The Strategy of Openness in Industrial Production

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Abstract:

Flexibility and adaptability of production systems are still some of the most discussed characteristics of production systems within the traditional manufacturing industry. Because of increasing complexity and dynamics within the corporate environment, some approaches to optimize these traditional characteristics are no longer sufficient to achieve competitive advantages. The ongoing paradigm shift from traditional industrial production to a system of value co-creation forces manufacturers to redefine their role and position within a more open value creation process. Companies have to add principles of openness to previous strategic success factors. In future, the competitiveness of a company will rather be determined by the ability to cooperate with different actors in heterogeneous global networks. Moreover, we have to be aware that the traditional factory as the central production facility will be dissolving more and more. A new strategic approach for those companies might be what we call the *Strategy of Openness*.

1) Introduction

According to Marc PRENSKY [1], who coined the term “Digital Natives” in 2001, we are living in a society where real and virtual worlds are melting together as we grow up in digital network communities. By means of digital communication media, sharing of knowledge and experiences has never been easier. Therefore, digital generations build up a social environment which is characterized through the use of digital technologies and a huge number of social network societies [2]. Especially innovative companies recognized the potential of this growing up generation. In modern start-up companies, e.g. the American automobile manufacturer Local Motors, “Digital Natives” become part of the value creation of the company as they act as manufacturers and product developers. They shape a fully integrated and networked corporate culture that can be characterized as a “do-it-yourself-society” [3], which can be described as a self-organized community of both extrinsically and intrinsically motivated individuals that participate in manufacturing processes [4] as part of a bottom-up-economic environment [6]. The traditional factory is replaced by web-based non-hierarchical corporate structures. PINE and GILLMORE are convinced that in the future the ability to create such a corporate culture would be a crucial precondition for long-term success [5]. To stand out against their competitors, companies have to create a “customer experience” in addition to the manufactured artefact. Their considerations are based on the assumption that artefacts of a value creation generally are substitutable with competitor’s products, but an implemented culture of a company and a unique customer experience is difficult to replace [5,6].

However, scientific research generally continues to focus on traditional value creation patterns and its optimal configuration. While it would be necessary to adapt existing patterns, prevailing key success factors like flexibility and adaptability are analyzed to ensure the success of the manufacturing industry in the future [7,8,9,10]. Cases like Local Motors prove that an adjustment

has been missing so far and an alignment of traditional patterns with respect to economic instruments and paradigms in both theory and practice is necessary. These alignments should be focused on the merging of production and consumption as well as on the increasing importance of “openness” as key success factor of industrial manufacturing.

1.1) Industrial value creation

To analyze the design of viable companies in the future, it is necessary to extend the traditional understanding of value creation. These days, the value creation process is no longer limited to the boundaries of a company. Rather, modern value creation systems are characterized by a variable number of actors and changing organizational structures. This paper follows a value creation taxonomy, which distinguishes between structures, processes and artefacts as well as the strategy of value creation [11].

Within the industrial value creation, the creation process of an artefact can be divided into tree sub-processes. In practice, the value adding activities “Research and Development”, “Production and Manufacturing” and “Marketing and Sales” [12] of a value creation system often take place simultaneously (Figure 1).

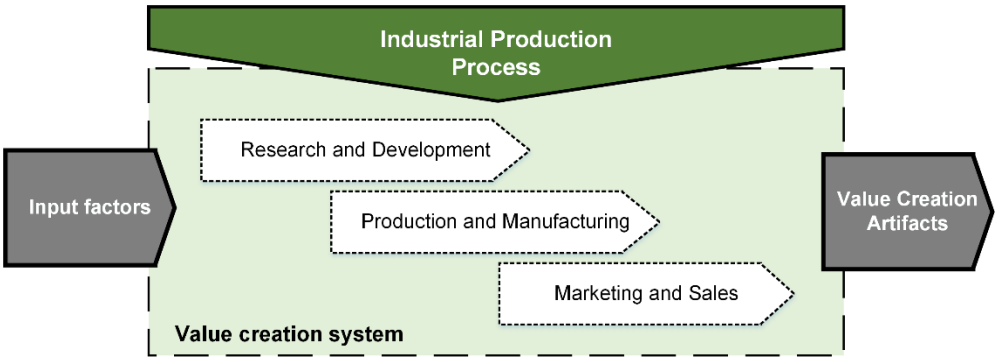

FIG 1: The process of Industrial Production [12,13]

Result of the value creation process is an artefact, which is composed of both intangible and tangible components. Based on the strategic orientation, each value creation system implements a different set of organizational instruments to secure long-term success. Depending on the selected strategy, six critical success factors are generally distinguished: “cost”, “time”, “flexibility”, “adaptability”, “quality” and “service” [14]. However, the success factor “flexibility” is often discussed as the most crucial factor as it enables a company to quickly react on changing business environments, e.g. changing customer requirements.

1.2) Flexibility, adaptability and openness

The number of published papers where flexibility and adaptability of manufacturing companies are claimed key requirements for future competitiveness grows steadily. Mostly, however, the compiled recommendations refer to a traditional understanding of value creation. In the framework of this contribution, flexibility as a structural characteristic of a system can be described as “the ability to change or react with little penalty in time, effort, cost or performance” [15] (see Figure 2). The need for flexibility results from a temporary gap between the actual and the desired status, e.g. with respect to the production volume in a value creation process. This gap is often caused by information deficits [16,17]. To increase the flexibility of a manufacturing

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company, it is necessary to distinguish between internal and external flexibility potentials. While the deployment of qualified personnel and the purchase of new machines, for example, refers to internal potentials, the value co-creation in production networks aims at external potential to raise the flexibility of a value creation system. The potential flexibility of a system could be shortly summarized as the entirety of all available courses of action for an implemented set of organizational structures.

According to WIENDAHL, flexibility of value creation systems can be referred to operative potentials while adaptability of a system could be described as organizational potential for change [18,8]. Therefore, adaptability describes the capacity of a system to adapt its basic organizational structures in order to provide new opportunities for flexibility (Figure 2).

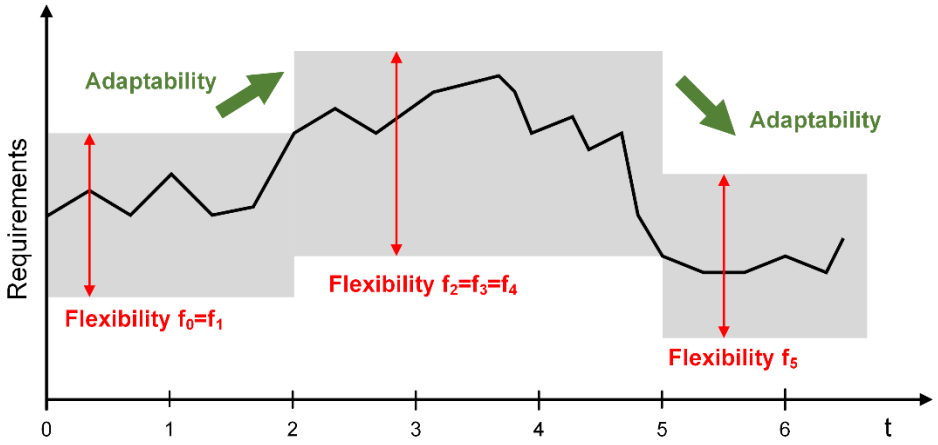

FIG 2: Flexibility and adaptability [19]

The adaptability of a value creation system is determined by the design of the corporate structures itself. By following existing research, companies have to create beneficial preconditions like the scalability, modularity, universality, compatibility and mobility of their system structures to increase their adaptability [19].

While flexibility and adaptability are well known “design recommendations” to increase the success of a value creation system, openness so far has been widely neglected in scientific investigations. In terms of systems theory, openness has to fulfil one of two system conditions. In contrast to a closed system, an open system is characterized by the interactions between at least one of its elements with element(s) of another system. As organized social systems are always in interactive relationships with surrounding systems, they can be viewed as open systems as a matter of principle. However, for reasons of simplification value creation systems were considered closed systems in the past. Through changes in the environment, the requirement for openness is increasing and no longer remains negligible. Openness is therefore not a completely new feature, but an inherent system property that is becoming increasingly relevant [20]. In this sense, openness describes the ability for interaction with other elements and at the same time is a prerequisite for the long-term viability of systems.

2) Openness as the key success factor

2.1) The limits of flexibility and adaptability in value creation systems

In this chapter, current recommendations to increase flexibility and adaptability of a company will be analyzed with respect to their capacity to ensure long-term viability of a value creation system. Because of increasing complexity and dynamics in the corporate environment, companies try to

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reduce corresponding uncertainties by increasing potentials for flexibility and adaptability. To answer the question on how efficient such a strategy could be, we analyzed the ratio between the complexity and dynamic of a manufacturing company and his corporate environment by looking at the research results of BLEICHER [29] (see Figure 5).

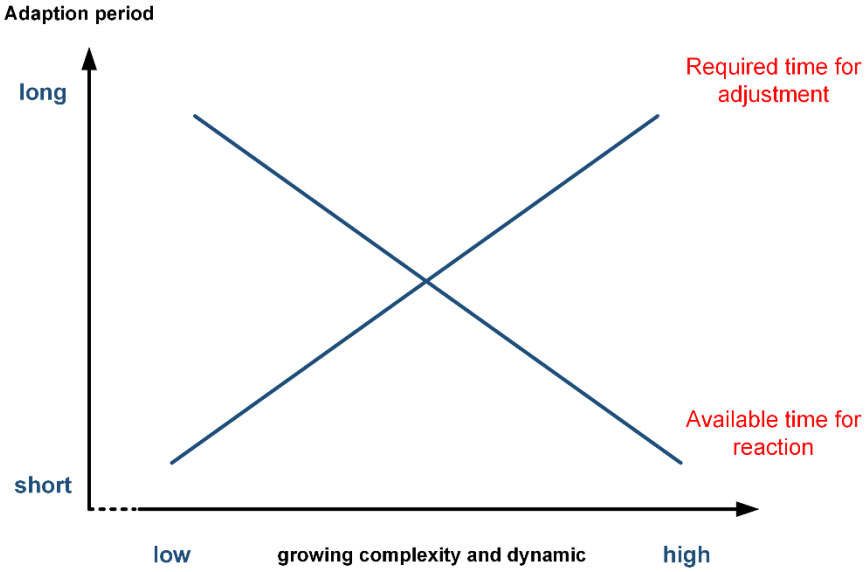

FIG 3: "time-scissor": the impact of a growing dynamic in the corporate environment [29]

ANSOFF describes the resulting imbalance as follows: "... the rate of environmental change has accelerated, and the firm's response has been made slower by growing size and complexity" [30]. While non-transparent environmental conditions lead to a longer period of adjustment by the firms, the available reaction time decreases, respectively. One reason for this disparity is an increasing dynamic corporate environment, which could be described as a reduction of the time span between changing system states. Internal complexity drivers that lead to increasing adjustment periods are among others a growing complexity of the firm's product program as well as the implementation of more extensive organizational structures [31]. To overcome the disparity of necessary adjustment time and available reaction time, companies often try to rise their in-house potential of flexibility to minimize their reaction time first.

Considering *the law of requisite variety* by ASHBY [32], we analyzed how useful this behavior could be in an increasingly networked society. For Ashby, a system is viable only if the variety, which consists of the degree of dynamics and complexity within a system, is at least as great as the variety of its peripheral system. While companies try to increase their flexible potential by means of individual working hours, lean organizational structures or a high degree of standardization [33], it is necessary to understand that a high flexibility causes long transport and "run through times" as well as a high intensity of resources, too. Flexibility is also limited by the capabilities and a minimum stability of a value creation system. By knowing that an internal flexibility may not be sufficient to control the variety of the corporate environment, many companies are organized in production networks. However, keeping a high level of flexibility is limited to resources and an increasing complexity in a value creation system does not automatically lead to a shorter period of adjustment.

In this regard, the adaptability of a system is often postulated as "the solution of all these problems". The desired degree of adaptability in terms of its efficiency is dependent on the level of the uncertainties in the corporate environment (see Figure 7).

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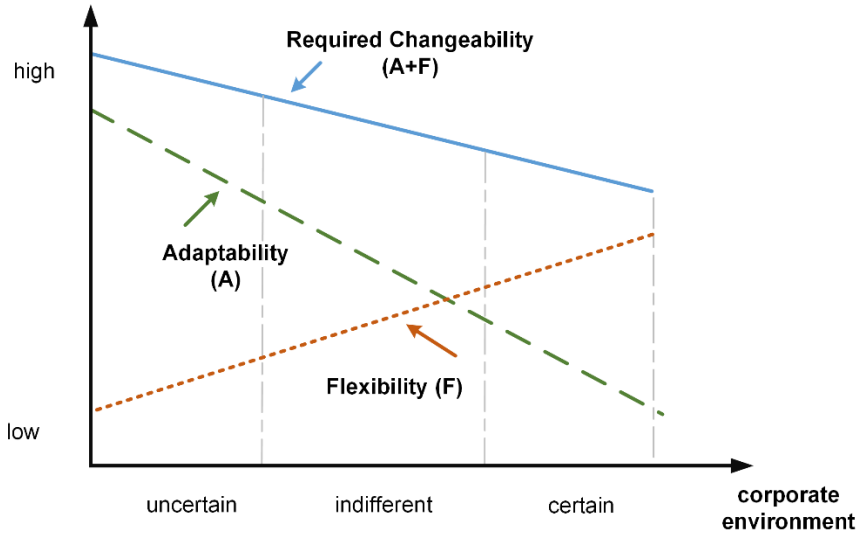

FIG 4: Required flexibility and adaptability [34,35]

In an uncertain corporate environment, a company should focus its activities on implementing a high degree of adaptability rather than high flexibility. On the other hand, a certain degree of flexibility is crucial for viability on a market. These circumstances imply that the required degree of flexibility and adaptability in a value creation system depends on the conditions of the corporate environment. However, in the age of information society it is more efficient to invest in adaptability rather than in flexibility.

While preconditions to foster adaptability within a company were developed, an equalization between the varieties of two systems with respect to the manufacturing industry is often not considered. Furthermore, design recommendations mostly concentrate on internal potentials to increase the adaptability of a value creation system. By giving up the traditional separation between the producer and consumer, the principle of openness as possible key success factor was analyzed.

2.2) Openness as key success factor

By understanding “openness” as a potential means to increase the variety and at the same decrease reaction time, future success of companies will be determined by the degree of openness. Like Local Motors, innovative companies have begun to consider this factor in their business model. With dissolving corporate borders, companies start interacting with their (former) consumers. These consumers are fully integrated in the processes of value creation. In accordance to TOFFLER [3], we call those individuals prosumers. By integrating “uncertainties” into the manufacturing process, company decrease the variety of the corporate environment. Additionally, the resource base within the creation value system increases. In the case of Local Motors, additional knowledge and human resources are only limited to the ability of self-organization of the prosumers. By means of digital tools, the value creation system will keep its level of agility despite increasing internal complexity and dynamics.

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3) Industrial value creation in the Information Society

3.1) From traditional value creation to value co-creation

Globalization, the spread and advancement of ICT as well as mass customization [21] are prevailing drivers for the transformation of structures, processes, strategies and artefacts of value creation systems [20]. To demonstrate that the process of adjustment of success factors has already started in practice, the authors distinguish four steps in the development of value creation systems (Figure 3).

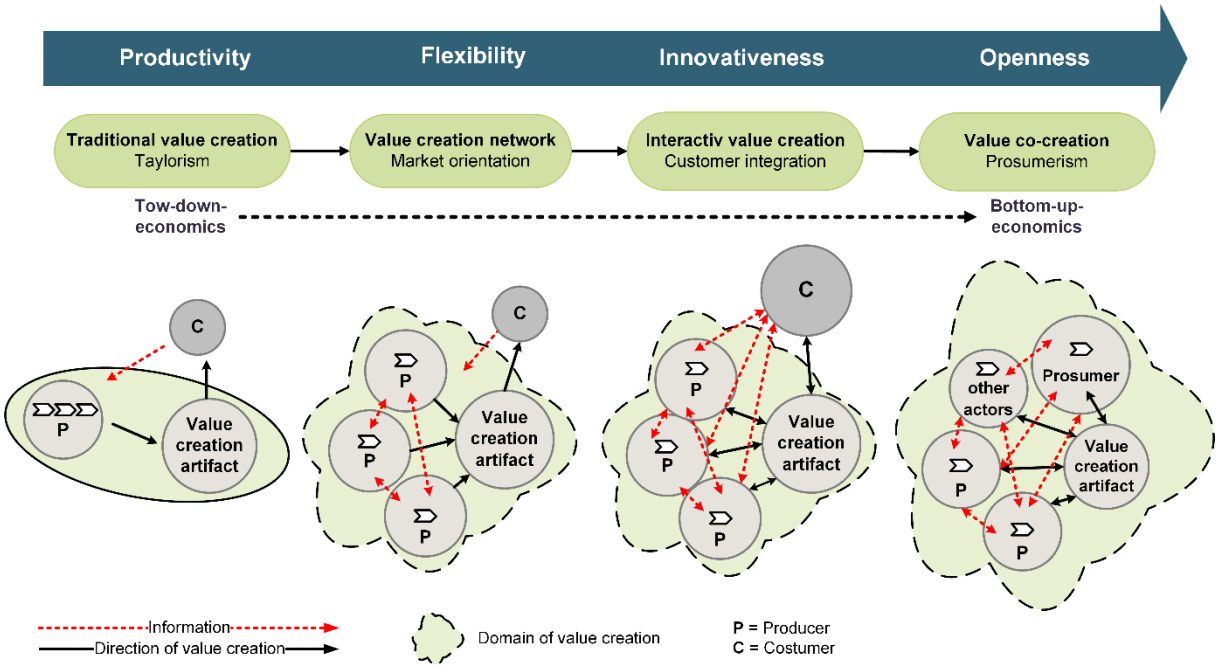

FIG 5: From traditional value creation to value co-creation [22,23]

3.1.1) Traditional value creation

The main characteristic of the traditional value creation pattern is the assumption that the process of value creation is limited due to the borders of a company. According to PORTER and his subdivision of the value chain in separately but linear structured value activities [24], the manufacturing company follows a clearly defined process of value creation, while value is measured by the profit margin. Hence, the company, as main actor, creates the value artefact in a directed process towards the customer, while the customer typically plays a passive role in the creation process. Production is hierarchically structured and centralizedand the corresponding tayloristic work structures are typically top-down implemented. Companies aim on rationalization and cost-reduction by concentrating on core competencies.

3.1.2) Value creation networks

Networks that enable companies to increase their individual profit relying on synergies are the second stage of value creation systems as a reaction on changes in the corporate environment [25]. Shorter product lifecycles and individual customer requirements due to the spread of ICT as well as new production technologies result in adjustments of existing corporate strategies. Value creation networks or clusters are characterized by complex-reciprocal, rather cooperative than competitive and relatively stable relationships between independent companies [26]. By increasing the strategic flexibility as well as the reduction of production cost achieved by external

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economies of scale, companies pursue collective efficiency. Therefore, the actors within value creation systems need the ability to interact effectively and efficiently with other elements in the system. These interactions require mutual trust among the actors [37]. The customer still has a passive role in the process of value creation. The classic network value creation is limited to value-creation relationships between independent companies.

3.1.3) Interactive value creation

Even today, customers are often considered as “passive actors” in a value creation system. As the information age created a society of individuals with positive attitude to participation and knowledge sharing, innovative companies use this openness to an active exchange of knowledge and integration of its customers within value creation processes [27]. Since knowledge becomes the most important resource of value creation, the benefit of an interactive value creation is the access to external knowledge in terms of customer needs and solution information. However, despite the integration of customers in so-called open innovation platforms or in the process of mass customization, the central element of value creation still remains the traditional centralized production in factories with its top-down implemented structures. Companies are often not interested in bi-directional knowledge sharing.

3.1.4) Model of value co-creation

According to TOFFLER, the role of the customer has changed due to the rise of the information society [3]. The result of this change is the manifestation of a “do-it-yourself-society”, where customers act as prosumers. On the one hand, they participate in the development of an artefact and, on the other hand, they are consumers of those artefacts. Companies assume new roles as mentors to provide a unique experience for the prosumers as supposed by PINE and GILLMORE [5]. RAMASWAMY and OZCAN describe these fundamental implications of viable companies as follows: “enterprises […] must be architected as a nexus of engagement platforms, organizing human agency to create value with, and for, all stake holding individuals as co-creators“ [28]. The model of co-creation is basically characterized by the fact that the classical, mostly hierarchical structures within a company are dissolving. A worldwide network of social communication platforms replaces the traditional factory in the value creation structure. In addition to the unlimited sharing of knowledge, it is important to implement a corporate culture, which is characterized by openness. Thereby, the basic performance potential of the value creation consists among other things of the ability of actors to self-organization. All four patterns of value creation can be observed in practice (Figure 4).

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	Traditional value creation	Value creation networks	Interactiv value creation	Value-co-creation
Strategy	Traditional competitive strategies (i.e. cost leadership) (top-down) ⇢ (bottom-up)			Strategy of openness (bottom-up)
Place of value creation	Factory	Network of factories	Network of factories / digital communication platform	Digital communication platforms
Organizational structure	Hierarchic	Hierarchic / Heterarchical	Hierarchic / Heterarchical	Heterarchical
Role of company	Control / Management of value creation			Mentor / advisor
Role of costumer	Passiv	Passiv	Activ integrated in value creation process	Control / Management of value creation (Prosumer)
Availability of knowledge	No exchange of knowledge	Exchange possible between companies	Exchange from consumer to producer	Bidirectional sharing
Ledership	Companies / Producer			Self-organization

FIG 6: Characteristics of value creation patterns

With the understanding of the process of value co-creation, the term “value creation network” also requires another meaning. While "the net" is a common synonym for the internet, the term "work" originally illustrated the result of a human creative activity.

3.2) Bottom-up economics

In addition to previous research results, these new patterns of value creation can be summed up under the term of “bottom-up economics” [11]. It differs essentially in its structure- and process-related character from traditional industrial production, which represents a manifestation of top-down economics. Bottom-up economics is characterized by a fusing of production and consumption, by distributed structures and processes and by collaboration as the most intensive form of interaction between actors. In all areas of value creation, signs of this paradigm change can be found. The concept of interactive strategy represents the starting point for the scientific discussion concerning interactive value creation, which results in a re-evaluation of the relationships between the actors involved in value creation. Together with the application of modern production principles, it forms an integrating strategic approach for the design of future value systems. Increasing individualization and the discontinuous demand behavior associated with it as well as the increase in complexity of expected services represent new challenges for manufacturers. Therefore, openness must be understood as a general way of thinking. Modern companies have low levels of hierarchy and are highly flexible with regard to their strategic approach. Furthermore, they follow a strategy of communication instead of competition. They have a high degree of changeability and are rather following an open source business model. Thus, innovative companies increase their viability not only by restructuring internal structures based on a traditional value creation pattern, but also by adapting the core business model and structures based on a unique corporate culture.

4) The Strategy of Openness

The ability to cooperate with other actors becomes crucial for companies in order to increase their limited in-house flexibility and adaptability and to raise commercial success. Solving complex problems and satisfying a high range of individualized customer needs is often

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accompanied by high costs. Companies mostly follow competitive strategies that try to maximize their own success by increasing their market share through an increase of their internal flexibility and adaptability (see Figure 6).

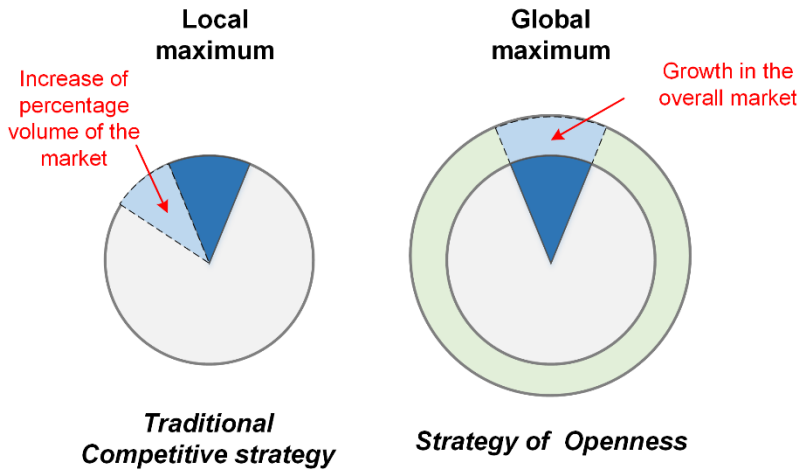

FIG 7: Strategy of Openness

According to ASHBY, this behavior will jeopardize the corporate success of a single company because of an increasing complexity and dynamics in the corporate environment. The collective aim of a corporate competitive behavior is to increase the total volume of their profit for example through achieving emergence effects. However, single actors like companies, experts, stakeholders, prosumers and voluntaries that work together follow different individual goals. While manufacturers follow commercial aims, voluntaries are mostly intrinsically motivated. Prosumers usually are interested in both: they want to be part of a community and increase their own profit through participating in the common value creation process. Therefore, traditional companies have to understand that they have to act in different roles within the value creation system. A successful company in the information rather acts as a mentor or leader within a self-organized process. To be viable in the long term, it should focus on creating communities and platforms that differ from other conventional value systems. RAMASWAMY and OZCAN describe these circumstances as follows: “strategy is not [longer] a game with knowable rules and finite options. The goal of the strategist is to effectively navigate through the fog of value creation opportunities” [36]. Sustainable manufacturing companies have to pursue a strategy of openness as a precondition for their success in the future. This strategy is characterized through a shared corporate culture, which provides the foundation for the success of the value co-creation process (see Figure 7). In addition, it requires an adjustment of organizational structures. Relying on the procedures of structural modularization of products and processes, companies have to create efficient external interfaces as access points for actors to participate in a common value creation process. Moreover, it is necessary to provide appropriate manufacturing technologies that are suitable for an interactive community platform. The process itself is characterized through self-organization and self-control of the actors.

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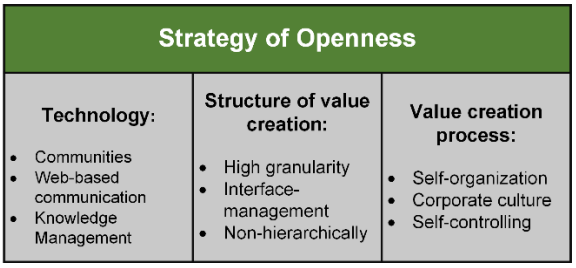

FIG 8: Elements of a sustainable value creation system

The central element or resource base of a value co-creation process is the knowledge of each actor. Therefore, it is essentially to make these knowledge resources more transparent and reintegrate it in a common value creation process. It also requires methods that preserve the generated knowledge in a community in order to reuse it in a later stage. Consequently, value co-creation has to be accompanied by suitable methods of inter-organizational knowledge management [38].

5) Conclusion

This paper has discussed the validity and role of the key success factors ”flexibility” and “adaptability” in the age of the information society, in which the principles of “bottom-up-economics” challenge the traditional understanding of value creation processes. Our analysis shows that the law of requisite variety of a system to ensure its competitiveness through raising internal flexibility and adaptability does not necessarily lead to a long-term viability of the system. While complexity and dynamics of the corporate environment increase, companies try to meet this situation by increasing their own complexity. This complexity is limited to an economic degree of flexibility and adaptability.

In view of this problem, the present contribution underlines the necessity of focusing on the merger of production and consumption as well as on the increasing importance of “openness” as a key success factor of industrial manufacturing in order to decrease the complexity of the corporate environment. A development from a centralized and automated mass production to a more decentralized as well as collaborative value creation can be observed. Innovative and successful companies (e.g. Local Motors, Quirky, Tesla Motors) with newly or restructured value creation structures are testament to the described paradigm shift towards value-co-creation.

As this paper shows, the future success of value creation systems depends on the implementation of the “strategy of openness”. However, the term strategy, in this context, has to be decoupled from the existing predominant understanding of a corporate strategy. Future strategies will be oriented on self-organized and self-controlled communities. A corporate culture being characterized by openness will ensure the loyalty of the all customers and other actors in the long term and is the foundation a participative value creation process. The company, which successfully implements the strategy of openness, finds itself in the role of a mentor and advisor within a bottom-up-economic environment.

Further research should focus on the analysis of these new value-co-creation strategies and success factors in order to gain a deeper understanding of the rising complexity and dynamics of the corporate environment.

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