to the influence of the Institute.

The increasing activity of the Institute naturally requires an increase in financial resources. It is very encouraging that these resources continue to flow in the form of subsidies. Initially, the subsidies came from only a few industrial enterprises, but later, as the Institute developed, the number of subsidizing institutions increased and subsidies began to come from state and municipal institutions. This fact proves, on the one hand, a growing understanding of the importance of scientific organization by the entire society, and on the other, recognition that the Institute is performing its task well.

The Institute currently has 100 members, including two honorary members: Prof. Ignacy Mościcki and Prof. Henry Le Chatelier. A significant portion of the members are foreign, all of them world-famous as distinguished activists in the field of scientific organization.

Outlining a brief sketch of the development of scientific organization in Poland, it is also worth noting the very successful development of research centers focused on work psychology. It should be emphasized that Taylor's work, especially his focus on the importance of selecting the right people for specific tasks, sparked great interest among physiologists and, above all, psychologists worldwide in this crucial issue. In the United States and Europe, a series of research laboratories were established to study human aptitudes.

These studies gradually developed in two directions: one aims to investigate the aptitudes of a given individual in order to indicate the professions they are best suited and to help them navigate their career path, while the second aims to check whether the aptitudes of a given individual meet the requirements and conditions of a given profession. The first direction is called vocational guidance, and the second is called selection or vocational selection.

In these works, Poland is not lagging behind, and it should be noted that the outstanding Polish scholar in the field of experimental psychology, the late Dr. Józefa Joteyko, already pointed out the necessity and possibility of such research in her presentation delivered at the Congress of Hygiene and Demography in Brussels in 1903.

The first psychotechnical laboratory, aimed at providing vocational guidance, was established in 1916 by the engineer Wacław Hauszyld at the association "Patronage over Youth in Crafts in Warsaw." Thanks to his tireless and selfless work, this laboratory has developed to the point where it is now one of the foremost laboratories of its kind in Europe.

After the war, the movement in this field significantly revived, especially when Dr. Józefa Joteyko returned to the country in 1919, around whom all the scientific forces dedicated to psychotechnics gathered.

In 1923, a psychotechnical workshop was established at the Teachers' Seminary in Łódź, led by Dr. Karpińska-Wojczyńska.

At the end of 1925, a psychotechnical laboratory was established at the Ministry of Communications in Warsaw to examine locomotive engineers and traffic service personnel.

In the same year, a laboratory was established under the name Psychotechnical Institute at the State School of Construction (*Zakład Psychotechniczny przy Państwowej Szkole Budownictwa*) in Warsaw. The purpose of this laboratory is the selection of students for vocational schools.

Both of the above laboratories are directed by engineer J. Wojciechowski.

At the same time, a psychotechnical laboratory was established in Lviv under the direction of Prof. E. Geisler and Dr. Zawirski.

Finally, at the end of 1925, a vocational guidance office was established, along with a psychotechnical workshop at the Patronage of Youth in Crafts in Lublin.

In 1926, a psychotechnical clinic was established at the Department of Health and Hygiene of the Warsaw City Hall under the direction of Dr. T. Juraszyński.

An important stage in the development of psychotechnics in Poland was the establishment of the Psychotechnical Society in Warsaw at the end of 1926, whose aim is to coordinate the work of members and the numerous existing research centers in this field. Dr. Józefa Joteyko took the lead in the Society. In order to better fulfill its goals, the Psychotechnical Society publishes a magazine (quarterly) titled *Psychotechnika.*

As we can see, the movement towards research in the field of work psychology has been developing rapidly in Poland in recent years. Research is conducted in the two directions mentioned earlier and, in addition, is significantly directed towards the study of youth aptitudes, thus being connected to pedagogy, which will undoubtedly contribute to the deepening of education for young people as future professional workers.

In this last direction, work began at the end of 1927 in Poznań, specifically, the School District Curatorship of Poznań organized, with the participation of Prof. Dr. S. Bachowski and Dr. H. Szuman, courses preparing teachers of psychotechnics for secondary and primary schools.

The number of psychotechnical centers is constantly increasing. In 1927, a psychotechnical workshop was established at the Industrial Museum in Krakow. This workshop, led by Dr. W. Medyński and engineer B. Biegeleisen, is actively engaged in researching aptitudes in various professions.

Finally, at the beginning of 1928, an important research facility was established for Polish military aviation, namely the psychophysiological laboratory at the Center for Aviation Medical Research, modeled on the first-class foreign laboratories of this kind. The director of the laboratory is Major Dr. W. Missiuro.

Considering the entire list of workshops aimed at studying aptitudes and ultimately making the best use of human labor while preserving the physical and moral strength of a person, we can see that in terms of the number of these workshops, Poland has fully matched other Western European countries. However, it is noticeable that these works are predominantly psychological in nature, with little consideration given to the physiological and hygienic aspects of work. But the same phenomenon can be seen abroad. This phenomenon is undoubtedly temporary and probably, in the near future, a balance will be achieved, especially since recently we have noted very serious work in the field of physiology and work hygiene by Prof. Karaffa-Korbutt and Prof. Szulc.

A characteristic and extremely positive feature of this entire movement is the active participation and cooperation of engineers with psychologists. This guarantees the best results when, by combining the research work of engineers, physiologists, psychologists, and hygienists on human labor issues, the best methods for its organization can be found.

Looking at the entirety of work in the field of scientific organization, it must be stated that these works have been developing rapidly in Poland in recent years. This was particularly highlighted during the 2nd Polish Congress of Scientific Organization in the first days of May 1928.

80 papers were presented at this Congress, most of which are reports on very successful applications in various branches of manufacturing work, and over 1000 participants are clear evidence not only of a significant achievement but also of great interest from broad social layers.

As for practical applications, it should be noted that a remarkable achievement is already noticeable in the metal industry in the manufacturing of machine tools, steam engines, and wagons, in the mining, chemical, sugar, and railway repair workshops industries.

A particularly noteworthy fact is that in most of these applications, Polish organizers start with the principle of harmonization, using the graphical method I mentioned earlier. This not only demonstrates that the achievements of Polish thought have finally found understanding in their own country, but also that Polish organizers are on the right track when significant results cannot be achieved in organization by starting with perfecting details without properly harmonizing the whole.

In conclusion, it should be stated that although the development of scientific organization in Poland has recently encountered significant obstacles and the initiative of relatively few individuals did not find support, these obstacles are now rapidly disappearing, and progress in this field is developing so quickly that undoubtedly, in the near future, Poland will be at the forefront of civilized nations in this respect.

Today, we can be sure that we will not retreat or stand still but move forward at an accelerated pace when not only society begins to realize the great power of efficient work, but the government strongly supports the development of scientific organization and takes the initiative in improving its administrative apparatus.

However, to ultimately consolidate this movement and achieve the far-reaching civilizational benefits for the entire nation that organization science can provide, we must take the next step which this science indicates, namely, that these benefits cannot be fully achieved until employers, workers, and consumers understand that there is no conflict in their interests and that the path to prosperity for the entire nation leads through cooperation, not struggle. Taylor was not utopian, claiming that there can be no scientific organization and no prosperity without such a revolution in the mentality of employers and workers, as his words have already been proven true in the United States.

Taylor, in stating this great truth, argued that the American nation would soon understand it, as it has more than enough common sense. Today, we see that he was not mistaken in this regard. So, to take this next step, we must rely on common sense. But do we have it in sufficient measure? I think so, and I even believe that it will prevail in the near future.

PRZEGLĄD ORGANIZACJI
MIESIĘCZNIK POŚWIĘCONY SPRAWOM ORGANIZACJI I ADMINISTRACJI ŻYCIA GOSPODARCZEGO
ORGAN INSTYTUTU NAUKOWEJ ORGANIZACJI
ROK III WARSZAWA, CZERWIEC 1928 Nr 6

II^{GI} POLSKI ZJAZD NAUKOWEJ ORGANIZACJI.

4 — 6 MAJ 1928.

Deuxième Congrès Polonais d'Organisation Scientifique.

Z INICJATYWY Polskiego Komitetu Naukowej Organizacji, w dniach 4, 5 i 6 maja r. b. odbył się w Warszawie II Polski Zjazd Naukowej Organizacji (I Zjazd odbył się w grudniu 1924 roku).

Jak już pisaliśmy, Zjazd obecny miał na celu ujawnienie postępów już dokonanych w Polsce na polu naukowej organizacji, skoordynowanie wysiłków, zmierzających do usprawnienia poszczególnych dziedzin naszego życia gospodarczego oraz zakreślenie wytycznych na przyszłość. Zjazd ten był więc jak gdyby stwierdzeniem stanu faktycznego, a zarazem obliczeniem się z siłami przed rozpoczęciem dalszej pracy na drodze podniesienia naszej sprawności gospodarczej i utrwalenia naszej młodej państwowości.

Na Zjazd przybyło z różnych krańców Polski zgórą 1100 uczestników, reprezentujących świat naukowy, instytucje rządowe i komunalne, przemysł, handel i finanse. Przybyło również szereg gości z zagranicy, a mianowicie: p. Harrington Emerson, znany u nas autor dzieła „Dwanaście zasad wydajności", inż. Wallace Clark, znany organizator przemysłu, prof. F. Mauro z Medjolanu, prezes Międzynarodowego Komitetu Naukowej Organizacji, prof. Mario Fossati, założyciel „Instytutu Fossati" w Turynie, dr. E. Zimmler, prezes Massarykowej Akademji Pracy, prof. F. Hasa, dr. J. Stocky, dr. Nahunek z Pragi Czeskiej, p. Paul Devinat, dyrektor Międzynarodowego Instytutu Naukowej Organizacji, prof. Cr. G. Stratilescu, prezes Rumuńskiego Komitetu Naukowej Organizacji. Prof. H. Le Chateli r miał również być naszym gościem, niestety jednak okoliczności rodzinne zmusiły go do odwołania w ostatniej chwili swego przyjazdu. Pani F. W. Taylor również musiała przed końcem kwietnia powrócić do Stanów Zjednoczonych i nie mogła przybyć na Zjazd.

Powitanie Inż. Harringtona Emersona (New York) w dniu 1 maja r. b. na lotnisku w Mokotowie.

Prace Zjazdu podzielone były na sześć sekcyj, a mianowicie:

1. organizacja w warsztatach mechanicznych,
2. różne zastosowania w przemyśle,
3. psychotechnika i szkolnictwo,
4. organizacja w urzędach i biurowości,
5. organizacja w rolnictwie,
6. organizacja w gospodarstwie domowem.

Na Zjazd przedstawiono ogółem zgórą 80 referatów, z tej liczby 8 przedstawili goście z zagranicy. Głębokie ujęcie poruszanych zagadnień świadczy o dużem zrozumieniu istoty i techniki organizacji.

Plenarne posiedzenie otwarcia odbyło się dnia 4 maja w Radzie Miejskiej, przy szczelnie wypełnionej sali. Przemówienie powitalne

Solemn meeting of the members of the Institute of Scientific Organization (May 4, 1928)

Organization Review [*Przegląd Organizacji*], 1928, Issue 3, No. 6, pp. 158-160

Plenarne posiedzenie otwarcia II-go Polskiego Zjazdu Naukowej Organizacji. dn. 4-go maja r. b. w Sali Rady Miejskiej w Warszawie.

Forward to the English edition:
This gathering, held at the premises of the Institute of Scientific Organization in Warsaw, marked a significant milestone: the 25th anniversary of Frederick Taylor's seminal work, "Shop Management". This event brought together eminent figures in the field of scientific management, including Henry Le Chatelier, Harrington Emerson, and Henry "Wallace" Clark.

During this meeting, the spotlight shone on Professor Adamiecki, particularly his pioneering work on the harmonization method. His contributions were seen as parallel in significance to Taylor's. Although it was suggested that wider recognition would have been achieved had his work been published in America, the late 1920s nonetheless saw growing appreciation for Adamiecki's work beyond his home country. This sentiment is echoed in the October, 1927 issue of the Bulletin of the Taylor Society, which stated: "Professor Adamiecki of Poland, whose research along similar lines was contemporaneous with that of Mr. Taylor, the tragedy being that at a time when neither had any intellectual companionship in their pioneer work, they were not in touch with each other personally."

Opening Remarks:

On May 4, in the premises of the Scientific Organization Institute, a solemn meeting of its members took place, dedicated to the 25th anniversary of the publication of the first fundamental work by F.W. Taylor, *Shop Management*.

At this meeting, foreign members of the Institute and foreign guests were present, who came to the Second Congress of Polish Scientific Organization, including: engineer H. Emerson, a well-known researcher in the field of scientific organization, author of the work *12 Principles of Efficiency;* Prof. Francesco Mauro, president of the International Committee of Scientific Organization (CIOS); Dr. E. Zimmler, president of the Masaryk Academy of Labor; Prof. Hasa, president of the Czech Committee of Scientific Organization; engineer [Henry Wallace] Clark, a prominent advisory engineer, working for several months in Poland on the organization of our manufacturing plants; Mr. Devinât, director of the International Institute in Geneva; Dr. Landauer, secretary general of the International Committee of Scientific Organization; Messrs. Nahunek and Stocki - from Czechoslovakia; Prof. Fossati - from Italy.

The President of the Republic, Prof. Ignacy Mościcki, honored the meeting with his presence and was elected an honorary member of the Institute.

Our government was represented by Mr. Minister of Agriculture Niezabytowski and Minister of Agricultural Reforms Prof. W. Staniewicz.

Opening Speech by Karol Adamiecki:

Prof. Adamiecki, Director of the Institute of Scientific Organization, opened the meeting with the following speech:

Opening today's solemn assembly, I must first announce that at the last meeting of the Institute, the following were elected as honorary members:

Professor Ignacy Mościcki
and Professor Henry Le Chatelier.

I confirm with the utmost joy that both have accepted this choice.

I do not need to emphasize how happy we are that these two famous people have decided to join our organization. Through their participation, they have clearly accentuated the authority of our Institute before the whole world. They are united with us by their great love for science and boundless dedication to the country and all mankind.

I have a strong faith that these ideas will always guide our institution, as a compass for all our activities.

I have the honor to welcome Mr. President and thank him for graciously honoring today's meeting with his presence, thereby endorsing our work.

I welcome you, Gentlemen, our distinguished guests, and especially those among our friends who have come from abroad to take part in this meeting.

Sir, Mr. Harrington Emerson, promoter of the idea of efficient work, contemporary of Taylor, tireless propagator of the ideas of cooperation and harmony - whose magnificent work *12*

Principles of Efficiency is well known in Poland and has indeed been one of the impulses influencing the minds of our society towards the study of scientific organization principles. I am even happier to see Mr. Emerson among us, as, despite his age, has decided to come to Warsaw by plane, thus personally demonstrating his sympathy for our nation.

I welcome Mr. Francesco Mauro, a wise and energetic activist, who managed to unite all the pioneers of scientific organization in such a short time on an international level, and who created the International Committee of Scientific Management [Comité International de l'Organisation Scientifique (CIOS)], taking its lead.

Dr. Eng. Zimmler, one of the founders of the Masaryk Academy of Labor, its current president, who, with youthful energy, develops the activities of this important institution for civilization, while tirelessly propagating the idea of bringing Slavic nations closer together in the field of efficient work.

Sir, Professor Hasa, educator of many Polish engineers.

I welcome our Czech friends, Mr. Stocki and Nahunek, Professor Stratilescu, promoter of scientific organization in Romania.

Professor Fossati, a collaborator of Prof. Mauro in promoting scientific organization in Italy.

Mr. Devinât, director of the International Institute of Scientific Organization in Geneva.

Dr. Landauer, representative of the heroic Belgian nation, secretary general of the International Committee.

Finally, I welcome Mr. Wallace Clark, who is working with us to introduce American methods to Polish industry.

I now propose Mr. Mauro as the chairman of our meeting, Mr. Zimmler, Mr. Emerson, and Mr. Drzewiecki as vice-chairmen, and Mr. Śmigielski as secretary.

After the presidium was constituted, Prof. F. Mauro took the floor.

Opening the meeting with a speech, addressing the President of the Republic, he stated that his presence confirmed that scientific organization is indeed a science, and that the development of these ideas, which guide everyone present, places people on certain heights, and that the work being done aims to raise the well-being of all humanity.

After Prof. Mauro finished his speech, Prof. Adamiecki spoke again:

Mr. President, Gentlemen,

When we created our Institute of Scientific Organization three years ago, we did not even dream that the ideas we were to promote would be accepted so quickly.

We never thought that we would find so many friends among the most distinguished people in the world in such a short time.

Reality has exceeded all our wishes.

This fact is so striking that it raises the question of how we achieved this? Why does our institution – located in one room in the second courtyard – now attract universal attention and interest the intellectual circles of our nation? Why does it now find proper understanding everywhere, and why does it have so many distinguished foreign friends who have gone to so much trouble to come to Warsaw to express their solidarity with our ideas?

Every phenomenon always has many causes, and probably in this case, there will be many that explain this fact. In any case, there is one of the most important, and in my opinion, so important that it immediately catches the eye. I am sure that all of you, Gentlemen, will agree with me if I say that this cause is the great idea that unites us all, the path for which we dedicate our time and energy.

It is the great idea of Taylor, his creative mind, which enlightens us and reveals new distant horizons of progress and well-being for all humanity.

This understanding made all of you, pioneers of Taylor's ideas, become our friends right away, despite the distance between countries, and gave us the opportunity to propagate these ideas in our country.

The strength of his intellect has facilitated such a rapid resonance with our appeal, both amongst us and you.

Finally, this mind is the reason you came to Warsaw today, driven by an invisible force, like soldiers to a bugle call, to pay tribute to the memory of this great American engineer. Today marks 25 years since Taylor presented his ideas at the American Society of Mechanical Engineers, ideas that became the foundation of the science of organization.

So, the present meeting is not coincidental but is a fact that we must manifest with a visible action.

On my part, I allow myself to propose the following on behalf of the Institute's Council:

Our Institute was founded three years ago. Its activities were initially so modest that we could not think about the possibility of celebrating the opening of the Institute. Having now published a series of works, we assume that today we have some basis for formally confirming the opening of this institution, and at the same time, to document it permanently, we wish to connect it with Taylor's idea.

If you accept my proposal, I ask you to sign this book on behalf of the Institute under the following resolution:

Solemn meeting of the members of the Institute of Scientific Organization and invited guests from abroad on May 4th, in the premises of the Institute.

Gathered on May 4, 1928, at the solemn session of the members of the Institute of Scientific Organization in Warsaw, recognizing the importance of the ideas of Frederick Winslow Taylor, which opened new distant horizons for the development of economic life for the benefit of all humanity and on the occasion of the 25th anniversary of F. Taylor's announcement of his fundamental work on scientific organization, "Shop Management," they resolved:

- To publish in Polish his second work: "The Principles of Scientific Management."
- To hang Taylor's portrait in the Institute's premises.
- To send expressions of respect in Taylor's name to the Taylor Society and Mrs. Taylor.

Engineer P. Drzewiecki [President of the Warsaw Technicians Association] Remarks:

Mr. President, gentlemen.

Having the good fortune to speak on this festive day, I must emphasize that today's celebration would be incomplete if we limited ourselves to honoring Taylor's memory.

For laying the foundations of the science of organization, Henry Le Chatelier's merits are as great as Taylor's. Taylor laid the stones for the foundation, which still needed to be bonded with cement to form a durable and cohesive whole. It was Henry Le Chatelier who completed this work, translating Taylor's ideas into scientific language in such a clear and beautiful way that only in his approach did the fundamental ideas of scientific organization and the great and distant perspectives that this new science opens become apparent.

I will briefly quote from Professor Le Chatelier:

> *When I carefully studied Taylor's work 'Shop Management,' I became convinced that it was a brilliant application of the scientific method to industrial problems.*
>
> *My effort has always been to popularize the application of science in industry - although I did not know how far it could reach, I did not even suspect the possibility of extending it far beyond the technical field and the possibility of applying it to the problems of work organization, trade, etc.*
>
> *So I was somewhat embarrassed when I realized that the science of this 'practical' man reaches much higher than my own, and from that moment on, wanting to remain faithful to the program I had outlined for myself, I felt compelled to become an apostle of Taylor's system.*

These words fully explain Henry Le Chatelier's attitude towards scientific organization. After several years of this apostolic mission, it must be acknowledged that he fulfilled it with such dedication and genius that today one cannot speak of Taylor without having in mind Henry Le Chatelier, as the second creator of this science, who consolidated and unified it with his genius. He deserves no less tribute and gratitude than the unforgettable great American engineer.

Today's celebration would be incomplete if I did not mention another great pioneer of scientific organization, whose 25th anniversary falls this year.

Indeed, this year marks the 25th anniversary of the publication of Professor K. Adamiecki's work titled *Harmonization*.

The fame of Professor Adamiecki, as the creator of the harmonization method, which has found such great application in scientific organization, is no less significant than Taylor's work, and as one of the well-known people from abroad told me, if Professor Adamiecki had published his work in America, his name would be as famous today as Taylor's name is currently.

To honor the merits of Professor Adamiecki, members of the Institute decided to present him with an address, which we ask those present here to sign.

The words spoken by Mr. Drzewiecki concerning Professor Adamiecki received a warm reception from those present.

The session was then closed, and everyone present signed the commemorative book of the Institute.

The meeting room was decorated with flags of the countries whose representatives came to the Congress, and the portraits of the President of the Republic, F.W. Taylor, and Prof. H. Le Chatelier, hanging against the background of their national flags, added solemnity to the occasion.

After the session ended, President Mościcki visited the premises of the Institute, wishing further persistent work for the benefit of the entire country.

This celebration was indeed a grand celebration for the Institute.

ski Witold — dyr. Państw. Wytw. Uzb.; Zagleniczny Jan — senator, w.-prezes Zw. Przem. Cukr.; gen. Zarzycki Ferdynand — zast. szefa Adm. Armji; Zaremba Erazm — dyr. Polsk. Inst. Adm.

KOMITET WYKONAWCZY.

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inż. S. Twardo — wojewoda warszawski
inż. Wagner — nacz. Wydz. Min. Kom.
inż J. Wojciechowski — kier. Zakł. Psychotechn. przy Minister. Komunikacji.

(—) *Prof. Karol Adamiecki*
Przewodniczący Polskiego Komitetu Naukowej Organizacji

(—) *Inż. Jan Śmigielski*
Generalny Sekretarz Komitetu Wykonawczego

(—) *Prof. Edwin Hauswald*
Prezes Komitetu Wykonawczego

Prace Zjazdu podzielone były na sześć sekcyj, a mianowicie:

1. Organizacja w warsztatach mechanicznych,
2. Różne zastosowania w przemyśle.
3. Psychotechnika i szkolnictwo,
4. Organizacja w urzędach i biurowości,
5. Organizacja w rolnictwie,
6. Organizacja w gospodarstwie domowem.

Na Zjazd przedstawiono ogółem zgórą 80 referatów, z tej liczby 8 przedstawili goście z zagranicy. Głębokie ujęcie poruszanych zagadnień świadczy o dużem zrozumieniu istoty i techniki organizacji.

Plenarne posiedzenie otwarcia odbyło się dnia 4 maja w Radzie Miejskiej, przy szczelnie wypełnionej sali. Przemówienie powitalne wygłosił prezes Polskiego Komitetu Naukowej Organizacji, prof. Karol Adamiecki.

PRZEMÓWIENIE PREZESA PROF. K. ADAMIECKIEGO.

Discours du prof. K. Adamiecki.

Panowie Ministrowie, Wasze Ekselencje, Panie i Panowie!

Przemawiając w imieniu Polskiego Komitetu Naukowej Organizacji, który zwołał ten zjazd, mama zaszczyt powitać wszystkich tu zebranych dostojnych gości. Witam Panów Ministrów, Przedstawicieli Rządu, Panów Posłów Zagranicznych, witam szczególnie serdecznie wszystkich naszych drogich gości zagranicznych, którzy nie szczędzili trudu, ażeby przybyć na nasz Zjazd i jeszcze raz dać dowód swej przyjaźni dla naszego narodu, (Oklaski) jak również zamanifestować swoją solidarność z nami w propagowaniu wielkich idei, zawartych w nauce organizacji.

Z pośród naszych zagranicznych gości witam gorąco najstarszego pioniera wydajnej pracy pana Harringtona Emersona (Oklaski). Witam go jako przedstawiciela sławnego narodu amerykańskiego i wszystkich naszych przyjaciół Amerykanów tu nieobecnych. Witam go tem serdeczniej, że otrzymawszy nasze zaproszenie nie zawahał się ani na chwilę, i pomimo swego podeszłego wieku przybył na skrzydłach aeroplanu by nam wykazać swą życzliwość do pracy wydajnej! (Oklaski).

Panie i Panowie! Trzy i pół lat temu odbył się w Warszawie Pierwszy Zjazd Naukowej Organizacji. Zjazd ten miał na celu pobudzenie naszego społeczeństwa do zainteresowania się naukową organizacją i do zastosowania jej metod w naszem życiu gospodarczem. Chodziło również o skoordynowanie rozpoczętych już w owym czasie prac na tem polu, prac być może jeszcze nielicznych i skromnych, ale pozwalających mieć nadzieję, że przy wspólnym zbiorowym wysiłku będzie można osiągnąć poważne wyniki w podniesieniu wydajności pracy na wszystkich polach naszego życia gospodarczego i narodowego.

Zjazd obecny przedewszystkiem ma na celu zrobienie bilansu z wyników, które osiągnęliśmy w ciągu tych trzech i pół lat, a następnie postawienie wytycznych na następny okres.

Co się tyczy pierwszego celu, to, mając sposobność ciągłego śledzenia tego ruchu muszę tu stwierdzić, że wyniki są już poważne.

O ile przed trzema laty widać było zaledwie pierwsze przebłyski ruchu naukowej organizacji w naszym kraju, to jednak ziarna rzucone na poprzednim Zjeździe padły widocznie na do-

Speech of the President Prof. K. Adamiecki, Polish Committee of Scientific Organization (May 4th, 1928)

Organization Review [*Przegląd Organizacji*], 1929, Issue 8, pp. 8-9

The Congress work was divided into six sections, namely:

- Organization in mechanical workshops,
- Various applications in industry,
- Psychotechnics and education,
- Organization in offices and paperwork,
- Organization in agriculture,
- Organization in household management.

In total, about 80 papers were presented at the Congress, with 8 of them presented by foreign guests. The profound approach to the discussed issues demonstrates a great understanding of the essence and techniques of organization.

The opening plenary session took place on May 4th in the City Council, with a fully occupied hall. The welcoming speech was delivered by the President of the Polish Institute of Scientific Organization, Prof. Karol Adamiecki.

Speech by President Prof. K. Adamiecki

Honorable Ministers, Your Excellencies, Ladies and Gentlemen!

Speaking on behalf of the Polish Committee of Scientific Organization, which convened this congress, I have the honor to welcome all the distinguished guests gathered here. I welcome the Honorable Ministers, Government Representatives, Foreign Delegates, and especially warmly all our dear foreign guests, who have spared no effort to attend our Congress and once again prove their friendship for our nation (Applause), as well as to demonstrate their solidarity with us in promoting the great ideas contained in the science of organization.

Among our foreign guests, I warmly welcome the oldest pioneer of efficient work, Mr. Harrington Emerson (Applause). We welcome him as a representative of the famous American nation and all our American friends who are not present here. We welcome him even more warmly, because upon receiving our invitation, he did not hesitate for a moment, and despite his advanced age, he came on the wings of an airplane to show his goodwill towards efficient work! (Applause).

Ladies and Gentlemen! Three and a half years ago, the First Congress of Scientific Organization took place in Warsaw. The aim of this Congress was to stimulate our society to take an interest in scientific organization and to apply its methods in our economic life. It was also about coordinating the work already started at that time in this field, work that may still be few and modest, but allowing us to hope that with a common collective effort, significant results can be achieved in increasing the efficiency of work in all areas of our economic and national life.

The main purpose of the current Congress is to take stock of the results we have achieved during these three and a half years and then set guidelines for the next period.

As for the first goal, having the opportunity to continuously monitor this movement, I must state here that the results are already significant.

Three years ago, we could only see the first glimpses of the scientific organization movement in our country, but the seeds sown at the previous Congress have evidently fallen on fertile ground, as they have now grown strong and are expanding more and more luxuriantly.

I do not need to prove that this is indeed the case, as from the numerous papers presented at the Congress, you will see for yourselves that the methods of scientific organization have already reached many aspects of our productive work and have brought very outstanding results in some cases.

Next, it should be noted that during the last three years, there has been a significant consolidation of efforts, as the Polish Institute of Scientific Organization was established, which brings together 11 institutions representing industry, agriculture, technical associations, psychotechnics, state administration, etc. In addition to community outreach, our Institute is also actively involved in the International Committee of Scientific Organization [CIOS], which currently unites almost all countries and has the task of exchanging ideas and stimulating efficient work in all countries.

I must emphasize with that this exchange of ideas plays a significant role in the movement currently taking place in our country in the field of scientific organization development. We have established numerous foreign relations and gained many very close friends who do not spare us words of encouragement and provide us with all the information we need.

Regarding the achieved results in the field of applying the methods of scientific organization, I must finally state that when compared to the progress made by other nations, Poland, although almost at the very end three years ago, is now close to the front lines.

However, despite these favorable results, we must remember that this is only the first small step on the path of progress. We must remember that progress in work efficiency, based on scientific methods, has no limits and is achieved gradually, by striving in stages for ever more distant and perfect models, established on the basis of a series of increasingly precise scientific analyses.

In this gradual approach to perfection, the scientific analysis of each production process, even if we believe it to be perfect and complete, always reveals new laws that give us the key to new further improvements.

Based on this principle and acknowledging the tangible results we have achieved thus far, we must seek new guidelines for further progress, and we must set ourselves a higher and more perfect model than the one we are already approaching.

If during the current Congress, guidelines for a new ideal model are proposed, which will stimulate our work on developing scientific organization with increasing enthusiasm, then the goal of our Congress will be fully achieved.

Wishing all participants success in their work and opening this Congress, I allow myself, on behalf of the Polish Committee of Scientific Organization, to propose to the Honorable Assembly to elect Professor Edwin Hauswald from Lviv as the President of the Congress and Engineer Jan Śmigielski from Warsaw as the main Secretary. (Applause).

After the election of Prof. E. Hauswald from Lviv as the chairman, the Congress was welcomed on behalf of the Government by Minister of Agriculture [Karol] Niezabytowski.

państwowej. Po wykładach słuchacze złożyli prace w postaci referatów na kilka zadanych tematów. Prace te miały na celu sprawdzenie stopnia opanowania przez słuchaczów tej nowej dziedziny wiedzy, jaką jest niewątpliwie racjonalna organizacja.

Wykłady prowadził inż. Jan Śmigielski, członek Instytutu Naukowej Organizacji.

PROTOKUŁ Z I-EGO ZEBRANIA SEKCJI CHEMICZNEJ PRZY INSTYTUCIE NAUKOWEJ ORGANIZACJI W WARSZAWIE

DNIA 4 GRUDNIA 1928 R.

Zebranie Sekcji rozpoczęło się w lokalu Instytutu Naukowej Organizacji, Mokotowska 51/53 o godzinie 6,30.

Obecnych 9 osób mianowicie: dyr. E. Trepka, dyr. Cz. Knoff, prof. K. Adamiecki, inż. Bornstein, inż. A. Vielrose, inż. Jan Wierusz-Kowalski, inż. J. Milewski, dyr. J. Pietruszyński, dyr. W. Holtorf.

Posiedzenie zagaił prof. Adamiecki, który po przywitaniu obecnych zaproponował inż. E. Trepkę, jako przewodniczącego Sekcji Przem. Chem. P. Trepka przyjmuje ten mandat prowizorycznie, stwierdzając swą niekompetencję i brak czasu. Na sekretarza generalnego powołano p. inż. J. Wierusz-Kowalskiego.

I. Dyskusja, dotycząca programu przyszłych prac Sekcji, ujawniła jednomyślność zebranych, którzy zdecydowali, że praca ma się odbywać w ścisłej koordynacji z Instytutem. Główny nacisk będzie położony na zebrania odczytowe i dyskusyjne Sekcji. Poza tem będą urządzane zebrania dyskusyjno-odczytowe na większą skalę, bądź w Polskiem Towarzystwie Chemicznem, bądź w Instytucie dla jego członków. Równolegle Sekcja będzie rozwijała działalność publicystyczną, przesyłając sprawozdania i referaty do „Przeglądu Organizacji". Wreszcie, Sekcja przyjmować będzie udział w Kongresach. Przewidywane jest również rozsyłanie odpowiednich ankiet do przedsiębiorstw chemicznych.

2. Postanowiono, że Sekcja Chem. będzie się starała przyjąć udział w pracach przygotowawczych w związku z mającym się odbyć w Paryżu IV-tym Kongresem Międzynarodowym Nauk. Org. (czerwiec, 1929 r.). Ponieważ na Polskę przypada kontyngent 12 referatów, więc prof. Adamiecki zawiadamia, że 1 — 2 referatów powinno przypaść tematom z dziedziny przemysłu chemicznego. Prof. Adamiecki prosi zebranych o zastanowienie się nad powyższym faktem i ewentualnie jak najśpieszniejsze zgłoszenie odpowiedniego referatu, gdyż termin składania ich upływa już 20 stycznia 1929 r. Będzie utworzony Komitet Kwalifikacyjny referatów i wyłonienie delegacji do Paryża.

W związku ze sprawą Kongresu paryskiego wpłynął na posiedzenie Sekcji list p. inż. Michała Bornsteina, skierowany do „Polskiego Komitetu Nauk. Org.", w którym komunikuje, że gotów jest złożyć referat na Kongres p. t. „O naukowej organizacji w przemyśle chemicznym w Polsce" i prosi o zawiadomienie go, czy Komitet zgodzi się na jego udział w Kongresie. Ze względu na bliski koniec terminu zgłaszania referatów — prosi o pośpieszne załatwienie tej sprawy. Polski Komitet Nauk. Org. list ten skierował do Sekcji Przemysłu Chemicznego.

Punkt 3 porządku dziennego obejmował referat p. inż. Wierusz-Kowalskiego p. t. „O zastosowaniu wykresów Gantta w przemyśle chemicznym". Referent po krótkiem przypomnieniu zasady i techniki kreślenia tych wykresów, podał przykład zastosowania ich do względnie skomplikowanej produkcji aldehydu mrówkowego sposobem ciągłym. Dzięki stosowaniu wykresów Gantta dla czasu biegu aparatu wydajności dobowej i zużycia surowca, co jest możliwe przy codziennem zestawianiu bilansu produktów przejściowych, osiągnięto przejrzystość produkcji i możność ingerowania codziennego na bieg fabrykacji.

Po referacie wywiązała się dość obszerna dyskusja, w której kolejno kilkakrotnie zabierali głos prof. Adamiecki, dyr. Trepka, inż. Bornstein, dyr. Holtorf i sam prelegent. Zdania co do znaczenia i dogodności wykresów Gantta dla przemysłu chemicznego były podzielone; wreszcie prof. Adamiecki w dłuższem przemówieniu wykazywał ich zalety i psychologiczne znaczenie.

Na zakończenie postanowiono poświęcić sprawie tych wykresów jeszcze jedno dyskusyjne posiedzenie Sekcji ze względu na doniosłość sprawy, różnicę zdań i zainteresowanie się obecnych tym tematem.

POLSKI KOMITET NAUKOWEJ ORGANIZACJI

IV MIĘDZYNARODOWY KONGRES NAUK. ORG. W PARYŻU 1929.

CYRKULARZ NR 1.

Działając z ramienia Międzynarodowego Komitetu Naukowej Organizacji Polski Komitet Nauk. Org. podaje do ogólnej wiadomości, że IV Międzynarodowy Kongres Naukowej Organizacji odbędzie się w Paryżu w dniach 19 — 23 czerwca 1929 roku.

Komitet Honorowy: Przewodniczącym Kongresu obrany został p. A. Tardieu, minister robót publicznych. Protektorat nad Kongresem objęli p. G. Doumerge, prezydent republiki francuskiej, jako przewodniczący Komitetu Honorowego oraz p. R. Poincaré, prezes rady ministrów.

Komitet Protektoratu Nauki. Utworzono również specjalny Komitet, składający się z wybitnych sił naukowych. Przewodniczącym tego Komitetu jest Prof. Henry Le Chatelier, Generalny Inspektor Górnictwa, Członek Instytutu.

Komitet Organizacyjny. W skład Komitetu Organizacyjnego wchodzą: Francuski Komitet Nauk. Org., który zajmuje się organizacją Kongresu, Komitet Międzynarodowy Naukowej Organizacji, Międzynarodowy Instytut Naukowej Organizacji, Komitety Narodowe poszczególnych krajów, większe ugrupowania naukowe, przemysłowe, handlowe, rolnicze i t. p.

Komitet Wykonawczy — składa się z pp. A. Tardieu, przewodniczącego Kongresu, M. Fould, Komisarza Generalnego, R. Satet, Sekretarza Generalnego (administracja i propaganda), M. Ponthiere, Referenta Generalnego (ocena i klasyfikacja referatów) oraz z szeregu Sekretarzy poszczególnych Sekcyj.

IV International Congress of Scientific Organization in Paris 1929 (Announcement)

Circular No. 1. Organization Review (*Przeglad Organizacj*): Dept. of the Institute of Scientific Organization, January, 1929, Issue 4, No. 1, pp. 32-33; see also Organization of the Household, 1928, No. 11

Karol Adamiecki:
Acting on behalf of the International Committee of Scientific Organization (CIOS), the Polish Scientific Committee announces to the general public that the IV International Congress of Scientific Organization will take place in Paris on June 19-23, 1929.

Honorary Committee: Mr. A. Tardieu, Minister of Public Works [and soon-to-be elected Prime Minister of France], was elected as the Chairman of the Congress. The project of the Congress is supported by Mr. G. Doumergue, President of the French Republic, as the Chairman of the Honorary Committee, and Mr. R. Poincaré, Prime Minister.

Committee for the Protection of Science: A special committee has been created. The Chairman of this Committee is Prof. Henry Le Chatelier, General Inspector of Mining, Member of the Institute.

Organizing Committee: The Organizing Committee includes the French Committee of Scientific Organization, which is responsible for organizing the Congress, the International Committee of Scientific Organization [CIOS], the International Institute of Scientific Organization, the National Committees of individual countries, major scientific associations, professional, trade, agricultural, and other organizations.

Executive Committee: The members are Mr. A. Tardieu, Chairman of the Congress, M. Fould, General Counsel, R. Satet, General Secretary (administration and propaganda), M. Polthiere, General Referee (evaluation and classification of reports), and the secretaries of the various Sections. The Committee is composed of distinguished scientific figures.

Reports: The priority for accepting reports will be given to those containing concrete applications of organizational methods already implemented in practice, rather than general principles known to everyone. Accepted reports will be printed and distributed to participants six weeks before the Congress, so they can prepare in advance for potential participation in discussions. Reports should be presented in French, English, or German, in two copies. A report should not exceed 10 pages of typewritten text (normal format, i.e., 210 x 297 mm - 30 lines per page). The author should attach a summary (15-20 lines) in French, English, and German (also in two copies). All drawings and tables should be made in dimensions established by the Polish Committee for Standardization (Technical drawing. Paper format. o-501) on durable white paper - in ink. Photographs should be of such quality that there is no need for retouching when making zincographic plates.

Congress Dates: The ceremonial opening session will take place on June 19, 1929. On June 20, 21, and 22, the Sections will work during normal hours, and the most distinguished representatives of individual countries will present their reports during afternoon hours. Scientific films will be screened during evening hours. The ceremonial closing session of the Congress will take place on Saturday, June 22, or in the morning of June 23. After the Congress, there will be a series of excursions to the most important industrial centers and manufacturing plants in France.

Division of Congressional Work: The Congress will be divided into six Sections, namely: 1) Industrial Section (production), 2) Agricultural Section (production), 3) Trade Section (exchange and transport), 4) State and Private Administration Section, 5) Household Management Section, 6) General Section. Each Section may be divided into sub-sections that will deal with specific issues in their respective fields. For example, the Industrial Section will be divided into several sub-sections: manufacturing, operating costs, and human resources. Authors will not present their reports but will only be able to express the main ideas contained in the reports during five-minute speeches, followed by answering questions and criticism. Each participant may speak during the Section's discussions on reports.

In connection with the decision to circulate reports before the Congress begins, the deadline for submitting reports in Warsaw has been set for April 20. Therefore, those wishing to submit a report for the Congress should send it as soon as possible, along with a brief summary, drawings, and diagrams to the Polish Committee of Scientific Organization in Warsaw, Mokotowska 51/53 (tel. 38-13). Since speaking time during the sessions will be limited to a minimum, participants are asked to illustrate their reports as much as possible with diagrams, graphics, and drawings that can be displayed in the conference halls.

A bronze medal, donated by the International Committee of Scientific Organization, will be awarded for the best report.

Conditions of participation: The entry fee has been set at 125 French francs for private individuals and 500 French francs for companies and institutions. Families of participants can attend the Congress by paying an entry fee of 60 French francs per person. The Polish Committee of Scientific Organization in Warsaw, Mokotowska 51/53, accepts payments. PKO account no. 16699.

People who wish to participate in the Congress are asked to send their applications to the Secretariat of the Polish Committee of Scientific Organization in Warsaw, Mokotowska Street 51/53, (tel. 38-13). Participant cards will be issued to those who register immediately after the confirmation from Paris.

Chairman of the Polish Committee of Scientific Organization
Prof. K. Adamiecki.

Notes on Papers: Since indicating specific issues that, when discussed at the international level, may contribute to the coordination of efforts and significant progress in the development of organizational science, the Organizing Committee of the Congress has decided to draw the special attention of all those who intend to submit papers to the following most relevant issues, as a guideline for topic selection.

Section I – Industry

Subsection 1. - Manufacturing:
Standardization:

- Examples of manufacturing individual parts, finished products, tools, and machine tools, simplification as a result of standardization. Waste elimination, cost of reorganization, and its results. Centralization and harmonization of standardization in a given country. The role of the International Institute of Standardization.

Time study:

- How to determine, record, and classify time study data in relation to its subsequent use in the same factory or in others.
- How different companies use time study data obtained by one of them to avoid the cost of duplicating the same research.
- The need to establish an International Office that would centralize time study data collected by individual countries. Can this task be entrusted to the International Institute of Scientific Organization in Geneva?

Organization Office:

- its activity (allocated time, calculation of actual time, performance bonuses) and the Office of Work Organization in the case of:
  a) serial production,
  b) individual production,
  c) maintenance and improvement of tools.

Subsection 2. Industrial accounting.

- Analysis of indirect costs and its impact on reducing operating costs.
- Industrial accounting and general accounting. How to select workers in serial production:
- selecting workers and assigning them to appropriate work,
- developing workers' ability for precise work and efficiency through the application of appropriate learning methods.

Section II – Agriculture

Subsection 1. - Production.

- Methods of labor division allowing for the stabilization of workers.
- Rational manual tools.

Subsection 2. - Agricultural accounting.

- Accounting in peasant farms and especially in those farms that do not have professional accountants.

Subsection 3. - Human factor.

- Psychological and vocational considerations that guide vocational counseling in directing individual workers to work in agriculture.

Section III - Trade

Subsection 1. - Market research. Business cycle forecasting. Defining the tasks of salespeople.

Subsection 2. – Commercial accounting. Operating costs. Determining commercial costs.

Subsection 3. - Human factor.

a) Identification and classification of various professions known under the name "salesperson".
b) Examples of the application of psychotechnical methods for selecting salespeople.

Section IV - Administration

Subsection 1. - Administration of private enterprises.

- Examples of the application of H. Fayol's administrative method. Papers will be grouped according to the basic divisions of this method, namely, forecasting, organization, command, coordination, control. Particular attention is drawn to forecasting and control.

Subsection 2. - State offices.

- Examples of increasing efficiency in offices. Offices for reorganization preparation.

Section V – Household Management

Subsection 1. - Home maintenance work.

- Dust: how it forms, how to avoid it, how to remove it.

Subsection 2. - Household accounting.

- Determining the operating costs of work in the household. Calculating the cost of work performed by people not on a permanent salary.

Subsection 3. - Human factor.

- Studying fatigue caused by work in the household.

Section VI – General Issues. Education. Outreach.

Subsection 1. - Terminology.

- Proposals and justifications for terms in the field of scientific organization.

Subsection 2. - Statistics.

- The possibility of organizing surveys and collecting statistics in different countries using standardized questionnaires, through which comparable conclusions can be drawn.

Subsection 3. - Education.

- Ways of introducing organizational science to all types of schools. Education and outreach using films.

z myślą, by ktoś potrafił lepiej poznać stan ich fabryki od nich samych.

Brak zdrowego rozsądku sprawia, że kierownik przedsiębiorstwa zamiast pogłębiać swą funkcję administratora, ima się spraw niewłaściwych, szkodząc tem wielce zakładowi. Znany mi jest wypadek, gdzie dyrektor fabryki miał się za urodzonego konstruktora maszyn, nie mając żadnych do tego kwalifikacyj. W innym wypadku zdolny skądinąd i energiczny kierownik nie dopuszczał z reguły asystentów swych i pomocników do głosu, odrzucając najbardziej rzeczowe ich uwagi lub rady. Możnaby wiele na ten temat powiedzieć, ale sprawy te należą raczej do psychologji, zajmującej w sprawach kierownictwa miejsce jedno z najwybitniejszych. Wielkie znaczenie przypisuje Emerson rzeczom takim, jak, między innemi, fachowa porada, którą kierownicy pogardzają często, uważając się za uniwersalnych specjalistów.

Co najciekawsze jednak, to, że osobnikowi zarażonemu mikrobem owym, który nazwałbym „baccilus industrialis", zdaje się, że jest urodzonym przemysłowcem, aczkolwiek brak mu elementarnego wykształcenia fachowego i jest w gruncie rzeczy dyletantem, nie mającym ani podstaw fachowych, ani praktyki odpowiedniej, na domiar złego zaś nie zwraca się do specjalistów, doprowadzając w ten sposób przedsiębiorstwo do ruiny. Dyletanci przemysłowi nie potrafią wyprowadzać nawet konsekwencyj ze swych niepowodzeń, kładąc je na karb braku szczęścia lub zbiegu niepomyślnych okoliczności.

Należy zwrócić uwagę, że i fachowcy nie na wiele się zdadzą, jeśli kierownik nie potrafi pracy ich odpowiednio skoordynować. Znałem fabrykę, którą stawiał pierwszorzędny budowniczy; był tam i doskonały elektryk i bardzo dobry hydraulik, ale nie było kierownika, któryby w sposób celowy potrafił wiedzę fachowców wykorzystać.

Ważną ponadto sprawą jest w kierownictwie dyscyplina, która bynajmniej nie wyklucza sprawiedliwego i uczciwego postępowania. Niesłychanie ważnemi czynnikami są jeszcze: codzienna kontrola i sprawozdania z działalności przemysłowej. Ileż to razy spotkać się można z faktem, że kierownicy nie wiedzą, co u nich się w fabryce dzieje, nie znają stanu interesów, nie wiedzą nawet, jakie mają roboty, o zyskach zaś zaledwie mgliste mają pojęcie. Nawet w przedsiębiorstwach wielkich istnieją sprawozdania roczne, zamiast miesięcznych, które jedynie mogłyby ujawniać anomalje przemysłowe. Każde, najmniejsze nawet przedsiębiorstwo musi być kontrolowane stale i dokładnie.

D. c. n.

NAUKOWA ORGANIZACJA CZY RACJONALIZACJA?

Organisation scientifique ou rationalisation?

Prof. KAROL ADAMIECKI.

POD WPŁYWEM różnych autorów i działaczy niemieckich na polu organizacji zaczął w ostatnich czasach wchodzić w życie wyraz *racjonalizacja* zamiast *naukowego zarządzania* (scientific management) lub *naukowej organizacji* (organisation scientifique). Podług zdania niektórych, słuszniej jest używać wyrazu racjonalizacja, z powodu, że obejmuje rzekomo szerzej zagadnienie osiągnięcia największego skutku użytecznego przy najmniejszym nakładzie środków wytwórczych.

Jakkolwiek istotnie sam wyraz racjonalizacja zawiera pojęcie ulepszenia lub udoskonalenia czegoś, natomiast w wyrazach naukowe zarządzanie i naukowa organizacja, pojęcie to tak wyraźnie nie występuje, jednakże nie jest to wystarczającym motywem, aby nazwy te zastąpić wyrazem racjonalizacja.

W ostatnich czasach spotyka się w różnych czasopismach, zwłaszcza niemieckich, artykuły, w których autorzy starają się wyjaśnić, co to jest racjonalizacja i co pod nią rozumieć należy. Trzeba jednak przyznać, że wszystkie te artykuły są wogóle dosyć mgliste i sprowadzają się ostatecznie do tautologji, w rodzaju „masło maślane".

Tymczasem, jeżeli chodzi o wyjaśnienie wyrazu racjonalizacja tym, którzy jego znaczenia nie rozumieją, to wystarczy powiedzieć poprostu, iż są to *wszelkie* sposoby, zmierzające do udoskonaleń we wszelkich dziedzinach, a więc i we wszystkich czynnościach oraz procesach gospodarczych.

Można więc powiedzieć, że racjonalizacją są wszystkie nauki techniczne i technologiczne, nauka organizacji, normalizacja i t. p., gdyż wszystkie one podają sposoby do osiągnięcia większego skutku użytecznego przy najmniejszym nakładzie energji, pracy, materjałów i innych środków wytwórczych.

Racjonalizacja jest pojęciem ogólnem i niema żadnego słusznego powodu zastępować wyrazem tym takie nazwy, jak naukowa organizacja, normalizacja lub tym podobne, określające ściślej pewne metody lub przedmioty, tak samo jak niema powodu do zastąpienia wyrazu stół wyrazem mebel.

Ci co z propozycją podobną występują, składają dowód, że nie rozumieją, czem jest *naukowa organizacja* i nie odróżniają metod naukowych od różnych przypadkowych sposobów ulepszeń, osiąganych drogą macania lub czystej empirji.

Scientific organization or rationalization? (1930)

Organization Review [*Przegląd Organizacji*], 1930, Vol. 5, No. 1, pp. 16-17

Forward to the English edition:
In this succinct article, which serves as an introduction of the topic Adamiecki would frequently revisit, readers are introduced to his humorous side as he candidly critiques the trend of replacing "scientific organization" with the popular movement of German "rationalization," a movement he feels has ignored the foundational principles of scientific management and whose explanations are vague and meaningless, analogous to declaring "butter is buttery." Adamiecki posits that the quickest route to improvement lies in the scientific method's iterative learning cycles, which involve continuous comparison of the "actual state" to the "ideal" standard and warned against falling prey to "unscrupulous" individuals who use current technical jargon to intentionally obscure the truth for personal gain.

Under the influence of various German authors and activists in the field of organization, the term “rationalization” has recently begun to be used instead of “scientific management” or “scientific organization.” According to some, it is more appropriate to use the term rationalization because it allegedly covers a broader issue of achieving the greatest useful outcomes with the least expenditure of productive resources.

Although the term rationalization itself indeed contains the concept of improvement or enhancement of something, while in the terms scientific management and scientific organization this concept is not so clearly present, this is not a sufficient reason to replace these names with the term rationalization.

Recently, various articles, especially in German magazines, have been published in which the authors try to explain what rationalization is and what should be understood by it. However, these articles are generally rather vague and ultimately boil down to tautology, something like "butter is buttery."

Meanwhile, if it comes to explaining the term rationalization to those who do not understand its meaning, it is enough to say simply that it includes all the ways aiming to improve in all areas, and therefore in all activities and economic processes as well.

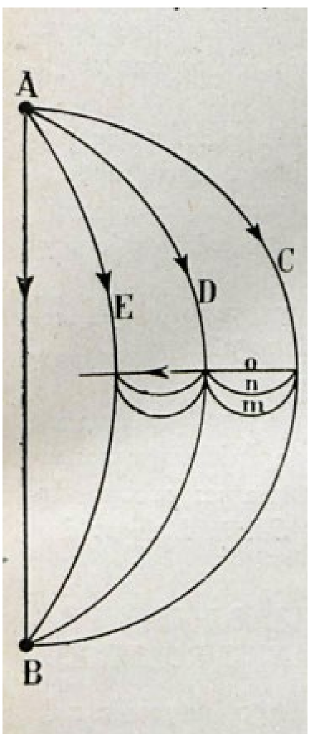
Therefore, one can say that rationalization includes all technical and technological sciences, organization science, standardization, etc., as they all provide ways to achieve greater useful outcomes with the lowest expenditure of energy, labor, materials, and other productive resources.

Rationalization is a general concept, and there is no valid reason to replace such terms as scientific organization, standardization, or similar terms, which define more precisely certain methods or subjects, just as there is no reason to replace the term “table” with the term “furniture.”

Those who propose such replacements provide evidence that they do not understand what scientific organization is and do not distinguish scientific methods from various random methods of improvement, including those achieved through trial and error or pure empiricism.

If the name rationalization has found so many supporters and has even infiltrated spheres that promote scientific organization, it may serve as evidence of how few people still understand the essence of scientific-experimental methods. This is also evidenced by the fact that some prefer to use the term “skill of organization” instead of “scientific organization,” while others call the discussion on the scientific nature of scientific organization a sterile, purely academic debate, claiming that it doesn't matter what it is called as long as the thing itself is practical.

It is difficult to convince people who do not distinguish the concept of furniture from the concept of a table that they should use the term "table" and not "furniture" when they have a table in mind, and not some other piece of furniture, like a sofa. For them, it will be just a futile discussion.



However, for those who truly understand the essence of scientific organization, which Professor Henry Le Chatelier brilliantly explained by precisely defining the essence of the experimental scientific method and indicating that Taylor essentially applied it to organizational issues, the dispute over whether to use the term "scientific organization" or "rationalization" is not an academic dispute but one of significant practical importance. The aim of these people is to direct the search for improvements along the shortest route, which is undoubtedly the path of the scientific method.

The goal of rationalization and scientific organization is the same: achieving the greatest useful outcomes with the lowest expenditure of productive resources. However, the best solution to any problem is always only one, just as between two points *A* and *B* there is only one shortest path - the straight-line *AB* (Fig.). If at a given moment we can only go along path *C* and find a way that indicates a shorter path *D*, and later path *E*, even shorter, and so on, we can call all these methods rationalization, but we can only call one of all the ways of finding a shorter path "scientific organization," namely the shortest way. In a figurative sense, we can say that when searching for path *D* instead of path *C*, we can search for it in many ways, like *m*, *n*, and so on. All of them will be rationalization, but only one way, *o*, will be the shortest, and this is precisely scientific organization when it comes to the field of management.

Therefore, Professor Le Chatelier, noting how few people understand the essence of the scientific method, rightly argues that since Taylor published his works, a large number of studies in the field of management have appeared in the literature, indicating various ways of improvement, often quite interesting, but rarely discovered through a truly scientific method.

The scientific method is like any other standard, a certain ideal set in advance. If we set a standard, we are compelled to compare the actual state with it and try to get closer to it; if we do not set it, we compare the actual state with the previous one, at best. We can indeed notice significant progress sometimes, but despite this, it may still be far from the perfect state.

The experimental-scientific method is the most perfect method for searching for laws of dependency between causes and effects. The more people involved in organization understand, apply, and distinguish it from other methods, generally called rationalization, the faster and more certain the elimination of waste will be.

There is, in principle, nothing against using the term rationalization as a general concept; however, it cannot replace the name scientific organization.

In conclusion, it should be added that such a change may only benefit a certain category of unscrupulous individuals among organization advisors who exploit various nebulous names for their personal purposes. It is easier to convince naive people that rationalization is something better, more practical, and leading faster to the goal than scientific organization, which many people are afraid of as pure theory. For such individuals, it is easier to sell any piece of furniture they have on hand rather than the table that the uninformed buyer truly needs, even though they do not know what it looks like.

PRZEGLĄD ORGANIZACJI

MIESIĘCZNIK POŚWIĘCONY SPRAWOM ORGANIZACJI I ADMINISTRACJI ŻYCIA GOSPODARCZEGO

ORGAN INSTYTUTU NAUKOWEJ ORGANIZACJI

ROK VII WARSZAWA, STYCZEŃ 1932 Nr 1

UWAGI DO DEFINICJI NAUKI ORGANIZACJI.

Remarques sur la définition de la science de l'organisation.

Prof. KAROL ADAMIECKI.

POWTARZAJĄCA się często dyskusja na jeden i ten sam temat staje się dla wielu ludzi dyskusją jałową, jakimś sporem akademickim, pozbawionym praktycznego znaczenia. W wielu wypadkach dyskusja taka stanowi istotnie jałową stratę czasu. Nie można jednak tego uogólniać. Dyskusja, wydająca się napozór bezużyteczną, posiada niekiedy ważne znaczenie praktyczne. Dotyczy to, między innemi, dyskusyj na temat ustalenia pewnego pojęcia i określenia wyrazem, najlepiej oddającym treść tego pojęcia, słowem — gdy chodzi o ścisłą jego definicję.

Od chwili, kiedy zostały ogłoszone pierwsze zasady Taylora, stanowiące podstawę nauki organizacji, a więc od 28 lat zgórą toczy się nieustająca prawie dyskusja na temat definicji tej nauki. Niedawno sprawa została skoncentrowana w specjalnej komisji, utworzonej przez Międzynarodowy Komitet Naukowej Organizacji.

Niestety, definicja, o której mowa, mimo zapisania już w tej materji tylu stron papieru, że możnaby z nich zestawić kilka grubych tomów, nie została dotychczas ustalona.

Głównem źródłem takiego niepowodzenia jest okoliczność, że bardzo mało jest jeszcze ludzi, którzy dobrze rozumieją istotę tej nauki mimo, iż poszczególne jej zasady i metody stosowane są dosyć szeroko w życiu praktycznem.

Winę takiego stanu rzeczy, być może, należałoby przypisać samemu Taylorowi, jeżeli wogóle o czyjejkolwiek winie w tej sprawie możnaby mówić.

Taylor dał nazwę, najlepiej odtwarzającą treść tej nauki, aczkolwiek samej treści nie zdefinjował należycie. Nie miał talentu do wypowiadania swych myśli i trzeba umieć czytać między wierszami, aby odkryć w jego pismach sedno rzeczy.

Jak dalece czytanie takie nie jest rzeczą łatwą, za dowód może posłużyć fakt, że jeśli chodzi o Europę, to tylko jeden człowiek odkrył odrazu i zrozumiał zasady Taylora; jest nim sławny fizyko-chemik francuski, prof. H. Le Chatelier.

Niestety, prof. Le Chatelier dopuścił nazwę francuską, z jednej strony, zbyt rozlewną, a z drugiej, zbyt zwężającą zakres tej nauki.

Nazwa, którą dał Taylor, „Scietnific Management", dosłownie „naukowe zarządzanie", została przetłumaczona na język francuski, jako „Organisation Scientifique du Travail" — „Naukowa Organizacja Pracy".

Jeżeli zastanowimy się nad postacią i treścią tej nauki tak, jak ona obecnie się skrystalizowała, to łatwo można zauważyć, iż jest to nauka zarządzania lub kierownictwa i to nauka doświadczalna, oparta na metodzie naukowo-doświadczalnej, a więc opierająca swe zasady i metody kierownictwa na prawach przyrody.

Z tego powodu nauka ta stała się już obecnie prawie tak samo ścisłą, jak fizyka lub chemja.

Jest to nauka w całem tego słowa znaczeniu ekonomiczna, gdyż celem jej jest odkrycie drogi do osiągnięcia największego skutku użytecznego przy najmniejszym nakładzie sił i środków. Jest ona również nauką kierownictwa, gdyż głównem zadaniem czynnika kierującego, czy to w najprostszym, czy najwięcej złożonym organizmie jest zawsze znalezienie i pokierowanie organizmem po takiej najekonomiczniejszej drodze.

Wprowadzenie do kierownictwa metody naukowo-doświadczalnej wywołuje w niem przewrót zasadniczy. Przez metodę tę kierownictwo przestaje być sztuką, a staje się nauką.

Notes on the Definition of Organizational Science (1932)

Organization Review [*Przegląd Organizacji*], 1932, Issue 7, No. 1, pp. 1-4

*[*Note, this article is out of chronological order as it serves as a continuation of the previous article "Scientific Organization or Rationalization?"]*

["Taylorism" vs "Scientific Organization of Work" vs. "Scientific Management"]

The frequent repetition of a discussion on the same topic becomes a sterile debate for many people, akin to an academic dispute devoid of practical significance. In many cases, such a discussion indeed constitutes a futile waste of time. However, one cannot generalize this. A seemingly useless discussion sometimes has important practical implications. This applies, among other things, to discussions on the establishment of a certain concept and determining the term that best reflects the content of this concept, in other words - when it comes to its precise definition.

From the moment the first principles of Taylor were announced, forming the basis of organizational science, an almost uninterrupted discussion on the definition of this science has been taking place for 28 years. Recently, the issue was concentrated in a special commission created by the International Committee of Scientific Organization [CIOS].

Unfortunately, the definition in question, despite having already filled so many pages of paper that several thick volumes could be compiled from them, has not yet been established.

The main source of such failure is the fact that there are still very few people who understand the essence of this science well, even though its individual principles and methods are quite widely applied in practical life.

Perhaps the blame for this situation should be attributed to Taylor himself, if one could speak of anyone's fault in this matter.

Taylor gave a name that best reflects the content of this science, although he did not properly define the content itself. He did not have the talent for expressing his thoughts, and one must be able to read between the lines to discover the essence of the matter in his writings.

To what extent such reading is not an easy task can be evidenced by the fact that, as far as Europe is concerned, only one person immediately discovered and understood Taylor's principles; this person is the famous French physicist and chemist, Prof. Henry Le Chatelier.

Unfortunately, Prof. Le Chatelier allowed a French term that was, on the one hand, too expansive, and on the other hand, too narrow in scope for this science.

The name Taylor gave, "Scientific Management," was translated into French as "Organisation Scientifique du Travail" - "Scientific Organization of Work."

If we consider the form and content of this science as it has crystallized today, it is easy to see that it is a science of management or leadership, and an experimental science based on the scientific-experimental method, thus basing its principles and methods of management on the laws of nature.

For this reason, this science has already become almost as precise as physics or chemistry.

It is an economic science in the full sense of the word, as its aim is to discover the path to achieving the greatest useful outcome with the least expenditure of effort and resources. It is also a science of leadership, as the main task of the directing factor, whether in the simplest or the most complex organism, is always to find and guide the organism along the most economical path.

The introduction of the scientific-experimental method to management brings about a fundamental change. Through this method, management ceases to be an art and becomes a science.

This transformation, however, cannot take place suddenly and completely, as scientific methods cannot immediately discover all the laws of dependence between causes and effects that come into play here. Until this happens, management will also have to rely on empirical methods, meaning it will to some extent remain an art. However, as the number of discovered laws and the principles derived from them increases, the art of management will give way to the science of management.

This process of transformation has now advanced significantly, as the general laws concerning the distribution of resources and means, as well as the useful effects, are known, and the most important principles of management have been established.

For this reason, we can say that the science of management has been significantly established.

The laws and principles on which this science is based concern two fundamental issues: building organisms that could operate most economically and managing them in the most economical way. For this reason, at first glance, it might seem that the term "management" does not fully correspond to the content of the first task, and that the term "organization" would be more appropriate.

However, if we think more deeply, we will notice that when solving the first issue, i.e., building organisms, the management factor comes to the forefront again, as the issue is about guiding the construction in such a way that the organism itself is built most economically and can operate most economically.

The term "organization" is used in various meanings, for example, as a structure or a certain action.

If we were to settle for the name "science of organization," it would always arouse the assumption that the primary focus is on the structure of the organism or its creation, while the main and most essential content - management - would be obscured.

As for the name "scientific organization of work," although the concept of management is more prominent here, the term "work" narrows the scope of management, which should be decisively removed, as it gives the impression that it concerns only human work. Meanwhile, the science of organization (management) is about utilizing all factors necessary for achieving a given useful outcome in the most economical way, including not only human labor but also natural energy, machines, devices, and other forms of capital, materials, and time.

For this reason, to avoid misunderstandings, the term "work" should be decisively removed from the name mentioned above.

The extent to which misunderstandings can arise from this is evidenced by the fact that some people understand the term work as a social class engaged in physical labor and interpret the scientific organization of work as organizing this group.

Among other names used to define this science, we often hear the names "Taylor System" or "Taylorism." Although it might be good to preserve the founder's name in the title out of respect for the founder of management science, it is necessary to avoid these names for the sake of the science on which he laid the main foundations, as they tell us nothing about its content.

It is worth mentioning here what Taylor himself thought about this issue.

When Professor H. Le Chatelier warned Taylor that in France his system would be introduced under the name of the engineers who would apply it, Taylor replied:

"I desire nothing more - it's all about spreading my ideas, so it's an indifferent matter under what name it will be done."

Today we see that this opinion is valid, but only insofar as we would like to derive the name from the creator's surname. On the other hand, when it comes to establishing a correct name for the science itself, the issue is not only not indifferent but extremely important, as it aims to avoid misunderstandings that arise not only in broad public opinion but also among those who engage in this science.

German “Rationalization”

The issue of establishing a correct name was complicated by the term "rationalization," which began to be used by the Germans and to some extent introduced into the international arena. This term has such a broad and general meaning that under it, one can understand all kinds of improvements, even those that may only seem like improvements in economic terms. It seems to me that the economic activity of the Germans after the war, carried out under the name "rationalization," provides a very striking proof that their "rationalization" led Germany to the overgrowth of mechanization and overproduction.

When Taylor's work became famous worldwide, the interest in it among German engineering circles was particularly high. In 1913, at the 54th Congress of the Association of German Engineers (Verein Deutscher Ingenieure) held in Leipzig, the Taylor system was the main subject of consideration. James Mapes Dodge, a friend of Taylor and one of the first to implement his system in a mechanical factory, was specially invited from America to participate in the congress.

At this congress, one of the prominent German engineers, Mr. F. Neuhausen, director of Borsig plants, made the following statement:

> *"One can only wish that in Germany this system would be widely understood and applied, as the nation that most economically manages its wealth and power and uses them with the best efficiency ratio will raise its prosperity and significantly outpace other nations."*

Despite such interest and enthusiasm for Taylor's system, the rich German literature that emerged from Taylor's system, and the feverish applications in German industry made after the war not under the name of the Taylor system or science of organization but under the name of rationalization, it turns out that Germany did not understand the experimental-scientific method of discovering the laws of dependence between causes and effects, the method that constitutes the fundamental idea of Taylor's system as a science of management.

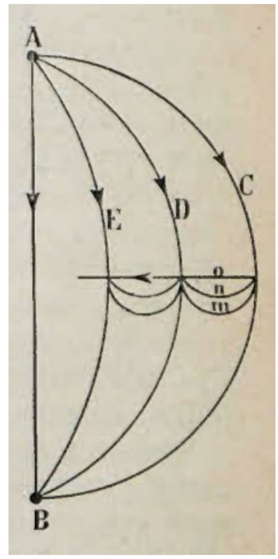
One could say that they only understood the mechanism, a certain system necessary for practical application based on the above idea. Evidence of this is the term "rationalization," which they used to describe various methods and systems of improvements, of which, of course, there is an infinite number.

Because this term has already entered the international arena, and many people use it instead of the name of the “science of management” or the “science of organization,” thus obscuring the essential content of this science and causing confusion of concepts, it is even more urgent and important to clearly define and name the science that Taylor called "scientific management" and in this way separate it from various methods and improvements, which can be generally described as "rationalization."

Rationalization, as I have already written on this matter in *Organization Review* (No. 1, 1930), is a general concept, and there is no valid reason to replace this term with such names as the science of organization, standardization, or similar ones that more precisely define certain methods or subjects, just as there is no reason to replace the word "table" with the word "furniture."

If the term rationalization has found many supporters and even crept into spheres that propagate the science of management, this may also serve as evidence of how few people still understand the essence of scientific-experimental methods.

The goal of rationalization and the science of management is the same: achieving the greatest useful outcome with the least input of productive resources. But the best solution to any problem is always only one, just as between two points *A* and *B* there is only one shortest path - a straight line *AB,* as shown in the figure. If at a given moment we can only go by route *C* and find a way that shows us a shorter route *D*, and later an even shorter route *E*, etc., then all these methods can be called rationalization, but only one of all the ways of finding a shorter path can be called the science of management, namely the shortest way. Figuratively, we can say that in searching for route *D* instead of route *C*, we can search for it in many ways *m* or *n*, etc. All of them will be rationalization, but only one method *o* will be the shortest, and this is precisely the subject of the science of management.



As for the precise definitions of the concepts of rationalization and the science of management, they should be formulated as follows:

Definition of rationalization.

Rationalization should be understood as all methods of action and technical procedures in directing the activities of both individual units and their groups, aimed at achieving a greater useful outcome with a smaller input of time, human labor, natural energy, materials, and other productive resources.

Definition of the science of management.

The science of management should be understood as the methods of action and technical procedures in directing the activities of both individual units and their groups, based on the knowledge and application of the laws of dependence between causes and effects, discovered through experimental-scientific methods, aimed at achieving the highest useful outcome with the least input of time, human labor, natural energy, and generally all productive resources.

As for this last definition, there may be a question only about the name.

In my opinion, the choice can only be made between the following two:

1. Science of organization
2. Scientific management.

Based on the above-mentioned reasons, in my opinion, we should stick to the name originally given by Taylor:

Science of management - (Scientific management).

There can be nothing against using the term rationalization, but it is not possible to identify all the methods that could be defined by this name with the science of management, or, as some may prefer - with the science of organization.

PRZEGLĄD ORGANIZACJI
MIESIĘCZNIK POŚWIĘCONY SPRAWOM ORGANIZACJI I ADMINISTRACJI ŻYCIA GOSPODARCZEGO
ORGAN INSTYTUTU NAUKOWEJ ORGANIZACJI

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UWAGI O SYSTEMIE AKORDOWYM ZASTOSOWANYM DO PRAC GRUPOWYCH.

Remarques sur le système de paye dans le travail collectif à forfait.

Prof. KAROL ADAMIECKI.

O AKORDOWYM systemie płac tyle już pisano, że, zdaje się, trudno jest coś do tej sprawy dorzucić, coby nie znudziło czytelnika, który ma z nią do czynienia. Zdecydowałem się wszakże skreślić kilka niżej podanych uwag dlatego, że w praktyce sprawa systemu akordowego jest wciąż jeszcze aktualna, a poza tem przekonałem się, iż należy uwypuklić mocniej niektóre ważne punkty systemu akordowego, na które zbyt mało dotychczas zwracano uwagi.

System akordu grupowego polega na tem, że wyznacza się pewną stawkę za jednostkę produkcji na całą grupę robotników zajętych przy tej produkcji, a następnie, jeżeli chodzi o produkcję masową, ciągnącą się stale, sumę ogólnego zarobku (stawka pomnożona przez produkcję) za pewien okres (np. za 2 tygodnie) dzieli się na wszystkich uczestników proporcjonalnie do wyrobionych przez nich dniówek i zasadniczego ich zarobku na dniówkę, to jest proporcjonalnie do zarobków uczestników, jakie wypadłyby podług zapłaty dniówkowej. Cały zarobek akordowy wykazuje się robotnikowi w zarobku obliczonym na dniówkę + dodatek obliczony w procentach od tego zarobku.

Charakterystyczną cechą tego systemu jest, że wszyscy robotnicy danej grupy są ściśle związani ze sobą zarobkami: każda najmniejsza choćby zmiana w liczbie dniówek wyrobionych przez poszczególnych robotników lub w liczbie robotników w grupie albo w płacach dniówkowych wpływa na wysokość zarobku każdego uczestnika. Ta udziałowa zasada zarobkowania jest uważana przez zwolenników tego systemu za główną jego zaletę, uważają bowiem, że pobudza samych robotników do zmniejszania liczebności grupy. Pomimo, iż pogląd taki wydaje się napozór słuszny, jednak w rzeczywistości zazwyczaj nie sprawdza się. Robotnicy nigdy prawie nie wykazują tendencji do zmniejszania liczby robotników w grupie, ponieważ obawiają się, że w razie, gdy zarobki pozostałych zwiększą się, to pracodawca będzie starać się zmniejszyć stawkę. Jeżeli robotnicy zgadzają się czasami na zmniejszenie liczby, lub sami starają się o to, to zdarza się to prawie wyłącznie tylko przy robotach czasowych, to jest kiedy stawka sama przez się upada po skończonej robocie.

Drugą zaletą akordu grupowego, jaką wysuwają jego zwolennicy, jest, że robotnicy, będąc związani ze sobą zarobkami, starają się jakoby sami najlepiej zorganizować między sobą robotę. Skutek taki istotnie daje się niekiedy zauważyć, ale tylko przy robotach prostych i o ile wszyscy uczestnicy grupy wykonują robotę mniej więcej jednakową, np. przy ręcznem kopaniu, ładowaniu, dowozie materjałów i t. p., w wypadkach zaś roboty więcej skomplikowanej, o czynnościach różnorodnych, zwłaszcza zaś, gdy główną robotę wykonywa jakiś aparat, urządzenie lub maszyna, nigdy nie daje się zauważyć, aby akord grupowy pobudzał robotników do lepszego zorganizowania roboty. Jest to zresztą sprawa zbyt złożona, aby robotnicy sami mogli ją rozwiązać.

W rzeczywistości okazuje się, że przy akordzie grupowym wszelkie zmiany w organizacji roboty są właściwie wielce utrudnione dlatego, że, choćby nawet dotyczyły tylko części grupy, to jednak dotykają zawsze materjalnych interesów wszystkich uczestników; jeżeli więc kierownik chce wprowadzić jakieś ulepszenia w organizacji roboty, płatnej podług akordu grupowego, to robotnicy stawiają opór szczególnie silny. Ponieważ przy fabrykacjach hutniczych warunki

Does Scientific Management Contribute to the Deepening of the Economic and Unemployment Crisis? (1932)

Organization Review (*Przegląd Organizacji*), 1931, Issue 6, no. 12, pp. 413-422

Forward to the English edition:
Written in the early years of the Great Depression, Adamiecki found himself defending scientific management against blame for the crisis. As with any tool, we are reminded that the science of organization is not inherently harmful but can be misused or misunderstood, leading to negative consequences. The main principles and laws of organizational science are examined, emphasizing the importance of fully understanding their essence and relationships to avoid errors that result in massive waste of resources and human potential. Proper planning when approaching factory automation is likewise crucial, ensuring workers are engaged "without sacrificing the human spirit or turning individuals into soulless machines."

Adamiecki further explores the impact of organizational science principles in various sectors, including manufacturing, trade, consumption, and finance. The analysis highlights the lack of harmony and coordination across these sectors, which can lead to bottlenecks and idleness, such as a case in a mill where a material constraint temporarily led to the unemployment of 10,000 workers downstream from the source of the issue. However, if correctly applied, these same tools can facilitate greater collaboration and efficiency across all sectors of society, promoting overall development and progress without compromising human values.

Introduction

The incredibly severe economic crisis and the scourge of unemployment that has engulfed the entire civilized world are forcing everyone to search for causes and solutions.

This is a completely natural reaction, as every person, when faced with disaster and recovering from the initial shock, almost instinctively searches for its causes. The only correct path toward a solution is to first locate the source and cause of the problem. Only after understanding the causes can one hope for effective resolution.

The current economic and unemployment crisis is such a huge, widespread disaster, revealing such a terrifying abyss in which the entirety of humanity's age-old cultural legacy may perish, that even yesterday's enemies are coming together and discussing how to find a solution with their combined forces.

Today, the main topic of joint deliberations of statesmen, economic leaders, economists, legislative bodies, scholars, etc., is the unemployment crisis.

The press from all over the world is teeming with articles on rescue measures and is filled with news about the course of the disaster. Most private individuals are talking and reflecting on the causes and ways to repair the difficult situation. Finally, everywhere, regulations are being issued, and special institutions are being created with the aim of applying temporary measures to alleviate the disaster and save those most affected by it.

Among the multitude of various factors in which different people see direct or indirect causes of the current economic and unemployment crisis, the science of organization, or as some say according to the latest fashionable terminology - rationalization, has also been found. There are indeed many people who claim that the science of organization contributes to the intensification of the unemployment crisis.

We all remember how scientific management was attacked from the very beginning, and how various people claimed that it would cause unemployment just like machines, throwing thousands of working people onto the streets.

However, we also remember that these attacks did not harm scientific management at all; on the contrary, we have witnessed how, despite significant resistance, it has rapidly grown and found increasingly wider applications. We have finally witnessed the first wave of attacks subsiding.

However, now, in the face of the unemployment crisis affecting not just thousands but millions of people, the wave of attacks on the scientific management has reappeared with such force that even some of its defenders have wavered, asking themselves whether there might be some evil or foolishness in it.

I must admit that the sudden wave initially took me aback, but only because I could not immediately find strong and clear arguments to explain the great error of those who see scientific management as one of the leading, or even minor contributing, causes of the crisis.

Now, having recovered from the initial unpleasant impression, I would like to express my opinion on this matter, and I even believe it is my duty to do so, as I have noticed that doubts and certain concerns have appeared among the members of our Institute (I even have evidence that they are quite serious). I admit that this worries me a little: I am not afraid for the development of the science, but for the continued successful growth of our institution, as it is quite clear that if the factors supporting us start to doubt the usefulness of scientific management, the development of the Institute could be seriously threatened.

I will not dwell on the various causes of the economic and unemployment crisis; these are highly complex phenomena, dependent on too many factors for me to feel competent enough to list, classify, and discuss with my modest knowledge of various aspects of economic life. I will touch on them only as much as they come to mind when considering whether scientific management and its principles can cause such negative consequences for humans as the unemployment crisis.

I think I can best emphasize my views by reminding you first of the purpose of scientific management and its main principles, and then examining whether there is any harmful element hidden within them.

Goal

The sole purpose of scientific management is to achieve the greatest useful outcome with the least expenditure of effort and resources needed to achieve it. Is there anything harmful for humans in this pursuit of the most perfect economy, or something contrary to human nature?

If we take a close look at not only humans but also the entire natural world, with all its creatures striving for their individual goals, we cannot help but notice that the pursuit of conserving energy and resources permeates all of nature, with everything seeking the path of least resistance. As for humans, not only is their organism built and operates according to this economic imperative, but they themselves, as individuals in the surrounding environment, have been tirelessly exerting their minds since the earliest dawn of their existence to find the easiest paths.

Why, nowadays, do civilized people engage so enthusiastically in sciences aimed at discovering the laws of nature? It is safe to assert that it is only to find easier paths, that is, to achieve the greatest effect with the least expenditure of effort and resources.

Thus, the goal of scientific management is the same as that of a whole host of other sciences and is not contrary to the fundamental striving of human beings. Even if today, out of fear that scientific management might cause harm, we were to destroy all of its achievements and forget its principles, humans would immediately return to it and rebuild it anew.

However, someone might say that there is nothing incorrect with the postulates of this science, but its principles and methods are harmful. Haven't there been many sciences and theories that have led people astray?

Let's examine the issue from this perspective.

Main principles

The first and most essential principles that this science considers as its foundation and undeniable fact can be formulated as follows: to achieve the greatest useful effect with the least expenditure of effort and resources in all activities and organizational issues, one must:

1) Clearly set each individual goal: the outcome we want to achieve;
2) Using the scientific method, discover all the causes that influence the expenditure of effort and resources, as well as the magnitude of the desirable outcome we are striving for, and discover the laws of dependence that occur here;
3) Then, based on these laws, develop the most perfect plan of action and course of conduct possible, and
4) Only then proceed with the execution of the plan and continuously verify the actual conditions against it.

Is there any point in these principles that could be criticized or some trap that might lead us down the wrong path?

I believe that no thinking person will find anything in the above principles that is contrary to common sense. Upon reflection, one must admit that there is no other course of action if we truly aim to increase the effect while reducing the expenditure of effort and resources.

In today's immensely complex economy, with the enormous number of causes influencing energy expenditure and desired outcome even in the simplest work processes, and with our still weak understanding of the laws of dependence between these causes and effects, it is not an exaggeration to say that proceeding without these principles is simply gambling, playing the lottery with an extremely small chance of winning, I would even say, lacking common sense.

Let us recall that Taylor, wanting to find the best and most economical way of transferring loads, had to work for several months just to go through the first stage of the above principles, discovering only some of the laws of dependence involved. So, what can we say about the truly scientific examination of work processes so complicated that we encounter them at every step and approach them light-heartedly, without proper investigation and planning, or with a plan based on very doubtful value assumptions and pious wishes for achieving the highest win?

We must admit that the above main principles of scientific management are simply a code of common sense, and that it is rather the non-compliance with them, and therefore, acting blindly, that may contribute to the unemployment crisis.

There is only one "but" hidden in the first principle. We say that a clear goal, i.e., the desirable outcome we want to achieve, must be set.

The crux of the matter lies in what we will consider as a desirable outcome. There is a story of a missionary, who, over an extended period, was explaining to a member of a cannibalistic tribe what good and evil are, and assuming he had already converted him, asked, "What will be good, and what will be evil?" The cannibal replied, "If I eat you, it will be good; if you eat me, it will be evil."

Unfortunately, to this day, people do not always orient themselves in what is useful and what is harmful, especially when it comes to the usefulness not only for themselves but also for the whole society.

We can see, therefore, that if someone is harmed as a result of applying the above main principles of organization, the cause of the harm cannot be attributed to these principles. Any mentally healthy person would only state that the chosen goal was harmful or mistaken.

For example, if someone sets a goal to increase production to the farthest limits but does not know that the market may become saturated with their product, and pursues this goal while strictly adhering to the above main principles of organization, they will undoubtedly cause a financial crisis and unemployment.

Laws

Let's push our analysis even further and ask ourselves: could the main dependency laws according to which scientific management operates be false?

Responding to this question is a bit more difficult than the previous two.

Let's consider the three fundamental laws of economics that govern the magnitude of the effort and resources expended, as well as the magnitude of the desired outcome, which scientific management commands to be followed in all human and machine work processes without exception:

1) The Law of Division of Labor
2) The Law of Concentration
3) The Law of Harmony

Careful observation indicates that these laws guide all living nature, including human beings, and that thanks to these laws, the highest economy is achieved in their life processes. Humans have also unwittingly relied on these laws from the very beginning of their existence.

Simply through observation, anyone can affirm that the remarkable advancements in the production of useful materials in recent times could not have been achieved without adherence to the aforementioned laws, particularly the law of division of labor. It is only by operating in accordance with these laws that we can attain the maximum output with the least amount of energy and resources.

So far, no facts have been found to suggest that better economic results can be achieved by acting against these laws.

However, one could argue that until recent times, humans have unconsciously submitted to these laws without fully realizing their essence and importance. And even when they began to realize that such laws exist and inexorably govern the economy of effort and resources, they became afraid of them and began to complain, assuming that they destroyed the human spirit, reducing people to the level of thoughtless machines or automatons.

Recall what has been said and written about the law of division of labor for the last 150 years. Scientific managment puts the "terrible" laws of division of labor, concentration, and harmony in the forefront and says that if we do not apply them to the furthest limits, we will not achieve the highest economy that we strive for.

If the assumption that these laws kill the human spirit is true, then we face the following tragic dilemma:

"If we apply these laws as recommended by the science of organization, we will achieve great material benefits, save our physical and mental strength, but upon reaching this goal, we will become soulless machines and automatons."

This raises a critical question: Can we find a balance between achieving the highest economy and preserving the human spirit, or are we destined to choose between material well-being and retaining our humanity?

If such were to be the end, it could indeed be said that scientific management not only leads people astray but directly to their ruin.

Having studied this science for many years, and perhaps, as some say, being one of the first to notice the close relationship between the aforementioned three laws and bring them to the forefront of the science of organization, I cannot refrain from expressing my thoughts on this dilemma.

If I had even the slightest doubt that these laws concealed such a trap, I would be the first to call on people to beware of them.

Of course, this is not a sufficient argument, as someone might say that my personal view may result from my faith, not from impartial observations of facts.

The accusation that the law of harmony will lead humans to automatism and destroy their spirit was first heard by me twenty-eight years ago when I dared to present my method of harmonization publicly. At that time, I did not find sufficient arguments to refute this accusation, and it hurt me deeply, as it was expressed in words directed straight at me, saying that with my harmonograms, I wanted to turn humans into machines.

However, I do not regret exposing myself to this blow; on the contrary, shortly afterward, I was grateful to my opponent for not wrapping his accusation in less sharp words. For it was the pain I experienced that prompted me to think more deeply, observe human work, and the phenomena resulting from the above laws.

From that moment on, I continuously dealt with this matter, and as my research deepened, instead of confirming the fears mentioned, I found more and more evidence that these laws could not and should not lead to such a terrible outcome of their application. Moreover, during this research, I became convinced that they are genuinely laws of nature, not some principles of action that humans have invented themselves.

This means that, although the concerns about these laws may be valid, there is also evidence to suggest that they do not inevitably lead to the feared outcome. The challenge, then, is to understand how to apply these laws in a way that harnesses their power without sacrificing the human spirit. This might involve finding a balance between efficiency and personal development or ensuring that people continue to have opportunities for creativity and self-expression within the confines of these laws.

These laws, like any law of nature, are relentless; they can bring great benefits to humans if, with a useful goal in mind, they strictly adhere to them, but they can also harm them mercilessly if they start to act against them or, not understanding them well, deviate from their command.

These laws can cause enormous damage when applied incorrectly or when, having thoroughly understood them, they are applied with great precision for the purpose of destruction rather than creation.

The laws in question act as automatically as any law of nature, for example, like the law of gravity, which humans can use for their own beneficial purposes but can also cause them great harm, or even deprive them of life if they act against it. Do people, knowing the law of gravity well, complain about it and consider it the cause of their misfortune? Perhaps people used to think so, but today no sane person would say that; instead, they would state that the misfortune occurred due to the carelessness of the injured party, who did not understand the law of gravity well or could not foresee that, in certain circumstances, the force of gravity would turn against them.

By carefully observing and analyzing all modern collective work processes, from the simplest to the most complex, from the perspective of the three mentioned laws, anyone can easily notice the great benefits achieved by humans when these laws are properly applied, as well as the great harm and losses when errors are made in their application.

The law of division of labor can indeed turn a person into a soulless machine and oppress them if we forget that it requires not only division but also the selection of an appropriate person or work cell for a given task.

Analyzing individual cases, however, we must acknowledge that there are still few people who understand the essence of the discussed laws of economics, especially the law of harmony and the relationship between them. It is precisely this that can be attributed to the astonishingly blatant sins against these laws, encountered at every turn, and the resulting enormous waste of human resources and means.

Errors in applying the laws.

As evidence that such a state of affairs currently exists in all areas of work, we could cite countless striking examples.

In order to prevent the potential negative consequences of applying these laws, it is crucial for people to fully comprehend their fundamentals as well as the relationships between them. By doing so, they can avoid the errors that lead to massive waste of resources and human potential. Only with this knowledge can we ensure that these laws are used effectively, without sacrificing the human spirit or turning individuals into soulless machines. By balancing the power of these laws with human values and creativity, we can achieve the best possible outcomes for society and individuals alike.

Imagine a modern iron foundry. Due to significant technical improvements aimed at maximizing the use of energy, fuel, and the greatest possible savings in human labor, and especially thanks to the intensive application of the laws of division and concentration, a modern foundry is almost completely different in terms of internal structure compared to a foundry from twenty to thirty years ago.

In the past, it was a rather loose connection of several departments, such as blast furnaces, steelworks, rolling mills, and a certain number of auxiliary departments.

Each of these departments operated and could function more or less independently. In any case, stagnation or hesitation in the operation of one of them did not immediately cause disturbances in the others.

In a modern foundry, all departments and their individual components are so subtly interconnected that the slightest disruption in the operation of one component almost immediately affects the others and the entire organization.

For several weeks, I investigated the reasons for the lack of electricity, causing frequent stagnation and thus unemployment in the rolling mills of a certain large, very modernly equipped steelworks. One Monday, when I arrived at the rolling mill, I found a great commotion, as nearly the entire mill was about to grind to a halt. After a few hours of searching for the cause, it turned out that it was a brief telephone conversation on Saturday evening between two very diligent heads of departments.

The head of the blast furnaces asked the head of the rail rolling mill if the mill would be running on Monday, as it often happened that this mill did not operate every day of the week due to lack of orders or irregular delivery of coal to the mill's boiler house. The head of the rail rolling mill responded that there was not yet enough coal at the boilers, but he had been notified that he would receive several carriages of coal at any moment, so he was preparing to run the mill at full steam on Monday.

The head of the blast furnaces immediately issued an order for the mixer to be completely filled with liquid raw material during Sunday, so that on Monday morning, the Bessemer steelworks would have an adequate supply and would not have to stop due to a lack of materials.

It should be noted that the Bessemer process relies exclusively on liquid raw material, sourced from the mixer, and directly provides the newly formed steel, in a still hot and malleable state, to the heating chambers of the rail rolling mill.

Unfortunately, the coal for the rail rolling mill did not arrive by Monday. The mill did not start, and then the filled mixer of the blast furnaces became a bottleneck that blocked the entire foundry. After several hours of searching for a way to salvage the situation, there was no other option but to slow down the operation of the blast furnaces, resulting in a lack of gas in the central boiler room, a significant slowdown in the operation of the electric power plant, and the shutdown of almost all factory departments: the Martin steelworks, several rolling mills for profiled iron and sheet metal, forges, auxiliary departments, slag cement factory, bridge department, etc. In short, unemployment for over 10,000 people, which lasted several hours until the bottleneck was finally removed.

One might say that I am presenting an exceptional case, that coal was withheld due to some unfortunate accident, but I must assure that similar bottlenecks, even not due to external causes in one or another component of modern iron foundries, occur quite often.

As for the example given, the only correct conclusion we can draw from it is that coal delivery was so poorly harmonized with the foundry's operation that even diligent managers had to base their decisions on uncertain assumptions.

Several weeks of investigating stagnation due to a lack of electricity in a given foundry, considered to be a kind of perfection in technical terms, led me to detect many errors throughout the plant against the laws of division, concentration, and especially harmony of selection and harmony of operation. These errors were the cause of very frequent bottlenecks, stagnation, and internal friction. Identifying some of them was to some extent a revelation for managers.

For example, it turned out that the main reason for the frequent stagnation in the rolling mills was not the lack of electricity, as everyone thought, but the poor distribution of work in the rolling mills, a lack of coordination of the rhythm of operation of individual rolling mills, the order of their operation, and the alignment of this operation with other departments. In other words, there was a lack of an action plan based on the above three laws.

Someone might say that the example given is exceptional and concerns only iron foundries. To this I would answer that only someone who has not looked closely at the internal structure and operation of modern production facilities could think so.

But anyone who has dealt with modern factories and understands the requirements of the laws on which the science of organization is based will undoubtedly confirm that I am not exaggerating when I claim that errors against these laws are the main brake on production and the cause of an incredible waste of resources and effort. If it were not for these errors, there would not be so many bottlenecks and temporary internal unemployment of people and machines in modern collective work organizations.

Organization and temporary unemployment.

Since all the individual organs of these factory organisms are interconnected and dependent on one another, if we improve the organization in any of them, such as a single department [or work cell], and not in others, and the entire organism does not grow at a given moment, the result is that part of the staff of the improved department must be reduced. If these people are immediately absorbed by other growing establishments and workshops, the improvement in organization will not cause unemployment; otherwise, it is quite clear that this small progress in economy will cause more or less long-lasting unemployment.

Indeed, if we consider longer periods, such unemployment will disappear, as the growth of workplaces continues unabated, albeit in waves.

The history of the introduction of machines also clearly indicates that machines generally have not reduced the demand for labor, but rather significantly increased it. However, any rapid pace of introducing machines undoubtedly causes temporary unemployment.

There is also no doubt that overly rapid improvements in organization must cause similar unemployment.

The principle of gradual introduction of improvements.

However, there is a fundamental question whether such improvements can be attributed to an organization based on scientific principles. We have the right to ask this question because the science of organization has discovered yet another general law concerning human labor, namely, the law of inertia of habits, which is as important as the law of physical inertia.

In addition, another general law has been discovered, the so-called law of contrariness, which concerns physical and chemical phenomena. This law is also confirmed in economic phenomena and in the processes of human labor. *[Le Chatelier's equilibrium theorem was sometimes referred to as the "law of opposition" or the "law of contrariness," stated as follows: "A change in one of the variables of a system at equilibrium produces a shift in the position of the equilibrium that counteracts the effects of this change." -Ed.]*

From these laws, an important principle emerges: in all cases where we deal with human labor, whether physical or mental, the introduction of organizational improvements should be gradual, otherwise, losses must occur in overcoming resistance.

The science of organization requires that all discovered laws be followed, not just some of them.

For this reason, we can say that improvements in organization, whether in individual parts or in the entire collective work organism, that do not take into account the principle of gradual introduction, even though other principles of the science of organization have been considered, cannot be fully attributed to the application of this science. It is an error that must cause damage.

For this reason, we can also argue with great probability that adherence to this principle is precisely the best means to avoid temporary unemployment when introducing organizational improvements.

Automation

If we hear so often today that automation has contributed significantly to the current unemployment, in light of the above principle of the science of organization, we can say that it is not automation itself, as such, that has done this, but its overly rapid pace. With even greater certainty, we can say that when examining existing devices, we encounter such an excess of them at every step that even if we eliminated the unemployment of people, there would still be enormous unemployment of rapidly aging machines and equipment, and therefore a waste of immobilized capital.

If people currently suffer from an excess of automation, it is not only because automation was introduced at too fast a pace, but primarily because it took place chaotically, rather than based on the principles of scientific management. In individual establishments, this can be seen at every step. This becomes especially apparent when we begin to improve the organization of existing facilities. We then notice monstrous errors in the harmony of mutual selection of work cells, committed because the installation of devices did not adhere to the extremely important principle of scientific management, which requires that first, a plan for the entire process be developed down to the smallest details, and only then a plan for installation.

If someone wanted to contradict me and say that educated specialist technicians based their installation and automation projects on adequate knowledge of a given production process and calculations, I must respond that this knowledge of processes and these calculations were too superficial and inaccurate, because even very capable designers had only a general idea of the technology of processes for which they designed machines and equipment, and a very weak understanding of the future internal organization of these processes.

Since people who are far from the industry might find such statements exaggerated, I must say that not only is there no exaggeration, but it would be somewhat strange if the situation were better, as the whole mindset of technicians and engineers has been directed mainly towards the design and construction of machines and equipment, not towards their economic side. To confirm this, it is enough to point out that in most higher education institutions preparing future production managers, teaching has been focused in this direction. Even the technology of various processes in these institutions is considered secondary subjects, not to mention such a young science as management, which has only begun to be introduced as a subject of teaching in a few places.

Some may take exception to the fact that, as an engineer myself, I level such harsh criticisms against the existing engineering profession, which I believe has contributed to an excess of machines and equipment, and consequently, to the crisis of unemployment for both people and capital. Some may even think that by defending scientific management, I am shifting the blame to other factors. However, in my considerations, I cannot take into account whether someone will like it or not. I base my claims solely on the foundation of many years of direct observation of the internal life and functioning of modern organizations. I express them, not to blame someone or something but to draw closer attention to the factors that affect the shortcomings of modern economic life and to find ways of improvement. In particular, I want to emphasize that the achievements of technical sciences, in their practical application, have not been captured by the principles of scientific management and, at best, were regulated by the innate talents of select individuals.

If we talk about the waste of resources and labor within production facilities, as well as disharmony that leads to temporary unemployment, so to speak, within these establishments, we can certainly argue that it is not scientific management or its principles that contribute to this, but rather the lack of it or acting against its principles.

Now let's broaden our scope beyond just a single production workshop.

Every economic process consists of production, exchange, and consumption. Let's delve into each of these.

Production

In the field of production, as we know, scientific management has already made significant breakthroughs, but even though it is finding wider and wider applications, we are still very far from its universal implementation. Its principles are implemented in isolated establishments, yet it hasn't permeated entire groups of interconnected enterprises, let alone being universally embraced across the entirety of the manufacturing sector, which should ideally function as one coherent organism. Indeed, the laws of division and concentration are naturally evolving, but it's challenging to discern any influence from the law of harmony or any concerted action based on rigorous scientific research.

Considering the entire manufacturing industry as a single entity, everyone can see that it is an organism composed of specialized organs, interconnected and dependent on each other. As a result of the division of labor and concentration, this mutual dependence of one organ on another has reached such distant boundaries that a disruption in the course of one almost immediately causes disturbances in the others and in the entire production organism. We have the same phenomenon as in a single production facility, only on a much larger scale.

So, when it comes to the entire manufacturing apparatus or its individual branches, we can at most state that the process of division and concentration has so far been carried out spontaneously and chaotically, but there is yet hardly any talk about the conscious application of these laws (especially the law of harmony) and the principles of organizational science. Only now is the awareness of the necessity for planned action beginning to appear.

I do not need to cite any examples to prove this claim. The negative effects of this situation, in the form of chronic stagnation and unemployment, constantly appearing in individual parts of the production apparatus, are too glaringly obvious to every observer, even those far from production.

Exchange

As for the second sector of the economic process - exchange, or trade, it can be said that scientific management is just taking its first steps. Only in recent years have sporadic attempts been made to proceed based on plans derived from deeper market research. There is, of course, a huge field for the application of organizational science, but the current state is still such that even individual production facilities, where the application of scientific management has advanced quite far in the field of production, will still have sales departments operating without a plan and without harmonization with production.

It should be noted that the trade sector is particularly difficult and overgrown terrain for the principles scientific management to quickly take root and flourish. Various prejudices have become deeply entrenched in this area, such as the belief that "a good merchant is one who can buy at the lowest price and sell at the highest price;" among less honest individuals and those operating over short distances, this prejudice takes on another form, that "a good merchant is only one who can cheat the best." Anyone who has had the opportunity to look behind the scenes of trade, albeit covered with a splendid advertising decoration, recoils in horror, seeing there, alongside honest individuals, swarms of filthy vermin operating through fraud, bribery, collusion, and kickbacks often called “commissions,” and so on.

Despite all the above, the first attempts to apply the principles of scientific management show that planned action based on scientific research in the field of trade will become the main guideline for future operations, despite difficult conditions. As this develops, the entire exchange mechanism will become increasingly harmonized with the production mechanism.

This harmonization, as a direct result of the application of the principles of organizational science, will undoubtedly contribute to the reduction of crises and unemployment.

Consumption

Allow me to touch briefly on the third sector of the economic process - consumption. I am not an economist, so I cannot express opinions on the application of the principles of scientific management in this area with as much certainty as a professional economist could. However, despite my superficial knowledge of economics, I believe I am not mistaken in asserting that the application of the first principle of organizational science in the field of consumption began a long time ago. Perhaps these studies were conducted using less rigorous methods than those used in natural sciences and often from the perspective of preconceived hypotheses and theoretical assumptions, but without question, these studies have already provided many unquestionable guidelines, if not for planning and directing consumption, then for planning production and exchange. Unfortunately, the chaotically functioning mechanisms of production and exchange have hardly made use of these guidelines.

Based on my observations, I am convinced that among the current managers of production and trade, there is a negligible number of those who have a clear understanding of the shape of the demand curve, expressing the dependence of demand on price, the factors affecting demand besides price, the curve of saleable demand value, the relationship of this curve to the curve of operating production costs, the critical points of production profitability, the limits of demand, and so on. How else can we explain that the directors of production blindly increased the production of certain items, which the market was unable to absorb, and thus unconsciously contributed to the unemployment crisis?

If they had guided the development of production based on the principles of scientific management, i.e., based their plans on consumption research, even if not yet entirely accurate, we would not have experienced such monstrous manifestations of overproduction as we witness today.

We see, then, that it is not the principles of scientific management that contribute to the emergence of crises and unemployment, but rather the lack of their application.

In the field of consumption, there are undoubtedly many elusive factors that depend on human psychology and will, and perhaps they will never be precisely predictable. As a result, our plans based on scientific research will always entail certain risks. However, by accurately predicting all the factors that can be foreseen and following the laws of dependence governing them, we will not proceed in such chaos as before, and the chances of unemployment crises will be reduced to a minimum!

Finance

In this discussion, while I won't delve into the vast and highly significant realm of finance, encompassing all facets of the economy, I'm confident that an expert in this domain could convincingly demonstrate that the principles of scientific management would yield substantial benefits when applied here.

Before summarizing my arguments, allow me to say a few more words concerning the overall picture.

Having examined the development of the economy so far and its current state, we can say that humans, using the achievements of some sciences and relying on only some economic laws without fully understanding them, have created a massive economic mechanism, a monstrously large machine whose individual components are intricately interdependent but do not fit together because they were built without proper consideration of the whole. They have created a mechanism that, with its enormity, overwhelms them, and once it has gained momentum, it cannot be tamed or directed with the knowledge and methods that humans have possessed and employed thus far. Only now are we just beginning to recognize the law of harmony, which we have defied in the construction and directing of this mechanism, and are just becoming aware that we require new methods of management.

Summing up all my previous arguments on whether scientific management creates or contributes to the deepening unemployment crisis, I can answer in the following way:

1) Scientific management not only does not contribute to the deepening of the unemployment crisis but, on the contrary, the current crisis and unemployment have reached such large proportions because its application has not yet penetrated all areas of economic life.
2) If the implementation of scientific management methods has, on several occasions, led to some workers becoming unemployed, it is because:
    a) the pace of introducing these principles in individual work areas did not correspond to progress in other areas;
    b) these methods were mainly used to increase production without taking into account the possibilities of sales or pursuing other aspirational goals;
    c) these methods were applied chaotically in individual workshops, without considering the subtle connection that exists between all interconnected organs of the modern economic organism;
    d) these principles and methods were often applied incorrectly or only some were followed, omitting other very important ones, or, finally, methods that had

nothing to do with scientific management were applied and considered scientific by some;

e) the current managers are largely unaware of the fundamental principles of scientific management and are generally far from understanding the new and very broad responsibilities imposed on them by modern economic mechanisms.

3) If it can be argued that the mechanization to date has undoubtedly contributed to temporary and chronic unemployment, it is almost exclusively because it was not captured within the principles scientific management.
4) The view that scientific management itself and its principles or methods lead to unemployment or other harm is simply proof that those making such claims have no idea about the fundamentals of this science or, at the very least, lack common sense.
5) The application of the principles of scientific organization can cause great harm to humans if someone uses them for criminal purposes, just as the application of any other science that discovers the laws of nature can be used for such purposes.

Conclusion

In conclusion, let me quote an honorary member of our Institute, Prof. H. Le Chatelier, made on this topic in June of the previous year:

> *"Scientific organization methods open up new horizons for us today. Let us make use of them to the fullest extent. Let us not discredit the progress of the human mind: its systematic vilification is criminal snobbery."*

In my opinion, Prof. Le Chatelier expressed himself too mildly: vilifying a science that is the embodiment of common sense is something worse than criminal snobbery, it is the heaviest human sin - stupidity.

Seeing how humanity has been immersed in this sin so far, how the spiritual culture of man has lagged behind the material achievements already attained with the help of science, I would not be surprised if modern scholars considered making sciences dealing with the laws of nature into secret knowledge, like the Egyptian priests, so that people could not use these sciences for their own destruction. Personally, I would not support such an idea, because I believe that scientific management will contribute to the development of human spiritual culture. If I did not have this faith and did not believe that spiritual culture would catch up with material achievements, I would take a more radical approach. Not only would I not strive to develop this science, but on the contrary, I would try to destroy all its accomplishments thus far.

mniejszym nakładzie czasu, pracy ludzkiej, energji przyrody, materjałów i innych środków wytwórczych.

Definicja nauki kierownictwa.

Pod nauką kierownictwa należy rozumieć sposoby postępowania oraz zabiegi techniczne przy kierowaniu działaniem tak oddzielnych jednostek, jak i ich zespołów, oparte na poznaniu i zastosowaniu praw zależności pomiędzy przyczynami i skutkami, odkrywanych metodą doświadczalno-naukową, a mające na celu osiągnięcie najwyższego wyniku użytecznego przy najmniejszym nakładzie czasu, pracy ludzkiej, energji przyrody i wogóle wszystkich środków wytwórczych.

Co do tej ostatniej definicji, to może zachodzić pytanie jedynie co do nazwy.

Mojem zdaniem, wybór może być zrobiony tylko z dwóch następujących nazw:

Nauka organizacji

Nauka kierownictwa.

Na podstawie wyżej przytoczonych motywów, mojem zdaniem, należy zatrzymać się na nazwie pierwotnie podanej przez Taylora:

Nauka kierownictwa — (Scientific management).

Nie można mieć nic przeciwko używaniu nazwy racjonalizacja, niepodobna jednak wszelkich metod, jakie możnaby tą nazwą określić, identyfikować z nauką kierownictwa, czy też, jak kto chce — z nauką organizacji.

ZASTOSOWANIE NAUKI KIEROWNICTWA (ORGANIZACJI) W ŻYCIU GOSPODARCZEM.

Application de la science de l'organisation à l'économie nationale.

Prof. KAROL ADAMIECKI.

ROZPATRUJĄC cały organizm życia gospodarczego pod kątem widzenia nauki organizacji, czyli nauki kierownictwa, musimy dojść do wniosku, że osiągnięcie największego wyniku użytecznego przy najmniejszym nakładzie sił i środków, tak w poszczególnych organach, jak i w całym organiźmie jest możliwe tylko przy zastosowaniu wszystkich zasad tej nauki, a więc przedewszystkiem, jeżeli będzie się działać podług zgóry ułożonego ogólnego planu, obejmującego wszystkie komórki.

Niektórzy zwolennicy polityki liberalnej w życiu gospodarczem wyprowadzają stąd wniosek, że nauka organizacji prowadzi wprost do socjalizmu, a zwłaszcza do najczystszej jego formy — komunizmu. Na poparcie tego wniosku wysuwają argument, że właśnie komuniści, stworzywszy niedawno olbrzymie państwo socjalistyczne, ujęli całe życie gospodarcze w jeden ogólny plan, znany pod nazwą „piatiletki".

Jest to wniosek najdalej idący.

Słyszy się również wnioski nie tak skrajne, wypowiadane nietylko przez zwolenników liberalizmu gospodarczego, ale i zwolenników innych doktryn gospodarczych, jak naprzykład, że nauka organizacji potwierdza konieczność wtrącania się organów państwowych do życia gospodarczego, lub że prowadzi do tak zwanego etatyzmu.

Nauka organizacji, ściślej mówiąc — nauka kierownictwa, jak każda inna nauka, odkrywająca prawa przyrody i ustalająca swe zasady na nich oparte, jest apolityczna. Ponieważ jednak ludzie sztukę zarządzania, a zwłaszcza państwem, nazywają polityką, socjaliści zaś i etatyści włączają do rządzenia państwem również kierowanie organizmem gospodarczym, przeto jestem zmuszony, rozpatrując najobszerniejszy zakres zastosowania nauki kierownictwa, dotknąć polityki.

Muszę się jednak zastrzec, że teren polityki jest dla mnie obcy, gdyż nigdy nie zajmowałem się polityką i politykiem nigdy nie byłem. Dlatego też, dotykając jej z musu, robię to bardzo niechętnie i obawiam się, że mogę nie być dokładnie zrozumiany, gdyż pod polityką i politykowaniem ludzie rozumieją tak dalece różne rzeczy, że ci, których zawodem jest polityka, często jeden drugiego nie rozumieją, lub starają się, aby ich inni nie rozumieli.

W celu uniknięcia możliwych nieporozumień zaznaczę na wstępie, że naukę należy odróżnić

Application of Scientific Management in the Economy (1932)

Organization Review [*Przegląd Organizacji*], 1932, Issue 7, No. 1, pp. 4-12

Forward to the English edition:
In this article, Karol Adamiecki separates the science of management from the art of politics, expressing his disapproval of the appropriation of both Taylorism, as well as his own work, by the Bolsheviks in support of their "five-year plan," an unsurprising stance given the turbulent backdrop of the 1917 conference and the subsequent execution of several of its attendees. Regarding the need for a change of approach to economic issues of the time, he acknowledges the array of challenges they faced, such as inertia of thought, the law of counteraction, a proliferation of superficial literature, and the impact of unqualified specialists.

To overcome these hurdles, Adamiecki advocates for a measured transition towards a more efficient and cooperative economic system. He proposes revised teaching methods, support for the growth of management science, and a cultural shift towards cooperation and harmony.

One of Adamiecki's key points in this article is the critical importance of the human factor in management science. He emphasizes the necessity of a skillset that prioritizes cooperation and collaboration, in stark contrast to the outdated belief that the interests of owners and workers are fundamentally contradictory. Adamiecki's perspective on the primary goal of an enterprise diverges significantly from conventional wisdom of the time. Rather than advocating profit as the main objective, he asserts that the enterprise's mission should be "first and foremost, the production and exchange of goods needed by people at an affordable price," followed by profit from invested capital and the well-being of employees working in the enterprise.

[The Science of Management vs the Art of Politics]

Considering the entire organism of economic life from the perspective of the science of organization, or scientific management, we must conclude that achieving the greatest useful result with the least effort and resources, both in individual organs and in the entire organism, is possible only by applying all the principles of this science, and thus, primarily, by acting according to a prearranged general plan that encompasses all cells.

Some proponents of liberal economic policy draw the conclusion from this that scientific management leads directly to socialism, and especially to its purest form - communism. To support this conclusion, they put forward the argument that the communists, having recently created a huge socialist state, have incorporated the entire economic structure into a single general plan, known as the "Five-Year Plan."

This is the farthest-reaching conclusion.

We also hear not-so-extreme conclusions, expressed not only by supporters of economic liberalism but also by supporters of other economic doctrines, such as the idea that scientific management confirms the necessity of state intervention in the economy or that it leads to so-called statism.

The science of organization, more precisely scientific management, like any other science that discovers the laws of nature and establishes its principles based on them, is apolitical. However, since people often refer to the art of management, and especially state management, as politics, and since socialists and statists include managing the economic organism within state governance, I am thus compelled, when considering the broadest scope of the application of the scientific management, to touch upon politics.

However, I must caveat that the realm of politics is foreign to me, as I have never been involved in politics and I have never been a politician. Therefore, touching upon it out of necessity, I do so with great reluctance, and I fear that I may not be fully understood. This is because under the terms "politics" and "politicking," people interpret vastly different matters. So much so, that those whose profession is politics often fail to understand each other, or strive to ensure they are misunderstood by others.

To avoid possible misunderstandings, I would like to point out at the outset that science should be distinguished from art. Science, especially experimental science (such as scientific management), bases its reasoning on strict observation of phenomena and discovered laws of nature, while art, and especially the art of governance - politics, is a matter of talent, based on preconceived doctrines and various premises that often have nothing to do with science.

[Does Scientific Management Lead to Communism?]

Now let's return to the conclusions mentioned earlier. Let's start with communism.

If we think a little about the sole purpose of the science of management, which is to achieve the greatest useful result with the least effort and resources, we will easily notice that this goal has nothing to do with either communism or any other political doctrine.

Just because socialists and communists, in pursuit of their goals, have come to the conclusion that everything should be managed according to a prearranged plan, it does not follow that the scientific management, which also indicates that one should act according to a prearranged plan, leads to communism.

We have already said that the principles of scientific management, aimed solely at achieving the greatest effect with the least effort and resources, can be applied to various purposes (See the article: "Does Scientific Management Contribute to the Deepening of the Economic and Unemployment Crisis?". Organization Review No. 12 from 1931).

When Lenin took power in Russia in 1917, he almost immediately announced a manifesto stating that socialist Russia and the dictatorship of the proletariat could be maintained only if Taylor's system, scientific management, was applied to production management. Lenin was sincere enough for us to believe him; therefore, we can say that scientific management itself is treated by communists as a means to their political ends.

However, if people use a certain means to achieve specific goals in several different cases, it does not logically follow that those goals are the same in all cases.

Thus, using simple logic, one cannot say that scientific management leads to communism.

If communists have come to the conclusion that everything must be managed according to a prearranged plan, it must be acknowledged that this is one of the most important ways to achieve the intended goal in the most economical way. One of their goals is the dictatorship of the proletariat, and to achieve this, they act according to a plan that encompasses the entire economic organism; similarly, anyone pursuing the realization of another dictatorship and proceeding in the same way can expect to achieve their goal more economically than if they were to act without a prearranged plan.

As for the second argument, supposedly confirming the assumption that scientific management leads to communism, that is, that the Bolsheviks were the first to include the entire economy of Russia in a single general plan and claim to act in accordance with scientific management, I must remind the reader that it was not the Bolsheviks who initiated this science. I also remind that socialists of all shades, including communists, before taking power in Russia, were the most ardent opponents of Taylor's system, which is the main basis of scientific management, and proclaimed that it is one of the most treacherous methods invented by capitalists for the exploitation of the proletariat. When, during long-lasting polemics held at that time on this subject, some socialists, cornered, finally admitted that Taylor's principles are indeed principles of management, having nothing to do with capitalism, they then declared sincerely that they themselves would make use of these principles, but would not allow capitalists to apply them.

Knowing the history of disputes and attacks on Taylor's system quite well, I could even risk claiming that the communists were among the first to appreciate the significance of this system, but they cleverly masked their views on this matter.

When they took power, they dropped the mask and now apotheosize Taylor in their own, characteristic way. It should also be remembered that the Bolsheviks established a whole series of institutions, on which they do not spare money, with the task, as they say, of developing the science of management. They have already published a considerable number of their own works and translated numerous books and articles, mainly from American and German literature.

I also had the misfortune to be among the authors whose works were published in the Bolshevik language and encountered original Bolshevik works referring to my authority.

But let's return to the main topic.

I believe that the above considerations are sufficient to conclude that scientific management has nothing to do with communism or the goals it pursues.

With regards to its application to the entire economy, scientific management neither necessitates the abolition of the natural right to property, nor does it insist that ownership of capital automatically grants the right to manage.

This science is so far beyond any political or economic doctrines that originate solely from human minds that attaching any of them to it distorts it to the extent that it ceases to be a true science.

That this is indeed the case can be seen, for example, from the Bolshevik plan itself, its implementation, and the Bolshevik literature on organization.

As for this literature, it is primarily a patchwork of various secondary methods and techniques used by scientific management in practical applications, interspersed here and there with genuinely scientific experiences. This entire patchwork is so permeated with Bolshevik doctrines that, at most, it can be considered the external shell of scientific management. Beyond it lies emptiness, devoid of the main guiding idea and spirit of science. As for the translations, anything that does not correspond to Bolshevik ideals is omitted, and quotes from foreign authors are often twisted.

However, it must be admitted that if one is interested only in secondary methods or management techniques, there is much interesting material to be found in Bolshevik literature.

As for the famous plan, called the "five-year plan," although I do not know it in detail, I can say in advance that it is not a plan based on scientific foundations, as required by the science of management.

I make this claim for the following reasons:

A plan derived from scientific management requires such extensive and profound preliminary scientific research that it is virtually impossible to carry it out in a short period of time in relation to such an enormous task as a plan for the entire economic organism of a large state. For illustration, let us recall that in order to prepare a plan for metal cutting in a mechanical workshop, scientific and experimental research had to be carried out, which lasted 26 years (Taylor's research).

Therefore, the plan called the "five-year plan," developed over a few years, could only have been put together hastily, perhaps to some extent based on some kind of statistics, but mainly on the basis of numbers that the Bolsheviks considered desirable for themselves. That this is indeed the case is evidenced by the actual results achieved, which significantly deviate from the established standards. In the case of a plan based on scientific research, the actual figures usually deviate only slightly from the standard ones.

As a second piece of evidence, the fact that the "five-year plan" was based on preconceived doctrines derived from the general communist program can be cited, while a genuinely scientific plan completely excludes any preconceived doctrines.

These preconceived ideas led the Bolsheviks, when implementing the plan, to use measures that have nothing to do with the methods and principles set forth by scientific management in the execution of the plan.

I believe that anyone who knows even superficially these methods will agree that they do not require machine guns, extraordinary commissions, or espionage, so widely employed by the Bolsheviks in the execution of their plan.

Finally, there is one more piece of evidence that the plan being implemented by the Bolsheviks is not based on scientific foundations, and even that the principles and methods they support and promote in their special institutions of "organizational science" are merely a substitute for this science.

In the field of the human factor, the science of organization must take into account all of its physical, psychological, intellectual, and spiritual, or moral, properties and needs. Ignoring the latter is to treat humans as equivalent to the machines they build themselves. Treating human physical and mental labor, even on the basis of the most accurate scientific method, cannot point to the best ways to manage humans, because they cannot be satisfied with the economy of their strength solely in material terms.

However, the Bolsheviks completely ignore the spiritual side of man, as evidenced by the destruction of religion. This results from the purely materialistic ideology of communism, which is an ideology contrary to human nature.

The scientific management seeks the easiest and most economical way for the whole person, not just for the human animal.

Summing up the above considerations, it can be said that communists cannot create and execute a general economic plan according to scientific management, of which they are allegedly proponents, as they are burdened with the original sin - preconceived doctrines. And they cannot get rid of these doctrines, as the entire structure of communism is based on them. If they renounced this sin, their entire structure would collapse.

[Scientific Management and State Socialism]

Let us now move on to other economic policy programs that also put forward the postulate of action according to a general plan. These include the so-called state socialism, or statism, which is the complete or partial control of the economic mechanism with the help of state organs.

If scientific management indicates that the highest economy in the entire economic organism can be achieved when its cells are included in a general, pre-arranged plan and when their actions are regulated according to this plan, some people inevitably ask whether state authorities are not called upon to develop such a plan and manage according to it. In other words, should we follow the path indicated by state socialism or statism?

Scientific management, as we can see, points to a method completely different from liberal principles and laissez-faire, which undoubtedly was one of the main reasons for such rampant and rapid development of modern economic life.

However, scientific management does not indicate which bodies of the existing social system should undertake this task.

If we immediately asserted that state authorities are best suited for this, as they already encompass and govern many extremely important areas of social life, we would have to admit, after closer reflection, that this would be another preconceived doctrine, not based on impartial scientific assumptions, which is contrary to the science of management.

Long-standing experience and observation of facts show that in all countries, economic enterprises run by state authorities have performed and continue to perform significantly worse in terms of economy than private enterprises, to such an extent that even the most zealous statist would find it difficult to find any exceptions in this regard.

Based on experience, therefore, a negative answer should be given to the above question.

Another argument of statists also does not withstand scientific criticism, namely that state authorities, as they care for the welfare of the entire society, have the most data for managing the economy, which also concerns the welfare of the entire society.

From a scientific point of view, this argument can be considered only a commendable wish of statists, as even a comparison with state authorities performing other functions, such as the administration of justice, public safety, education, etc., does not provide the possibility to determine whether these functions have ever been performed economically enough to be considered a model, especially such a model as required by scientific management.

There is, therefore, no basis for pre-judging that state authorities are primarily called upon to perform such a gigantic task as managing the economy based on the principles of management science.

The question arises: who or which institutions will be able to solve such a great task as setting up the best plan for the entire economy and managing it in the most economical way?

Should this be left to private initiative and managers who have so far been directing economic life? To answer this question, we need to take a closer look at the development so far and the results achieved.

If we look at the economy thus far, which has developed almost exclusively through private initiative and on the basis of liberal principles, we can see, as we mentioned in the previous article, that the basic laws of economy: division and concentration, have been at work here for quite some time. Evidence of concentration are various groupings of certain industries, such as cartels and syndicates of various forms, trusts, associations of industrialists in particular industries, the merging of enterprises with the same production into larger units, etc.

All these concentrations aimed, and still aim, mainly at limiting free competition and, to a lesser or greater extent, carrying out planned actions in a larger or smaller area of economic life.

However, the application of the law of concentration did not result from a complete awareness of the economic significance of this law, but rather from the understanding that unrestricted free competition does not allow for running a business with the desired profit and without losses.

Moreover, these concentrations primarily aimed at planned actions not towards improving technical aspects and reducing costs in entire industrial sectors, but mainly towards a joint sales price policy, or a joint defense of business interests against the increasingly strong labor unions, or against the interference of state factors, which increasingly affected the interests of economic life.

If the creation of these concentrations led to better economic results, it can be said that it appeared automatically, as a direct consequence of the law of concentration, and not due to a planned and conscious action towards achieving greater utility with less effort and resources. Perhaps in trusts, planned action in this direction is more clearly manifested.

In any case, observing these phenomena in various areas of economic life, it can be easily noticed that they did not stem from the theory and principles of management science, but appeared spontaneously under the influence of life necessities. Moreover, practice has outpaced theory, as these phenomena began much earlier than the advent of management science.

If the current science indicates that this planned action must be significantly expanded, deepened, and carried out according to strictly defined principles not only in individual cells and groups but in the entire organism of economic life, there is no contradiction with what has been happening spontaneously and chaotically under the rule of free competition and private initiative.

As we currently see, theory has already caught up with practice and points to new horizons so distant that people who are still used to thinking in categories of unrestricted private initiative and free competition may find it a dangerous upheaval.

If we consider that the principle of private initiative, which has employed a range of exact and applied sciences, was the main driving force behind unprecedented economic development, it would seem that today, when faced with such a gigantic challenge, planned action according to the principles of the new exact science of management should also be left to private initiative, i.e., without changing anything in this principle, everything should be left to the natural course of events.

However, analyzing this issue more deeply and comparing the principles of management science with the previous methods of management and deeply rooted certain concepts and doctrines in the minds of people who have so far directed the economy, we come to the conclusion that this issue cannot be resolved in such a simple way.

[Scientific Management]

Scientific management places such high demands on managers at all levels, its principles and methods differ significantly from previous management methods, and its fundamental ideas are so opposed to the ideas that have taken root in the mentality of people participating in economic life, that one cannot expect economic improvement with the help of this science without the intervention of some factor capable of influencing the change of the current ideology of managers.

Since the human factor, with all its characteristics and aspirations, comes to the forefront in management science, it introduces many new principles, whether derived from the fundamental laws of economics discussed in the previous article or from other laws governing human nature.

It is impossible within the scope of this article to enumerate and justify all the principles and ideas contained in scientific management, so we will limit ourselves to pointing out some of them to emphasize the magnitude of changes that must take place in the mentality and ideology of managers in order to meet the great economic challenges we currently face.

First and foremost, the second principle of scientific management - the study of all economic issues using the scientific-experimental method, and the third principle - planning based on discovered laws, require a strictly scientific mindset from managers, fundamentally different from the previous approach, which was mainly based on empiricism, relying on chance and personal experience.

The above principles, as well as a whole series of others, multiply the managers’ work and impose new duties on them, which previous managers hardly knew or, not considering them their own, transferred to subordinate bodies.

Scientific management, emphasizing the close connection and mutual dependence of all enterprises and economic units in the entire economic organism, forces a change in the previous ideology of managers, which had been established under the influence of the principle of free competition.

This ideology allowed managers of individual enterprises to act without looking at others, or even against their interests.

Scientific management, due to the economy, both of the entire economic organism and the economy of individual units, requires an ideology that is exactly the opposite. It requires cooperation instead of acting only in one's own backyard without looking at others.

Application of scientific management in the economy

Research on the laws expressing the interdependence between individual components of the operating costs and their dependence on production, and then the comparison of these studies with research on the dependence of demand on the selling price of the product, showed that there is no fundamental contradiction between the increase in profit from capital, the increase in workers' earnings, and the decrease in the selling price of the product.

Scientific management, therefore, requires a fundamental change in the previous views of managers on this issue. Until now, there was a widespread belief that the interests of the owner, the worker, and the consumer are completely contradictory. Supported by various economic doctrines derived from false assumptions, this belief has even evolved into a kind of faith that the struggle of all against all is a factor of progress.

Management science, based on the aforementioned research and the law of harmony, puts forward a completely opposite principle - the principle of cooperation and collaboration.

This principle, as well as the realization of the importance of individual enterprises in the entire economic organism, leads to the necessity of a complete change in the previous view of managers on the purpose of the enterprise. Until now, it was believed that the sole purpose of an enterprise is profit from capital, and it was believed that striving for other goals is contrary to the raison d'être of the enterprise.

The principles of scientific management emphasize that the purpose of every enterprise is, first and foremost, the production and exchange of goods needed by people at an affordable price, followed by profit from invested capital and the well-being of employees working in the enterprise.

Since scientific management puts the human factor and the economy of human resources first, while maintaining the highest preservation of this source of energy and ensuring the spiritual needs of people at work, it imposes new duties on the manager, to which little or no attention has been paid so far. Thus, it is the manager's responsibility to instill in his subordinates a spirit of cooperation and maintain spiritual harmony, without which the third fundamental law of economics, namely the law of harmony of selection and action, cannot be fully applied.

Without going into details, it can already be seen from the brief outline above how significant a level of knowledge a manager must achieve in order to meet the challenges imposed by scientific management.

We also see that his role in economic life fundamentally changes compared to the one he has played thus far; he becomes a representative of the interests of all groups participating in economic processes, and not just one, for example, capital owners, as it has predominantly been until now.

Scientific management clearly indicates the previous view that only two factors, capital and labor (understood as the physical work of people), operate in economic processes is too narrow. It introduces a third, independent, and perhaps the most important factor - *leadership*.

However, in order for a manager to become this powerful agent, and to be the creator and executor of the plan, both in individual enterprises and in their groups and the entire economic organism, they must meet exceedingly higher qualifications than before.

Therefore, the implementation of scientific management and achieving the greatest useful effect with the least expenditure of resources comes down to establishing very high qualification standards for managerial forces, then preparing these forces and finally selecting them.

These qualifications can be divided into 3 types: intellectual, psychological, and spiritual. Setting the highest standards for all these types and comparing them with the current state of the aptitude of existing managers, it is easy to notice that there is an extremely small number of people whose qualifications would meet these standards, and the general level is still so low that drawing up a general plan based on scientific management for the entire economy and implementing it is a *matter of the distant future*, especially since it is also conditioned by getting rid of various false superstitions and beliefs and raising intellectual and moral culture in all social strata. We know how far behind this level has remained compared to the already achieved material gains.

The application of management science does not require any preconceived doctrines and political ideas, and therefore the answer to the question of who can take on the role of manager both in individual specialized organs and in the entire economic life organism is simply: "*the one who can.*"

As we can see, management science does not require any political programs, whether socialist, capitalist, statist, etc. Instead, it puts forward the paramount principle of managing all components of economic life by people who possess the characteristics and advantages corresponding to new, very high standards. The issue of management, therefore, comes down primarily to conscious and strict adherence to the law of division and selection of the appropriate individual or body for each particular activity.

Although at first glance such a statement of the matter may seem trivial, a little reflection will show how far today's state of affairs deviates from this simple truth.

Today, every reasonable person understands that a machine, for example, a car, can be expertly operated only by someone who knows its mechanism perfectly, has the appropriate properties needed for driving, and has gained some experience and skill.

Does the car owner ever think that the mere fact of owning a car is already sufficient qualification for driving it?

So what can we say about this seemingly trivial truth about the selection of people to manage such complex mechanisms as the current organs of the entire great organism of economic life, especially an organism built with cardinal errors against the fundamental laws of economics: division, concentration, and harmony?

How do the existing theories and methods of selecting people for managerial positions look in light of this simple principle of selection? A capital owner believes that merely possessing capital in the form of a production workshop is sufficient qualification for managing that workshop.

Socialists put in the worker's head that management belongs to the proletariat.

A financier, dealing with his own and others' money, also believes that he is entitled to the top position in management.

The leading stock market speculators, having bought shares of companies, also feels entitled to manage them.

A statist believes that only managing enterprises with the help of government bodies will give the best economic results and does not even realize how far the existing system of selecting managers in government bodies deviates from the principles of management science.

An engineer, possessing an engineering diploma, also believes that this is enough to take a managerial position. A graduate merchant or lawyer thinks the same way.

Everyone, even a talented dilettante with protection, believes they have sufficient qualifications for management.

Finally, a shrewd political economist occupies the highest economic positions with complete confidence, even though he would not dare to sit behind the wheel of a car to drive it.

All these people can even deliver entire theories about management methods and criticize management science without even having a concept of its fundamentals.

From the above picture, it can be seen that the application of scientific management to the entire economy, and thus operating according to a general plan consistent with the laws of economics, can be realized at a very slow pace as the mentioned superstitions, so contrary to common sense, will fade, and the principles of organizational science will penetrate minds in their place.

[Obstacles and Catalysts to the Scientific Management transformation]

A sudden improvement is not possible because the inertia of thought and habits, as well as the law of counteraction (Le Chatelier, van 't Hoff), stand in the way.

The only means to accelerate the pace of progress in this respect is to prepare new people who will think in categories of management science and possess virtues and properties corresponding to managerial positions. This is, of course, a matter of not only education but also upbringing. To move in this direction, it is necessary to revise existing teaching and upbringing methods in schools, starting from the lowest to the highest, and introduce appropriate changes. In addition, all social spheres and government bodies should support the development of scientific management and its practical applications.

This movement began almost immediately after the announcement of F.W. Taylor's works, and it has expanded so much that one can easily notice that, despite quite natural resistance, the awareness of the necessity of introducing the principles of scientific management into teaching is penetrating deeper and deeper into economic spheres and is becoming entrenched in broad public opinion.

This movement might have progressed more rapidly if it hadn't been for the deluge of specialized literature, dealing with various minor improvements in organization and management. Often these works are classified by authors and readers who fail to grasp the fundamental principles of scientific management, and incorrectly label them as theories or applications of this discipline.

The inhibiting factor is also various experiments in improving organization by certain “organizational” specialists who undertake these (often unsuccessful) improvements for money under the label of scientific management (organization), while in reality, they have little to no connection with it.

These specialists currently enjoy a wide playing field, as many organizational leaders, who have yet to grasp the principles of scientific management, would like to achieve tangible results as quickly as possible. They believe that such a self-proclaimed organizational advisor, especially with a foreign brand, will introduce changes that will quickly bring significant benefits. The favorite hobby horse of these advisors is the alleged practicality of their proposed methods, compared to principles based on theory; they understand well that many people have an aversion to scientific theories. Thus, they exploit the naivety of the managers who hire them, those who do not understand that the entire theory of scientific management is, above all, a code of common sense.

However, these factors are not of fundamental importance, and their harmful influence will gradually decrease as the principles of scientific management increasingly penetrate human minds.

Let's return to the liberal principle under which economic life has developed so far. As we have already mentioned, this complete freedom was the main factor in the robust growth of the economy. Here, those possessing personal initiative and talent were in high demand. Perhaps this circumstance was even a greater stimulant than the prospect of personal profits.

Another very positive aspect of the free competition principle is self-regulation, the mutual adjustment of various organs of economic processes. Thanks to this self-regulation, cells operating less economically had to die and give way to cells more economically perfect.

However, one downside of development under the influence of liberal principles is the significant waste of energy and resources, something that this self-regulation was unable to prevent. While these losses were relatively small at the beginning, due to the modest level of technical development, the situation has changed dramatically. Now, given the advanced and costly machinery we have today, the mutual self-adjustment of processes and systems falls short as a regulatory mechanism, unable to prevent the massive losses and crises that are an inevitable outcome of chaotic operations.

There is no doubt that for the further development of the enormous economic machine, the principle of free competition and rivalry must be replaced by the principle of structured cooperation.

However, it would not be reasonable to imagine that this could be done immediately with the help of some revolutionary procedure or through the transition from private to so-called state economy.

First of all, there arises the necessity to cultivate a new generation of managers, individuals who not only understand the principles of scientific management, but also appreciate the expanded role they must play as dictated by this approach.

We must also remember that the process of planning production and exchange based on scientific consumer research studies is just beginning to take its first steps.

Furthermore, a sudden change would be contrary to the fundamental principles of scientific management, which are entirely evolutionary and do not prescribe any sudden leaps.

Finally, in the transition to a new principle of economic development, all the positive factors of the free competition principle must be applied – that is, the initiative and personal talents of managers, and the factor of self-regulation in its new, improved form.

Scientific management does not exclude traditional talents developed through management experience, but rather channels them into specific frameworks. The science itself is powerless and will bring little benefit if it's employed by people without talent. On the other hand, talent, when supported by science, becomes a powerful lever for progress.

[Conclusion]

In conclusion, let me quote the words of F. W. Taylor:

> *"There is no science of management until there is a complete revolution in the mentality of workers and managers … It is a fantasy to think that with the help of management science, rapid progress can be achieved."*

And I would add that scientific management is a science that instructs how to build from the foundation, not from the roof, supported by ideas and doctrines conceived from the mind, not from experience.

In summary of the above considerations, the following should be stated:

1. The model plan, based on rigorous scientific research, i.e., the action plan required by scientific management, has nothing in common with the action plan resulting from various political programs.
2. If scientific management indicates that the most economical effect can be achieved only by acting according to a plan based on scientific research, it does not follow that government institutions or people who are distinguished only by their adherence to preconceived economic theories are entitled to develop and manage such a plan.
3. Planned action based on scientific management can develop only gradually as the number of sufficiently qualified managers increases.
4. Any artificial acceleration of planning, either through excessive government intervention or overly zealous leaders lacking adequate qualifications, will inevitably cause confusion and hinder progress rather than accelerating it.
5. Covering the entire economy with a general plan is a matter of the distant future.
6. The only rational path towards this goal is:
    a) The most intensive education and training of people who will meet the qualifications required of scientific management,
    b) Supporting the development of scientific management and its applications,
    c) Raising the overall spiritual culture of all social strata,
    d) Education aimed at replacing existing prejudices and instilling the principles of cooperation and harmony in people's minds,
    e) Supporting planned action based on scientific research in all areas of economic life, both in private enterprises and state institutions.

Part II – Prefaces to Books

Forward to the English edition

Starting in the mid-1920s, Karol Adamiecki introduced Polish translations of five pivotal texts in the newly established field of scientific management. Each of these works outlines the foundational principles of the discipline's theory and practice. The translated texts include:

1. ***The Waste in Industry Report:** Adamiecki's introduction to the 1925 Polish translation of this groundbreaking 1921 study on industrial inefficiency profoundly impacted the United States and the wider industrial world by highlighting the pressing issues of waste and inefficiency.*
2. ***Harrington Emerson's 12 Principles of Performance**: Emerson extended the ideas of scientific management beyond those originally proposed by Taylor. His work represents a significant evolution in the principles of scientific management, particularly with his emphasis on a more humanistic and gradual approach—aligning closely with Adamiecki's own perspectives.*
3. ***Frederick Taylor's Shop Management**: Despite criticisms of Taylor's writings, there's no denying his intuitive understanding of the scientific method and his pioneering development of efficient work systems. "Shop Management" is widely acknowledged as the seminal book that laid the groundwork for the entire scientific management movement and was translated into Polish as a token of appreciation for the assistance given by the Taylor Society to the Polish Institute of Scientific Organization.*
4. ***Henry Le Chatelier's Philosophy of Taylor's System**: Karol Adamiecki personally arranged the collected works of his and Taylor's mutual friend, Henry Le Chatelier, in a logical sequence and translated them from French to Polish, highlighting the importance he attributed to Le Chatelier's work. In this document, the renowned chemist and physicist distilled the essence of the scientific method presented in Taylor's work and introduced the first two laws that helped establish the field of scientific management: the Law of Division of Labor as articulated by Adam Smith, and the laws of concentration and integration observable in nature. Adamiecki solidified this foundation by introducing his own third law, the Law of Harmony.*
5. ***Prof. Jan Zawidzki's text on Henry Le Chatelier as the successor of F.W. Taylor**: By incorporating this work, Adamiecki acknowledges Le Chatelier's role in the dissemination and refinement of Taylor's principles throughout Europe, demonstrating their sustained relevance and impact.*

In his introductions, Karol Adamiecki echoed the counterintuitive notion that to genuinely understand Taylorism, non-experts should avoid reading Taylor until they had a firm grasp of the underlying principles better elucidated in the other works. As Adamiecki noted in 1929, "Taylor did not have the gift of expressing his thoughts... not emphasizing the guiding ideas he based them on enough, especially the scientific experimental method he followed, which Professor H. Le Chatelier brilliantly highlighted." This critique, while incisive, was widely acknowledged among Taylor's closest friends and followers and was not intended to undermine Taylor's seminal contributions. The respect and admiration Karol garnered from the Taylor Society and Mrs. Louis M. Taylor, Frederick's widow, is evidenced by their heartfelt condolences upon his death in 1933.

WASTE IN INDUSTRY

By the COMMITTEE ON ELIMINATION OF WASTE IN INDUSTRY *of the* FEDERATED AMERICAN ENGINEERING SOCIETIES

FIRST EDITION
THIRD IMPRESSION

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1921

Waste in Industry, Preface to the 1925 Polish Edition

English Edition: Waste in Industry, American Engineering Council, 1921

The Executive Committee of the Scientific Organization of Labor in Poland [today: TNOiK], which this year began publishing books on organization, deemed it necessary to issue a Polish translation of the book *Waste in Industry*. This work, the result of collective research conducted by the most distinguished American engineers, led by engineer Herbert Hoover, can undoubtedly be counted among the best engineering works of recent times. It is a diagnosis of the most important diseases to which industry - this important productive organ of modern societies - is subject.

Although the research was aimed at identifying the causes of losses and waste in industry in the United States of America, the diagnosis presented here applies to all countries, as most of the identified diseases can be found everywhere. The differences are noticeable only in the degree of the disease, not in its essence. Therefore, all the causes of waste of human labor, natural energy, material, and time presented in this work also exist in all branches of Polish industry, and they are even more dangerous here, as our industry, much weaker in technical and financial terms compared to the American one, is burdened with its own diseases that do not exist in America.

Familiarizing ourselves with *Waste in Industry* in our productive, technical, legislative, and governmental spheres will undoubtedly bring great benefit, as it will stimulate reflection on ways to heal our economy and contribute to the abandonment of experiments that are inconsistent with the fundamental laws of economics.

This work has particularly great value because it does not limit itself to pointing out the causes of waste, but also provides the main remedies. It indicates the great responsibilities that fall on all the factors impacting the economy. Anyone who reads this book carefully will understand that industry and industrial work are not fields limited to personal or class interests, but a great field of work belonging to the whole nation, which can yield the greatest results only when all those working in it are animated by a sense of citizenship and cooperation.

The Executive Committee believes that *Waste in Industry* will be especially beneficial to Polish engineers who play such an important, managerial role in productive work. In this book, they will find a great wealth of creative ideas, and above all, a stimulus to apply new, great ideas contained in the principles and methods of scientific organization.

By publishing this book, the Executive Committee hopes that in our country, among engineers and manufacturers, there will be people of goodwill who will initiate research into our industry, in order to make an impartial and accurate assessment of its deficiencies and indicate means of repair. Taking the initiative in this matter will be one of the first tasks of our Institute of Scientific Organization (INO) that has recently been established.

The Executive Committee considers it their duty to express sincere thanks to the American Society of Engineers for their selfless permission to publish this book in Polish, and especially to the Executive Secretary of the Society, engineer L. W. Wallace, who has already shown us great kindness and assistance in initiating our work. The kindness and honor shown to us by engineer Herbert Hoover, whose name every Pole will always remember with gratitude for his help to the victims of war, is a great encouragement and honor for us.

By presenting this fifth book of our publishing house to the readers, the Executive Committee considers it its special duty to express gratitude here to the Central Sugar Council, the Board of the Łódź Power Plant, the Board of the Piotr Drzewiecki Fund, and the Board of the Warsaw Gasworks for their substantial material assistance, as well as to all the co-workers who spared no effort in the development of this publication.

Prof. K. Adamiecki,
Chairman of the Executive Committee of the Institute of Scientific Organization in Poland.
Warsaw, December 1925.

Prefaces to books

THE

TWELVE PRINCIPLES OF EFFICIENCY

BY

HARRINGTON EMERSON

NEW YORK

THE ENGINEERING MAGAZINE

1912

12 Principles of Efficiency, H. Emerson, Preface to the Polish Edition (1925)

Until now, the widely held belief is that the entire content of "scientific organization," which Americans call "scientific management," is contained in the so-called "Taylor system." However, this belief is too one-sided and shows how little all the ideas that form the basis of this new knowledge are still known. Apart from F. W. Taylor, there were other pioneers who laid the foundations of scientific organization. They include the American engineer Harrington Emerson. When F. W. Taylor began to experimentally identify significant losses in human labor due to a lack of deeper understanding of the factors on which its useful efficiency depends, and when he still kept the results of his research secret, at roughly the same time, Harrington Emerson was also thinking about the great waste of human labor, natural energy, and time. However, he came to his conclusions in a slightly different way than Taylor. A man of profound, comprehensive education, great observational talent, and above all, an immensely developed sense of social and human ideals, observing modern technological progress and vibrant industrial life, noticed that, despite brilliant external appearances, this progress goes hand in hand with great waste of material and spiritual wealth.

In search of the causes of this situation, Harrington Emerson reached a higher level than Taylor, which allowed him to embrace broader horizons and draw more general conclusions. For this reason, seeing a greater complexity of economic and social phenomena than it appears to people focused on details, Emerson, in his principles and methods, is a greater evolutionist—he understands that real progress can be achieved only gradually and proposes methods that are not as ad hoc and radical as those of Taylor and his followers.

Emerson's efficiency principles are of particular value because they prioritize the moral element. For people accustomed to looking at economic phenomena from a purely materialistic perspective, considering productive work only as a source of material well-being and personal profits, and recognizing only truths that can be captured by a mathematical expression and measured by units of physical and chemical measures, some ideas and principles of Harrington Emerson may seem like idealism, impossible to apply in practice. However, this kind of approach cannot serve as a criterion for issuing a correct judgment regarding the principles advocated by Emerson, just as the opinion of people who cannot distinguish colors cannot serve as a basis for claiming that red or green does not exist. Fortunately, today this materialistic color blindness is losing its raison d'être, and the great successes of people like [Henry] Ford are increasingly convinced that striving for higher category goals and adhering to ethical principles can not only be reconciled with material progress but also strengthen it.

This idealistic current is increasingly permeating all areas of American life, and in the organization of productive work, it becomes a fundamental factor. Although at first glance, it may seem strange that there is a turn towards idealism among American "businessmen," on deeper reflection, it is easy to conclude that this is a completely natural phenomenon. The practical, energetic, and clear-eyed American, comparing the effort with the useful result, had to notice that only by fully coordinating all positive factors and excluding negative ones is the highest efficiency possible, and that spiritual elements have a significant role among these factors, so he had to conclude that only by taking into account both material and moral needs of humanity is the highest useful result possible.

Among all American engineers and activists who sought to base the production organization on scientific principles, Harrington Emerson is one of the first to emphasize the importance of the human factor. He synthesized a series of principles aimed not only at eliminating the waste of material wealth but also at raising the productive work to a higher level of civilization. If we consider the law of harmony, understood in the broadest sense, as one of the most important economic laws, then Harrington Emerson can be considered a pioneer of spiritual harmony applied to productive work.

As the concept of spiritual harmony gains traction in various aspects of American life, it is important to recognize the contributions of visionaries like Harrington Emerson, who have laid the groundwork for a more holistic approach to economic and social development. By emphasizing the human factor and the importance of ethical principles, Emerson's ideas continue to inspire and shape the way we think about work, productivity, and progress in the modern world.

In conclusion, the principles and ideas put forth by Harrington Emerson offer a valuable perspective on scientific management, going beyond the Taylor system and incorporating both material and moral aspects. His emphasis on the human factor and the importance of spiritual harmony in productive work has influenced the way we approach economic and social development, providing a more comprehensive and ethically grounded framework for progress.

The *Twelve Principles of Efficiency* are not the work of a moralizing and sky-gazing puritan, but the work of a practical and profound thinker who primarily addresses the issues of productivity on the basis of the common good. We believe that it is essential for us, Poles, to become acquainted with Emerson's work to find rational ways of applying the methods of scientific organization on our soil. Purely materialistic ideas and principles are too incompatible with the character of our nation to rely solely on them for progress in harnessing the wealth contained in our work. That is why we believe that we should pay particular attention to this highly significant shift, which is becoming increasingly evident in the American economy.

A significant advantage of Emerson's book is its vividness, as well as the large number of examples and comparisons that encourage the reader to think more deeply about various issues in the field of technology and organization.

Harrington Emerson's principles regarding analysis, establishing a model work plan, and executing according to such a plan, generally do not differ from Taylor's principles - he is just less radical in determining the standard. If the standard for performing a task can be considered a kind of goal to be pursued, then Taylor sets it very far away at once, while Emerson, taking more into account the average existing conditions, sets the goal closer and after achieving it, sets the next further one, and so on, approaching perfection gradually. However, he differs significantly from the Taylor school in one aspect, namely the management system. Taylor, in order to remove the excess of duties and functions that managers are burdened with in a conventional hierarchical system, appoints several managers, exercising different functions and giving parallel and direct instructions to the executor. Taylor calls this system functional. Emerson, also recognizing that the manager in a conventional hierarchical system is not able to cope with all duties, especially if he is to solve each issue based on a detailed analysis and planning, adds specialists to solve various matters, but in the role of assistant-advisers without the right to give direct orders to the executor. This system is similar to the staff in the army. This system does not violate the hierarchical structure and the principle of unity of direction, so necessary for maintaining discipline as the basis for harmonious cooperation.

Reflecting on the benefits that may arise for our nation from instilling in our minds the concepts contained in the new science of work organization, I have come to the conclusion that we Poles should first and foremost familiarize ourselves with the ideas and principles advocated by Harrington Emerson. First and foremost, because the "idealism" of this engineer-philosopher is so close to the spiritual qualities of Poles and as a result, the efficiency principles he propagates are the framework in which the creative elements of our national ideology can optimally develop; and finally, because he also identifies the significant and great civilizational task that stands before every manager-organizer.

Scientific management must not only be understood, but also deeply felt, to be applied most effectively in practice. That is why I am deeply convinced that those Polish readers of *The 12 Principles of Efficiency* who best understand and most deeply resonate with Emerson's ideas will achieve the best results, implementing these principles in life.

Harrington Emerson, in his book published 13 years ago, harshly condemned the wastefulness in American manufacturing and at the same time believed that the sound judgment of the American nation would overcome this disease. And he was not mistaken in his predictions. Today's progress in the organization of productive work in the United States is so great that if Emerson were to write a new edition of this book, many of the heavily stigmatized flaws causing wastefulness could no longer be identified. However, it was not solely the sound judgment of the Americans that contributed to this improvement but undoubtedly also the ideas instilled by Henry Emerson.

I would be happy if the Polish edition of this book achieved such a quick and positive result, and in this way, Emerson's faith in the "ideals of the Polish nation," which he beautifully mentioned in his preface to this edition, would be confirmed.

To my co-workers: Ms. Irena Szumlakowska, engineers: A. Kucharzewski and M. Domański, I express here my sincere gratitude for the enthusiasm they put into the editorial work on this book.

PROF. KAROL ADAMIECKI.

Shop Management

BY

FREDERICK WINSLOW TAYLOR, M.E., Sc.D.

PAST PRESIDENT OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

Author of "The Principles of Scientific Management"

WITH AN INTRODUCTION BY

HENRY R. TOWNE

PRESIDENT OF THE YALE & TOWNE MFG. CO.

HARPER & BROTHERS PUBLISHERS

NEW YORK AND LONDON

1911

Forward to the Frederic Taylor’s Shop Management (Polish Edition 1926)

Many Polish readers are familiar with the works of F. W. Taylor not from the original English versions, but mainly from translations into languages that are more familiar to us - German, French, Russian. Since these books were quite abundant, it would seem that there is not much need for the translation of Taylor's works into Polish at present, especially since they were published several years ago and there has been a great deal of books and articles on Taylorism in all languages.

So many might ask why publish an old work that is already so well known? This objection would be valid if Taylor's principles were already adequately understood by a wider readership. However, this is not the case, primarily because there are so many works on Taylor's principles that obscure, rather than clarify, their content. Even translators of Taylor's works into foreign languages made abbreviations or comments tinged with their own tendencies, indicating that they did not themselves fully understand Taylor's fundamental ideas. Furthermore, commentators began to appear in our country who sometimes completely distorted these ideas and made it difficult for the reader to form an impartial judgment.

Because Taylor's principles are truly the starting point in scientific management and have not lost anything in value to this day, although this science has been significantly deepened and expanded since then, the publication of Taylor's works in Polish has become a necessity in order to develop an impartial view in Polish readers and to acquaint them with these works at the source.

The purpose of this book is precisely this, and therefore it has been translated without any abbreviations, with the closest possible rendering of the author's ideas. We believe that this is the best way to contribute to the eradication of false views, so widespread about Taylor's principles, and to correct the one-sided understanding by those readers who have read various authors writing about Taylorism, but still do not understand it well.

Since the author did not include all his thoughts on organization in the book *Shop Management*, the reader should read his other works as well in order to become familiar with the entirety of his principles, methods, and views, such as: *The Piece Rate System* (1895), *On the Art of Cutting Metals* (1906), *The Principles of Scientific Management* (1911).

The Institute of Scientific Organization (INO) will probably try to publish them in Polish in the future, but for now, in order to partially fill this gap, the following smaller works have been included in this edition: *Notes on Belting, Why Are Industrialists Reluctant to Hire Technicians with Higher Education?,* and *The Principles of Scientific Management*.

However, when it comes to gaining the best understanding of Taylor's principles, the reader should also familiarize themselves with the works of the famous French professor, Henry Le Chatelier. He is the only commentator who has properly illuminated Taylor's ideas and highlighted with simplicity and insight, characteristic of the French genius, what constitutes their main content.

All of Prof. Henry Le Chatelier's works on this topic have been translated into Polish and collected into one whole under the title *The Philosophy of the Taylor System* (Publication of the Institute of Scientific Organization, 1926).

Prof. K. Adamiecki.
Warsaw, April 1926.

Prefaces to books

Format normalny
A5 (148×210 mm.)

FILOZOFJA SYSTEMU TAYLORA

PRZEZ
PROFESORA HENRY LE CHATELIER,
CZŁONKA AKADEMJI FRANCUSKIEJ

TŁUMACZENIE I UKŁAD
INŻ. KAROLA ADAMIECKIEGO,
PROFESORA POLITECHNIKI WARSZAWSKIEJ.

WARSZAWA
1926

NAKŁADEM INSTYTUTU NAUKOWEJ ORGANIZACJI
PRZY MUZEUM PRZEMYSŁU i ROLNICTWA, KRAK.-PRZEDM 66.

Philosophy of Taylor’s System, Henry Le Chatelier, Translator’s Forward to the Polish Edition (1926)

The so-called "Taylor system," as the foundation of scientific management, has long since made its impact felt in our country. However, for quite some time, its echoes were faint, failing to leave significant impressions even on those who should have been most receptive to them. It was only after the war—particularly when our society, after years of unfortunate experiences, started to understand that boosting productivity is crucial for improving prosperity and strengthening the state's stability—that we saw heightened interest in methods designed to enhance efficiency and productivity. Therefore, we hear more and more frequently expressions such as "Taylorism," "Taylor's system," and "scientific management." In recent times, it has even become somewhat fashionable in our country and many people have been discussing this topic.

Judging by this publicity, one might suppose that many people in our country understand what scientific management is all about. But this would be a false conclusion, because upon closer examination, it will be found that their number is simply negligible. Even among those who have read Taylor's works and sifted through many works of other authors in this field, there are very few who have properly understood the fundamentals of the subject.

This is due to a number of reasons. First of all, Taylor himself puts too little emphasis in his works on the most important things and fails to express his thoughts methodically enough, sometimes putting too much emphasis on less important details. Then, among the great literature, as it appeared on Taylorism, there are a lot of books and articles that don't explain, but rather, obfuscate the matter. Some authors, supporters of Taylor's system, often focus primarily on secondary details, missing the forest for the trees. Conversely, opponents tend to interpret Taylor's ideas in ways that best support their counter-arguments, sometimes distorting his original intent in the process.

In addition to the above reasons that make it difficult for the reader to understand Taylor's organizational principles, there are other factors that contribute to the formation of completely false and negative concepts about these principles in the minds of many.

Socialists, who consider the issue of productivity from the perspective of the political struggle between "labor" and "capital," contribute especially to the dissemination of these erroneous concepts in public opinion. For them, Taylor's assertion regarding cooperation, collaboration, earnings dependent on the individual efficiency of the employee, raising his prosperity without the need to resort to toppling the entire social system, etc., are simply heresy that strikes at the "holiest" canons of Marxist faith. Therefore, adherents of this faith, in their fight against the Taylor system, distort its fundamental ideas and spread the worst possible opinion.

Since the literature on Taylorism coming from these spheres is very abundant, especially in the field of journalism, the conviction has arisen among many people that Taylorism is a monstrous means of overloading and exploiting the worker to the benefit of capitalist entrepreneurs.

To strengthen this completely false opinion, there are also contributions from some theorists in the field of the psychology and physiology of work, who, whether due to a lack of understanding of Taylor's basic idea or under the influence of preconceived notions, express negative opinions about the Taylor system[1].

Various amateurs also contribute to discrediting the Taylor system, as well as scientific management in general, in the eyes of the public. These individuals try to introduce certain details of the organization in practice, having a weak understanding of the main principles, especially many of the so-called "scientific organization advisors," who have in view not so much the true improvement of the organization, but their own interests. These people, not having the necessary experience, are often very imaginative in advertising, as well as in writing books and articles calculated for effect.

The principles of scientific management, despite their wide publicity, have penetrated only very few minds. This is due to various circumstances and the fact that new ideas take time for the human mind to process. However, because the application of these principles in all fields of productive work is of utmost importance and urgency, accelerating the process of their dissemination becomes necessary. One of the most effective means to this end is to familiarize Polish readers with the principles of scientific management in their purest form. Therefore, works of the proper creators of this science or the best commentators should be added to our literature.

Regarding Taylor's principles, there is only one commentator who presented them in exactly this form and captured Taylor's main guiding idea even better than the author himself. It is the famous professor, Henry Le Chatelier, who was the first to understand the importance of applying science to organization in Europe and became a fervent defender and pioneer of the Taylor system. If a Polish reader truly wishes to understand the full depth of this system, they should study this book. In my opinion, this is not only the only way to thoroughly familiarize oneself with the Taylor system, but also to understand how powerful the scientific method can be in production processes, where empiricism almost exclusively prevails. Professor Henry Le Chatelier is an unparalleled pioneer in this regard, an apostle of experimental science, and undoubtedly correct in claiming that only with its help can man reach the furthest limits in understanding the laws of nature and their application.

1) Here, professional reluctance on the part of a certain group of physiologists and psychologists also seems to play a role; they cannot forgive Taylor for daring to enter their field as an engineer, trying to solve some problems related to the physiology and psychology of work. Perhaps it would have been more politically astute on his part to seek help from physiologists and psychologists on these issues, but it would not have helped him solve his problems any better, because thirty years ago, physiology was just taking its first steps in the field of research on human work, and psychology entered this path much later. Therefore, if some of Taylor's solutions in this area seem too empirical and inaccurate in the light of the current state of the physiology and psychology of work, one cannot draw a negative conclusion about his principles from this. Simple justice, however, would require that he be credited even with the merit of trying to solve these problems as best he could, and above all, of having tackled them at all, thereby giving impetus to physiologists and psychologists to take an interest in them and enter the path of scientific research on the physiology and psychology of work.

Professor Le Chatelier's works on the Taylor system appeared in the form of a series of articles published in various journals or pamphlets over the course of several years, starting in 1914. Since in these articles Prof. Le Chatelier presented the Taylor system each time as a compact whole, only illustrating it with various examples, it was necessary not only to translate them, but also to arrange the content in such a way that the author's main guiding idea would be best highlighted without too much repetition. Undertaking this task, to a certain extent editorial, is a great honor for me, as the author completely trusted me in this regard, leaving me complete freedom in the arrangement. I tried to do this task as well as possible, avoiding shortcuts that would detract from the flow of thought expressed by the author. In this way, the first part was composed from several articles. The second part included translations of the rest of the articles without any changes to the arrangement. Although some of the ideas expressed in them are repeated from the first part, I did not consider it appropriate to make any deletions, both for the sake of preserving the integrity of the topic of each article and because these repetitions provide appropriate emphasize.

Prof. Le Chatelier, in almost all of his articles on the Taylor system, makes comments and comparisons concerning industrial work and the education of technicians in France. I have kept these comments in their entirety in this translation, as they can be applied completely, and perhaps even to a greater extent, to our own circumstances.

In presenting this book to the Polish reader, I am convinced that it will have the same impact as it did in France, which is not only to contribute to a proper understanding of the Taylor system, but also to increase the number of people who will pave the way for true science in production workshops.

Finally, I cannot refrain from expressing my tribute to the venerable Professor Le Chatelier and my great gratitude for his kindness and assistance that he showed me in translating his work.

I would also like to thank Professor W. Broniewski for allowing me to include the biography that he recently wrote on the occasion of the 50th anniversary of Professor Henry Le Chatelier [of his marriage to Geneviève Nicolas], and in this way contributed to popularizing the name of this great and deserving man among Polish readers.

Karol Adamiecki, Warszaw, Feb, 1926 r.

Jan Zawidzki.

Henry Le Chatelier

Wspomnienie jubileuszowe (1871—1921)[1].

Henry Le Chatelier. Notice jubilaire (1871—1921).

Sfery naukowe i techniczne francuskie obchodziły w dniu 22-im stycznia b. r., w sposób uroczysty, jubileusz piędziesięcioletniej działalności naukowej Henryka Le Chateliera, profesora Sorbonny oraz członka Akademji Nauk. W uroczystości tej wzięli udział również wybitni przedstawicieli świata naukowego i technicznego Anglji, Ameryki, Danji i Szwecji. Jubilatowi wręczono medal pamiątkowy, a zarazem utworzono przy Paryzkiej Akademji Nauk fundację wieczystą jego imienia, której odsetki przeznaczono na popieranie doświadczalnych prac badawczych z dziedziny techniki.

Aczkolwiek mówi i pisze się u nas wiele o przyjaźni polsko-francuskiej, aczkolwiek zaznacza się potrzebę wzmocnienia wpływów kultury i nauki francuskiej na naszą umysłowość, podnosi potrzebę nawiązania bliższych stosunków wzajemnych, tem niemniej polskie sfery naukowe i techniczne nie wzięły udziału w pomienionej uroczystości jubileuszowej, a czasopisma nasze nie podały o niej żadnej wzmianki.

Pragnąc choć w części naprawić to przeoczenie i niedopatrzenie, podjąłem niełatwe zadanie przedstawienia w krótkim odczycie wielostronnej działalności naukowej jubilata, będącego jednym z najznakomitszych współczesnych fizyko-chemików, a zarazem niewąt-

[1]) Odczyt wygłoszony na posiedzeniu Polsk. Tow. Chem. w dniu 13-ym maja 1922 r.

Introduction: Henry Le Chatelier as the successor of F.W. Taylor, Prof Jan Zawidzki (1928)

When considering the entire activity of Prof. Henry Le Chatelier, what strikes one the most is the immensely broad scope of the mind of this great man. He does not confine himself exclusively to his specialty - the fields of physics and chemistry, but he rises to heights from which he captures with his penetrating gaze the entirety of phenomena concerning both inanimate and living nature. He takes a particular interest in manifestations of economic and social life.

In this respect, as if to contradict himself, he continually propagates that, in order to accomplish something in science, one must focus on certain issues only, set a specific and limited goal, and measure every detail while researching. But this contradiction is only apparent, for he himself is faithful to this principle in all research work he undertakes; the diversity of issues, which he is interested in, testifies only to the genius of his mind, always reaching to the depths of the very essence of a phenomenon, as well as to his high and subtle spiritual culture, vividly responding to the currents of social life.

The second prominent feature of Prof. Le Chatelier is that, in all his thoughts, expressed on various subjects, whether concerning physicochemical phenomena, industrial and economic issues, or finally matters of education and upbringing of the youth, one general idea always shines through: "experimental science, searching for laws of dependence between cause and effect." This idea resonates in every word spoken by him, and you would say that if Prof. Le Chatelier speaks on matters far beyond the scope of his specialty as a physicochemist, he does so to instill this idea into all minds, to instill faith in the law of causality, to teach the experimental method and to strengthen the belief that only with the help of this method can one find the infallible path to the truth.

In this regard, he is unmatched, and perhaps the only proponent among today's scholars. He is a staunch enemy of empiricism, speculative thinking, and preconceived doctrines, which so easily obscure reality and have led so many minds astray, and in the approach to economic and social issues, have established so many unfortunate and false dogmas in people's heads.

This promotional activity of Prof. Le Chatelier is a particularly cherished aspect of his creative work. I believe I am not mistaken in asserting that this fondness for science explains his enthusiasm for Taylor's work, which he is such a passionate promoter and defender of. In it, he found, above all, a purely scientific method applied to the immensely complex phenomena of industrial work, as well as an excellent confirmation of the idea he propagates.

Taylor's work resonated with Le Chatelier particularly for the reason that Taylor, despite not possessing a theoretical background, nonetheless, guided by an innate faith in the law of causality and sound judgment in his experimental research, went through all stages of the scientific method, applying it to solving far more complex problems than those addressed in scholars' laboratories. This circumstance undoubtedly contributed significantly to the vivid sympathy and admiration with which Le Chatelier repeatedly turned to the person of Taylor himself. This sympathy was also evoked by the fact that both shared common ideals of selflessly serving the general good of humanity.

Apart from that, Le Chatelier immediately understood how vast and far-reaching the horizons opened by Taylor's work were and how significant their impact would be on the economic and social life of civilized nations.

All of this prompted Henry Le Chatelier to wholeheartedly propagate Taylor's ideas, and he undoubtedly played a significant role in spreading these ideas throughout Europe, especially in France.

However, it is essential to emphasize that Henry Le Chatelier contributed primarily to the proper understanding of Taylor's thoughts and principles, as in his speeches and numerous articles on the subject, he made it clear what Taylor himself could not express, which is the most important aspect of his work, namely the scientific method, which Le Chatelier defined with such extraordinary clarity.

Much has been written about Taylor's system. Today, there is already vast literature on this subject, especially American, but none of these works, including the author himself, provide a proper understanding of the fundamentals of scientific organization. One can read all these books and still have a vague idea of the subject. Only the concise works of Prof. Le Chatelier, until recently scattered in separate brochures and articles in various journals, provide a clear picture of the ideas of the great American engineer.

For several years now, Prof. Le Chatelier has not missed any opportunity to emphasize the importance of scientific management and defend Taylor's ideas, which are often attacked and falsely interpreted.

In addition, he consistently takes the initiative in all efforts aimed at teaching and implementing scientific management in France. As a result, he has become the center around which an ever-growing circle of promoters of scientific management in French conferences. Today, he is undoubtedly the most respected and deserving pioneer of scientific management and Taylor's successor in Europe.

In recognition of his great merits, the American Taylor Society has chosen him as its honorary member.

Since interest in scientific management in our country has been growing rapidly in recent times, it is of great importance that our literature already includes translations of Prof. Le Chatelier's works on Taylor's system, collected into one volume. Soon, a translation of his latest book "Science and Industry" (Science et Industrie, 1926) will be published, in which the author addresses the most vital topics of the present day with his characteristic extraordinary simplicity and clarity, further emphasizing the significance of Taylor's principles.

The fact that Prof. Le Chatelier readily accepted our invitation to visit Warsaw in early May for the II Polish Congress of Scientific Organization, despite his advanced age and the considerable sacrifice of undertaking such a long journey, serves as proof of his commitment to the development of Taylor's ideas. Prof. Le Chatelier demonstrates an extraordinary friendship towards our nation, wishing to contribute his spoken word to stimulate minds in our country towards understanding the great ideas contained in the science of organization.

I also extend my thanks to Prof. W. Broniewski for allowing me to include the biography he recently wrote on the occasion of Prof. H. Le Chatelier's 50-year wedding anniversary, thus contributing to the popularization of the name of this great and deserving man among Polish readers.

Warsaw, May 1928.
Prof. Karol Adamiecki.

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Appendix A: Memorial Addresses (1933)

Organizational Review (*Przegląd Organizacji*), 1933, Issue 8

HONORING THE MERITS of the late Prof. KAROL ADAMIECKI

At the initiative of the Institute of Scientific Organization, the Association of Technicians, and the Circle of Engineers and Technologists, a solemn meeting was held on Friday, June 9, 1933, at 8 pm in the building of the Association of Technicians in Warsaw, under the chairmanship of Prof. Ignacy Radziszewski, dedicated to honoring the merits of the late Prof. Karol Adamiecki.

After the opening of the meeting by the Chairman, at whose request those present honored the memory of the deceased by standing up, speeches were delivered by Eng. Piotr Drzewiecki and Prof. Stefan Biedrzycki, members of the Board of the Institute of Scientific Organization, and Eng. Edward Sochaczewski, a representative of the Circle of Scientific Organization Students of the Warsaw University of Technology.

The content of the speeches was as follows:

SPEECH by Eng. P. DRZEWIECKI

Mr. Chairman, Ladies and Gentlemen, Colleagues,

The life and work of the late Karol Adamiecki, dedicated primarily to a single field that he held dear, serves as a testament to the significant achievements that can be attained by an individual through persistent and systematic work.

The late Karol Adamiecki was born in 1866; he came from an engineering family; after graduating from the Łódź High School with a gold medal, he studied at the St. Petersburg Institute of Technology, which he completed at the age of 25 with the degree of engineer-technologist.

After completing his theoretical studies, he entered practical work as an engineer, mainly as a manager of technological processes, especially metallurgical ones.

Having a research-oriented and exceptionally insightful mind, he subjected the course of technological processes to a thorough analysis, examining means aimed at increasing the efficiency of production work.

After numerous works carried out in many manufacturing plants, in 1903 he developed and announced his own method of improving the efficiency of collective work using graphical analysis, establishing harmonious teamwork. He published this method in *Technical Review* (*Przegląd Techniczny*) in 1909.

Despite the importance of this method, it did not attract the attention of the technical and industrial world at the time, as it was published only in Polish and Russian.

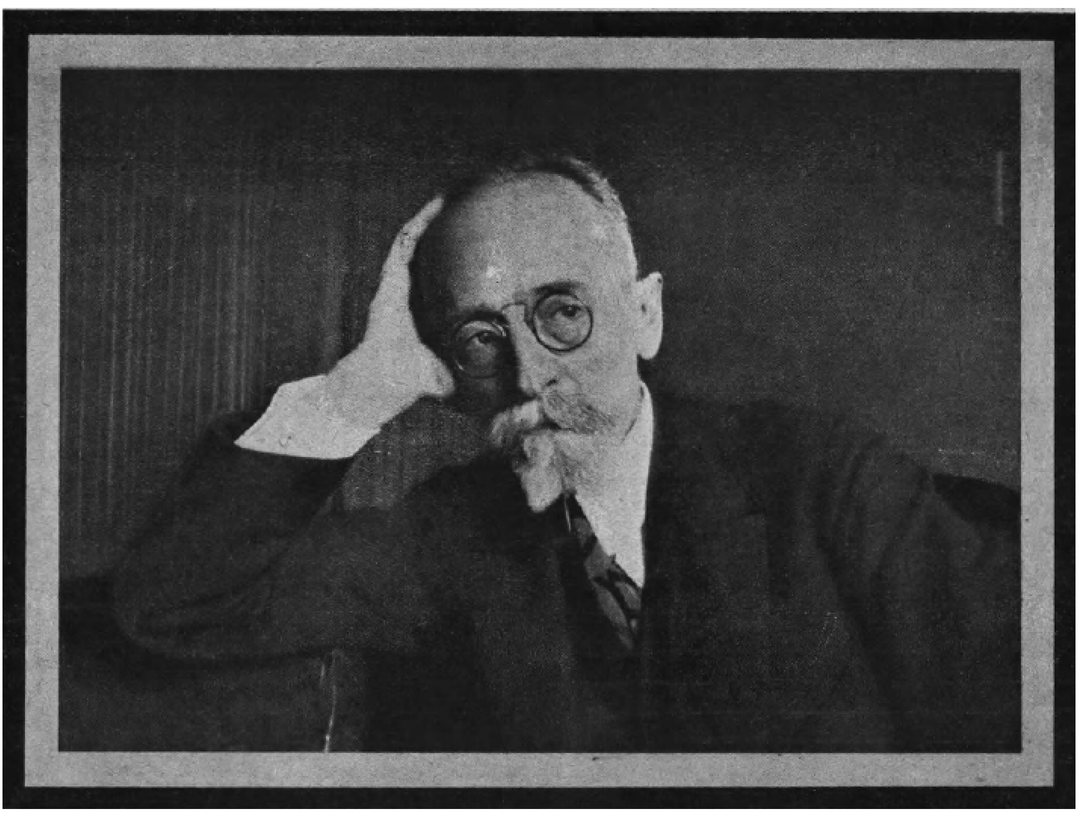
This method of harmonizing collective work was created by Prof. Karol Adamiecki simultaneously with Taylor's works, who, working in the opposite hemisphere, laid the foundations for the scientific study of human labor for the first time.

Taylor's works concerned the improvement of individual efficiency, while Prof. Karol Adamiecki's works focused on improving the efficiency of collective work and became an important complement to Taylor's works. Today, both of these methods are the basis of contemporary organization science.

As soon as Prof. Karol Adamiecki returned to his reborn homeland after the war, his works, previously carried out within individual establishments, acquired a broader and more significant meaning, as they were devoted to introducing proper organization in the re-emerging post-war economy of Poland.

Already in the autumn of 1919, Prof. Karol Adamiecki began lecturing at the Warsaw University of Technology, later taking over the newly created chair of "Principles of Organization of Work and Industrial Establishments."

At the same time, he successfully sought the establishment of circles of scientific organization engineers in Polish technical associations, in order to arouse the interest of the technical and industrial world in improving organization by applying the guidelines of the new science of organization.



Established by these circles at the initiative of Prof. Karol Adamiecki, the Association published a series of fundamental works in the field of scientific management, under the editorship of Prof. Adamiecki, laying a solid foundation for the development of this knowledge in Poland.

Prof. Karol Adamiecki's efforts, aimed at promoting scientific management, culminated in the creation of a central hub, which was the Institute of Scientific Organization (INO) [today the Institute of Organization and Management Sciences, [TNOiK)], radiating numerous ways and methods in Polish society for the dissemination of proper organizational principles.

Established in 1925, the Institute of Scientific Organization, of which Prof. Karol Adamiecki was a co-founder, honorary member, and director, gathered a significant number of collaborators and developed a broad publishing, lecture, educational, public relations, advisory, and conference campaign that gained recognition not only in the country but also abroad.

Thanks to the educational work of Professor Karol Adamiecki at the Institute of Scientific Organization and the Warsaw University of Technology, a large group of skilled technicians and managers of industry became promoters of scientific management in Poland.

The work of Prof. Karol Adamiecki at domestic and international conferences has gained widespread recognition, and the activities of the Institute of Scientific Organization, to which Prof. Karol Adamiecki selflessly devoted not only his work and significant financial resources but also his entire care and soul, quickly grew. Prof. Karol Adamiecki was appointed Vice-President of the International Committee of Scientific Organization [CIOS], a member of the Board of the International Institute of Scientific Organization, and President of the Polish Committee of Scientific Organization.

At the 5th International Congress of Scientific Organization in Amsterdam, Prof. Karol Adamiecki received high distinction in the form of the "Plaque d'Or" badge.

The Masaryk Academy of Labor elected him as its member and awarded him a Diploma of Recognition. Poland honored him with the Polonia Restituta Order, and Czechoslovakia with the Order of the White Lion.

The character and activities of the late Prof. Karol Adamiecki are well-known in this circle, as he often spoke from this place, always finding applause and support for the ideas he advocated.

Here, in 1908, a quarter of a century ago, he first publicly presented his scientific method to Polish society, a method concerning the harmonization of work, which only at the end of his life gained such outstanding recognition that it was awarded by the International Committee of Scientific Organization last year.

Prof. Karol Adamiecki was given the opportunity to contribute his extensive experience, gained via many years of work, to the rebuilding of his revived homeland. In doing so, his aspirations were fulfilled. At the end of his hardworking life, he worked exclusively for the common good and earned high recognition.

His diligent life, marked by 42 years of work devoted to a single field, became the foundation for a wide-ranging and beneficial action for the reborn homeland: the idea of proper organization and its popularization.

Karol Adamiecki is the standard-bearer of this idea in Poland, a standard-bearer around which the work of scientific management was gathered and which will continue to serve as a guide for efficient and properly organized work in Polish society.

Our colleague, engineer and professor Karol Adamiecki, has earned the gratitude of his homeland.

SPEECH BY Prof. S. BIEDRZYCKI

A person not familiar with the subject might be amazed when reading the biography of Frederick Taylor. What did this man, whose name became synonymous with a thorough reorganization of industry, accomplish in his life? Here is a dry summary of his achievements:

1. Improved the steam hammer.
2. Changed the system for sorting bicycle bearings.
3. Dealt with the maintenance of transmission belts.
4. Identified the most appropriate grass mixture for sowing lawns.
5. Invented high-speed steel and indicated the proper cutting speed for metals.
6. Wrote a book on managing a manufacturing workshop.
7. Reformed the piece-rate wage system.

Is that all? the astonished reader might ask.
Does such a shift from steam hammers to bicycle bearings, from metal cutting to wage systems, and from belt maintenance to golf course lawns constitute the essence of Taylorism, which is now blamed for causing overproduction and triggering a deep global crisis?

And what are the achievements of the late Karol Adamiecki?

In 1894, he investigated the bending strength of boiler plates, depending on their dimensions and shape, and as a result of these studies, the Petersburg Ministry of Communications changed its standards in this field. Between 1895 and 1899, he examined the causes of frequent breakages of various parts in rolling mills and pointed out to the designers where the root of the problem lay.

In 1904, he dealt with the phenomenon of rusting roof sheets, and the results of these studies were presented here, from this lectern, in 1909. Between 1907 and 1909, he investigated the heat balance in drying rooms and brickworks and presented his findings here in 1912.

Between 1907 and 1909, he was involved in the pressing processes of ceramic products and demonstrated the need for uniform pressure.

In 1911, he presented the results of his research in the field of ceramic furnaces here.

In 1918, during the shortage of fuel materials, he designed a heating stove for apartments, which saved 40% of fuel consumption.

And again, we see a strange inconsistency in the subjects of his work; there are issues of material strength, thermal management problems, rolling mill research, and brickworks research!

Perhaps the main significance here lies in the element of inventiveness and the improvements he introduced?

But which of the senior engineers present in this room, whose fate has thrown them from one field to another, could not demonstrate a similar list of various small inventions and improvements introduced by themselves in factories? I'll go even further! Which of the artisan masters, even if they were illiterate, could not demonstrate a series of inventions? Can this determine a person's fame? In that case, how many famous people would we have among the myriad inventors, with whom each of you has probably encountered in your lives!

No! For neither Taylor nor Adamiecki was technical inventiveness the goal of their lives.

The inventions made by them were not the goal, but merely a means to achieve completely different objectives.

Although Taylor did not conduct such systematic studies as Adamiecki, both of them came from the era when a young person adept of technical knowledge was given only mathematical and design information, as if everyone in their future careers were to work exclusively in design offices. And if the young engineer went not to that office but to the so-called "factory management," to directing operations, he would be helpless in the face of a whole range of administrative and organizational issues, the existence of which was not even mentioned to him at the university. And if he asked his older colleagues where to learn these things, they usually replied that the art of management depended primarily on a certain innate administrative sense that one had to be born with and that had to be further refined in practical life; books on these issues were not written, and there was no scientific discipline that would deal scientifically with these mundane everyday issues. And no one at that time taught the young engineer that in another scientific field, namely plant physiology, the so-called "law of minimum" had been known for several years, stating that although the growth of a plant depends on a whole range of its mineral nutrients, the yield is dependent only on one nutrient - namely the one that is least present in a given soil.

And no one told the young technician that this Liebig's "law of minimum" had been extended by economists to all economic, organizational, and administrative issues. But it was precisely Taylor and Adamiecki who, initially perhaps completely unconsciously, oriented themselves in the fact that the success of a company always depends primarily on the production issue, which in a given company is in the worst position at a given moment. And this is precisely the explanation for the fact that both Taylor and Adamiecki shifted in their activity from one issue to another, as it always depended on where they expected to find this Liebig's "minimum."

Although Taylor ended his activity with the book "The Principles of Scientific Management" as an illustration of the applicability of the law of minimum to technical life, it cannot be said that his idea was strictly defined and accurately presented there. Taylor, like many other Americans, knew how to work and found the intuitive way to proceed, but he could not teach and could not create a science. Therefore, you can still find enthusiasts of Taylorism in America who give propagandistic lectures under the title "What Taylorism is not," forgetting the fundamental thesis of logic that "definition is not made through negation." And when Americans are pressed against the wall with the demand: "give me a scientific definition of Taylorism," they reply: "come to us to see how it is done, but go to the Germans to ask what it is called."

Adamiecki proceeded quite differently from Taylor. Already in 1895, he conducted time measurements in rolling thin sheet metal, demonstrating his orientation in the overall work, and in 1903 he gave a presentation at the Technical Society in Yekaterinoslav [modern day Dnipro] on the "principles of collective work." I omit the fact that this presentation aroused great interest and became the basis for a series of reorganizational works, but I draw attention to the fact that already in 1903, the late Adamiecki had the view that the mistakes in the organization of collective work most often constituted the minimum, determining the success or failure of an enterprise. And while Taylor continued to look for the causes of the problem in various technical details and individual mistakes, Adamiecki clearly stood on the platform of organization, although he did not yet use the term "harmony," which was the main motto of his later activity.

In 1908, he gave a presentation from this podium on the principles of collective organization, in which he provided a graphical method of analyzing and planning work, so not only talking about what he did and how he did it, but also teaching others how to do it.

In 1918, he discussed the issue of examining operating costs here, which for him were not only the basis for determining the selling price, but primarily the test of the proper organization of the enterprise.

In 1924, he presented a paper to the Congress in Prague, Czech Republic, which was somewhat a synthesis of his entire work, covering:

1. the laws of optimal production,
2. the laws of harmony in collective work,
3. the laws of division of labor alongside the laws of concentration of labor.

However, the proper synthesis of his thoughts is contained in two handwritten works that he compiled only in the last years of his life.

In this way, step by step, Adamiecki moved towards his goal and his idea, proclaiming that the laws of harmony as the laws of organization determine the success of every undertaking, and that these laws can not only be studied and researched like any other branch of knowledge, but also should be studied and researched.

Finally, when he managed to crystallize his views into a whole, he became not only an ardent promoter of this idea, which he called scientific management, but also very jealous of the purity and correctness of this idea. Knowing from the American experience how many laypeople would want to misuse the name of this idea to earn money as advisors, discrediting his lofty idea, he restrained a series of these or other initiatives if he was not sure that these actions would strictly correspond to his ideas. When he was allowed to open the Institute of Scientific Organization, he directed all his efforts towards assembling a library in all the languages of the world and to adapt the works to the Polish language that best represented the principle of scientific management. This resulted in a series of strange books that are considered translations from English or French, but which cannot be found in the originals, as they are compilations of various articles and excerpts from book editions; thanks to this, the views of a particular author on a certain issue are easier to understand from the Polish edition than from the scattered original articles in various magazines.

His work, undervalued in his own country, was nevertheless recognized abroad, which saw in Adamiecki one of the creators of a new branch of knowledge. I remember with what astonishment one of the delegates of the Polish industry at the international congress listened to the words of the Italian Mauro, who claimed that Italians were envious of Poland for both Adamiecki and his publishing activity. In contrast to Taylor, Adamiecki knew precisely what he was doing and what he was aiming for, and he clearly taught people how to research and study the issues of organization and management.

But the late Karol Adamiecki, like all of us, was only human and therefore had his flaws and human shortcomings. Those who did not know him closely and did not know what to appreciate in him could be very discouraged by his behavior; how many times, when it came to making an urgent and important decision, Adamiecki himself, who advocated time studies and taught about wasting time, instead of issuing orders, rested his head on his hand as we see in this portrait, and became deeply lost in thought, not seeing the losses resulting from a lack of decision. His mind was then racing through various technical details to grasp the fundamental idea, abstracting from the forms in which this idea stood before him.

This puzzled and outraged more than one person. But hasn't history recorded the opinion of Charles Darwin's cook? When someone told her that Darwin was a great man, she indignantly denied it. "Where is he great and wise? Rather, he's confused! Because when I call him to dinner, he's ready to stand in the middle of the garden and watch the leaves of flowers for hours, forgetting that the soup is cooling on the table and the roast is burning in the oven!"

The late Adamiecki was a thinker and a creator of new ideas, and we must forgive him for not being an efficient reproducer of other people's ideas or a "brave" worker in the everyday sense of the word. However, as the saying goes, "the dead travel fast." Day by day, our memories of Adamiecki as an ordinary man, full of ordinary human flaws and shortcomings, will fade; day by day, our personal memories of him will detach from his name. But instead, day by day, his fundamental ideas will become more distinct, and then we will say about him what we say about his ideas, that they are great.

And the time will come when, not only in the education of technicians but also economists, Adamiecki's thesis that organization and management cannot be left to the fate of "innate" abilities but must be studied and educated will find proper recognition. Then we will realize that alongside the names of Taylor, Fayol, Le Chatelier, Adamiecki's name will be considered fundamental in this field of knowledge. And then Poland will take pride in the fact that it was the Pole Adamiecki who contributed the principle of harmony in organization and management to the universal treasury. And only then will the general public understand the justification of my claim—Honor to his memory!

SPEECH by Engineer E. SOCHACZEWSKI

Mr. President Drzewiecki and Professor Biedrzycki have presented in their excellent reports the life, work, and essence of Karol Adamiecki's scientific achievements. In my opinion, as one of his young students, it is important to illustrate the Professor's relationship with the youth.

Karol Adamiecki taught two subjects at the Warsaw University of Technology: "Rolling and Forging" and "Principles of Work Organization." "Principles of Work Organization," as less related to technical issues, did not speak as strongly to the interests of young students. The relatively small importance attached to the degree from the "Principles of Work Organization" exam contributed even more to the decrease in attendance at these excellent lectures. However, the students' encounters with factory life during summer internships had an impact. Senior students, even from those departments where "Principles of Work Organization" were an optional subject, realizing the dominant importance of organization for the course and development of a company during factory internships, gathered at Karol Adamiecki's lectures, listened to them with the deepest interest, and after the lectures, they still detained the professor at the lectern for a long time, listening to the answers he willingly provided to additional questions related to the lectures.

Against the backdrop of these lectures, a group of students, led by Zygmunt Sławiński, founded the Warsaw University of Technology Students' Scientific Organization Circle in May 1930. The professor's relationship with this student circle is much more characteristic than the lectures themselves when it comes to illustrating Karol Adamiecki's relationship with the youth. At first, the professor feared that the new student group was a reflection of the fashionable pursuit of scientific management slogans, discouraged us from any more ostentatious propaganda performances, and encouraged us to deepen our studies. Over time, the professor became more and more convinced that the group of people who had joined the Warsaw University of Technology Students' Scientific Organization Circle were not seeking personal publicity or some immediate benefits, but rather wanted to deepen their knowledge of organizational science together, more efficiently.

The professor's attitude towards us became increasingly friendly. The professor allowed us to use the library of the Institute of Scientific Organization, provided the Institute's room for courses and propaganda studies, and above all, tightened personal contact, with more frequent, more direct, and deeper exchange of thoughts taking place. The professor often had very long conversations with the founders and leaders of the Circle, either in the privacy of his office at the

University of Technology or in his private residence. Against the backdrop of these conversations, the answer to the most important question for us young people began to emerge: where are we heading, where is the end of the decline of workshops, where is the limit of unemployment, where is the dam of the flooding wave of pessimism, poverty, and tragic retreat of progress from the occupied positions? From Karol Adamiecki's words, his far-sighted, unwavering thought, animated by an unshakable faith in the victory of sound reason over pseudo-educated wisdom, flowed towards us.

We understood that the world has a future ahead of it, we understood that increasing the efficiency of production will lead to the supply of societies with all those goods that today are in vain desired by large masses of people. Implementing such an organization of social forces to ensure a practically fair distribution of the fruits of production, to realize a short, efficient working week and longer, more joyful days of spiritual development than today, is a difficult, enormous task, but not an impossible one; even more: this task requires the fastest solution, and forces us to develop it due to the helpless march into the unknown depths of the crisis.

Professor Adamiecki firmly believed in the bright tomorrow of humanity, and he expressed this belief in the conversations he held in the last months of his life with Stanisław Jelnicki and Tadeusz Twardowski, who are now leading the Circle of Scientific Organization Students at the Warsaw University of Technology. Professor Adamiecki told them that:

> *"the only method to lead the world out of economic chaos is to train an appropriate group of leaders who will ensure social peace."*

Knowing the difficulties of being a leader, Professor Adamiecki warned against hasty experiments in the field of planned economy, saying that:

> *"It is good that our economists are against planned economy; it protects this excellent tool from being used by unskilled craftsmen."*

And that's why, for us young people, the professor was not only an outstanding scholar, not only highly appreciated during his lifetime, a famous man worldwide...

Karol Adamiecki was, is, and will be for us a fervent pioneer of efficiency, fighting against waste and loving work. Adamiecki was not a popularizer and propagandist of scientific management – he was a pioneer in the most dignified sense of the word. Adamiecki was a man who did not seek publicity for his work, but knew how to choose people who, believing in the purposefulness of the work, would undertake any task assigned to them with joy, initiative, and persistent energy. This irreplaceable leader of progress knew how to inspire, enlighten, and direct these people along the shortest path to their goal.

Had Karol Adamiecki spent his entire life promoting the science of organization among the masses, his idea might not have outlived its creator for long. But this great man chose another path – and that is why, when he left us, he left behind two fortresses of his idea: the Institute of Scientific Organization and Management, and the Circle of Scientific Organization Students at the

Warsaw University of Technology. Two small groups of people, faithful to their leader's idea in every action and to their last breath.

On behalf of the young students of Karol Adamiecki, I make this statement:

"By our actions, we have decided to build a monument of gratitude to the one who inspired our movement, who gave us faith that the darkness of today is not the twilight of civilization, and who gave us the method and showed us the path along which, by persistently following, we will reach a bright tomorrow and happiness – the era of harmony."

After the above speeches were delivered, the Chairman, Prof. I. Radziszewski, read out a letter sent to the Presidium from former Minister of Agricultural Reforms Prof. Witold Staniewicz, a member of the Institute of Scientific Organization. The content of the letter is presented below.

Esteemed Gentlemen!
Thanking you kindly for the gracious invitation, I regret to inform you that I will not be able to personally pay tribute to the great merits of the late Professor Adamiecki. Therefore, I would like to assure you, even in writing, that my thoughts will be with you tomorrow evening, as I will always gratefully remember the help and enlightened advice of the deceased, which I constantly used in my state work.

With high respect,
(—) Prof. Witold Staniewicz

CONDOLENCE MESSAGES AND LETTERS. OBITUARIES

The death of Prof. Karol Adamiecki not only cast a shadow of mourning over the Institute, which the deceased was the director of, but also caused painful echoes in the scientific world and leading spheres of society – both in Poland and abroad.

Numerous crowds gathered at the Powązki Cemetery on the day of the funeral, expressing their grief for the untimely death of the eminent scholar and paying their last respects to the late Karol Adamiecki.

A series of speeches were given at the open grave to honor the memory of the deceased. On behalf of the Warsaw University of Technology, speeches were delivered by: J.M. Rector Prof. W. Chrzanowski, and the Dean of the Faculty of Mechanics Prof. W. Suchowiak. In turn, speeches were given by: Engineer Piotr Drzewiecki – on behalf of the Institute of Scientific Organization; Engineer Jan Jeziorański – on behalf of the Circle of Engineers and Technologists; Engineer Bolesław Krajewski – on behalf of the Scientific Organization Section in Upper Silesia; Kazimierz Barliński, M.A. – on behalf of the staff of the Institute of Scientific Organization; Stanisław Jelnicki – on behalf of the Circle of Scientific Organization Students at the Warsaw University of Technology; Juljan Antoszkiewicz – on behalf of the craftsmen's community.

Deep sorrow is also evident in the numerous condolence letters and telegrams sent from Poland and abroad to the Institute of Scientific Organization and the Polish Committee of Scientific Organization.

Condolences were sent by the following individuals and institutions:
Dr. Engineer Bronisław Biegeleisen; Prof. Witold Staniewicz; Engineer Aleksander Ciszewski; Engineer Stanisław Orzechowski; Board of Radzionków Mine; Dr. Wacław Ponikowski; Attorney Cezary Ponikowski; L. Kruszelnicki; Gen. Aleksander Litwinowicz, Commander of O.K. 3 (Grodno); Father Florjan M. Koźmin, Superior of the Monastery and Director of the publishing house "Rycerz Niepokalanej"; Central Association of Polish Industry; Board of Block-Brun Industrial and Commercial Company S.A.; Antoni Wieniawski; Scientific Circle of the Society of Students and Graduates of the Higher School of Commerce in Poznań (Scientific Organization Section); Prof. Edwin Hauswald; Jan Gizowski; Łódź Association of Technicians; Col. Kazimierz Meyer, director of P.Z. Inż.; Institute of Rational Office Methods "Organizacja Nowoczesna" Ltd.; Scientific Organization Circle in Lviv; Scientific Organization Circle of Students of Warsaw University of Technology; Bank Gospodarstwa Krajowego.

Percy S. Brown – Associate of Edward A. Filene (Boston); H.S. Person, director of Taylor Society (New York); M.S. Taylor, wife of Fr. W. Taylor (Philadelphia); Alfred Goldschmidt, President of the Belgian National Committee of Scientific Organization (Brussels); Lillian M. Gilbreth (New Jersey U.S.A.); American Engineering Council (Washington); Ente Nazionale Italiano per l'Organizzazione Scientifica del Lavoro; Dr. Edmond Landauer, Vice President of the International Committee of Scientific Organization; Wallace Clark; Charles de Freminville, former President of the International Committee of Scientific Organization (Paris); L. Urwick, director of the International Institute of Scientific Organization in Geneva; Engineer Francesco Mauro, President of the Council of the International Institute of Scientific Organization; V.W. van Gogh from Amsterdam; Romanian Institute of Scientific Organization (Bucharest); Powers Gesellschaft (Berlin); Engineer Dr. Emil Zimmler (Prague); Robert Satet (Paris); Commission Romande de Rationalisation (Geneva); Jugoslovenski Narodni Komitet za Naucnu Organizaciju Rada (Zagreb); Therese Leroy (Paris); Prof. Henry Le Chatelier (Paris), Mrs. Garcin-Guynet (Paris); Comite National de l'Organisation Franęaise (Paris); Prof. Hasa (Prague, Czech); Engineer Dr. Stanisław Spacek (Prague); Masaryk Academy of Labor (Prague); Gen. William Crozier (Washington).

Below, we provide the content of some of the condolence letters received from abroad.

LETTER FROM PERCY S. BROWN

from Boston

"Through your letter of May 17th, I learned with profound regret of the death of Professor Charles Adamiecki. During the nearly two years that I spent in Geneva with the International Management Institute, I had frequent contact with Professor Adamiecki. He showed me many courtesies in Warsaw. I spent many pleasant hours with him again at Rome and on a number of occasions at Geneva. I had a deep regard for him and a profound appreciation of his contributions to scientific management. To me, his passing is a personal loss, as it must be to those who were more closely associated with him. I extend to the Institute for Scientific Management my sympathy for their loss of such a competent manager.

Sincerely,
(-) Percy S. Brown
Associate of Edward A. Filene.

LETTER FROM H.S. PERSON

from the Taylor Society, New York.

Esteemed Friends,

The President and the Directors of the Taylor Society, on behalf of all members of the Society, express to you their sympathetic understanding of the great loss which your Society, your country, and students of management the world over have suffered in the death of Professor Adamiecki. It has been the privilege of few countries to give the world creative leadership in the analysis and development of management as a science. That privilege has been Poland's. The friends of Taylor share your just pride as well as your irreparable loss.

Respectfully,
(-) H.S. Person
Managing Director.

LETTER FROM MRS. TAYLOR

My dear Mr. Mileski,

It is with much regret that I have learned through your letter of May 17th of the death of Professor Charles Adamiecki, a devoted student of Mr. Taylor's ideas, which were so similar in their origin. Please accept my sincere sympathy. Scientific Management has lost a valuable contributor to world's progress.

Very sincerely yours,
Sonise M.S. Taylor
(Mrs. Frederick W.)

AMERICAN ENGINEERING COUNCIL

Washington, D.C.

I exceedingly regretted to learn of the death of Prof. Adamiecki. I can fully appreciate how his associates feel and the loss entailed by the Institute for Scientific Management. Among all those whom I met at the International Conference on Scientific Management in 1924, Prof. Adamiecki made one of the most outstanding impressions. I greatly admired his personality and ability. It has been a pleasure to me to have maintained a correspondence contact with him through these many years.

I appreciate very much your kindness in informing me of his death. I wish for you and the Institute continued success notwithstanding the loss you have suffered.

Sincerely yours,
(-) L.W. Wallace
Executive Secretary

E.N.I.O.S

ENTE NAZIONALE ITALIANO PER L'ORGANIZZAZIONE
SCIENTIFICA DEL LAVORO

Rome

We received your esteemed letter dated 16th of this month and were truly saddened to learn of the death of Prof. Adamiecki, President of your esteemed National Committee.

The death of the illustrious Prof. Adamiecki will certainly be received with great sorrow by all scholars of scientific work organization, as everyone recognizes the great contribution that the illustrious deceased has made to this field of study.

On behalf of E.N.I.O.S. and all scholars of organizational matters, we ask you to convey our deepest condolences to the family of the illustrious deceased, extending to the entire Polish Nation, which has been deprived of one of its most valiant scientists with the death of Prof. Adamiecki.

Distinct regards.
The Secretary-General
(-) illegible signature

LETTER FROM Dr. E. LANDAUER

It is with deep sorrow and emotion that I learned from your letter of May 17th the death of my dear friend, Professor Adamiecki. It is when events of this kind surprise us that we appreciate more than ever the extraordinary services that rare personalities render to humanity.

The name of your late president will remain immortal among the few great minds that have contributed in a very special way to the development of civilization and science. All those who, in any capacity, had the opportunity to approach him, appreciate his high science, his great heart, and his constant concern for all human questions, will carry with you in their hearts and minds the mourning that strikes us all so cruelly.

Please convey my condolences to the family of Professor Adamiecki, the Polish National Committee, and the Polish National Institute for Scientific Organization, expressing my deep regrets and great affliction.

Please accept, Mr. Secretary-General, the expression of my distinguished sentiments.

(-) E. Landauer.
Vice-President of the International Committee for Scientific Organization

LETTER FROM DE FREMINVILLE

Former President of the International Committee for Scientific Organization

Dear Director,
It is with deep sorrow that I learned of the death of Professor Charles Adamiecki. It goes without saying that I had the greatest admiration for the role he played in the movement for the scientific organization of work, to which he brought views of the greatest originality and value. I was very happy to be able to appreciate, during our encounters, the charm of his conversations and the high moral value of his character.

I kindly ask you to convey my heartfelt condolences to his family and all his collaborators and friends.

(-) Ch. de Freminville

LETTER FROM L. URWICK

Director of the International Institute for Scientific Organization in Geneva

Mr. Director,

I was deeply struck by the announcement of the death of Professor Adamiecki. The International Institute for the Scientific Organization of Work deplores this loss, which deprives the rationalization movement of one of its earliest pioneers and an eminent scholar whose work has been admired by all specialists for its depth and originality.

Professor Adamiecki devoted himself to scientific management using methods of precision and elegance that earned him a reputation that surpassed not only the borders of Poland but also those of Europe. It is, therefore, to the memory of a universally known scientist and a man whose charm has been appreciated by all those who have approached him that I wish to pay tribute today, on my own behalf and on behalf of all my collaborators.

Please accept, Mr. Director, the assurance of my most distinguished consideration.

(-) L. Urwick

LETTER FROM PROF. HENRY LE CHATELIER

from Paris

Dear Sir,

I am deeply moved to learn of the death of Professor Adamiecki. I knew that he had been suffering in recent years, but I believed he had recovered. His death is a significant loss to the Science of Organization. He had been a pioneer in this field. Personally, I have fond memories of the very pleasant relations I had with him, and I have always regretted that my health and old age did not allow me to go to Warsaw to convey the deep esteem I had for his work.

Please be the interpreter of my condolences to your colleagues at the Institute of Organization and the members of Mr. Adamiecki's family.

Please accept, Dear Sir, the expression of my high consideration.

(-) H. Le Chatelier

FRENCH NATIONAL COMMITTEE FOR ORGANIZATION

Paris

Gentlemen,

We learn with sorrow the mourning that strikes you in the person of Professor Adamiecki, your President, whose name will always remain in our memory as one of the pioneers of Scientific Work Organization, and I present to you on behalf of the Board of Directors and on behalf of all the members of the C.N.O.F., the expression of our heartfelt condolences.

Please accept, Gentlemen, the expression of our distinguished sentiments.

(-) P. Dalbouze

President of the French National Committee for Organization

Appendix A: Memorial Addresses

LETTER FROM Dr. S. SPACEK
from Prague

Dear Sirs,
I received the very sad news about the death of the esteemed president of the Institute, Professor K. Adamiecki. I feel this great loss together with you and ask you to accept my sincere condolences and convey them to the esteemed family of the professor.

Professor Adamiecki's name is well known in Czechoslovakia, and his outstanding work is highly valued among experts. His death represents an irreplaceable loss not only for the Polish nation but also for us and for all Slavic people.

With a sincere expression of sympathy,
faithfully devoted
(-) Dr. Eng. Stan. Spacek

MASARYK ACADEMY OF LABOR
Prague.

Dear Sirs,
We were deeply affected by the sad news of the death of Mr. Prof. Eng. Karol Adamiecki, a highly deserving engineer, organizer, and our sincere friend, a valuable collaborator, and member.

We assure you that the Masaryk Academy of Labor will always keep the deceased in honorable memory, and our entire engineering community and all our members deeply regret this painful loss suffered by the engineering profession in brotherly Poland. We kindly ask you to convey our deep condolences to the family of Prof. Eng. Karol Adamiecki.

Please accept, dear Sirs, the expression of our own respect
For the Presidium
Masaryk Academy of Labor
Eng. B. Mansfeld, General Secretary.
Prof. Eng. Dr. J. Pantoflicek, President

The domestic and foreign press reacted to the news of the death of Prof. K. Adamiecki by publishing numerous biographical notes and obituaries.

From the foreign press received so far at the Institute, articles about the life and work of the late Prof. Karol Adamiecki can be found in the following journals:

Bulletin of the International Institute of Scientific Organization of Labor, No. 6, June 1933. [French]

Bulletin of the International Institute of Scientific Organization of Labor, No. 7, July 1933. Posthumous tribute, written by Prof. Limperg, President of the International Committee of Scientific Organization and L. Urwick, Director of the International Institute of Scientific Organization.

Methods for the administration of the enterprise of the organization of office work, Paris, No. 5, June 1933. Article written by Th. Leroy.

Bulletin of the French National Committee for Organization, No. 5, May 1933.

Bulletin of the French National Committee for Organization, No. 6, June 1933. Complementary notice on Professor Adamiecki (with portrait).

Bulletin of the Belgian National Committee for Scientific Organization, No. 7, July 1933. Posthumous tribute dedicated to Prof. Karol Adamiecki.

Organization, News of the Czechoslovak National Committee for Scientific Organization, Prague. No. 6, June 1933.

Bullet of the Dutch Institute of Efficiency: Amsterdam. June 1933.

Dr. E. Zimmler, former President, Masaryk Academy of Labor in Prague
The Masaryk Academy of Labor in Prague has sent an obituary written by the former President of the Academy, Eng. Dr. E. Zimmler. Below is the content of this obituary.

Slavic engineer of humanity, precursor of TAYLOR.
It is a well-known phenomenon that the inventions and works of Slavic creators are often overlooked in recognition on the world stage, and that fame is often given to personalities of other nationalities for the same discoveries, which have at their disposal large promotional resources, whereas the Slavic researcher works unknown and isolated in their laboratory, lacking powerful patrons.

One such modest engineer-pioneer was the recently deceased engineer Karol Adamiecki, professor at the Polish Technical University in Warsaw, who, earlier than the famous promoter of the principles of scientific management, engineer F. Taylor, came forward with similar considerations and lessons, which, unfortunately, were lost in the hustle and bustle of the world's major workplaces and were recognized and admired only when applied the American engineer.

We, Czechoslovak engineers, are obliged to remember this fact due to our kinship, that the Polish engineer was the first to discover the working methods that are now truly becoming the driving force behind the entire system. But this obligation is heightened by sincere friendship, and even effective love, which this most modest engineer-researcher always demonstrated to us, Czechoslovak engineers, and to our entire homeland, faithfully, sincerely, and constantly.

Eng. K. Adamiecki was born on March 18, 1866, in Polish Dąbrowa, where his father was an engineer. He studied in Łódź and in 1891 obtained a technological engineering diploma in St. Petersburg. From 1891 to 1899, he worked at the "Huta Bankowa" ironworks in Dąbrowa, then became a factory manager at the Hartman Rolling Mills in Lugansk, 1901-1905 director of foundries in Yekaterinoslav, later in Ostrovets and Bogoslovsky in the Urals, and finally the general director of the "Korvinów" ceramic factory near Częstochowa in Poland.

Since 1911, he worked as a consulting engineer with an office in Warsaw, working for the largest factories in Russia, and became a professor at the Technical University in Warsaw in 1919.

Eng. Adamiecki had extensive experience in industrial production, and it is a significant sign of his genius that he did not solely focus on profit-making concerns but devoted all the strength of his spirit to thinking about how to make the worker's labor more productive, economical, fruitful, lighter, and more beneficial. His Slavic-sensitive heart led him on this path of social and technical humanity.

As early as 1903, he presented his theory of the harmonogram, i.e., a set of principles according to which the best results are achieved when individual phases of production execution are harmonized with each other so that all unnecessary movements and losses of material, energy, and time are eliminated, which is the core of the so-called Taylor theory, at the Russian Engineers' Association in Yekaterinoslav. Adamiecki's research was based on his study of labor in the rolling mills of Huta Bankowa, conducted in 1896, which led to a significant improvement in the rolling mills' performance and an improvement in the workers' conditions.

However, his lecture in 1909 at the Technical Society in Warsaw and his articles published in *Technical Review* in 1909 were lost in the global movement, which drowned out the voice of the modest Polish engineer, and so this pioneer, Poland, and the Slavic world were deprived.

Only when the contributions of Czechoslovak engineers, with the help of American engineers, sparked the rationalization movement at the memorable International Congress for Scientific Management (PIMCO) in Prague in 1924, where we could first welcome Eng. Adamiecki at the head of the Polish delegation and when Adamiecki founded the National Institute for Scientific Organization in Poland [TNOiK], where this congress of Polish engineers, pioneers of this new knowledge, convened in 1928. At this congress, in the presence of the President of the Polish Republic, Eng. Mościcki, and the most prominent Polish engineers in an unprecedented number gathered, as well as a delegation of Czechoslovak engineers, the great truth of Eng. K. Adamiecki's primacy in the invention of the principles of scientific management was publicly acknowledged and signed by Eng. Mościcki, who was a student of Prof. Adamiecki, and by all present, declaring this primacy clearly demonstrated. Thus, great moral satisfaction was given to the humble engineer, which is especially worth noting today in everlasting memory over his grave. Emboldened by the Prague Congress, Engineer K. Adamiecki, with his characteristic zeal and dedication, reignited his longstanding passion for his work. With support from the Polish government and industry, he was able to establish the Organizational Institute in Warsaw and launch local committees for scientific management throughout Poland. From our personal knowledge of these institutions and their great work, we must express our great admiration and all the respect that engineers, industrialists, and the Polish government have taken to support the work of their great pioneer. It is undeniable that our Polish brothers have far surpassed us, and that we can learn a lot from them, which, unfortunately, the unfavorable times do not allow us to achieve at home. This is all the more admirable as Poland suffered greatly from the damage caused by the First World War, and with the help of its modern-minded engineers and industrialists, it was able to make truly commendable efforts to elevate its liberated homeland.

Prof. Eng. K. Adamiecki has always remained in their eyes an exemplary engineer of humanity, devoted to pure ideals and infinitely loyal to the welfare of his homeland and his people. The collection of his writings is remarkable and accessible to us, a true treasure trove of lofty and useful ideas.

Eng. K. Adamiecki was, of course, later recognized abroad. He was a recognized authority and vice-chairman of the International Committee for Scientific Management, which is the center of the entire movement.

The global crisis led to an unjust accusation against rationalization, and this found a fervent, convincing, and incisive defender in Engineer K. Adamiecki, who staunchly upheld the principles of scientific management.

In this great work, his strength was exhausted, and he died after a long illness on May 16, 1933.

With him, the engineering world, Slavdom, and Poland lost an outstanding creative spirit, a shining and fervent star in spirit and heart, a faithful son of noble Poland, and to us Czechoslovaks, a sincere and loyal friend, whose kindness is rare in the world.

Czechoslovak engineering and the Masaryk Academy of Labor, of which Eng. K. Adamiecki was a member, will always cherish the honorable memory of this precious friend.

Honor be to the memory of engineer
Karol Adamiecki,
and everlasting memory.
Eng. Dr. h. c. E. Zimmler, retired.

BIOGRAPHICAL SKETCH AND TECHNICAL-SCIENTIFIC ACTIVITY of the late PROF. K. ADAMIECKI

A FEW DATES FROM THE LIFE OF Prof. K. ADAMIECKI

Karol Adamiecki was born in Dąbrowa Górnicza, named after his father, mining engineer Karol Adamiecki, on March 18, 1866.

In 1884, he graduated from high school with a gold medal in Łódź (Higher School of Crafts). He completed his higher education at the Technological Institute in St. Petersburg, graduating in 1891 with a degree in technology engineering.

From 1891 to 1899, he worked at the Huta Bankowa Works in Dąbrowa Górnicza, initially as a draftsman in the technical office, and then as an assistant to the head of the sheet rolling mill department. In 1899, he took up the position of head of the rolling mill department at the Iron and Steel Works and Steam Locomotive Factory (Hartman Works) in Lugansk in southern Russia.

After two years of working in this position, he was appointed technical director of the Iron Pipe and Iron Rolling Mills Joint Stock Company in Yekaterinoslav (southern Russia), where he remained for four years, until 1905.

In 1906, he spent a year in Poland as the director of Ostrowiec Iron and Steel Works in Ostrowiec, then returned to Russia, having been appointed a technical consultant for Bogosławski Iron and Steel Works in the Urals.

He spent the four-year period from 1907 to 1911 as the managing director of the Joint Stock Company "Korwinów" Ceramic Works near Częstochowa; during the subsequent four-year period, he ran his own technical and consulting office in Warsaw, while also serving as an advisor at the machine and wagon factory of the Joint Stock Company Lilpop, Rau, and Loewenstein.

The events of the war once again moved Karol Adamiecki to Russia, where he spends two years (1915–1917) as a technical advisor in the evacuated factory of the aforementioned company in Kremenchug. In the following year, he serves as a technical consultant at several iron and steel plants in southern Russia.

After returning to Poland at the end of the war, he began lecturing on scientific management at the Warsaw University of Technology in 1919, and in 1922, he was appointed to the newly established chair of "Principles of Work and Industrial Plant Organization" at the same university.

From 1925, he held the position of director of the Institute of Scientific Organization in Warsaw, of which he was one of the main founders, and from 1926, he also held the position of president of the Polish Institute of Scientific Organization, which was established at his initiative, as well as vice-president of the International Committee of Scientific Organization.

In the last years of his life, alongside giving lectures at the University of Technology, he devoted himself almost entirely to the affairs of the Institute of Scientific Organization, which, thanks to his tireless creative and inventive work, experienced increasingly intensive development year after year, occupying a prominent place among scientific research institutions in the country and emerging as a leader among related institutions abroad.

TECHNICAL-SCIENTIFIC WORKS

Work in the field of steel and iron strength tests (1894)

Due to misunderstandings arising from the testing of cast iron boiler plates according to the technical conditions of the Russian Ministry of Communications, engineer K. Adamiecki conducted a series of tests and studies on the dependence of sample strength on their dimensions and shape. The main focus was on bending tests.

By measuring elementary elongations and incorporating the results into appropriate charts, the significant dependence of deformation on sample dimensions and shape became apparent. The studies also showed that some tests, required by the specified technical conditions, are entirely impossible for steel and iron. These studies were the reason for the Ministry to change the technical specifications.

A brief summary of this work was printed in the journal of the Russian iron industrialists' office. The results of the above work have broader significance, as they largely explain how important the shape of a structure is for its strength, especially when subjected to impacts and variable loads. Engineer K. Adamiecki conducted these studies in 1894.

Works on rolling mills- 1895-1899

From 1895 to 1899, engineer Karol Adamiecki conducted studies on the bending of rolls and their deformation during sheet rolling, depending on pressure and roll heating. For these studies, he designed a device that provided graphical charts of deformation, magnified 150 times. A series of observations made with this device highlighted the significant importance of the aforementioned deformations on the sheet rolling process, especially for thin sheets.

It was also clearly explained what shape (hyperbolic profile) should be given to the rolls under different rolling conditions. This issue had not been studied before, despite its significant and fundamental importance for thin sheet rolling, and in practice, it is still resolved visually by masters who mostly keep their experience secret.

In connection with the previous studies, Adamiecki made longer observations during this period on the impacts that occur during rolling, ways to reduce them, and preventing the disastrous effects of impacts on various rolling mill components. These studies led him to the conclusion that the most effective means of preventing the frequent breakage of various parts of the rolling mill is to design them in the form of so-called shapes of equal strength, or at least as close to them as possible, and that the breakages, which happen so often in rolling mills, mostly result from designers not paying enough attention to this principle.

The results of these works were not printed and remain in manuscript form to this day.

Design works

During the period of 1899–1903, the following devices and works were carried out according to the designs of engineer K. Adamiecki:

a) The thick sheet rolling mill in the locomotive factory in Lugansk (Southern Russia) was rebuilt.
b) The universal rolling mill in the ironworks in Ekaterinoslav was rebuilt.
c) The pipe rolling mill there was also rebuilt.
d) A thin sheet rolling mill was built there.

In all these constructions, various improvements were applied, resulting from previous studies on the impact resistance of individual rolling mill components. As a result of these applications, the breakage of rolls and other parts, so common in conventional rolling mill constructions, was almost completely eliminated.

In 1912, a corrugated sheet rolling mill was built in the K. Rudzki and S-ka plant in Minsk Mazowiecki according to Adamiecki’s design. It is a Daelen-type mill capable of corrugating sheets of indefinite length with various profiles, from 30 x 30 mm to 150 x 150 mm and sheet thicknesses up to 5 mm. Rolling is done cold.

Roofing sheet rust research (1904)
In 1904, Karol Adamiecki conducted extensive research on roofing sheet rusting. Although the research lasted only three weeks, it demonstrated the significant importance of magnetic oxide, which covers the sheet in the form of a blue coating, as protection against rust, especially for Ural sheets not containing sulfur (some types of Ural sheets, as is known, can last on the roof for several decades without rusting).

These studies can serve as a contribution to the very thorough and extensive research carried out around the same time at the Lyzvyansky plants in the Urals by engineer Adam Onufrovich.

The results of engineer his research were presented in a lecture at the Association of Technicians in Warsaw on December 10, 1909. This lecture has not yet been printed.

Theoretical and practical work in the field of furnace construction
When examining ceramic furnaces in the light of Professor Grum Grzymajlo's hydraulic theory of hot gas flow, engineer K. Adamiecki found that most of the various systems of ceramic furnaces have fundamental flaws (e.g., the Hoffman furnace), resulting in significant heat loss and uneven firing.

Based on these studies, Adamiecki developed his own design of a circular chamber ceramic furnace, in which these main flaws are eliminated. Just before the war, such a furnace was built for firing refractory products in one of the factories in Poland.

As a contribution to this matter, he published a short popular outline on the conditions of the proper operation of ceramic furnaces.

When examining Professor Grum-Grzymajlo's hydraulic theory of furnaces, Adamiecki noted the incomplete agreement of the phenomena occurring in furnaces with this theory and that some corrections should be made to it.

This matter was presented in a lecture at the Association of Technicians in Warsaw on October 13, 1911. This lecture has not yet been printed.

In the period 1918–1920, engineer Karol Adamiecki designed a tile stove for heating apartments. This construction resulted from the aforementioned research on industrial furnaces. These stoves began to be manufactured on a large scale in one of the factories in Poland. Practical results showed that his stoves provide fuel savings of up to 40% and are twice as small as traditional stoves with the same heat capacity.

Research on dryers in ceramic plants (1907-1909)
In the period 1907-1909, engineer K. Adamiecki conducted studies on the drying process. These studies led him to find a graphical method that significantly facilitated the basic calculations

necessary in drying technology. This method also allowed him to establish the main guidelines to be followed when setting up dryers and showed why a significant majority of dryers installed in brick factories perform poorly, not providing the results expected by various dryer designers.

Together with the above research, Adamiecki conducted comparative studies on heat balances in various brick factory installations. The resulting graphical charts provide a clear picture of the sources of excess heat, which can be used to dry raw materials.

The main outlines of this work were presented in a lecture at the Association of Technicians in Warsaw on February 9, 1912. This work remains in manuscript form.

Research in the field of pressing ceramic products

Research on the processing and forming of brick products, carried out by engineer K. Adamiecki in the period 1907-1911, led to the improvement of the screw design in screw presses, which significantly increased press efficiency.

During this time, Adamiecki investigated the pressure distribution when forming drawn roof tiles and other brick products. These studies led him to find a rational way of regulating these pressures and equalizing them by using appropriate outlet calibration. At the same time, it became clear that most of the causes of failure in ceramic product manufacturing (cracking, warping) stem from uneven pressures during pressing. The method of equalizing pressures he discovered largely overcomes these difficulties and eliminates the trial-and-error approach so common in ceramic manufacturing.

This work has not yet been published in print.

Works in the field of organizational science (management)

In 1895, engineer K. Adamiecki began researching the time of individual operations in the rolling of thin sheets. This timekeeping was done to find the reasons for low production. After two years of research, he applied a special graphing method, which not only greatly facilitated the research but also provided the opportunity to rationally organize the entire production process. The application of this method resulted in an immediate increase in daily production by more than 2.5 times.

In the period 1899-1901, Adamiecki continued research in this direction in various rolling mills and improved the graphical method of organizing collective work.

Among other things, this method was applied by engineer Adamiecki to the reconstruction of the pipe rolling mill department at the Ironworks in Yekaterinoslav. Thanks to a detailed analysis of all work in advance, the establishment of standard times for all activities, and the compilation of a graphical work plan, the entire reconstruction lasted 3 months, which was an extraordinary result, as without applying such organization, this work would have taken at least 8 months, as originally assumed.

In March 1903, Adamiecki presented for the first time a report at the Technical Society in Yekaterinoslav on his principles of organizing collective work. This report sparked a lively discussion, and the famous Russian metallurgist Prof. Kulibin, who attended the lecture, acknowledged that this work would have significant importance and influence the change of views in managing production work.

This report was not printed, but as it turned out later, it was the reason that in Russia various attempts were made to test this method in practice.

In the period 1903-1907, Adamiecki continued his studies in this direction, collecting a wealth of material concerning the process of manufacturing rails, beams, various types of bar iron, wire rolling, and other work in iron foundries.

Additionally, during this period, he conducted extensive research on the relationship between the operating costs and the intensity of production. The result of these studies was the highlighting of significant losses caused by wasted time.

In 1908, Adamiecki delivered a lecture at the Association of Technicians in Warsaw, in which he established the main principles of organizing collective work and his method of analysis and planning of this work. As an introduction to this lecture, research on operating costs and losses caused by wasted time were presented.

This lecture was printed in the *Technical Review* in 1909 (No. 17, 18, 19, and 20). This article was soon translated into Russian, and the magazine *Zhurnal Metallurgicheskogo Obshchestva* quoted it as one of the outstanding works in the field of organization.

In the following years, Karol Adamiecki's organization method was applied many times, always with very successful results. For example, he applied it to organize the forging of various train carriage parts in one of the carriage factories. When forging coupling hooks, the productivity of the department engaged in this work more than quadrupled, and the consumption of fuel decreased by nearly a factor of 3. In the period 1915-1917, engineer Adamiecki applied his method on a larger scale in the construction of a projectile factory for earthworks, masonry, reinforced concrete, assembly, and so on.

The above-mentioned article *Technical Review* was the reason that some industrial plants began to use engineer Karol Adamiecki's methods. The Dnieper Metallurgical Plants in Kamenskoye went the furthest in this regard. A few years before the war, a new wire rolling mill was designed there according to this method, namely, the entire action plan for the rolling mill was laid out first, and the design of the installation itself was adapted to it. This method was also applied in the same plants in the construction of industrial furnaces. According to the management, extremely positive results were achieved thanks to the application of this method.

In connection with the organization issues of industrial plants, Adamiecki conducted extensive studies on energy management in one of the largest iron foundries in southern Russia in 1917. By capturing the entire process of generating electricity from blast furnace gases and transferring it to all departments and workshops in special charts, it was possible to find and numerically highlight all the reasons for frequent stagnation caused by a lack of electricity. Several main reasons, resulting from installation defects and poor organization, turned out to be somewhat surprising for the plant managers, as with the traditional comparison methods, these reasons had been masked.

These studies had the positive effect of averting a sharp conflict between workers and the management of the plants. The workers, by then completely revolutionized, interfered with the management of the plants with the help of their "soviets." In this case, the "soviet" saw the cause of the lack of electricity exclusively in the "sabotage" carried out by engineers. Engineer Karol Adamiecki's research clearly showed that various "orders" introduced by the "soviet" were one of the main causes of the lack of electricity and various other stagnations.

The graphic method, which was applied in this case, has a broader significance, as it can serve as a model for conducting continuous control of the stream of production, both of individual work cells and the entire industrial plant. The materials collected during these studies constitute a valuable contribution to the organization. These materials have not yet been published.

In 1918, engineer Karol Adamiecki conducted research on the increase in operating costs in several foundries in southern Russia in connection with the decline in production and labor productivity during the first year of the Russian Revolution. The results of these studies were presented at one of the meetings of the Association of Technicians in Warsaw in 1919. (They were not printed).

All the above studies led Adamiecki to certain general conclusions regarding management, as well as to the establishment of:

1. the law of optimal production (economic characteristics of the productive organism) and
2. the law of harmony in the selection and operation of collective labor departments.

At the same time, engineer Karol Adamiecki pointed out that these two laws, together with the law of division of labor and concentration, constitute the main economic basis of management science. These conclusions were presented in general outlines in his report at the International Congress in Prague in July 1924.

The basic works of engineer Karol Adamiecki in the field of management science have been developed and prepared in recent years and are still in manuscript form. These are:

1. Principles of management science.
2. Operating cost and its calculation.

Published works in Polish since 1923 [omitted here: see Table of Contents of this Collection]

In foreign literature, the following articles about engineer K. Adamiecki's works have appeared:

1924 - "Scientific Organisation of work" report for the International Congress of Prague, July 1924, by prof. Charles Adamiecki.
1927 - La theorie de l'harmonisation et les harmonogrammes du prof. Ch. Adamiecki, adapted by Therese Leroy. Mon Bureau No. 11, 12.
1930 - L'Organisation Scientifique ou Rationalisation - by prof. Adamiecki. Bulletin of the National Committee of French Organization No. 9
1931 - L'harmonogramme ou tableau harmonographique - Mon Bureau No. 4.
1931 - Le diagramographe - Mon Bureau No. 5.
1931 - La Loi de L'Harmonie et les Harmonogrammes du prof. Adamiecki, - Bulletin of the National Committee of French Organization No. 7.
1931 - Le trava’l collectif et la loi de l'harmonisation industrielle - Bulletin of the National Beige Committee for Scientific Organization, No. 9, 10, 11, 12
1931 - Diagramograph und Harmonograph, new tools for planning, statistics and control - Journal of Planning, Statistics and Control - Journal of Organization No. 10.
1931 - Der Harmonograph, ein neurartiges Mittel zur schaubildlichen Darstellung von Betriebsvorgangen. - Wirtschaftlichkeit No. 108.
1931 - Graficke znazorneni provozu harmonografeni - Nova Prace No. 7-8.
1931 - Harmonografy - Reports of the Czechoslovak Committee for Scientific Organization, No. 1.
1932 - Application de la science de l'organisation a la vie economique - by prof. Charles Adamiecki. - Bulletin of the National Committee of French Organization No. 6.
1932 - Poznamky o definici organisacni vedy. Sbornik Masarykovy Akademie Prace No. 1.
1932 - Prispiva veda o organisaci k prohlubeni krise a nezamestnanosti? Sbornik Masarykovy Akademie Pr ace No. 1.
1932 - Diagramograf - Reports of the Czechoslovak National Committee for Scientific Organization, No. 1.

No. 1378

THE PRESENT STATE OF THE ART OF INDUSTRIAL MANAGEMENT

MAJORITY REPORT OF SUB-COMMITTEE ON ADMINISTRATION

During the past few years a number of striking phenomena, in connection with industrial management, must have become evident even to the most superficial observer. The more important are:

a The widespread, popular interest in the subject which had its rise in a statement made before the Interstate Commerce Commission, in a hearing on the matter of proposed advances in freight rates by carriers. An attorney for the shippers stated on November 21, 1910, that it was estimated that by the application of newly discovered principles of management "in the railroad operation of this country an economy of $1,000,000 a day is possible," and further that these principles can be applied with equal success "in every form of business activity." This popular interest is shown by the great number of articles published in the daily papers and popular magazines, mediums that give but scant attention to technical subjects, except of the most striking nature.

b The suddenly intensified interest in the subject on the part of employers and business executives in many lines of activity, shown by lectures, addresses, professional papers and reports presented to their associations.

c The opposition of labor unions to the newer methods of management, shown by statements of labor leaders, in a few instances by strikes, and by an attempt to

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Presented at the Annual Meeting 1912, of The American Society of Mechanical Engineers.

Appendix C: Recommended Reading

Adamiecki, Karol, Original Texts (Polish), Warsaw Polytechnic Digital Library (Bibliteka Cyfrowa Politechnika Warsawska). http://bcpw.bg.pw.edu.pl/Content/6055/adamiecki_bibliografia.html

Le Chatelier, Henry Louis. (1926) *Le Taylorisme.*

Committee on Elimination of Waste in Industry of the Federated American Engineering Societies. (1921). *Waste in Industry*. Federated American Engineering Societies; McGraw-Hill Book Company.

Czech, Alojzy - Karol Adamiecki - *polski współtwórca nauki organizacji i zarządzania : (biografia i dokonania)* [*Karol Adamiecki - Polish co-creator of the science of organization and management: (biography and achievements)*]

Dodge, J. M. (1912). *The Present State of the Art of Industrial Management (No.1378).* Transactions of the American Society of Mechanical Engineers, 34, 1132.

Emerson, Harrington. *The Twelve Principles of Efficiency*

Straszewicz, Zygmunt. *Zarys ekonomji politycznej (Outline of Political Economy)*

Sub-Committee on Administration of the American Society of Mechanical Engineers. (1912*). The Present State of the Art of Industrial Management*. Transactions of the American Society of Mechanical Engineers, 34, 1132.

Zawidzki, Jan (1928). *Henry Le Chatelier as the successor of F.W. Taylor*

**List of the recommended works sent by the Taylor Society to the Polish Institute for the Organization of Work is listed at the end of the article "Relations with America"(1927).*

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About the translators

Craig and Olga Stritar, a husband-and-wife team, bring a unique blend of experiences to the translation of these works.

Olga spent her formative years assisting in her family's ceramics factory in Poland, where she developed a keen interest in the harmony and efficiency of the production process. Today, as a sought-after landscape architect, she owns and operates her own business in the San Francisco Bay Area, Artistic Garden Designs (artisticgardendesigns.com).

Craig's career has been marked by a dynamic and diverse range of leadership roles spanning from his time as a Special Operations squad leader in the 3d Ranger Battalion, to various management and consulting positions across sectors such as healthcare, Alaskan commercial fishing, manufacturing, distribution, and biotech. A passionate advocate for the human side of organizational transformation and process improvement, Craig established First Principles Leadership (firstprinciplesleadership.org) where he serves as a principal consultant.