

Future-proof forms of organization in project-oriented mechanical engineering. The balancing act between yesterday's tradition and hasty modernity.

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Abstract

Many companies are confronted with external and internal changes, which also lead to the existing forms of organization being put to the test. The influences on these are also shown, as are the most widely used and established organizational systems. Subsequently, this work treats forms of organization in their various forms, and the distinction between systems and forms of organization is presented. External requirements for companies such as increasing agility and shorter response times as well as internal requirements by employees are discussed. This from the point of view of the topicality or the future viability of the organisational structure. It also mentions the complex process of reorganization, in which employee engagement should be the focus. For project-oriented mechanical engineering, possible forms of organisation are identified that will best take account of this segment of the company and its requirements in the future. It also provides an outlook on continuous change processes.

Keywords:

Organisational form, organizational system, restructuring, generational change, agile working

Introduction

Like all areas, a company is undergoing constant change. New products must be developed, established products must be adapted to changing needs and production is also subject to permanent optimisation and change. In the field of technological changes, increasing bandwidths and the increasing availability of mobile networks have led to more mobility, and on the other hand, information and communication structures have led to increased interactivity. Mechanical engineering in Germany is one of the key industries of our economy and, through the development and production of new machines and production facilities, contributes continuously to the fact that products and goods can be produced in the necessary way. Here, machining and machine tools or analgesics for surface finishing can be cited as examples, which are also exported to many countries.¹

Changes in the economic environment can be attributed on the one hand to changes in the behaviour of customers, who have become both more demanding about their individual wishes and more critical of products and services. Many machines are not offered as finalized catalogue goods, such as laptops, dust sours or washing machines, but are individually adapted or completely redesigned for a customer. It should be noted that some globally established special machine builders are based here on land and have exclusively specialized in machine and analgesic construction at the customer's request. All these trades are carried out as projects in

¹ See. Picot A. (2015), p. 516

the respective companies, which are individually focused on the customer and the respective specifications.²

In order to be able to successfully complete these projects within the set time and cost framework to the satisfaction of the customer, it is necessary, among other things, to adapt the organization of the company to this type of order processing in order to ensure an optimal course. If one examines the organisational process in more detail, it quickly becomes apparent that the formal aim is to create rules for determining the distribution of tasks and coordination, procedural guidelines for the processing of transactions, complaints, delimitations of competences, right of instruction, signature powers, etc. in the company.³

An immensely advanced digitization influences the companies of classical mechanical engineering due to the structures and working methods, which have mostly been consolidated over decades. The consequences of increasing digitalization, such as a further opening salary gap or how many jobs can be saved as a result, here experts speak of up to 80% in the low-wage sector, remain unclear.⁴

Methods and Findings

The research question of this paper is, “How high is the impact of the form of organization on the economic success of project oriented mechanical companies?”

To answer this research question the method of structured Content Analysis as outlined by Mayring was used.

7 categories and 1984 Codings were created and then interpreted.

1. Established forms of organization

Organization charts of companies represent the structure of a company by visualizing the structure of the organization in a simplified way. Here, the individual employees are immediately reflected in their area or organizational unit and an affiliation is shown. Often this also results in a certain connection.

² See. Steinle C. (2008)

³ See. Steinmann H. (2013), p. 383

⁴ See. Hofert S. (2018), p. 20

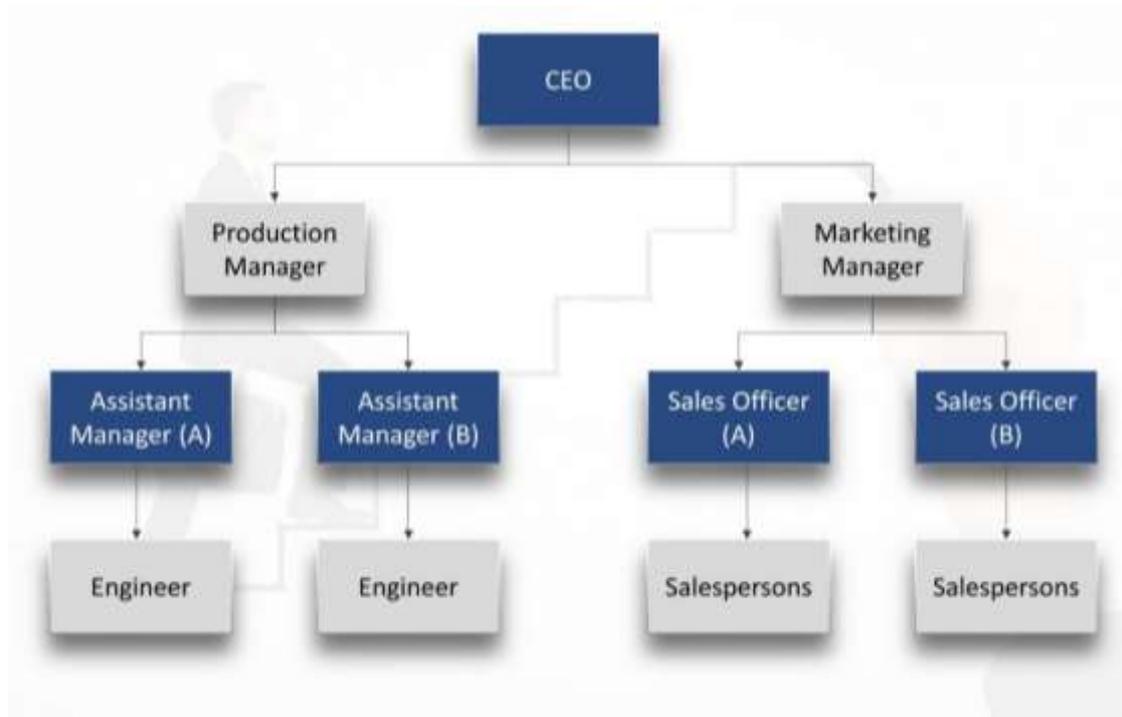


Figure 1: Line Organizational Structure⁵

Here we can look at a classic system structure of a small or medium-sized company, as it can be found very often in the European economic area, since line systems are the oldest organizational structures. This structure, which has mostly grown, is also mentioned in the first place in countless literary works and presented as soon as the subject area of the organizational structure is dealt with. This is also a very streamlined form of organizational structure, in which each employee is subordinated to only one manager. This has also resulted in catchy names such as group leaders, department heads or head of department. Even in large corporations operating worldwide, these can still be found today.⁶⁷

Other forms of organizational systems have evolved over time to continue to meet changing requirements and influences. This is called organizational systems:

- Liniensystemen
- Funktionssystemen / Mehrliniensysteme
- Stabliniensystemen

However, organizational systems that represent a lot of organizational units should not be confused with organizational forms. Here, too, as already mentioned and shown above, a classic functional organisation can be observed in small or medium-sized enterprises. Here, too, historical development plays a role, as the individual functions gradually deduct and develop during the growth process of a company.

Influencing factors are crucial for the form of the organization, for example, which service a company performs, which form, and size of the company is available, which manufacturing,

⁵ See. Line Structure Organization (2020)

⁶ See. Olfert K. (2015), p. 156

⁷ See. Olfert K. (2015), p. 157

and information technologies are used. Here we are talking, for example, about forms of organization such as:⁸

- Sektorialorganisation
- Funktionalorganisation
- Spartenorganisation
- Matrixorganisation
- Tensororganisation
- Derived forms of organization

For project-oriented mechanical engineering, an organizational system with lines or bar lines and an organizational form with functional orientation can be assumed to be the most widespread.

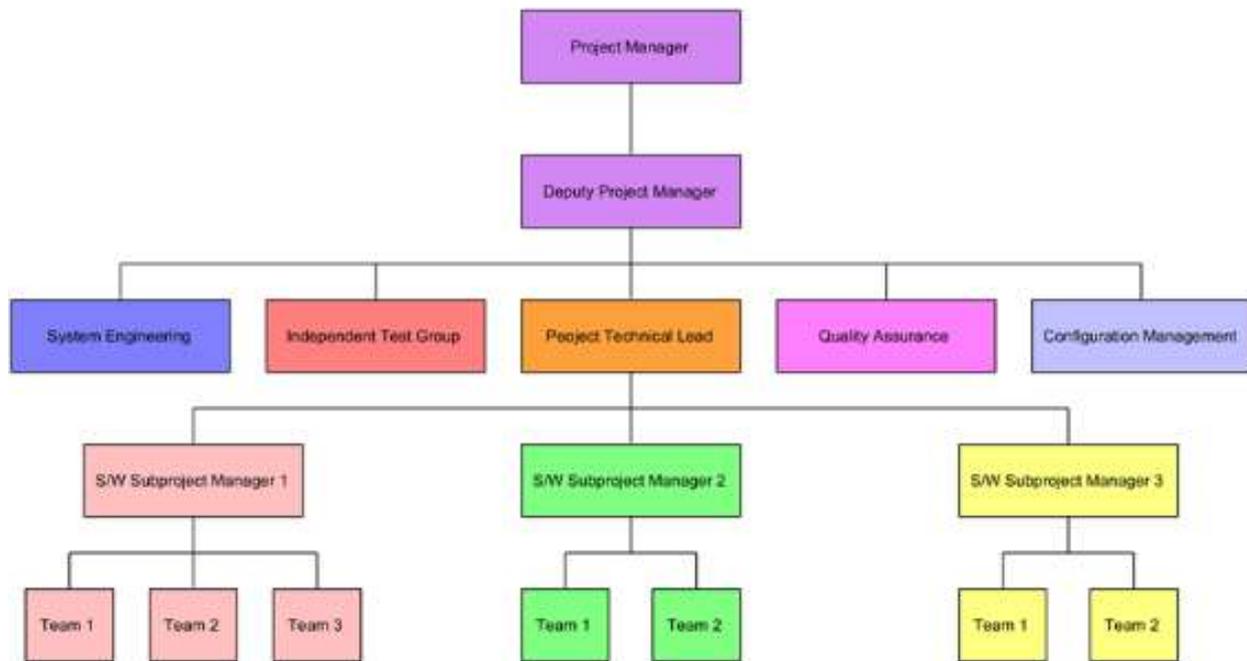
I do not wish to discuss and describe the above-mentioned forms and systems further, but rather to highlight the possibilities and the need for change. The values and self-understanding of grown companies with a long tradition should not be questioned in any way here, but rather they must be preserved and transferred into sustainable approaches for change.

2. Established project structures

The project structure is an image of the project organization and is, like the organizational structure of a company, a visualization of the structure. If we look at Figure 1 and Figure 2, we can see clearly matching structures. However, this is only related to the structure of the functions. In terms of content, these functions are fundamentally different. The project team, which finds itself in this structure, aims at the successful realization and execution of the project. The customer is king and has the highest priority, although the customer is internal lysor.⁹

⁸ See. Kieser A. (2007)

⁹ See. Brandt M. (2019), p. 19

Figure 2: Project Organization Chart¹⁰

A project often requires people with a wide range of qualifications and professions. Also, the large part of the project often requires a part- or sub-projects. This is necessary to maintain the necessary transparency and enable project controlling. Typically, and unfortunately, the problematic state is often the focus of interest instead of paying our attention to the resolved final state.¹¹ The project manager and his sub-project managers are the key people and are responsible for the project. Whereas each participant is responsible for the success. Only as a team can tasks be handled efficiently and effectively.

3. Questions, obstacles, and analysis of internal and external influences

In view of the established and mostly organized in traditional staff lines organizations, project execution is often not feasible without frictional losses.

The question here is how an organizational structure should be structured to enable more efficient project execution.

This does not mean the internal one-off project, for example, to introduce a new customer management software in the company. Rather, it is aimed at companies that are involved in projects in their core business. As mentioned at the beginning, special machine construction is an industry that handles customer orders almost exclusively in individual projects.

3.1. External influences on the organisation

External influences, which are increasingly difficult to cope with with established systems and forms, can be expected from several directions. Globalised competition can no longer be a new influence.

Rather, it is the customers who, also through political, climatic, and social influences, are prompted to make ever faster and deeper adjustments to their production facilities, which are

¹⁰ See. Project Organization Chart (2020)

¹¹ See. Andler N. (2015), p. 29

approaching machine and plant manufacturers with new challenges. This concerns the technological areas as well as the development time available. This can be seen in e-mobility. Due to more ambitious targets for climate protection and the reduction of CO₂ emissions, vehicle manufacturers are forced to develop and produce more and more vehicles of this type. Decades of development or experience can no longer be used here. Mechanical engineering is thus also confronted with rapid development and massive technology changes. Further expertise needs to be developed and changes must be governed even more quickly.

As a result, there is a growing need to be able to react more quickly in the organization to keep up with the pace of the customers. A more agile approach is to be promoted. Work is being done to generate further time savings in the project and to be able to react better to ever-increasing changes and optimizations on the machine or plant.

Some approaches from software development are taken over and try to transfer them to the development, engineering and commissioning of machines and plants. A wide range of challenges are faced. On the one hand, unlike software development, it is usually not a completely independent small sub-trades that can be optimized using the try and error process. On the other hand, the requirement of highly flexible and fast solutions is not feasible due to physical and technical constraints. Standards, regulations, and directives, such as 2006/42/EC of the European Parliament, also require a high level of safety for products.¹²

3.2. Internal influences on the organisation

Another, very significant, influence factor on changes in the organization is the employees. Here, also due to the demographic spiral and the expectations of the employees, it becomes more and more decisive to face these challenges and to position itself as an employer attractive for service providers.

The prevailing thinking with financial means and with the prospect of a leadership position can be maintained in the long term. Younger generations have different expectations of their employer, such as flexible working hours and places. There is also a very limited emphasis on taking on personnel or management responsibilities. More and more teamwork and project work are being focused with an open and independent design of the workflow.

In this context, it is also a good place to talk about aspects of domination and hierarchies. Generation Y and Z employees are more critical of these. The frequently cited control range of less than ten people is also increasingly called into question as this entails a very fine and deep hierarchical structure. This is contrary to the team and project idea with more flexible areas of responsibility and topic. The more recent literature therefore recommends the establishment of relatively flat hierarchies, which allows a higher degree of flexibility, communication density and greater proximity to the organizational goal. This promotes teamwork and project work and enables a desired freedom of design as well as the assumption of responsibility for the respective share of the work.¹³

3.3. Change processes in the company

There is no doubt that changes are coming to companies and their organisation. Not only the direction of change, but also the nature and process of how this goes about is an important aspect. Kotter, Lewin and Krüger are mostly quoted here. The goal is always to involve the

¹² See. ABI, L 157/24 (9.6.2006)

¹³ See. Steinman H. (2013), p. 402

people involved and those who are affected by it in the process of change. Broad acceptance and the participation of upheavals is an extremely important psychological aspect that should be considered in the planning of change. A clear and proactive information policy in the company serves to prepare and promotes the implementation of the transformation process. The central objective of the communication measures within a reorganization project is to control the perception of the employees in which, from a certain degree of maturity of the plans, they perceive the intended reorganisations completely and without distortion.¹⁴ In today's world of work, employees are an important success factor that should receive full attention, as the self-image of them is also changing. From the recipient and exporter of instructions in past decades to the present day, a massive change has taken place. There is clearly a tendency towards horizontal cooperation in the sense of self-voting, whereby the initiative is to start from the taskforce itself, they establish the necessary links at their own discretion. The new form of organisation should make this possible.¹⁵

3.4. Project management in the company

When we lay the structures of the organization, in the classical sense, and the structure of a project on top of each other, we see more cross-crossing than matching arrangements.

Take the engineering of a classic engineering company to illustrate the problem. Many other substructures are subordinated to the management, which are subdivided into business units or product areas. Distinctions by location can also be found. Smaller companies tend to have a flatter hierarchy. Regardless, in most cases, we will eventually find engineering following the path of management. This is also often divided into mechanics and software or electrics. All employees who are involved in the constructive elaboration are subordinated to the head of the engineering department. This management function is responsible for the classification, resource planning and quality and progress monitoring for all employees. Now we have a variety of projects in which small groups, teams, or individuals from the engineering world work.

Now we hire the main project manager or project manager who is solely responsible for the execution of an order or project. It can include all phases, deadlines, and the need for resources. In this case, this is usually a very dynamic process, which always requires the revision of the plans. External influences such as customer requests for changes or postponements of planning documents have a direct impact on the project plan. There are also shifts due to internal influences such as delivery difficulties of components or production errors.

One of the most common difficulties is resource planning. On the one hand, the head of engineering tries to plan long-term and efficiently without having the detailed insights into the projects. On the other hand, the project managers without access to resources with the need to be able to react quickly and adequately to changes to be able to realize the project in the schedule. We are then talking about a staff project organisation in which the task of coordinating and motivating the project participants is assigned to a project manager, but he has no formal decision-making rights over the functional areas.¹⁶

Results

Finding a sustainable form of organization for project-oriented mechanical engineering is a challenge for management. The question also arises as to whether an adaptation to the existing

¹⁴ See. Picot A. (2015), p. 560

¹⁵ See. Steinmann H. (2013) p. 406

¹⁶ See. Picot A. (2015), p. 389 f

form is necessary at all. If the change of the organization is considered sensible and expedient, the challenge is now to choose a form that also suits the company. As part of the reorganization as a fundamental rethinking and radical redesign of companies, the high importance of business processes for the success of the company was recognized. A simple selection and adaptation of existing forms of organization cannot therefore always be effective or produce an unoptimal result. So-called derived forms of organization are conducive to specific tasks and company orientations. Here you can give examples:¹⁷

- Center-Organisation
- Holding Organisation
- SEG-Management Organisation
- Product management organization
- Process management organization
- Customer management organization
- Project Management Organization

For the area of project-oriented mechanical engineering discussed here, it is obvious to deal with forms that are oriented towards project and customer management. The coupling of organizational units and their information channels can lead to different forms of project organization. Here, too, it is possible to work with line, staff, or matrix organization. The project manager role is of particular importance here. The demands on the social competence of the project leader are considerable, such as the ability and willingness to approach, listen to and accept and respect the employees as persons.¹⁸¹⁹

A matrix project organization can also be set up in horizontal orientation. Positively remarkable in such a form of organization is that the department and project managers have an influence on the group in their field. However, there is a negative impact on a high level of coordination and delimitation of competences.²⁰

When considering functional and process specialization in project-related mechanical engineering, one can come across a matrix of functional and process-oriented organizational units. The high process and customer specification in relation to an infrastructure and functional specificity leads to the conclusion that a matrix of differently working units represents an optimum. Lateral communication and cooperation are an important aspect of which can be handed over to a substantive authority and does not require a line authority. Decision-making processes and interpersonal relationships must be such that a person can carry out his or her duties even if he or she is hierarchically subordinate to two or more persons.²¹²²

Process-oriented forms of organization focus exclusively on the process. Known organizational structures and hierarchy levels are no longer relevant. Process management is the orientation towards the customer, the quality, and the employees, which means that this can also be described as customer- and employee-oriented corporate management.²³

¹⁷ See. Hammer M. / Champy J. (2003)

¹⁸ See. Burghardt M. (2008), p. 350ff

¹⁹ See. Birches K. (2003)

²⁰ See. Bleicher K. (1991)

²¹ See. Picot A. (2015), p. 387

²² See. Steinmann H. (2013), p. 413

²³ See. Schnetzer R. (2014), p.86

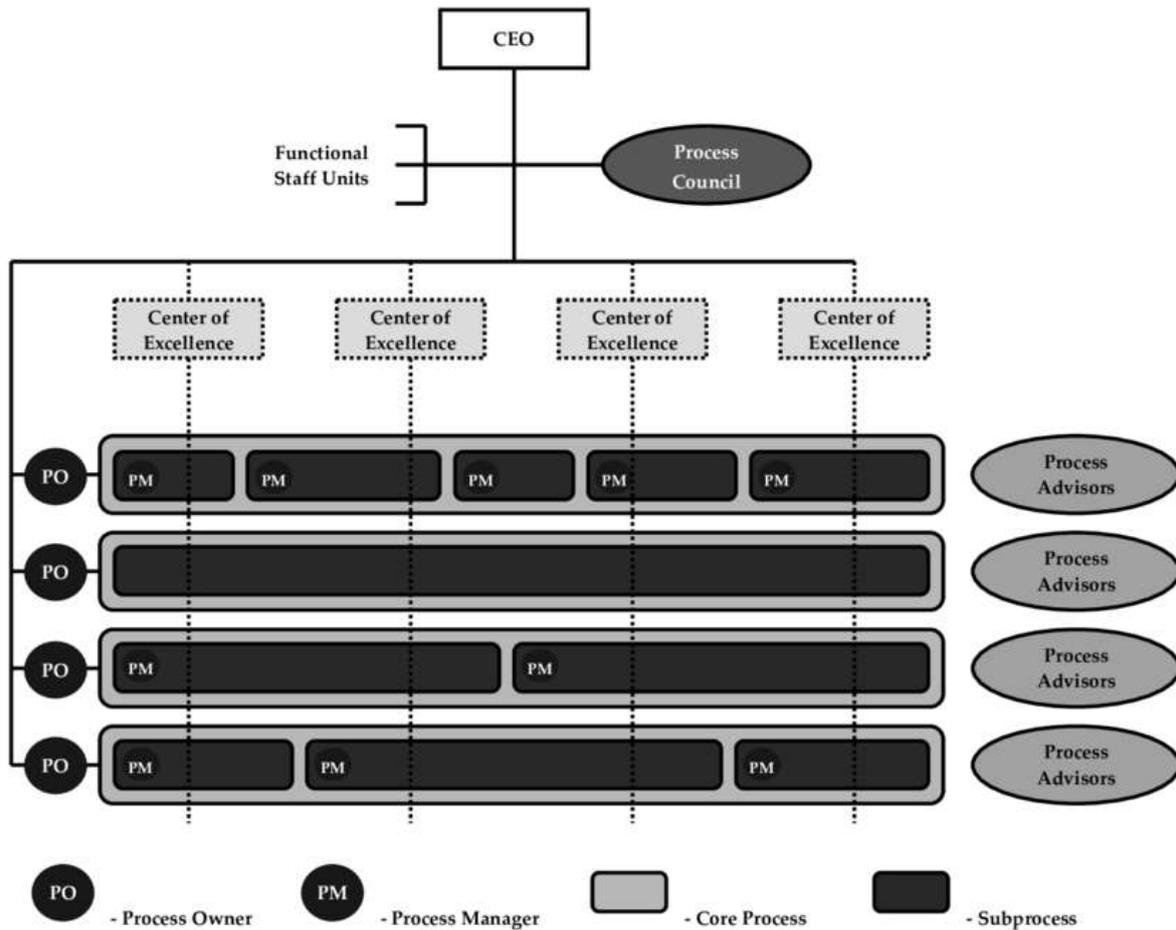


Figure3: Process Based Organizational Structure²⁴

In the future, the form of dynamic networks can also be used as a partial form of organization for project-oriented mechanical engineering. This probably excludes staff functions, commercial parts as well as manufacturing-oriented parts. The models of the dynamic network are based on informal communication and coordination at their own discretion, in which specialized experts, which are distributed throughout the organizational unit, form the basis of this form of organisation.²⁵

Discussion

As already mentioned, the adaptation of existing or theoretically generated organizational structures can be problematic. Here, advantages and disadvantages must be confronted decisively. Ah, for the project-oriented mechanical engineering considered here, a takeover of other economic sectors is to be considered critically. Take the media-highly praised approaches of software developers. Google and Facebook are also often quoted by reference to apply forward-looking forms of organization in which employees can optimally develop their potential independently and independently. In the case of clearly defined and defined task packages whose processors have similar qualifications and expertise, this is quite effective. The team consists of software developers who must solve their software-based tasks creatively, but

²⁴ See. Process Structure (2020)

²⁵ See. Steinmann H. (2013), p. 412

interface problems are rather minor, except in the software. On the other hand, this is much more challenging in an interdisciplinary task such as a special mechatronic machine. Various faculties work together here, from development to software, mechanical design and purchasing to assembly and commissioning. Getting a dynamic team vote here is extremely difficult to assess.

Staff line organizations in which a project structure is implemented often leaves frustration and disappointment on the part of the project manager, as he must always, formally speaking, act as a petitioner for resources. Agile action is often only possible here if the persons responsible for the functional areas show great willingness and understanding for the needs of the project.

Matrix organizations in which formal decision-making rights are transferred to the project manager is a step towards taking project needs into account. There are two aspects to be noted. On the one hand, very close communication between those responsible for the function as well as for the project is immensely important to always pursue a common goal and to deal with influences or currents in harmony. On the other hand, clear communication with the persons involved is indispensable to avoid confusion, since conflicting instructions can cause incomprehension or frustration among several officers of instruction. This type of organization requires an immense amount of communication at the management level.

Project organizations where, for the duration of the project, the management and coordination of the employees is fully handed over to the project management can access the resources transferred to them dynamically and agilely, in the sense of optimal project implementation. In the form described here, a strong fluctuation in the quantity of certain subject-specific resources is more difficult to dampen down since no functional areas exist. Project focus can also lead to a neglect of employee development. A comparison of the project areas is also desirable here. Likewise, there is the danger that a self-preservation one project is established in order to maintain it itself. A so-called perseverance can be set.²⁶

Hybrid systems can be considered, which, depending on the requirements and specific business model, represent an optimal solution.

A historically grown staff line organization can be maintained in which staff areas such as Human Resources, Purchasing and Accounting are located. Product areas provide a way to implement specialization and avoid disproportionately large units. In this area or areas, a project organization can be implemented to focus on the customer and the respective product. However, a manageable functional area can also be established in which employee development is the focus and from which peak demand can be covered in the projects. This is conceivable for areas such as engineering and operations. With such hybrid organizational structures can be used effectively on specialists.

Conclusion

It can be declared that a clear recommendation for a specific form of organization cannot be given. We see the task of bringing units together in one organization and focusing on the

²⁶ See. Picot A. (2015), p. 393 f

company's success, even with partially completely different ways of working. The most important asset, the employee, always in focus, even with the changing needs, is a challenge for all decision-makers in the company. A rigid insistence on old-fashioned organizational structures established over decades will, sooner or later, no longer meet the requirements. Here, too, there must be a change. However, this must be planned in a sound manner and implemented carefully. The integration of all employees in the company, the transparency and clarity, as well as the traceability of decisions is the key to the success of the transformation process. The Zeil should be a project-oriented form of organization in which a flat hierarchy enables employees to communicate directly and make independent decisions. Individual processes and areas in the company should also be considered to ensure the company's success for the future.

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