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Contribution to the industry-specific identification and selection of a business model in machinery and equipment industry

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Abstract

Industry 4.0 introduces a paradigm shift that will lead to changes of business models in many e. Today, industrial companies are gradually transforming their traditional and transaction-based business models into new business models made possible by cyber-physical systems. New business models such as as-a-service or platform-based business models emerge. This change brings enormous opportunities, but also many risks for the manufacturing industry. Many companies are faced with the problem of choosing from the multitude of new business models. The business model development to be found in literature primarily follows the needs of the customer. Machinery and equipment industry is a particularly interesting sector since more than 50% of the customers in machinery and equipment industry come from the same sector.

This paper develops a process model for the industry-specific selection of business models. The model includes the following questions: Which business models can be selected in the field of machinery and equipment industry? Which possible goals can be pursued with the respective business models? Which criteria are useful for deciding on the respective business model?

Keywords

Industry 4.0; business model; machinery and equipment industry

1. Introduction

New business models will be increasingly important for manufacturing companies in the future. Nevertheless, traditional companies, for instance in machinery and equipment industry, are reluctant to question and transform their own classic business models. However, due to the technological change in the course of Industry 4.0, it is necessary to question one's own business model. Shorter innovation and product cycles open up traditional business fields to players from outside. The systematic consideration of business model innovations has shown that there are specific patterns [1]. These business model patterns are generic and can in principle be applied to any industry. This paper examines how machinery and equipment industry can use these patterns and select a suitable pattern.

2. Problem definition

Machinery and equipment industry is an important economic sector. In terms of turnover, machinery and equipment industry is the second most important sector in Germany and by far the largest sector in terms of number of employees [2]. In contrast to the automotive or process industry, machinery and equipment industry is a SME sector. Approximately 85% of the companies are small or medium-sized [3]. In addition,

machinery and equipment industry is divided into many different branches. This and the fact that there are so many SMEs leads to a strongly heterarchical customer-supplier relationship in machinery and equipment industry [4] [5]. This means that for many companies it is not easy to define who the customer is and what market power the customer or supplier has.

In addition to current challenges for machinery and equipment industry from outside, such as international trade conflicts and the associated gloomy global economy, there are challenges inherent to the industry. The most important of these problems for companies is adherence to delivery dates, followed by manufacturing and development costs. Quality is currently only a minor challenge. [6].

In addition to these challenges, the fourth industrial revolution has created new challenges for machinery and equipment industry in order to defend its position as a world leader. Industry 4.0 is defined as "the intelligent networking of machines and processes in industry with the aid of information and communication technology". This definition is strongly based on technologies for Industry 4.0 cyber-physical systems, cloud computing and smart factory enablers for industry 4.0 [7]. Nevertheless, in Industry 4.0 it is not a technology push that matters but a customer and market-specific solution. In order to carry out a benefit-driven transformation, a suitable business model must be selected, so that Industry 4.0 can be successfully introduced [8].

The strategic problem is that these new technologies make classic business models obsolete. Nevertheless, companies in the machinery and equipment industry are sticking strongly to their long-established transaction-based business models with long life cycles.

Business model development in machinery and equipment industry can be divided into an evolutionary business model innovation that maintains the industry logic and a disruptive business model innovation that changes the industry logic. Previous business model development has often been evolutionary and driven by the customer. Thus, customer tasks were taken over by the company and a transformation from a part to a system supplier was carried out with the associated complexity [7].

Disruptive business model innovations that contradict the logic of the respective industry are currently also being pursued by companies in the machinery and equipment industry sector. The advantage here is that machinery and equipment industry traditionally thinks very customer-oriented and also takes them into account when developing business models. However, current studies show that these business model innovations are often just an idea and do not move towards realization. Companies that are already active in the market beyond the idea phase are confronted with high initial investments and cannot yet realize potential returns, which is why many companies shy away from this step [9] [10].

Although there is a clear advantage of investing in business model innovation [11], companies hesitate. There are two reasons, which are related to each other. First, companies see the relevance of investing in business model innovation, but don't know how to start and where to invest. Second, companies which have invested in a broad field of business model innovations could not profitable returns from it, only focused investments were profitable by now [10].

Thus, it is necessary to provide assistance and clearly point out the possibilities and advantages of new business models.

3. Business model and pattern development

There is no generally accepted definition of the term business model in literature. However, the common definitions all point in similar directions. A business model describes the way in which a company creates value for its customers and earns money in the process. Similar definitions can be found in Osterwalder [12], Gassmann [1] or Nagl [13]. Business models take place at various company hierarchy levels. There are

generic business models up for entire industries or specific business models down to products or services [14]. The framework for business models within a company is formed by the strategy, within which the business model is described and selected [15].

A business model is usually described using a methodology. The methodologies are similar and differ only in detail. For example, Osterwalder uses 9 building blocks to describe a business model, Gassmann 4. When it comes to business model development or innovation, these methodologies usually start from the customer or the value proposition. The development of new business models and the observation and description of business models showed, that many business models are not new and have great similarities [1]. They mostly function according to the same pattern. Examples of such business model patterns are multi-sided platforms, a business model in which the value is not created by the company itself, but the value is created by the exchange of two parties or long-tail business model, in which not the core customers but many niches are served. Table 1 shows a selection of business model patterns that can be found in literature

Table 1: Selection of business model pattern compilations in the literature

Author	Patterns described by the author	Comment
Gassmann	55	generic, transferable to all industries, claim to almost complete mapping of all possible business models
Osterwalder	5	only exemplary, no claim to completeness
Kinkel et al.	5	describes only approaches

The approaches presented in Table 1 show a selection of business model patterns. They, however, only describe possible advantages for companies within the patterns by example or are so generic that a sector-specific consideration is not possible. Also a process for the systematic selection of the business models is not used.

4. Framework architecture

In the previous chapters, the problem of machinery and equipment industry with regard to new business models was explained. The state of the art was presented with the deficit that there is no industry-specific approach for machine and plant construction. In this chapter, the basic procedure of the model described in this paper is explained.

The methodology follows three steps. In the first step, "Identification of key business models", the aim is to form a set from which one or more business models can be selected in further steps. In the second step, criteria are compiled on the basis of which a business model is selected from step 1 or on the basis of which a business model can be discarded. After successful selection, the third step addresses implementation. This step is not discussed in this paper.

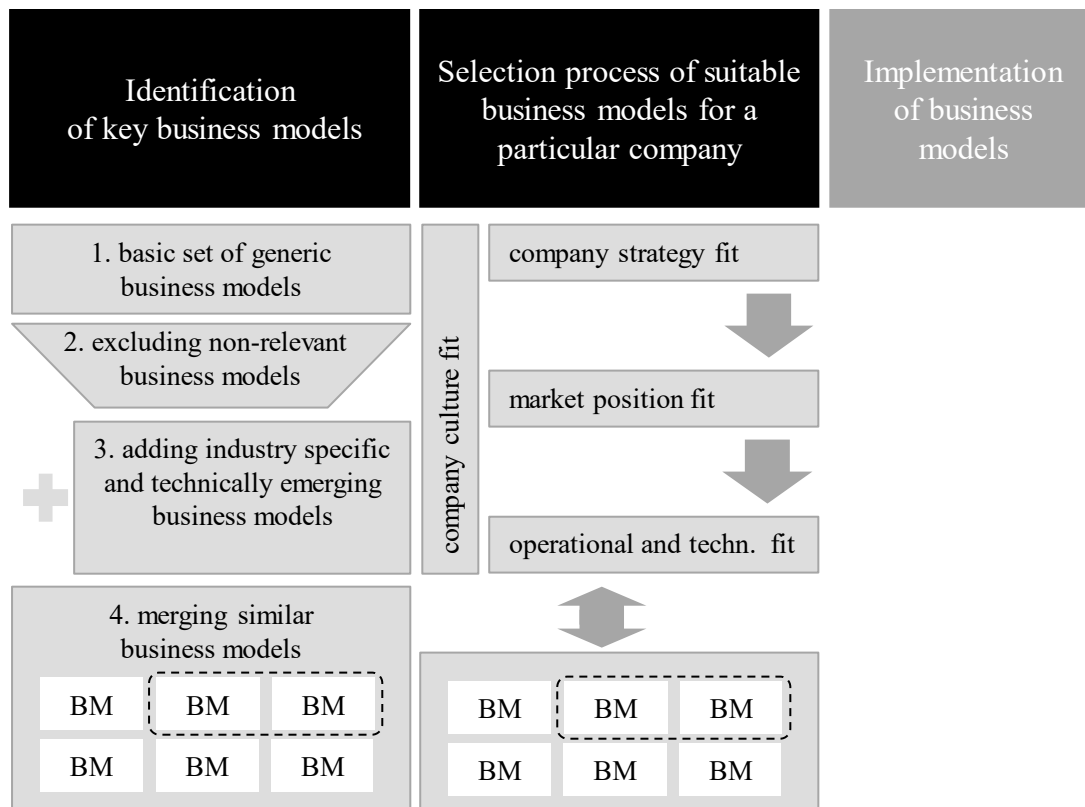


Figure 1. Approach of the methodology for selecting business model patterns

The aim of the first step is to form a tangible number of business model samples in order to design a selection methodology. The identification of relevant business models begins with the basic set of generic business models (1.). Then, a filter is applied (2.), which screens industry-specific business models that are relevant for machinery and equipment industry. In the next step (3), unobserved business models are added, that are based on existing businesses and immanent in industry or emergent due to new technologies. In the last step (4.), similar business models are merged from the collected business models. Thus, a collection is compiled on the basis of which possible business models at the industry level are then led to possible business models at the enterprise level. In the second step, each of the business models is then checked for consistency using various criteria and a top-down approach. The criteria are as follows: cultural fit, strategic fit, market fit, operational and technological fit

The objective is not to determine whether a business model works or not. This has to happen in practice or in the next step of implementation. It is examined here, in which pattern difficulties arise, so that the best functioning business model can be selected.

5. Selection process

As described, the selection process is divided into two parts. First, the business models possible for the regarded industry are selected and then, in a second step, those that are possible for a company in the respective industry.

5.1 Identification of key business models

The first step is divided into four sub steps. They consist of the basic set, filters, other business models, and summarizations.

5.1.1 Basic set of generic business model patterns

Here, a basic set is used as the basis for possible business model patterns. The compilation of Gassmann's 55 business model patterns is suitable. Since 90% of all generic business model patterns are already represented here, this is a good starting point [1]. The transfer of the generic compilation and any other business models that are not yet included in this collection can be carried out in the next steps.

5.1.2 Filter

From the 55 business models, a qualitative filter is now used to select the suitable business models. This filter throws out inadequate business models to select those that are possible for manufacturing companies and known from practice. This results in the following business models: Digitalization Sensor as a Service, Two-Sided Market, Guaranteed Availability, Mass Customization, Pay-per-Use, Performance-based Contracting, Rent Instead of Buy and Subscription.

5.1.3 Adding further business models

The eight business models mentioned above will, in the next step, be expanded to include others that do not count among the basic set, but nevertheless already appear in the regarded industry. For instance, the Mass Customization business model only carries out individualizations [1]. In industry, the additional business model of a Configurator has been developed, due to increasing complexity. This makes it possible to map complex product designs using standardized interfaces. Production and the customer largely automate this process, since the customer configures the product himself and can thus trigger a production order.

5.1.4 Merging similar business models

Some of the nine business model patterns, that are similar in the regarded industry can now be merged. On the one hand, Two-Sided Market and Digitalization as a service can be combined to form platform business model patterns. The similarities occurring here are on the one hand a marketplace for physical goods and on the other hand a marketplace for data. In both cases, the company acts as a broker between suppliers and buyers. A further pooling can be carried out with guaranteed availability, pay-per-use and performance-based contracting to service-oriented business models. All three business models combine a transformation of transaction-based sale of machines towards service orientation. On the one hand, the input (availability), the throughput (pay-per-use) and the output (performance) are sold service-oriented, i.e. as a service.

6. Selection process for a suitable business model for a particular company

The selection of the respective possible business model patterns at company level must be made individually for each company. This is why a top-down approach is used here.

6.1 Company Culture Fit

First, it is checked whether the cultural fit of a company or the attitude towards business model innovations is given. This is particularly decisive for a transformation to a platform-oriented business model. This is because a rethink must take place throughout the entire company [16]. Since here money is no longer earned through the transaction of self-produced goods, but the company acts as an intermediary between suppliers and customers. Particularly critical is the entry into a cooperation with former competitors and thus the thinking in business eco systems.

6.2 Company Strategy Fit

At the strategic level, a decision must be made whether and to what extent investments in new business models should be made. It must also be evaluated at the strategic level, how external pressure will affect the company in a medium-term perspective, and how foreign players will penetrate the existing business model and disrupt it with new business models [7].

6.3 Market Position Fit

At the market level, the environment, development and the company's past and future position must be taken into account. The decisive factor here is whether a company possesses the market power to approach its customers with new business models. It is also decisive, how the market environment will change in the future. For example, new suppliers, mainly from emerging markets, who offer more competitive prices at a reasonable quality, can pose a threat. Service-oriented business models thus can offer the advantage of higher quality and an advantage in the investment decision like a transformation from capital expenditure to operational expenditure.

6.4 Operative and Technical Fit

Decisions must be made at operational and technological level, how a suitable new business model can be introduced. In particular, a configurator and the associated automatic or automated production and assembly of products require the technical possibility and a high degree of operational excellence. But also other business models need competences in a company due to their new high demand of ICT technology.

7. Summary and Outlook

In this paper, a methodology has been developed that describes an industry-specific approach for machinery and equipment manufacturers that can operate new business models as a result of the changes within Industry 4.0. First, the current and future problems were presented on the basis of current literature, in order to then present the state of the art. It was shown that so far, industry-specific consideration of business models do not exist. Furthermore, a methodology for selecting a model was presented and described in detail. First, a branch-wide compilation of possible business models was described, followed by a company-specific selection.

Further research should be on the implementation and integration process for the selected business model. This would then focus on organizational change and address issues mentioned in chapter 6. Also, further research in similar industries like process or automotive industry makes sense, since industry specific research on business models is relatively scarce by now.

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Biography

David Maximilian Doerr (*1989) is a research associate at the Fraunhofer Institute for Manufacturing Engineering and Automation IPA. He studied industrial engineering at the RWTH Aachen University. Since 2017 he is coordinator for business models at the Fraunhofer IPA. Since 2019 he has been working in the Corporate Strategy and Development Department and is Deputy Manager of the Fraunhofer Project Centre for Smart Manufacturing in Shanghai.

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