



THE INFLUENCES OF ORGANIZATION ON LEADERSHIP IN THE DESIGN PROCESS: RESULTS OF AN INVESTIGATION IN FIVE INDUSTRIAL COMPANIES

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Keywords: empirical study, leadership, management, organization, design process

1. Introduction

This article focuses on what kind of role organization plays for leadership and management in product development, and in which way product development can be optimized by a better organization, management or leadership.

This question is being approached by psychologists and construction methodizers in the context of an interdisciplinary project sponsored by the DFG (Deutsche Forschungsgemeinschaft). The empirical observation of the construction process in industry serves as the basis for this project. Until now, we have investigated five industrial product development departments and coached four of them to do better work. In this abstract we are presenting the experience of these investigations and our first detailed findings, focusing on the influence of organization. In addition to this, the theories, methods, and detailed findings of the investigations will be presented in this paper.

Prof. Dr. Ehrlenspiel has noticed, on the other hand, that until now, leadership problems have not been the focus of the research in construction. In his book, "Integrierte Produktentwicklung" (Integrated Product Development) [Ehrlenspiel 1995], he demonstrates the need for this research.

A further need to examine the leadership processes arises from the fact that the biggest part of the later costs in product development is committed to the concept phase, as in the early phases of the engineering design. And it is exactly in these early phases that the executives have the greatest influence on the product, whereas turning the concept later into a concrete product is carried out in general by the developers themselves, because leadership decisions have multiplicative consequences.

One can surely argue that there have already been numerous worldwide investigations and publications from various branches of science on the topic of leadership/management. Several examinations were carried out in areas, such as business management, organizational psychology, and human engineering, to name a few. In Germany alone, more than 1000 authors in the last 30 years have published works on the theme of leadership [Probst 1987]. Unfortunately, none of the investigations deal with leadership processes in engineering design. Thus, a considerable gap exists, which must be closed by empirical investigations [Lüdcke 2001]. What is missing are investigations in industry, in which leadership processes are observed in a situation-specific context. Therefore, the most essential factors of influence and needs of the leadership processes in engineering design should be recognized in order to perform engineering design more efficiently. In other words, building up on the recognized leadership processes should purposefully be supported and shaped through organizational measures, methods, training, and check lists.

2. Research objects and methods

The objects of the investigation are the engineering design departments, the product development processes and the leadership processes occurring within them, as well as the organizational and process structures of the environment in which they are operating. We have investigated five companies so far. The companies which were examined have an annual turnover of \$1,625 million to \$4.201 million and of 10 to 400 employees in the product development departments. The duration of the projects ranges from two days to five years. Their assignments range from commissioned work to new-, variant-, and adaptation constructions. This shows that we investigated a wide range of product development and that our results will not be specific for only one application case.

The following figure shows the integral approach. One can see how the leadership processes influence each other in the context of organization, resources, teams, individual behavior and tasks.

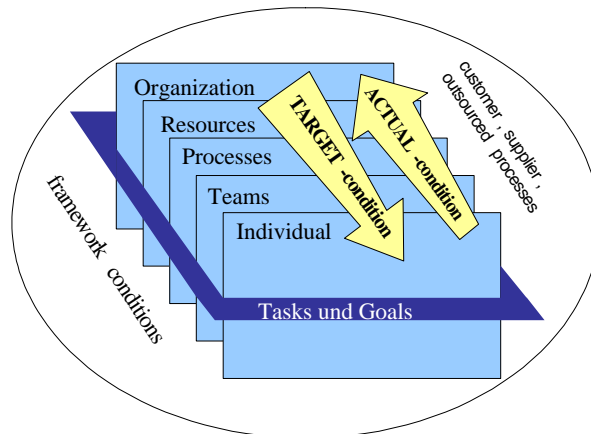


Figure 1. Investigation model

This is one of our investigation models. From top to bottom the individual has room to move and rules provided. This is called the **target** condition. The individual defines the **actual** condition through their individual acting and especially through the individual leading.

Taking this into account, we use a house of investigation methods to analyze and describe the influence of the organization on the leadership, based on the investigation methods from our predecessors [Wallmeier 2000].

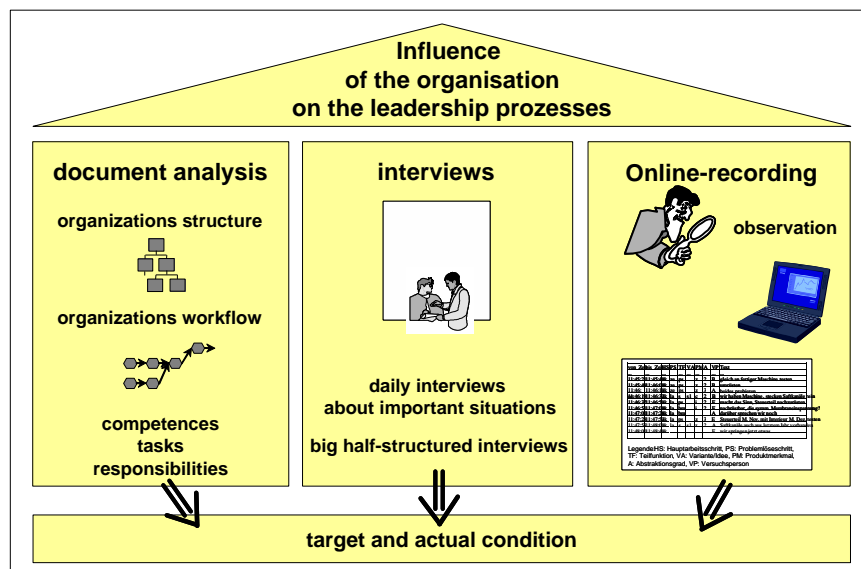


Figure 2. Investigation methods

The three columns are:

- **Analyzing the documents** from the investigated companies, specifically from the product development departments.
- **Conducting half-structured interviews** with the employees from the product development departments.
- **Recording online** for 2 weeks at each company, we recorded throughout the day the interaction and the activities of the observed persons.

In the following, our investigation methods are explained in greater detail.

From the **document analysis**, the structure-, process- and product development organization was derived. Through this information was obtained about the target processes in development departments and the role of the official leading persons in it. For the detailed tasks of the leaders and employees, their job descriptions were analyzed. From this knowledge, we could already identify first possible problem areas.

The **interviews** were carried out in two steps. First, short reflection interviews concerning important situations were made every day during the observation time. From the interviews were gathered, among other things, ideas and aims as well as their judgment of single process sections.

Longer half-structured interviews were carried out to derive a picture of the motivations, aims, and considerations in order for the participant to judge the leadership processes from various points of view.

A point of interest was their self management, perception and assessment of the development processes, their own leadership behavior and the assessment of the leadership behavior of their supervisors. In addition to this, questions were posed about the company culture and problems of the company.

The third step was the **online recording**. Five to twelve persons in the investigated companies were observed in the space of 3 to 10 days. Each company was observed for two weeks. During the observation, every conversation and every activity was documented using a special computer-program on a laptop. In this way, the leaders were accompanied throughout the working day and their observed behavior and interaction was documented with starting and ending times. Since that time, we have more than 200,000 entries. After this, the online recordings were reworked and classified. Points of interest are the planning horizon of the situations and tasks, the initiator of situations, the working contents and the leadership activities. The number and duration time of situations and activities were also considered.

3. Definitions and Hypotheses

The following definitions of leadership are based on the results of the investigations. They are explained in more detail in the paper [Luedcke 2001]:

Leadership is a guiding function in the engineering process.

- Leadership influences the development process either directly or indirectly through the responsible designers.
- Anyone in the design team can take on leadership functions, even if they are not formally legitimized.
- In specific situations any involved person can be temporarily accepted in a leadership role.
- Efficient leadership depends strongly on the situation at hand.
- Leadership processes take place on different levels (Engineering design content; Coordinative-planning; Relationship-orientated)

Successful leadership behavior can appear differently in the conceptual-design phase than, e.g., in the embodiment-design phase. In the first case, a democratic style of management could be appropriate, whereas in the other situation an authoritarian style of management would be more suitable [Lüdcke 2000; Lüdcke 2001]. The term “leadership” differs from the term “management”. The latter tends to be more process-oriented. “Leadership” implies more personality and contains the specific behaviour, e.g. the words and intonation a person uses, as well as the type of leadership one favors : democratic or more authoritative.

The **organization influences** the leadership in four ways:

- a) Processes and competences are not clarified
- b) Processes and competences are unreasonably defined
- c) Processes and competences are not known
- d) Processes and competences are not realized

These facts are the reason for inefficient leadership and inefficient product development processes.

In case “a”, e.g., scopes of action arise which are used individually.

In case “b”, an organization exists, but the contents are not well defined, so that people have the wrong competences for their tasks.

Case “c” means that good processes are defined but the communication (verbal and optical) doesn’t mediate or the mediation becomes so bad that employees and leaders do not know them.

In case “d”, the defined processes are not realized, which can have several reasons. The employees do not accept the processes, or the processes do not fit the situations’ demands. Another possibility is that the leading persons do not motivate their employees to do what the process definition describes.

4. Results

The results discussed here are only organizationally specific. Many other results of our industrial investigations can not be presented in this paper.

The most important results are that the same general problems in all product development departments arise, in addition to other specific problems. Unexpectedly, the results show that very different kinds of companies often experience the same problems within their organization.

The general problems can be distinguished according to our hypotheses, in those which are caused by an **missing** organization, an **inefficient** organization, a **not knowing** organization and an organization which is **not realized** by the employees. In the following, some founded examples for each of the organizational problems and their consequences are explained.

Results of a **missing** organization, e.g. a missing project-management, were observed. In this company, it was not clear which tasks and competences the project leader and the assisting project leader have. Through this, the assisting project leaders do what they want to do and what they can do best. So they are involved most of the time with technical topics, because they are former engineers. Therefore, many problems in coordinating the divisional tasks were due to a lack in leading the mechanical designers.. The project leader was overtaxed to obtain an overview of his project. Throughout the interviews, it was ascertained that the project leader saw the problem that his/her assisting project leaders were dealing to little with the coordination. However, the assistants state that the project leader is concerned with coordination.

In other words, a missing rule which defines the competences and the tasks has the consequences that the project leader is dissatisfied with his/her assisting project leader(s), and that the project is not controlled and led as it should be.

An **inadequate** organization results when roles of process definition exist but are not practicable. To give an example, in company 3, it was observed that the task of an engineering designer required the involvement of other employees. So, he/she gives partial results to employees in his/her own department and other departments in the company. After this, the results of the other employees are necessary to go on with his/her major task, this is shown in the following figure.

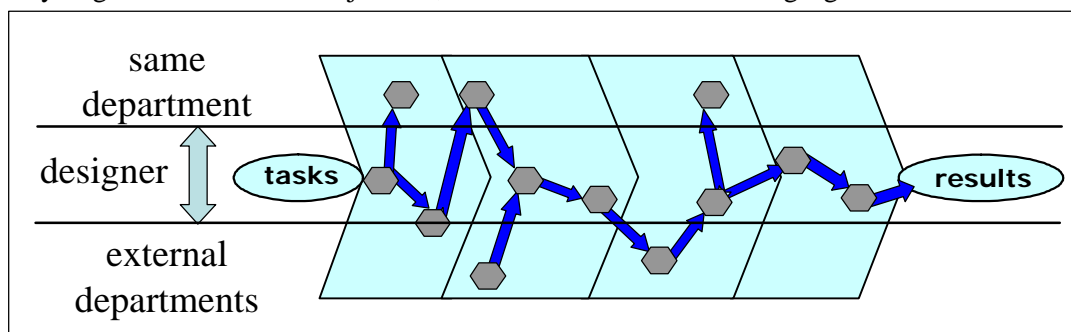


Figure 3. Inadequate process definition

The problem is that he/she has no formal authority to demand the results from his/her colleagues. Because the processes are interdependent [Eppinger 1994] this results in procrastination and disgruntlement on the part of the employees. Because the tasks were subject to deadlines, the project leader had often to depend on his/her superior to define the priority of the tasks for the other colleagues. In short, due to the defective organization, superfluous leadership situations are caused.

Another cause of unreasonable processes are impracticable process definitions which were the result of the use of the ISO or DIN standards in product development departments. That means processes are still defined, but through increased effort to handle this standard processes are going on as well as they did before process definition.

If processes and competences are well defined, but **unknown**, they have no effect. For example, in all investigated companies, the job description is so obsolete that the employees do not know what is demanded of them. It does not describe the current position of the employees.

Cases were also observed in which processes and competences are well known and defined, but they are **not realized**. The reason for this often lies in the motivation and capabilities of the employees and the leading people. On the one hand, the leaders know that they are not acting as the organization intended. On the other hand, it is obvious that a manager knows that action is required; he simply does not know the proper course of action to solve the intended process.

Thus, defined development processes, such as design reviews and danger analysis, were not performed by the employees. The interviews show that it is often time pressure or the lack of understanding of the importance which leads to disregard. The leading persons fail to communicate the importance of a step, or they do not motivate their employees enough. In other words, they do not call in the results of the defined processes.

All four problems, which are concerned with organization, influence the leadership. Through this the leading persons are involved in inefficient leadership situations. Missing, inefficient, not knowing and unrealized organization are the **causes for superfluous, not inquired and unnecessary leadership actions**.

The following are some of the most relevant problems of all the companies. It is interesting that these problems equally occur independent of the industrial sector, the size of the companies, the specific organizational structure and course.

The project management is often not consequent enough with its methods. In some cases, the employees and leaders are not qualified as well as they should be. That is why it is so important that project management be more firm and thorough, in order to optimize the success parameter, cost, time and quality.

For the huge number of projects which are performed in industries, a multi-project management is often useful. However, it is often absent or not conscientiously applied, so that the tasks between the projects are not coordinated and supply bottleneck can not be well balanced.

Insufficient planning at the beginning and throughout the course of the project and tasks were the reason for many problems. This results in uncoordinated tasks, time lags, double workload, and too much iteration. But the planning is not a single task, rather the continuous controlling planning and guidance is the condition for a project success. It was often observed that insufficient controlling of the project course, and as a result, an inefficient adaptation of the project plan, were normal.

Particularly, the job descriptions are insufficient. They are incomplete, impracticable or obsolete, which produces confusion as to which competences and tasks the leaders have and for which tasks they are responsible.

Meetings were identified as an important cause of inefficient processes, as well. The reasons for the inefficiency of meetings are the lack of knowledge of moderation methods and techniques. The results are discussions which are poorly structured, complex problems which are not visualized, and important decisions which go undocumented.

5. Summary and outlook

The concept of leadership is closely bonded with the concept of organization: one defines and influences the other. The consequences and situations in which these problems arise are shown in this paper. Surely, it gives detailed concepts of project planning and organization concepts. However, the

reason for such inefficiency can often be found in the individual behavior and capabilities of both leaders and employees [c.p. Frankenberger 1998]. The motivation to do something better requires that the involved persons recognize the problems and their course. What was actually observed is that involved persons often do not recognize their problems. Another problem is that every employee and leader is an individual person with his/her own impressions, problem solving techniques, goals and aims, which makes it very difficult to incorporate them in one unanimously accepted process. However, it cannot be denied that this is the condition for effective work in a group, in divisional work and in a large number of projects.

What is required now is to work out concepts to wake up problem consciousness, in order to improve the motivation of the employees. Furthermore, individual concepts for the investigated companies will be established to initiate change processes. This includes project management books, use of methods to structure processes, etc.

We look forward to presenting some selected problem fields with detailed reasons and possible remedies at the DESIGN conference. A detailed explanation of our investigation methods will be presented in a future paper.

Acknowledgements

This project, entitled "Leadership in the engineering design", is funded by the DFG (Deutsche Forschungsgemeinschaft). The DFG is the main public funding body for scientific research in Germany.

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