

Modernisation of Industrial Engineering. Enhanced Participation of Employees

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Abstract

This paper addresses the opportunities and barriers of and prerequisites for the participatory design approach employed in industrial engineering. It discusses the results of a research project carried out at several sites of a German car manufacturer. With the intention of involving the manufacturing workforce in the process of setting their performance targets, the management of this car manufacturer reorganised the basic principles of its time and capacity planning. The paper argues that, on the basis of a so called High-Performance Work System, this concept improves and increases the manufacturing workforce's commitment, motivation and competence.

Keywords:

Industrial engineering; Participation; Production system

1 INTRODUCTION

Traditional corporate industrial engineering (IE) apparently no longer meets the demands of companies today. The reason for this is that increasing demands for more flexibility and higher cost pressure are making it necessary to involve employees in the planning, controlling and optimising of work processes. This stands in direct opposition to the primarily centralised approach of IE which is widely practiced. The possibility of extending worker participation to IE activities therefore raises the following question: How can this be achieved without limiting IE's vital functions in the areas of controlling and process-optimisation? The following is an attempt to answer this question and is based on research done at four sites of a German car manufacturer.

2 INDUSTRIAL ENGINEERING AND WORKER PARTICIPATION

2.1 Tasks of Industrial Engineering

IE concerns the planning, designing and controlling of a company's operational systems. Theoretically, it should unite economic goals with a humane form of work organisation. In this case, humane means taking the values and needs of workers seriously [1]. However, in operational practice, giving equal fundamental value to economic and humane criteria does not mix well with a one-sided orientation toward economic optimisation [2].

IE depends on the collection of data for its main tasks, and time management studies are the basis for defining production schedules, determining standard times and continually improving operating systems. How workers should perform their tasks is thereby determined by a centralised IE Department which is not organised to include worker participation. For their time studies and rationalisation, IE's experts do not consult the workers, but the works council (Betriebsrat). IE communicates the determined standard times to lower-level management, the foremen and

forewomen (Meister/Meisterin), who monitor the achievement of goals (figure 1).

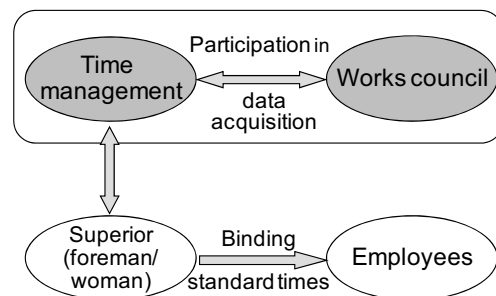


Figure 1: Traditional time management.

Not involving operational workers in setting standard times has its disadvantages. These include limiting the learning opportunities of workers and a loss of motivation and flexibility. Under these conditions, a company can hardly expect its production workers to be committed to applying their skills to kaizen activities or to take active roles in the company beyond the duties outlined in their contracts. Against this backdrop, the management of the car manufacturer in this study has recognised the need for modernisation and has begun to question the efficiency of those work processes which are only managed centrally.

Many articles have been published lately about new directions in IE. However, the authors of these articles are primarily interested in standardising work processes [3] [4], while they fail to consider the involvement of operational workers in IE activities. This is a point that deserves criticism because IE will not be able to successfully free itself from Taylorist forms of work organisation without the direct participation of workers.

2.2 Advantages of Participation

Early studies in the sociology of organisations already pointed out that Taylorist work systems could have unwanted side-effects. One of the gravest side-effects is called 'dysfunctional

organizational learning' [5]. This means that standardised practices and their justification are more important to workers than targeting optimal production and meeting the changing demands of customers. Under these circumstances, Taylorist organisation leads to a loss of flexibility. Furthermore, a centralized planning and controlling of working processes requires a central department, which uses up resources without generating added value. Therefore, limiting the division and specialisation of labour and using partially autonomous units of organisation to meet complex requirements is beneficial [6].

In this respect, management has the task of convincing workers to voluntarily cooperate and show willingness [7]. One way of achieving this is to involve workers in those company decisions which do not necessarily need to be reached centrally. This is the core of the participatory approach in work organisation.

Since the 1990s, we have seen three main arguments that stress the economical benefits of participation:

The **organisation** argument reasoning that decentralised decisions and partially autonomous work groups provide relief for management and departments. Participation also enables a speedier reaction to interruptions in the production run.

The **resources and potential** argument that points out how participation is beneficial for building up intelligent and competent personnel. Improvements in human resources can broaden the company's range of possible actions and can become a factor that competitors cannot imitate.

The **corporate culture** argument stating that participation is an intelligent solution for mediating between the conflicting interests of management and workers. It allows trust to develop and encourages the 'extra-role behaviour' of workers.

According to these three arguments, participation is an integral part of a High-Performance Work System, which also serves as a benchmark for the German company in this study.

2.3 High-Performance Work Systems

The term High-Performance Work System (HPWS) refers to a type of production system which empirical studies have proven is extremely economically efficient [8]. The core components of a HPWS are autonomy in work processes, intensive communication, self-managing teams, worker participation in decisions, incentives and qualifications [9].

Several studies have proven that a HPWS encourages employees to become active beyond the duties stated in their contracts [10]. This 'extra-role behaviour' can be seen in the optimisation of operating systems and the flexible combination of knowledge and skills in the work process. Thus, a HPWS creates gains in productivity and flexibility while creating attractive working conditions.

High-performance work systems can be characterised by highly standardised work methods, but because workers participate in setting system standards, these also have a democratic character [11], enhancing employee motivation.

3 INTEGRATION OF TIME MANAGEMENT AND PARTICIPATION

In the following, I will present the results of an empirical study done at four sites belonging to a German car manufacturer. Under the banner '**Reorganisation of Time Management**',

the company set itself the goal of involving its employees in the process of setting performance standards. The study is based on 8 on-site inspections, 32 interviews of experts, 25 group discussions and 545 written surveys of group members and lower management personnel (foremen/forewomen).

3.1 Challenges and Goals

The reorganisation process within the company was intended to create a new space for thoughts and actions in order to mediate between the interests of operational personnel and management. This mediation was also the special challenge of this labour policy project. The operating plan targets which companies set always consist of reducing costs and increasing productivity, and these goals of rationalisation conflict with the interests of operational employees who want to maintain their jobs in the long-term, their ability to work and their employability. Therefore, labour policies must cultivate a process that satisfies the point of view of both production workers and management personnel. One possible solution is a **model of dialogue** in which lower management and their employees jointly establish performance standards and optimise accompanying operating systems in order to reach the company's operating targets. The participation of production personnel in the structuring of time management sets the following goals:

- The broader understanding of operating processes on the part of operational employees.
- The greater responsibility of operational employees in the company's operations.
- The establishment of a culture of trust between management and production personnel.
- The utilisation of operational employees' skills in the process of kaizen.
- The repositioning of IE as an in-house service provider.

3.2 Fundamental Approach and Operational Practice

Production employees and their immediate operational superiors play key roles in the reorganisation of time management (figure 2).

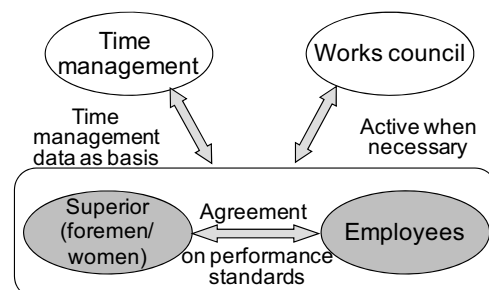


Figure 2: Reorganised time management.

Foremen/forewomen and employees jointly set goals by establishing a dialogue in which they decide how many employees are needed to complete a certain production volume. Company management therefore cannot one-sidedly set the performance standards. In return for a fixed performance standard, employees receive secure, invariable wages. Time management experts from IE collect data and assist in the process implementation. Each group chooses a representative to take part in the decision making process.

This person receives special training and mediates between his or her team colleagues and the foreman/forewoman.

This strategy was applied in the entire company through its company regulations, but it has been implemented in a variety of ways. In some plants, the dialogue for setting targets was teamed with a kaizen process and ambitious goals to save costs. However, this procedure was not typical for all the sites in question. In some locations, IE staff plays very different roles in the goal-setting process: IE can have a leading role, it can function as a service provider, or it does not play any role at all.

3.3 Ambivalent Operational Experiences

For each of the different operational groups, the operational experiences with this approach were ambivalent. A mere 41% of the foremen/forewomen and 22% of the group members surveyed believe the implementation of the new strategy is successful. This contrasts with 64% of foremen/forewomen and 58% of group members who believe the new regulation fundamentally makes sense. This implies that there are deficits in the implementation and organisation of the otherwise generally accepted approach. IE staff and managers also have mixed feelings.

The following problems with implementation were observed:

- Groups tend to argue with managers higher than foreman/forewoman about the performance standards to be agreed upon: Managers want to cut down on personnel in order to pressurise group members to improve, while group members strategise to maintain a certain amount of leeway and autonomy. The majority of the group representatives feel they are put under pressure to sign contracts for which they are later criticised by their colleagues.
- The relations between the groups and the IE Department can also be somewhat strained. Group members accuse IE of often being unwilling to cooperate, and IE believes the groups and foremen/forewomen are unwilling to contribute to goals of rationalisation.
- The result of this is that agreeing on goals takes a great deal of time or does not occur at all. Another point is that reorganisation does not lead to a culture of trust in many of the production sectors. Instead, group members feel reorganisation is purely a form of rationalisation and the promise of participation is not being kept.

These points of criticism represent the experiences of employees in roughly 60% of the reorganised areas of production. According to the surveys, the factors affecting the success or failure of this process do not include the following: the technical level of production, the difference between assembly and manufacture, and the level of qualification of employees.

4 CONDITIONS FOR SUCCESS

After assessing the interviews, it was determined that the conditions for a successful reorganisation of time management depend on the type of work organisation and on the quality of the goal-setting process.

4.1 Type of Work Organisation

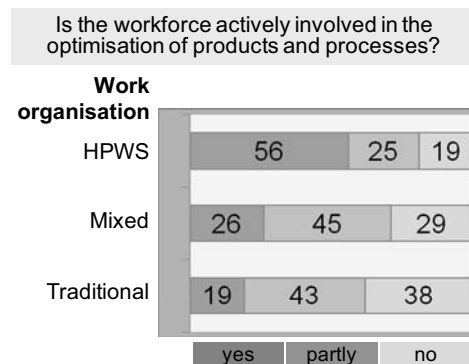
Ideally, a HPWS can be distinguished from a **traditional form of work organisation** (figure 3) based on Taylorism, which

does not cultivate a dialogue with employees and has a foreman/forewoman who organises the operating business of the group as the lowest level of management. In a **HPWS**, partially autonomous work groups exist, employees and managers communicate according to a model of dialogue, and production sectors are managed by foremen/forewomen who are able to encourage groups to independently manage themselves and who are also more involved in planning and improvement than traditional foremen/forewomen.

<i>criteria</i>	HPWS	Mixed	Traditional
Work form	Partially autonomous group work	Contains elements of HPWS and traditional models	Taylorist work forms
Level of participation	Dialogue model		Antagonistic model
Type of superior	Upgraded foreman/woman		Traditional foreman/woman

Figure 3: Types of work organisation.

The type of work organisation has a measurable effect on the experiences of group members and their superiors. An excellent example of this is worker participation in improvement processes. Compared to a traditional form of work organisation, the reorganisation of time management in a HPWS results in a high level of employee participation in improvement measures (figure 4). This means that the type of group work, the level of participation and the type of foreman/forewoman are necessary conditions for achieving success.



n = 107 Foremen/women in 4 sites; data in %

Figure 4: Labour policies and kaizen participation.

From the point of view of IE and labour policy, another condition for success is the quality of goal-setting processes.

4.2 Quality of Goal-Setting Processes

The process of setting goals must be organised in a way which takes the conflicting interests of management and employees into account. However, it is unlikely that the company's operating targets can be smoothly coupled with employees' interests in the open discussions of the goal-setting process. In order to avoid unproductive power struggles between employees and management, a structured approach is vital (figure 5).

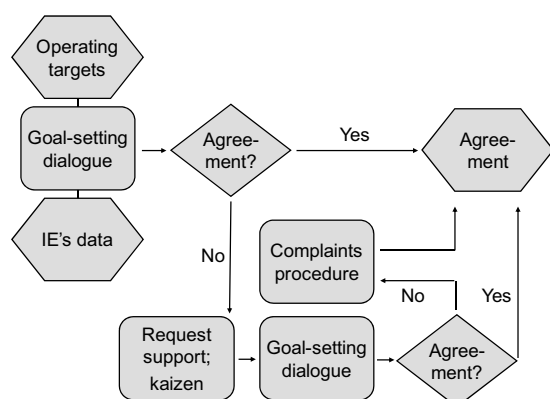


Figure 5: Ideal procedure model for setting goals.

The basis for lower management's and production personnel's ability to set goals together is time management data and the plant's operating plan targets. It is the responsibility of lower management to take these basic requirements into account in its dialogue with the workers and to therefore assume the role of leaders and mediators. The foremen and forewomen must initiate the process of setting goals while taking the workers' point of view into account. If no agreement can be reached, they initiate the next step. They can request assistance, for example from IE personnel, or they can initiate kaizen activities to increase the likelihood of achieving operating plan targets. If no agreement is achieved after a second dialogue has been initiated, they should initiate a **complaints procedure** as soon as possible. A committee with an equal number of representatives from the works council and management is responsible for such matters.

This process model offers ideal conditions for a functional dialogue by allowing conflicts to be expressed without the risk of hindering the agreement process. Having a dialogue also prevents workers from becoming overtaxed through unjustly high performance standards [12]. The company in this study planned to implement this process model in all of its sites, but in reality this was rarely done with consistency. The main reasons for this were overtaxed and underqualified lower management personnel and a lack of acceptance of the dialogue model on the part of middle management.

Where these obstacles were not present, the reorganised time management system proved very practical. It not only allows a high level of worker participation, it also encourages a sharper focus on the company's operational targets.

5 SUMMARY

In this paper, a German car manufacturer serves as an example for how including workers in the process of setting performance standards can modernise IE. However, reorganising time management can only lead to positive results under the following two conditions: The work system

must comply with the basic principles of a High-Performance Work System, and the goal-setting process must guarantee that the company's operating targets are taken into account and the performance standards are agreed upon, even in cases of conflicting interests.

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