

Industrial Engineering in Organizational Structure of Company

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Abstract: - This article dealt with industrial engineering from the perspective of its appropriate incorporation into the organizational structure of a company. Industrial engineering is a relatively new multidisciplinary field of study which combines technical knowledge of engineering disciplines with knowledge of corporate governance. Industrial engineering strives for the most efficient use of the company resources (financial resources, labour, information and skills of people themselves etc.). Its main task therefore is to rationalize, optimize and improve both production and non-production processes. The aim of this paper was to reflect on the position of industrial engineering in the organizational structure of a company, on job content of this department, as well as on assessment and motivation of individual industrial engineers. In the end of the paper the actual situation in Czech companies was outlined.

Key-Words: - Organizational structure, industrial engineering, LEAN, process improvement.

1 Introduction

At first it is worth mentioning that missing box named “industrial engineering” in the organizational structure scheme does not necessarily mean that the company does not intentionally pursue optimization and process improvement. It may just mean that the company simply names this department by some alternative term which, however, is essentially identical. Such terms as process engineering, engineering, process improvement or Kaizen department are used for the departments dealing with industrial engineering too. Analogically, employees working in industrial engineering are then called process engineers, change managers, lean managers, lean specialists, kaizen managers, kaizen specialists etc.

In recent years industrial engineering has gained its importance, as evidenced by the fact that in Czech companies it is far from an unknown term. Moreover, there are only few companies without this department in their organizational structures. If the companies omitted it, they would not effectively take advantage of opportunities offered by IE.

However, in order to enable full utilization of the potential of this discipline, one should keep in mind several factors which could ultimately influence the efficiency of industrial engineering in the company in a significant way. The most important ones include:

- position of this department in the organizational structure
- job content of the department, its responsibilities and authorities
- system of assessment of the department performance [14].

2 Industrial Engineering (IE)–definition, history of discipline, basics, opinions on this discipline and its classification, social capital framework for IE

In context of system- intensive and human – centric systems, we can count IE to the group: Human-centered engineered systems. Kimbler [8] wrote

this definition: This was the basis of our profession at its origin, and, although the form of the study has evolved, it is the basis of our profession today.... As other engineers foster advances through innovative new technologies, industrial engineers deal with those technologies in their implementation and use. But we can use in context of modern industrial engineering methods some process-oriented cost accounting, calculations and budgets and rates costing (for example production salaries, machine hours, production material etc.) [13].

Huges [7] described, that scholarship by historians of science and technology suggest that the context, case history, and historical narrative need to be examined within the systems and networks produced by social actors and their organizations; conceptualizations of industrial engineering are similarly produced. Pioneers in industrial engineering came from a variety of backgrounds including psychology, mathematics, engineering, and management. It is necessary include the impact of: Frederick Winslow Taylor, Charles Babbage, Henry Robinson Towne, Henry Ford and Henry Gantt, Frank Bunker Gilbreth and Lillian Gilbreth.

IE continues to explicitly include the connection between people and technology as part of the definition of the discipline said Bix [4]. To understand the basis and consequences of the stereotype that industrial engineering is easy discipline, we explored the foundation of how disciplines have previously been classified in a hierarchical sense. Specifically, the description of industrial engineering as “Imaginary Engineering” recalls the notion that the sciences can be classified on a scale from “soft” to “hard.” A hierarchy of disciplines was published over a century ago by Auguste Comte [5], classifying disciplines focusing on positivist approaches as “hard,” and by inference, superior to other disciplines. Some works for example works by Beyer and Gordon [3], and Smith, Best, Stubbs, Johnston, and Archibald [10] paralleled Comte’s conclusions and advanced the measurement of “hardness” from an ordinal scale to an interval scale. The trend toward refining the measurement of “hardness” is an indication that it is a widely accepted notion.

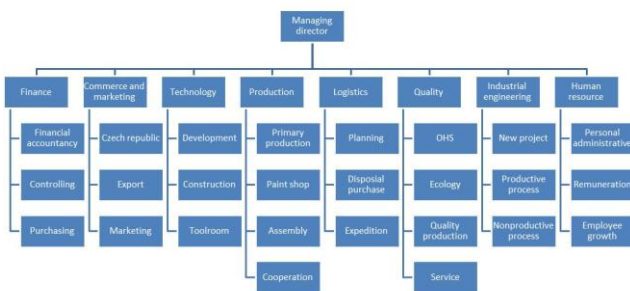
Two perceptions that Foor and Walden [6] identified as separating industrial engineering from other engineering disciplines were distance from technology and a less rigorous curriculum. What Foor and Walden call “distance from technology” have strong parallels to themes in earlier research

that would describe this distinction as “less likely to use graphs,” “softer,” and “less positivist.” Murphy et al. [9] in their study describes that IE is easier than other engineering disciplines to a lack of understanding of what IEs do. If industrial engineering is stereotyped as easier than other engineering disciplines, it is easier to marginalize the discipline says Stevens, Amos, Garrison, & Jocus, because engineering has been found to operate as a meritocracy of difficulty [11]. In deepening of analysis of the context of IE [2], some of the findings in the literature cited above may be related to the acquisition of “social capital.” According to Stanton-Salazar and Dornbusch [12], social capital refers to “a set of properties existing within socially patterned associations among people that, when activated, enable them to accomplish their goals or to empower themselves in some meaningful way”.

3 Position of the department in the organizational structure

There are many various ways how the industrial engineering department is incorporated into organizational structures of Czech companies. Probably the most common is to incorporate this department under production. It is also often incorporated under technology department, technical preparation of production or under quality department. However, we have also met a case when the industrial engineering department comes under logistics department, financial management and audit or even under department of management and maintenance of premises. Which arrangement is the right? Where the industrial engineering department should be incorporated? Apparently, there is no unambiguous and generally accepted answer to these questions. Its incorporation should be always based on the strategy of the organization and should reflect what the organization expects of it and where the organization plans to direct its activities. And this is often a stumbling block and one of the main reasons of subsequent failures. Even the company’s management themselves often have no clear idea about activities of this department and about strategy of its future development. Consequently, ridiculous situations often come up, when industrial engineers appear under asset management or maintenance department. How such situation occurs? The management simply have no idea where to put an industrial engineer and therefore they incorporate him/her under organizational unit which is currently undersized or under manager who is the most favourable to such arrangement.

Nevertheless, let us get back to the question of the “optimal” incorporation of this department into the organizational structure. We do not claim that incorporation of industrial engineering under production or technology department, which is the most usual nowadays, must be naturally incorrect. No doubt there exist companies for which this position is suitable and possibly advantageous in some measure. This happens in the case that the main and primary objective of the department is solely to improve processes in production or to solve especially technical issues within the given product group. Under these circumstances, this incorporation is quite logical. However, one cannot expect that the industrial engineer’s job content – process optimization and improvement of production and non-production processes – will be met. Due to such incorporation, the field of activity of an industrial engineer is significantly restricted, especially as regards his/her competencies across the company. Then it is nearly impossible for him/her to deal with optimization of business processes for example in the sales department, as competencies of his/her team or of IE department surely do not reach so far. In order to fully exploit the potential offered by industrial engineering through its activities, this department needs to be completely independent and autonomous and must be incorporated directly under director general. In such case the head of industrial engineering department becomes a part of the top management of the company. He/she gains a unique opportunity to influence efficiency across the entire organizational structure. However, such incorporation is conditioned by conviction, or better said by inclination to optimize not only production activities.



Picture 1: Example of an organizational structure [1]

3 Job content of the department, its responsibilities and authorities

Work subject of the industrial engineering department can be categorized from several points of view. From the perspective of field of activity,

activities of this department can be divided into:

- Improvement of processes in development and pre-production stages
- Production processes improvement
- Non-production processes improvement
- Trainings and education of employees in a field of processes improvement

3.1 Improvement of processes in development and pre-production stages

As for this field, one cannot expect an industrial engineer to design technical or structural design of a new product. However, he/she may assist in proposed solution opponency with regard to subsequent problems and wastage in production, potentially caused by this solution. In case that the industrial engineer has the knowledge of innovative methods, he/she can be in this stage also a very useful moderator of workshop focused on products, processes and technology innovation.

3.2 Production processes improvement

Improvement of production processes is probably the most common job content of an industrial engineer. It includes all activities associated with optimization and standardization of production processes.

3.3 Non - production processes improvement

Nowadays the field of non-production processes becomes more and more popular. In this field the industrial engineer most often plays a role of moderator. Both internally and externally realized projects can be in question.

3.4 Trainings and education of employees in a field of processes improvement

Education and development of employees in a field of processes improvement is very important and at the same time very underrated domain. Entire lean production rises and falls with the employees themselves, which is something we often overlook or do not want to realize. The industrial engineer’s task is not only to methodically educate the employees, but also to keep them sufficiently informed about realized projects, gained results and future strategy, and thus to motivate and integrate them into the IE activities.

From the perspective of activities performed by industrial engineers, the categorization can be as follows:

- **Realization** of activities and minor projects. The most of activities is performed directly by the industrial engineering department. In general, this

category includes especially visualization and standardization of the processes which are inevitable prerequisites for subsequent improvement.

- **Leadership** of processes improvement projects of complex nature. The industrial engineer plays a role of project manager.
- **Moderating** of workshops aiming to improvement of processes both in production and non-production stages.
- **Education and training** of employees in a field of processes improvement.

Job content of the industrial engineering departments, or actually of the industrial engineers themselves, certainly depends on the type of organization where the activity is performed. As far as the branch of an international company dealing with assembling operations without its own contribution into development is concerned, the industrial engineer's role in pre-production and developmental stages is naturally minimized. Instead, the industrial engineer will realize his/her potential in the production start stage and in the subsequent optimization of production processes. Another factor with a significant impact on the job content of this department is the technology used. Industrial engineer's job content in an engineering company will be largely focused on the maximal utilization of the machinery, and thus its overall efficiency. It also relates a range of methods and tools used, which will be predominately focused on introduction, assessment and increasing of the OEE (CEZ), Total Productive Maintenance or SMED method – Single Minute Exchange of Dies and on the related determination of an optimal run. On the other hand, as far as purely assembling company is concerned, the job content will be completely different. Industrial engineering will aim to utilize human resources as efficiently as possible and thus naturally to setup appropriate work conditions. There is an excellent probability that great accent will be put on analysis and measurement of performance, especially on predetermined motion time systems (e.g. the MOST method – Maynard Operation Sequence Technique), operations balancing, material flows on a workplace, supplying of an assembly with material and last but not least on ergonomics.

4 Assessment of the industrial engineering department performance

How to assess work efficiency of industrial engineering department or of industrial engineer as an individual? Some managers or companies owners

have relatively clear answer to this question. The profit yielded by an industrial manager to the company should be at least ten times higher than his/her monthly salary. This criterion for assessment of industrial engineer's performance seems to be comprehensible. However, reality is often slightly different and some issues regarding performance assessment arise, especially in the following areas:

- **corporate culture**

It is necessary to realize that in case that corporate culture is not sufficiently developed and industrial engineer does not feel any other than financial motivation, entire assessment of the department performance may easily deteriorate to "play on numbers". And who else should master this "play on numbers" better than the industrial engineer?

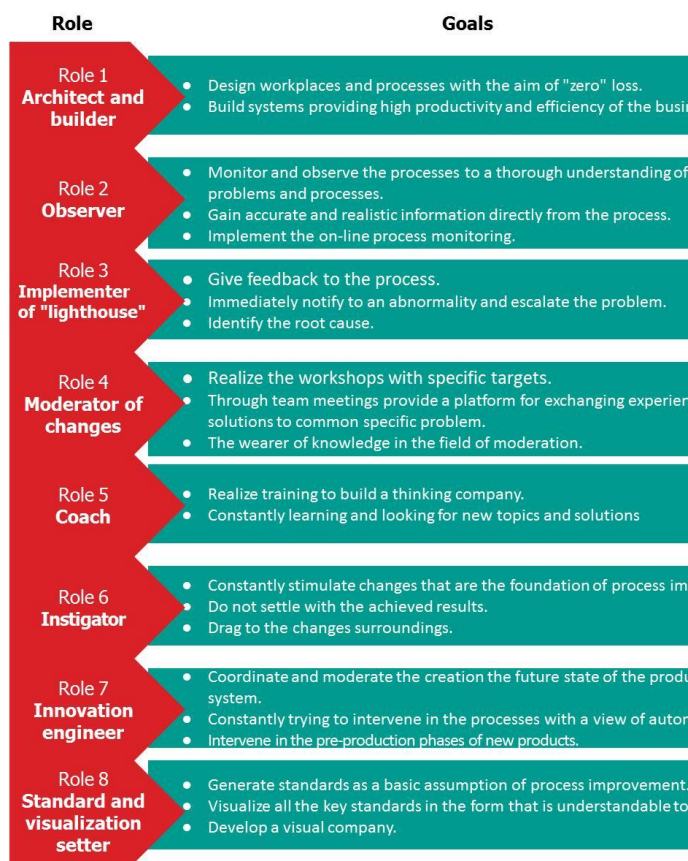
- **job content of the department**

Job content plays a big part. In case we want to steer into pre-production stages, it is evidently irrelevant to reward the industrial engineer's work with a proportion of savings realized in the current production. Another thing we should bear in mind is that this department's work is not only about rough figures and optimization proposals. Many times it is much more complicated to press the suggestions at employees themselves or in other departments. Therefore, it is very important to master also so-called soft skills, which are, however, a bit difficult to incorporate into metrics of the department's performance assessment. Job content can be support with Business Process Change Management, as we define in our article [15].

- **authorities and competencies**

In this field are especially projects taking place across several departments or even across the entire company. Industrial engineering department is often assessed negatively on some projects, although in essence it did not have any competence to influence them. This certainly relates to already mentioned way of incorporation of the IE department into the company's organizational structure. In case that industrial engineering department comes under production, it has only very few competencies to bring a lean administration project to successful conclusion.

What proportion of salary should be conditioned by meeting these objectives? We suppose that this conditional part should be somewhere between 30% and 40%. If the conditional part was lower, it might not be motivating enough. On the other hand, if the proportion of the conditional part of the salary was higher, no space would remain for activities which cannot be unambiguously transformed into measurable objectives.



Picture 2: Roles of an industrial engineer [own authors].

5 The factual situation in Czech companies

We have recently tried to carry out a minor survey with the objective to map basic information about departments dealing with processes improvement. Approximately 20 Czech companies from various industries were involved in the survey. Here we state some examples of the survey questions:

- name of the organizational unit dealing with processes improvement
- incorporation of this unit into the organizational structure
- number of employees in this department in relation to the total number of the company employees
- job content of the department
- remuneration system for employees of the department

5.1 Name of the organizational unit dealing with processes improvement

The most commonly used name for this department is Industrial Engineering, or Process Engineering, occurring in more than 50% of companies (the English version, Industrial Engineering, was

included in this category as well). Such terms as Processes Optimization, Technical Development or Business Excellence occurred less, frequently.

5.2 Incorporation of this unit into the organizational structure

Quite interesting finding is that this department comes directly under director general or factory manager only in three companies. In six companies this department is under production and in four companies it comes under technical manager. Remaining 40% of companies use relatively individual incorporation into their organizational structures. The interesting ways of incorporation include the industrial engineering department coming under logistics and asset management.

5.3 Number of employees in this department in relation to the total number of the company employees

On average, each employee of this department receives almost 250 company employees. Absolute number of employees in this department ranged the most frequently from 2 to 5. Probably the greatest extreme was found out in a Moravian company where nearly 1 000 employees receive only one industrial engineer.

5.4 Job content of the department

This question aimed at the main subject of work and at definition of another three most frequent secondary activities. The most common job content of the department or of the industrial engineer as an individual was production processes optimization. Only in three surveyed companies industrial engineers deal also with improvement of non-production processes. This department does not participate in rationalization of pre-production stages in any company. In the production field the department most frequently deals with layouts and assembling lines optimization or with monitoring and increasing defined indicators – such as KPI, CEZ etc. Another indispensable activity is training of employees.

5.5 Remuneration system for employees of the department

In vast majority of companies the remuneration system is linked to objectives. The extent to which these objectives are met is then transformed into variable component of the salary. Only in three companies the salary is completely independent of meeting the objectives and thus has a nature of a fixed component only. The objectives are usually

linked to fulfilling the performance indicators and work quality indicators, or to introduction of production system elements. Only in two cases the objectives are linked to fulfilling tasks and meeting deadlines of concrete projects. Proportion of the variable component of the salary ranges from 3% to 10% in 60% of the companies. Only in 15% of the companies the IE employees' variable component of the salary exceeds 20%.

6 Conclusion

Finally, we can only add that besides knowing methods and techniques of work rationalization and processes optimization, industrial engineer also needs to master soft skills, primarily communication. Especially when taking into account that for industrial engineer it is a must to cooperate with colleagues across the organization from the top structures to the ordinary employees. That is why this skill needs to be developed too. It should also be noted that thanks to knowledge of production processes, as well as of supportive and administrative processes, IE employee has a great potential to rise within the organizational structure. Important contributors to this potential are both gained experiences and excellent knowledge of individual processes from their basics, as well as working on a project management basis.

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