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Open Organization in Engineering Design

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Abstract

Organizations face various challenges caused by social and economic change. Particular problems are the demographical change and thus the lack of skilled labour and changed employee needs. An approach to face these challenges is the idea to open up organizational boundaries and adjust them towards the organization's environment. This paper clarifies this Open Organization approach with background in the field of product development. The goal of this contribution is to introduce the concept of Open Organization into the product development domain by specifying our understanding of Open Organization. Therefore existing definitions and descriptions from literature are analysed. Within this topic our research focuses on two opening dimensions of an organization: Knowledge and persons. Both can be commonly used or shared over existing organizational boundaries. Accordingly, a classification of opening types is presented. A main finding of our research is that 'open' is not merely a status to describe organizations – instead, the opening of an organization is a process that requires constant adjustments and negotiations.
This paper contributes an approach to support the opening process of companies with focus on the development process. Open Organization extends the idea of Open Innovation by adding the exchange of individuals as knowledge carriers to the exchange of knowledge. This approach consists of a set of developed methods, strategies and tools.

Keywords: Open Organization, Product Development, Collaboration, Organizational Boundaries

1 Introduction

Demographic change in industrialized countries poses major challenges to both economy as a whole as well as individual companies. Firms have to cope with a shrinking and aging workforce, thus struggling to acquire and maintain competences that are crucial to the innovative process. High R&D investments combined with cost pressure, shortening innovation cycles and increasingly complex product development processes (e. g. due to globalization) put companies under further economic pressure and may even discourage

innovation due to high risks associated with failing. Therefore the inclusion of external key personnel is no longer just an option, but has become a necessity for many companies, on the one hand to react more flexible to changing conditions and on the other hand to gain access to rare resources and specific competencies. This calls for a new form of organization that accounts for increased demands for flexibility, reacts sensitively to the needs of its employees and provides support for the challenges that may arise in an open work environment.

The basic approach of the research project RAKOON is to adopt the central ideas of Open Innovation to not only the innovation process, but to the whole organization (with special focus on the product development process). We thereby create a concept proposal for an 'Open Organization', a term which has recently gained in popularity (Whitehurst, 2014; Foster, 2015). Innovative developments are not achieved solely by 'lifeless' R&D departments, but are a result of cooperation across the organization, from the management down to the shop floor (Pfeiffer et al. 2012). Demand for innovation thus affects the whole organization, requiring openness on an organizational level as well as sensitivity for the 'whole' individual. Even though organizations have never been completely 'closed', the Open Organization therefore represents a change of perspective. Figure 1 shows a comparison between a prototypical 'closed' organization and our proposal for an Open Organization.

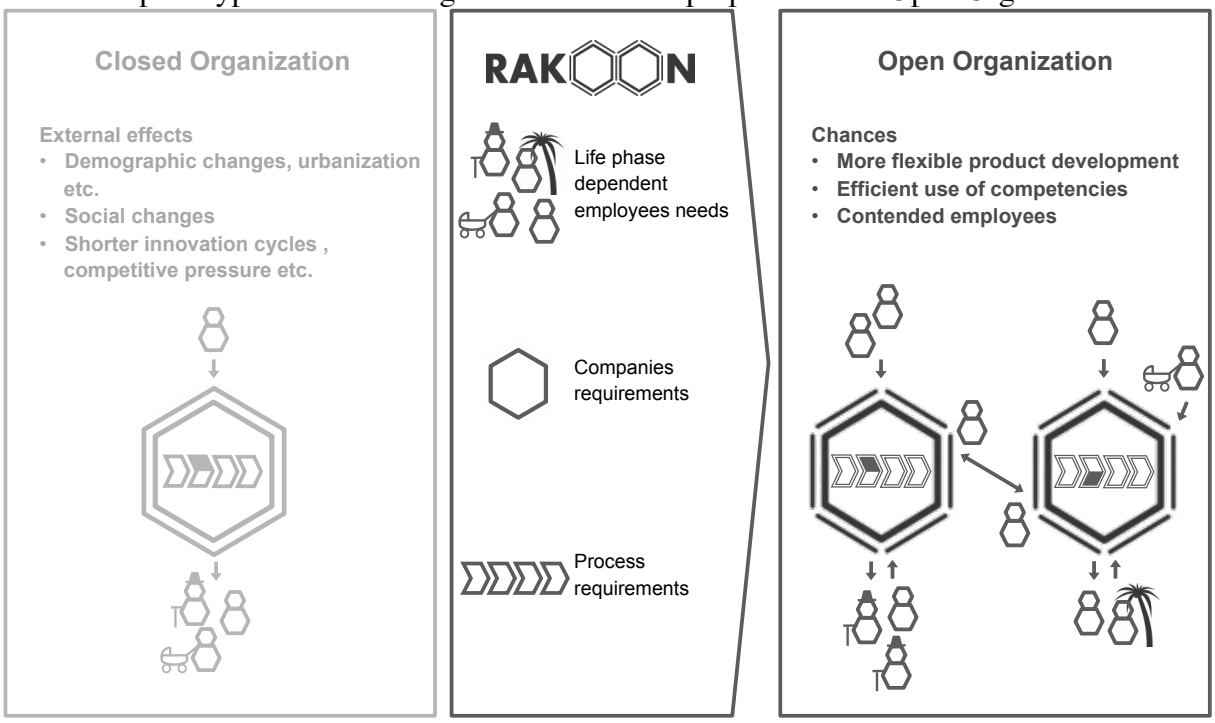

Figure 1: 'Closed' and 'open' Organization

We draw on an extensive literature review and original empirical data from in-depth qualitative interviews with employees and managers in three companies of differing sizes and industry sectors (mechanical engineering, game development, software development). The subject of these interviews was the development process of a particular product. We identified relevant internal as well as external stakeholders and actors, cooperation structures, competencies required in each step of the development process, critical situations and needs of the employees.

This article is structured as follows: First, we will give a brief introduction into the rise of Open Organizations and present an overview of existing understandings. We then introduce our own definition and differentiate between different types of opening and opening

strategies. Afterwards we give an overview of our integrated RAKOON approach for Open Organization and finish with concluding remarks.

2 Background

2.1 From industrialization to Open Organization

In the beginning of industrialization, strict hierarchies, as established by Frederick Taylor, enabled mass production and distribution of goods (Ashkenas, Ulrich, Jick, & Kerr 2002). These organizations were dependent on great leaders as decision makers (Foster, 2014). Changing conditions in the organizational environment challenged many companies. Even big companies struggled due to fast change, with adequate adaptability of organizational capabilities seeming necessary to survive. In the twentieth century, four critical factors were crucial for the success of companies according to Ashkenas et al. (2002):

- Size – bigger companies were able to work more efficiently and gain scale advantages
- Role clarity – clear distinctions of tasks and authorities
- Specialization – division of tasks, creation of highly specialized capabilities
- Control – control specialized tasks to achieve optimal performance

In the middle of the 20th century, organizational design changed from a centralized, hierarchical system to more decentralized forms, e.g. matrix organization (Galbraith, 1994). This does not necessarily entail advantages for decision making, but improves the ability to react quickly to changing conditions (Foster, 2014). The previously defined success factors were not sufficient anymore. A set of additional factors is given by Ashkenas et al. (2002):

- Speed – speed in acting, strategical changes, product development or customer responses
- Flexibility – people handle multiple tasks, teams are frequently reformed
- Integration – specialists are gathered to accomplish tasks together
- Innovation – innovations are essential to adapt to changing market situations

Decentralized organizations are more agile under pressure and are able to adjust quickly according to given circumstances (Foster, 2014). An approach to solve these challenges is to open up the organization. The idea of opening up company's boundaries is not new. Dorn (1993) proposed openness as a corporate principle in the early 90s. Redlich et al. (2014) describe openness as a key success factor of value co-creation in production networks. Open Source projects and Crowdsourcing (Howe, 2008) are well known from the software industry. Open Innovation (Chesbrough, 2006) is a rising method to support and open the company's development process with focus on manufacturer and user integration (Hippel, 2005). Lakhani, Lifshitz-Assaf, & Tushman (2013) point out the ability to alter (open and close) organizational boundaries across a range of activities dependent on the boundary conditions. Volberda (2011) lists assets, knowledge and skills as potential external resources to integrate into the company, with a combination of internal and external resources causing mutual benefits.

2.2 Current understanding of Open Organization

Concepts of Open Organization aim to upon up every part of an organization. An Open Organization structures itself by its interaction with the environment and thus a continuous adaption (Foster, 2014). Lateral communication and organization has two significant

advantages, on the one hand the capability to make important decisions more often (Foster, 2014) and the other hand the division of work (Galbraith, 1994).

In order to reorganize organizational structures, different boundaries need to be reshaped (Ashkenas et al., 2002):

- Vertical boundaries represent manifestations of hierarchy. But ideas should be considered independently from the rank of a person. Hierarchies are still needed to avoid organizational chaos.
- Horizontal boundaries are situated between functional departments of an organization. Opening these boundaries gives managers access to more capacities.
- External boundaries separate companies from their environment. Opening external boundaries can lead to more effective collaboration along the value chain.
- Geographic boundaries work in different markets and countries. Use local and cultural differences as a source of innovation.

Foster (2014) defines an Open Organization as peer interaction which crosses organizational, generational, and cultural boundaries to collaborate with others for the expressed purpose of producing an end-product and sharing the source-materials, blueprints, and documentation freely within the organization. He formulates functional rules of an Open Organization: a written governance, open participation, self-management, defined best practices, absolute respect for skills and knowledge, public ownership of knowledge, diversity and an affirmative environment. The focus, however, is more on open source communities, whose organizational design is different to those of more traditional markets.

Table 1: Statements in context of Open Organization

Author	**Statement**
Dorn, 1993	Openness to the outside requires openness to the inside. The open system "enterprise" consists of independently acting units that seek a common goal with constant adjustment of the system.
Bodó & Schramm, 2004	Open and closed organizations differ in the way they deal with their internal and external affairs as a result of their different philosophies
Volberda, 2011	External resources are assets, knowledge, skills that lie outside the boundary of corporations. Resource integration – mutually beneficial combination of external and internal resources.
Lakhani et al., 2013	alter (open and close) its boundaries across a range of activities continuously shift boundaries to suit strategic, technical and competitive needs
Redlich et al., 2014	Open system is distinguished by the fact that at least one of its elements is involved in interactions with elements of another system. System's position to surrounding systems and permeability of system boundary
Foster, 2014	Sharing of ideas, knowledge, resources and skills across organizational,

	generational, and cultural boundaries […] highly adaptable, flat, agile, self-led formal organizational system.
Whitehurst, 2015	An open organization is an organization that engages participative communities both inside and out, respond to opportunities more quickly, has access to resources and talent outside the organization, and inspires, motivates, and empowers people at all levels to act with accountability.
Ashkenas et al., 2002	Allowing exchange of information, resources and ideas via permeable boundaries

Mainly differing in terminology, the approach of Ashkenas et al. (2002) is not about opening an organization, but rather loosening its boundaries. Boundaries of an organization are compared to flexible and permeable membranes of a living organism. Child (2005) describes virtual organizations as organizations which avoid rigid hierarchies and boundaries. The ideas of flexible workforce and intensive integration of external partner coincide with our understanding of Open Organization. Table 1 presents an overview of selected existing statements of various authors in context of Open Organization to deepen the understanding.

The presented literature shows that Open Organization is about open organizational boundaries (external and internal), sharing resources, the organizational structure itself, collaborative working, the way individuals act and the individuals' phase of life. Our research primarily focuses on companies that develop any kind of products (Weidmann & Lindemann, 2015). Furthermore, the integration of new working cultures (Bartz & Schmutzer), e.g. active collaboration is an additional factor in our understanding of an Open Organization.

3 Open Organization of Engineering Design

3.1 Definition of Open Organization

Based on our research as well as existing concepts, we define Open Organizations as follows: Open Organizations aim for the long-term goal to generate added value for the organization through the situational adjustment of internal and external organizational boundaries. We focus on the opening of the product development process on the two dimensions Individuals (active and flexible integration of personnel, e.g. use of freelancers, engineering services, exchange of personnel) and exchange of knowledge and ideas (e.g. Crowdsourcing, customer integration).

On both dimensions, Individuals and knowledge, risks are identified. The main risks are losing human resources and knowledge loss. Both lead to a competitive disadvantage of the own organization, basically of monetary nature. Organizations are neither completely 'opened' nor 'closed', but the inward and outward opening results from (more or less) strategic decisions and is practiced in a selective and targeted way (Huchler, 2015). We consequently assume that 'more open' does not automatically equal 'better'. Instead, the appropriate degree of openness is dependent on industry sector, size of the respective company etc. For example, one can assume that a very high degree of openness (informal 'on-demand' cooperation/collaboration across internal as well as external boundaries, high transparency and culture of trust) can be beneficial for a small game development company, but will neither be practical nor sensible for an arms manufacturer.

The approach of Open Organization extends the concept of Open Innovation. Open Innovation is a paradigm that focuses on the integration and combination of internal and external ideas in the innovation process (Chesbrough, 2006). However, Open Organization focuses on the management of organizational boundaries and includes both external as well as internal exchange of knowledge and knowledge carriers (individuals).

3.2 Classification of Opening

The previously presented description of Open Organization includes different types of opening. We collected examples of opening from literature and industry and classified them into categories to gain an understanding about types and mechanisms of opening. Opening can exceed different types of organizational boundaries and have different directions (Figure 2). It can be carried out within a corporate boundary (internal) and over corporate boundaries (external). Therefore a definition of internal and external boundaries is still subject of our research. The opening can be carried out both ways, from outside to inside and from inside to outside.

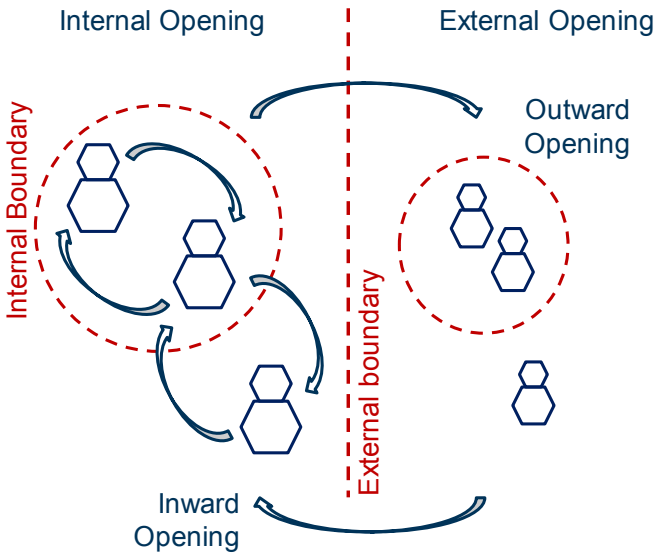

Figure 2: Classification of Opening

Additionally, we defined four levels of opening which were distinctive and suitable for the classification of our collected examples. The highest level describes inter-organizational collaboration, thus networks of organizations. The second and third level are intra-organizational, with the focus getting more granular and changing from a company focus to a more deepened focus on single departments within a company. The last level with the smallest focus is on individuals itself. Special focus is put on this level because it operates on all other levels and has a high potential impact.

Opening is a process which is executed on all levels, whereby there is no status of completely ‘closed’ or completely ‘open’. A core aspect of our research is to measure a company’s actual degree of openness (per department, business unit etc.) and to determine a company-specific recommended degree of openness, so we can support companies in their opening process. This will not be discussed in detail in this paper. A first approach is described in Lang & Lindemann (2015).

3.3 Strategies of Opening

Based on our empirical findings, we differentiate between three types of strategies to increase the openness of organizational boundaries (Sauer, Burgenmeister, Porschen-Hueck, & Huchler, 2014): Planned openness, prepared openness and engaging openness. Although these strategies may increase flexibility and innovative potential, they can also entail negative side effects.

Planned openness describes highly planned long-term decisions on organizational boundaries (which can especially be observed in larger companies). It follows a top-down logic and relies on formalization, predictability and control mechanisms. Transnationalization – the decision to cooperate between branches/companies across national borders by offshoring business processes, utilizing foreign external service providers etc. – serves as an example of this, which can potentially be abused to evade labor standards and establish more ambiguous/precarious employment. Both the mechanical engineering company and the software development company we examined exhibit some type of transnationalization: The first cooperates with an Indian engineering service provider, whereas the latter established a branch in Eastern Europe. This creates further challenges for both firms – e.g. cultural differences and resulting misunderstandings, the need to communicate almost exclusively over distance – which should be considered by personnel departments.

Prepared openness seeks to formally establish organizational conditions that explicitly allow for and encourage open situations and work processes, thereby providing a framework for openness. It does not, however, dictate how these situations should play out or how workers are supposed to (re-)act. A prime example for this strategy is the use of Agile Methods like Scrum, a concept that had originally been created in the context of software development. While there is no single implementation of Scrum or Agile Methods in general, the different forms share an open culture of communication as well as a specific openness towards the customer.

Lastly, engaging openness describes (possibly implicit and unknowingly employed) strategies that aim for the highest possible degree of openness. E.g., especially some smaller firms rely heavily on-demand collaboration (both with internal as well as external actors) and reacting spontaneously to work situations (situativity) instead of project management tools. During our interviews, we especially observed this strategy in the small game development company (which could therefore be described as the most ‘open’ organization in our analysis) that almost seamlessly incorporates freelancers and exchanges employees with other local game development companies at the drop of a hat. In this case, collaboration does not rely on formal meetings, but is centered on the work object and work itself. While engaging openness provides flexibility and certainly can prevent stress otherwise caused by excessive bureaucracy and control mechanisms, it may potentially also lead to under-organization with disregard for available resources and overly lenient handling of responsibilities.

As the presented strategies already suggest, one of the main challenges in the management of an Open Organization is the mediation between flexibility and stability. While, as has been shown, a certain degree of flexibility is necessary for organizations in order to be able to react to changing external conditions, stability remains important for long-term decision-making and retaining a corporate identity. Therefore, it is crucial to establish anchors of stability. Organizations will have to reflectively assess the polar opposites ‘closedness and openness’ as well as ‘stability and flexibility’ – there is no simple ‘one fits all’ solution (Porschen-Hueck &

Huchler, 2016). There are multiple organizational layers and aspects which have to be considered and adjusted accordingly (work conditions, work organization, leadership model etc.). Most importantly, we maintain that an Open Organization cannot be managed solely top-down. It requires a perspective that regards organizations in their entirety and considers all organizational levels down to the shop floor, paying special attention to employees' needs and trying to adhere to the principles of 'decent work'.

4 RAKOON Approach

Our approach of Open Organization focuses on the development process. Figure 4 schematically presents a development process, with symbolized previous and following process steps. We assume opening can take place on every process step on both dimensions, individuals (knowledge carriers) and knowledge. As mentioned before, opening can cross several organizational levels, starting from an individual's one up to a network level. Methods and strategies support the opening across defined organizational levels. With this model (Figure 3) we want to sensitize for the topic of Open Organization in the context of engineering design and collocate our research activities into a framework. This model is aimed at researchers as well as practitioners. On the one hand it clarifies our understanding of Open Organization, connects project contents and describes our research directions, on the other hand it illustrates potential fields of action for practitioners who want to implement a more open thinking into their company and provides supporting tools to accomplish this.

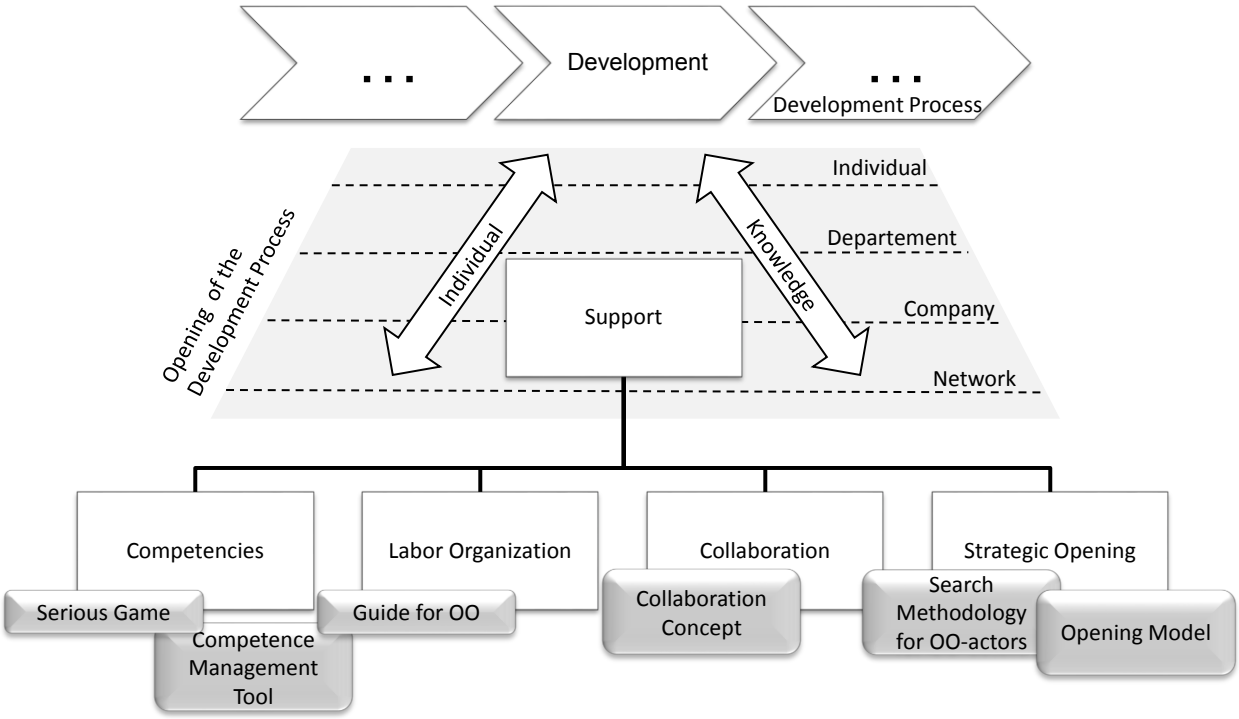

Figure 3: RAKOON Open Organization Model

The model shows six tools which are categorized according to their main field of action (Competencies, Labor Organization, Collaboration and Strategic Opening). These tools are developed within the project to support the opening process. In further publications we present the content of the model in more detail:

- Opening Model – Supports the definition of the optimal opening level at each development process step (Lang & Lindemann, 2015)

- Collaboration concept – Supports planning and implementation of a situation-specific collaboration concept in Open Organizations (Kremer, Münzberg, & Lindemann, 2016)
- Search methodology for OO-actors – Gives methodological support to find appropriate project partners (Guertler, Saucken, Schneider, & Lindemann, 2015; Guertler, Wiedemann, & Lindemann, 2015)
- Competence Management Tool – Supports project managers in occupation of project roles and positions (Huchler, Porschen-Hueck, & Sauer, 2015)
- Serious Game – Playfully develops individual's competences for Open Organizations (Müller, 2015)
- Guide for Open Organization (OO-Compass) – Contains background information and general advice for designing and managing an Open Organization

5 Conclusion & Outlook

The opening up of organizational boundaries is not a new concept and was already in focus of several research activities in the past. They mostly focus on specific aspects, e.g. Open Innovation. Open Organization extends the Open Innovation concept by additionally taking knowledge carriers into account. It aims for the long-term goal to generate added value for the organization through the situational adjustment of internal and external organizational boundaries. Several types of opening exist and opening crosses different organizational levels. Our Open Organization model clarifies our understanding and provides developed tools and methodologies which support the opening process.

The approach, model and tools still require further specification and evaluation. A future field of research will be the collection and classification of methods, tools and strategies to consciously organize openness. A definition of internal and external boundaries is still subject of our research.

Please check http://www.openorganisation.de/ for further information.

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