Ecosystems, strategy and business models in the age of digitization - How the manufacturing industry is going to change its logic

Dominik Paulus-Rohmer*, Heike Schattona, Thomas Bauernhansla, b

*Institute of Industrial Manufacturing and Management – IFF, University of Stuttgart, Nobelst. 12, 70569 Stuttgart, Germany
bFraunhofer Institute for Manufacturing Engineering and Automation – IPA, Nobelst. 12, 70569 Stuttgart, Germany

* Corresponding author. Tel.: +49 711-970-1075; fax: +49-711-970-1928. E-mail address: dominik.paulus-rohmer@ipa.fraunhofer.de

Abstract

The digital transformation of people’s everyday life is progressing; almost everybody uses connected devices, shares information and builds a network according to the existing preferences or needs. A similar development takes place in the industrial environment, e.g. the IT- and software industry is already organized in deeply connected ecosystems. In ecosystems there are different strategic roles an organization can play, which affects an organization’s business strategy. If the firm is aware of this fact, it can adapt its strategy after having analyzed its position in the surrounding ecosystem. The strategy is implemented by an according business model. This business model will cause the active change of the organization’s role in the ecosystem and the digitization offers opportunities for implementation. This development is also going to change the traditional manufacturing sector. Thus, the change of the industry logic needs to be integrated into strategic decisions to be competitive in the future. In this paper an approach to handle these developments in the organization’s environment is addressed. The model of the ecosystem is transferred to the manufacturing industry. Based on this transfer and analysis, a roadmap for a consistent alignment of a firm in an ecosystem is suggested.

Keywords: Ecosystems; strategy; digitization; business models; manufacturing industry;

1. Introduction and motivation

Digitization has changed B2C-relationships significantly in form of connected devices and digital networks. This is also going to affect B2B sectors in the future, since according to a study provided by MIT Technology Review the amount of connected devices will increase from 17 billion in 2014 to 28 billion in 2020. The majority of the increase will consist of connected “things”, small devices that interact with each other. This may trigger a significant renewal of the traditional value chain of the manufacturing industry since digitization will offer completely new ways of value creation e.g. by offering added value by data analysis or integrating the customer via development platforms. Ecosystems of firms will evolve and create value for the customers. As a consequence firms of the manufacturing industry will have to adapt to this evolution by adjusting their strategy and business model.

This is the focus of this paper. First, the state of the art is examined and – based on this – an approach for the relationship between digitization, ecosystem, strategy and business model is suggested. Afterwards, the logic is applied to the manufacturing industry and examples for how to adapt a strategy in an ecosystem are given. In conclusion, a roadmap how to approach the position in an ecosystem for manufacturing firms is developed and future need for research is pointed out.

2. State of the art of ecosystem, business model and strategy

The following section outlines the state of the art in the field of the ecosystems, business models and strategy.
2.1. Ecosystems

Firstly, it is important to understand that the digitization brings business organization closer together. Thus, the nature and strength of interactions between those organizations gains significant importance, also because nowadays the industry structure is highly distributed among a large number of companies. According to [1] this development can be conceived similar to biological ecosystems, where the interaction between organisms is crucial to their survival because they depend on each other. [2] defines a business ecosystem “to be a dynamic structure which consists of an interconnected population of organizations.” Furthermore [3] states that an “ecosystem is at its core a plan for how the contributions in the proposed system will be modularized and what sorts of firms will provide which element”. The participants include every organization that contributes to value creation for the customer in form of products or services [1]. Ecosystems can also overlap each other, since one company can be part of more than one ecosystem. Also competitors, customers, regulatory authorities and other stakeholder who implicitly influence the processes are a part of an ecosystem [4].

This means that an organization should think not according to its value chain anymore but in ecosystems and the position the company occupies in an ecosystem. Derived from the IT-sector, [5] recognized four general types of strategies in an ecosystem depending on the turbulence of innovation and the complexity of relationships of the firm as depicted in Fig. 1.

![Types of ecosystem strategies](image)

The keystone acts as a hub in the ecosystem since the improvement of the ecosystem health is one of his main tasks. Only a small part of the ecosystem is occupied by a keystone and it provides the tools and instruments for the ecosystem to survive also under a high level of turbulence and innovation. That means that a keystone protects the ecosystem against encroachment to ensure its survival [5]. Niches reflect the bulk of an ecosystem, but they resemble the content of what the ecosystem does and the keystone shapes the organizational aspect of what it does. From a strategic perspective, the niche player tries to specialize and differentiate himself from the other niche companies in the ecosystem [5]. In contrast to a keystone the physical dominator occupies a large part of the ecosystem and takes over other roles like niches in the ecosystem. The value is mostly generated by the physical dominator, but since the joint value creation misses out it results in a lower level of innovation [5]. Commodity is the last role, but this reflects businesses that are competing solely via price and volume [5]. According to [5] this is no strategy a firm should be aiming at in the long term.

Apart from the strategic position in an ecosystem it is also important to consider the direct connection between different firms on a network level. The position between upstream and downstream activities plays an important role when it comes to creating competitive advantage. Challenges within upstream activities – respectively firms that deliver components for the focal firm – increase the competitive advantage of the focal firm if they can manage them. On the other hand, downstream activities which are also seen as the delivery of complements by the focal firm, do not create competitive advantage in case of challenges [6]. This can be seen as the logic between niche players, whereas keystones try to bring together the complements in order to create value for the customer. The strategy of a physical dominator in contrast would try to vertically integrate providers of complements to avoid the competitive environment that can create disadvantages. [6] points out that the business model plays a very important role in the business ecosystem setting.

2.2. Business Models

Innovations have always been an important lever for the growth and competitiveness of a company. Until a few years ago, an investment in research and development activities for creating and developing new technologies and products was considered to be adequate for operating competitively in the market [7]. In current time, however, a focus on mere product and process innovation are totally insufficient for many sectors [8]. This is where business models come into play.

Although the business model concept has been discussed in literature for several years, a commonly accepted definition has not yet evolved [9]. Relevant application contexts for this paper can be roughly clustered in two research fields: technology and innovation as well as strategy.

As representative of the research field technology and innovation, [10] use the business model to describe how to capture value from technology. Thus, they define a business model as “the heuristic logic that connects technical potential with the realization of economic value” [10]. Furthermore, a business model “performs two important functions: value creation and value capturing” [11]. [12] illustrates the advantages of open business models which help to create value by leveraging an increasing number of internal as well as external concepts. The open business model concept, therefore, allows companies to benefit of trade in intellectual property that has not yet been brought to product maturity. In relation to shorter product life cycles and associated high investment costs in innovations, an open business model could also be an opportunity to guarantee long-term competitiveness. A well designed business model can also have a supporting effect on marketing activities of innovative technologies and compensate technological weaknesses. A technology with mediocre maturity pursued by a great business model may be
more valuable than a technology achieving the maximum maturity pursued by an average business model [13]. Inspired by the interpretation of [14] this work assumes that “a business model articulates the logic and provides data and other evidence that support a value proposition for the customer, and a viable structure of revenues and costs for the enterprise delivering that value” [14].

As mentioned above, there is a mutual interaction of business models and technological innovation. Nevertheless, the business model construct is clearly separable from technology. Of course, path-breaking technological developments enable new business models, but innovative business models can also arise without technology development, like the just-in-time production system [11], [15]. For sectors that are influenced by digitization it is a challenge to develop an adapted business model and appropriate technology. The challenge is to elaborate the interactive connection between the influence of technological developments on business model innovations as well as on the organization of technology development. To solve these problems, managers can revert to existing approaches or experiments [16], alternatively they can take an ecosystem perspective in order to discover the possibilities that technology offers for forward-looking business models [11].

[17] and [18] investigate business models regarding to strategic issues. Referring to the concept of Peter Drucker, aspects as customer, customer value as well as the economic logic of the business are addressed [17]. In further works the term business model is often used interchangeably with the term strategy, nevertheless, these are two concepts which have effects on different levels [11], [13]. In general, the business model represents the mediator between the strategic level and the operational respectively tactical level. The definition of a company’s vision and mission occur in the superior, normative level [19].

The distinction and relationship between business model, strategy and tactics are analyzed with particular intensity in [18]. According to their definition, a business model consists of a set of “specific choices made by management” [18] and the resulting consequences. Every organization makes choices which have consequences; therefore, every organization has a business model. In contrast to the strategy, a business model appears observable and thereby partly imitable for externals [14]. The strategy coincides with the company’s business model and only seems completely visible in trivial situations [20].

2.3. Strategy

The strategy is what defines the purpose of a company, but there are different interpretations of its content and context. To start from another perspective: Strategy is not operational excellence. This is because benchmarking among competitors will lead to a convergence of the competition and sooner or later the different firms will be indistinguishable [21]. Moreover, the preservation of what is distinct about a company – the performance of “different activities from competitors or similar activities in different ways” [21] – is what contributes to a successful strategy. There are three principles that characterize a strategic position [21]:

- Creating a unique and valuable position
- Focus on core competencies consistent with the position
- Find synergies between activities to prevent imitation

To make this more concrete, “a truly strategic decision occurs only at the nexus of three organizational considerations — where it adds value, how it handles and employs imitation and how it defines its perimeter” [22]. These decisions lead to a long-term competitive advantage, short-term issues like operational optimizations do not count as strategy. Sustainable value creation is the goal of any strategy [22]. To prevent the delivered value from imitation, it has to be protected by increasing the difficulty of copying. To link these two elements, the scope of the company needs to be defined, respectively the level of vertical and horizontal integration as well as diversification [22]. Thus strategy and business models are different concepts but closely related [20]. Strategy decisions provide the frame for the activity system or, in other terms, the business model of the organization [20].

Fig. 2 Relation between strategy, business model and tactics (following [9])

To protect the competitive advantage created by strategy from imitation, the business model needs to be analyzed and set up with isolation mechanisms [14]. When a business model is implemented there is a specific tactical set. That means that there are possibilities to change single aspects of a business model – like the choice of a supplier or the price setting. Those choices are based on the tactics stage of a business model and this relation is depicted in Fig. 2 [20].

Applying the previous concept of strategy to the keystone or shaper position in the ecosystem, there are particular aspects to consider. First of all, a shaping strategy needs a critical mass of participants to be successful. This can be achieved by transparently showing the opportunities of the ecosystem to potential participants, setting standards for an easy participation and showing the commitment by investing in the shaping strategy. The participants should also know that the shaper has no interest in competition but in cooperation with the participants of the ecosystem. If this is fulfilled, the participants will share risks and learn from one another [23].
While emerging, digitization also gains more importance regarding strategy and needs to be considered when formulating a strategy [24]. Digital strategy should not only be a functional strategy anymore, but an “organizational strategy formulated and executed by leveraging digital resources to create differential value” [24].

3. Approach for the relationship between ecosystem, strategy and business model

The question that needs to be discussed is, how do digitization, ecosystems, strategy and business models interact and influence each other. Fig. 3 presents an overview of the relationships between the elements in form of influencing factors and types of strategy development. To start with, digitization is the main driver for a change in competition and the organization of different sectors. Companies, consumers and products will be massively interconnected due to digital networks [1]. This leads to increased network effects and a joint value creation in ecosystems, which provide solutions for end customers. Digitization also has a significant impact on strategy. Due to the increased transparency, it is hard to establish operational advantages and the barriers of entry for new firms are lowered. From the buyers perspective, bargaining power is shifted towards end customers, also because switching costs are reduced. On the other hand, there are new markets that can be addressed by using the means of digitization. Furthermore, the core competencies can also be influenced if the value that is provided to the customer will change compared to the current situation [25].

Finally digitization also provides new technologies like big data or platforms to design new business models according the goal set by strategy. A fundamental factor for the cost structure of a business model is the transformation of fixed costs into variable costs by digitization [14]. In the outlined situation, there are two possible ways to adapt a position in an ecosystem via strategy. The first course of action is to consider the dynamics of the surrounding ecosystem into strategy development. This means that the strategy of an organization is no longer restricted to the internal view of the company but extended to the environment of the company: the ecosystem. By doing so, the company is actively positioning itself in the market by adapting one of the general ecosystem strategies previously presented. The second way describes the reactive way of positioning in an ecosystem. This occurs, if a company has the possibilities to become e.g. a keystone and the surrounding ecosystem demands the organization to accept this role. In this case, the company’s strategy has to be adapted to the role the company is “forced” into. Both ways lead to new business models, since new strategic decisions always result in new business model choices [20]. Another critical factor worth considering is the maturity level of a firm’s business model. To be able to put a strategy into practice the company should integrate its business model into the innovation process or already think of it as a platform [8].

4. Applying the approach to the manufacturing industry

The manufacturing industry is characterized by the production of capital goods that are long-lasting and capital intensive. Furthermore, those products are sold to other companies in a business to business relationship and in the value chain manufacturing companies act as suppliers for machines, equipment or components. Historically, manufacturing companies have focused on product and technology innovation and at the same time on reducing costs wherever possible. Additionally, they offer services to complement their products and raise margins [26].

In form of the industrial internet or Industrie 4.0 in Germany, digitization is approaching and affecting this sector. As described in the previous chapter, new possibilities are available and the emergence of ecosystems is emerging. The niche and the physical dominator strategy are already established by various companies and there are also examples for organizations which delivered commodities. Schunk or Pepperl & Fuchs are typical niche players; one specialized in the manufacturing of grippers and the other in the sector of sensors and actuators. They are able to use new business models fitting their strategy like data-based services or platforms to provide a better value to their customers. Stihl, a company selling chain saws and garden equipment, has won several insourcing awards. They try to map the whole value chain on their own and can, therefore, be considered a follower of the physical dominator strategy. Digitization provides the means to create more intelligent products and connect them with protection clothing for example. A sector of the manufacturing industry – where it becomes obvious that commodity is no desirable strategy – is the production of solar panels. Earlier forming a niche where product and technological innovation was the base for competitive advantage, it quickly became a price-based commodity. Several companies vanished, because the production was outsourced to China due to cheaper workforce.

A new development in the manufacturing industry is the evolvement of keystones. They take advantage of the need for standards and tools in separate sectors of the industry but also protect the ecosystem from the entry of third parties like IT companies [27]. To illustrate our previous assumption of two
ways how a firm can position itself in an ecosystem, the firms Farmnet 365 and Siemens will function as practical examples. Farmnet 365 – a subsidiary of Claas, a manufacturer of land machinery – chose the active way of positioning itself as a keystone or shaper within the ecosystem in the sector of agricultural machinery. They actively developed the idea of bringing services to farmers by using a platform, which has access to data of used machines. The service apps of the partners on the platform use the data to create value offerings like showing the best way to harvest a field depending on weather conditions and sustainability or to calculate the amount of fertilizers based on historical yield on a field. Contrary to this example Siemens is a large group including energy, industry, infrastructure and healthcare activities. Siemens has the prerequisites to move into the position of a keystone, what was expected by the customers and the industry. Together with SAP they work on providing an open cloud platform for industrial customers where for example data based services can be hosted.

5. Roadmap for manufacturing firms

Fig. 4 illustrates a roadmap for strategic positioning in an ecosystem by implementing the appropriate business model, taking into account the impact of digital trends. The result can be an adaption of an existing position in the ecosystem and business model or a new position in the ecosystem accompanied by the creation of a new business model.

The digitization forms the basis for this approach and enables the achievement of profit above average in the long run. Strategically relevant is the ratio of hardware and software of a product, modularization, individualization as well as the network with other products or systems [27]. Digital systems, such as cyber-physical systems, enable a network of humans, machines or productions. Platforms, e.g. marketplaces or development platforms provide a life-cycle environment and communication tool for economic availability of software and hardware modules. Development platforms enhance the cooperation capability towards customers, suppliers and partners, which goes beyond a mere buyer-seller relationship. The customer can also be involved in the product manufacturing process, which provides a considerable added-value for the customer.

To evaluate how digitization can improve a company’s position in the market, first the firm’s current position in the ecosystem needs to be analyzed. An internal analysis in order to describe the current company strategy considering the available resources and capabilities is essential. The external analysis focuses on aspects such as local and global customer demands, market and competitive situation and general technological trends, e.g. additive manufacturing. Challenges in any position of an ecosystem limit the company’s ability to create and capture value in varying degrees. Therefore, upcoming keystones like Trumpf – a firm providing manufacturing solutions in the fields of machine tools, laser and electronics – also provide complements (software as a service and financing) to enable value creation for their customers. In the case of Trumpf, internal resources were established in the recent years, such as competence in IT, an extensive network of customers and partners, a company-wide sharing of technologies and experiences as well as data access to their distributed products.

After the company’s current positioning is analyzed, it is necessary to actively adapt the company’s vision and strategy to reach the target position in the ecosystem. In some cases, the desired position can also be consistent with the already existing position. The aim of the strategy adaption is to strengthen competitive advantages. By comparing internal conditions with external demands, ideally a gap in the market can be discovered – the potential for a competitive position. Afterwards, a feasibility analysis is necessary for a holistic consideration of the firm’s new business strategy. A clear differentiation from the competition by unique selling points represents the goal, but the effort to achieve this aim also has to be evaluated according to its associated risks.

The three dimensions of strategy – value, imitation and perimeter – should be considered in the strategic initiative regarding to the future position in the ecosystem. The main aims of strategy are to define the type of value, the way of sharing value, to prevent or ensure imitation as well as to redefine a perimeter. Concerning the value, the balance between increases in profits and sustainability as well as handling social aspects regarding the firm’s mission, are two main questions. Imitation plays a key role in strategic considerations regarding the creation and defense of competitive advantages as well as the imitation of existing business models. Perimeter focuses on the definition and setting of limits to the firm’s scope what is especially relevant regarding the core competencies. The steps with the highest degree of value creation should be included in the scope of the firm [22].

In the example of Trumpf the internal resources as well as the customer potential and demand for a digital business platform and digital services, particularly for manufacturing companies, were available. Thus, Trumpf obtained a pioneering role as keystone by implementing a service-based differentiation strategy. The third step focuses on the realization of the strategic position which can only be reached by an adequate and appropriate business model. Strategy entails designing, and if
it is required, redesigning of business models [22]. Ideas of business models should be generated in creative workshops or inspired by existing business models patterns, c.f. [7]. The development of business models and derivation prototypes represent the next steps. A feasibility analysis reveals the available and the necessary resources for the future business models. After this stage, unsuitable business model ideas and prototypes can be rejected. Afterwards, business cases have to be created and evaluated regarding their economic efficiency while taking the entire company’s business case into account. Based on this analysis and after further identification of inappropriate business models, scenarios are developed for the remaining concepts. Trumpf already uses software as a service in the manufacturing sector in order to tap into new value structures. For the planning of production processes Trumpf has recently implemented the digital, open business platform called Axoom which connects systems, machines as well as workplaces. One main advantage of this platform is the collaboration and interlinking of components of different manufacturers (platform as a service).

The fourth step focuses on the implementation of the new or modified business model. In the planning phase, potential organizational adjustments and changes in corporate culture should be addressed and communicated. Controlling and monitoring processes follow the implementation of the business model. If any inconsistencies occur during the phase of review, iteration loops have to be carried out which optionally require an adaption of the strategy.

6. Conclusion and future fields of research

Strategy is the basis for business models, but since the emergence of ecosystems is inevitable, it is not sufficient to develop a strategy for the own company. The view needs to be expanded to the surrounding ecosystem and the position of the focal firm in it. Especially the manufacturing industry will face severe changes in the future – keystone or shapers will be needed to enable a structured and sustainable development of the industry. Their function is to protect the ecosystem around them and provide the means and tools for a joint value creation. A roadmap is suggested, how firms can adapt their strategy and implement appropriate business models to realize their strategy.

Research this field is at an early stage and there are several fields of research that need better insight in the future. First, the criteria for the position of manufacturing firms in an ecosystem need to be specified and more concrete. Based on this, a systematic analysis of the strategic dimensions that connect the ecosystem strategy and the internal strategy of a firm needs to be developed. Furthermore, the feasibility of the strategy requires systematic evaluation. When it comes to the realization of the strategy, the question which business model is suitable for the particular position in an ecosystem and why this is the case calls for investigation.

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