Design of Tailored Subscription Business Models – A Guide for Machinery and Equipment Manufacturers

Y. Liu(✉), A. Gützlaff, S. Cremer, T. Grbev, and G. Schuh

Laboratory for Machine Tools and Production Engineering (WZL), RWTH Aachen University, Campus-Boulevard 30, 52074 Aachen, Germany
y.liu@wzl.rwth-aachen.de

Abstract. Machinery and equipment manufacturers especially from high wage countries are increasingly under pressure to extend their competitive differentiation. Studies show that innovation in business models can create stronger differentiation than innovation in products and processes. Especially in the software industry, subscription-based business models have recently formed new champions who dominate the markets. Unfortunately, it is so far unclear what "subscription" means in the machinery and equipment industry, what offers it can contain and how the offers can be delivered. This work supports machinery and equipment manufacturers by answering these three fundamental questions. Firstly, an adequate definition of subscription business models in the machinery and equipment industry is introduced. Secondly, a holistic understanding of potential offers within a subscription business model is provided. Thirdly, supporting success factors and requirements for the creation of the offers are identified.

Keywords: Machinery and equipment industry · Subscription · Business model

1 Introduction

The German machinery and equipment (hereinafter M&E) industry generates appr. EUR 233 bn in revenue each year. It ranks third place in the global competition after China and the USA [1]. As competitors from emerging countries are catching up on innovative capability but remaining at relatively low cost structures [2], the competition is becoming increasingly fierce. Especially companies from high wage countries need to find ways to differentiate from competitors. Traditional means of product and process innovations seem no longer sufficient. Instead, innovations in business models are gaining more importance as they can fulfill the customers' needs better [3].

Among various new business models, the so-called subscription-based business models (hereinafter subscription models) have gained particularly broad attention in the recent years. Especially in the software industry, new champions were formed

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who now dominate the markets. Subscription companies grow their revenue in average more than nine times faster than the S&P 500[1] [4]. It is because of this success that manufacturers from the M&E industry are also developing and testing subscription models [5]. The potential benefits for both customers and manufacturers are manifold and partly comparable to the software industry. On the customers' side, these benefits include, for example, higher financial flexibility and customer centricity. On the manufacturers' side, benefits include, for example, better financial planning basis and a long-term customer relationship [4]. At the same time, manufacturers may also be able to monetize Industrie 4.0 potentials more effectively than so far [6].

By looking at existing successful subscription models, it also becomes obvious that a variety of customer-centered values need to be generated [4, 7]. This implies that M&E manufacturers can only be successful if their customers, i.e. industrial companies that are using the machines and equipment, to be successful in their own markets. One of the major keys for any industrial company is to constantly increase the productivity [8]. Yet despite all digitalization efforts in the recent years, the German manufacturing industry has experienced a total productivity increase of only 1.3% between the years 2011 and 2018 [9]. This phenomenon is also referred to as the "productivity paradox" [8]. By helping their customers to increase their productivity, manufacturers of the M&E industry can strengthen their own competitive position.

The introduction of subscription models is a new frontier in the M&E industry. Since it is significantly different from the software industry, a direct imitation of existing subscription models is not possible. The complexity of customers' needs and potential solutions to meet them poses a great challenge to M&E manufacturers. Therefore, the authors of this work aim to answer three fundamental questions in order to support M&E manufacturers in tailoring their own, unique subscription model:

1. What does "subscription" mean in the M&E industry?
2. Which offers can be included in subscription models?
3. Which success factors and requirements need to be considered?

2 Research Approach

In order to answer these questions, an extensive literature research was conducted. It was found that subscription models have not yet gained much attention in the production research due to its novelty in the manufacturing industry. However, service-related business models, product service systems and smart services partly show similarities to subscription models. The literature research was therefore extended to these academic fields in order to identify relevant existing approaches.

[1] Standard & Poor's 500: Stock market index comprising 500 large companies listed on stock exchanges in the United States of America.

It was found that the research questions can only be partly answered with existing approaches. They provide a basic understanding for subscription businesses in general, but no definition for its application specifically in the M&E industry. Only few works provide a selection of potential offers, but no extensive overview and structure are available. Success factors and requirements are only singularly mentioned in some literature. However, no holistic overview or model was found.

Based on these findings, a case study of 107 existing subscription models was conducted. While the literature review was mostly focused on the M&E industry, the case studies included subscription models both from within and outside of the M&E industry. Especially successful cases were found in the software, service and entertainment industries where subscription models are widespread by now. The case studies were conducted by means of scientific publications, company information, third party reports and personal interviews.

In the first step, an adequate definition of "subscription models in the M&E industry" is developed. The elementary subscription characteristics is provided by existing literature, e.g. by Gassmann et al. [10]. However, according to Osterwalder and Pigneur, business model innovation is about creating customer value [11]. Based on the same idea, this work expands the elementary definition by outlining core value propositions for subscription customers in the M&E indsutry. This is done by extracting the most constitutive value propositions from case studies of existing, successful subscription models. However, since the vast majority of the analyzed cases are located outside of the M&E industry, their transferability to the M&E industry is also analyzed.

In the second step, potential offers are identified which can create the value propositions. Three sources are used: traditional offers within the M&E industry based on literature review, existing subscription offers within the M&E industry based on case studies, and existing subscription offers outside of the M&E industry based on case studies. As a continuous increase of productivity is one of the major challenges for the customers of the M&E industry, i.e. manufacturing companies, the identified offers are especially evaluated on their potential to increase the machines' and equipment's performance and utilization.

In the third step, success factors which can increase the fulfillment level of the value propositions from step 1 and therefore increase the customer value are identified. While success factors from existing subscription models within the M&E industry can be directly considered, those from subscription models outside of the M&E industry need to be evaluated on their transferability.

Based on the aggregated results of value propositions, offers and success factors, requirements for the M&E manufacturer are identified in the fourth step. These requirements would enable the transformation and the operation of subscription models. They include both the technical and the organizational dimension.

The research approach is visualized in Fig. 1.

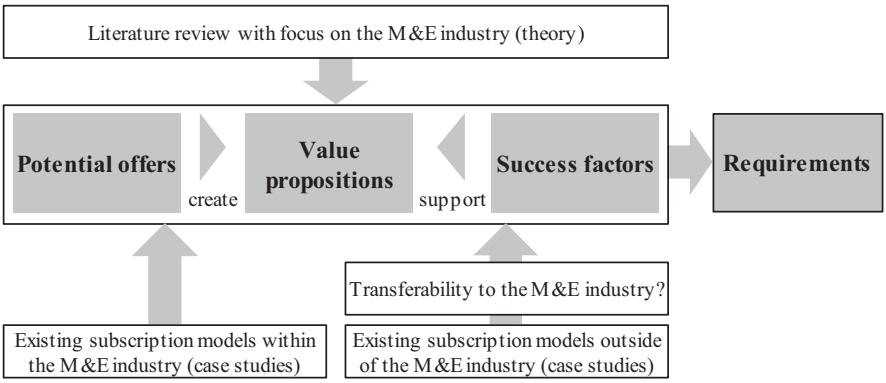

Fig. 1. Research approch for the presented work.

3 Definition of "subscription" in the Machinery and Equipment Industry

Traditionally, subscription models describe recurrent payments for recurring values. They were first applied in the book and newspaper industry in the 17th century [10]. Today's successful subscription models especially emphasize the importance of *customer centricity* and suggest a wider definition in order to capture the nature of their success [4]. Consequently, an appropriate understanding of modern subscription models needs to be developed. Based on the paradigm *customer centricity*, the authors of this work identified five core value propositions for the M&E industry. They are briefly introduced in the following.

Customized Offers Providers can greatly increase the customers' satisfaction by focusing on their problems instead of high quality products alone. Since all customers are different, individual solutions are required [12]. One way to do so is to provide customized physical products, digital products and services. Furthermore, a customized mix of standardized offers may also generate customized solutions but still maintaining an economic cost structure.

Continuous Productivity Increase Increasing the customer' productivity only once is not enough. The case study shows that subscription customers also need to be provided with new offers on a regular basis in order to achieve long-term satisfaction. Likewise, M&E manufacturers not only need to continuously improve their physical products, digital products and services, but also frequently generate new offers [6]. By doing so, the customers' productivity can be continuously improved.

Flexibility Subscription customers seem to value the freedom in products and services over the actual price [13]. In consequence, M&E manufacturers need to allow their customers to change between the products and services flexibly. Although this might be difficult to apply to the machines, it might be possible to apply to machine components, given a modular design. Customers also enjoy a significant financial

flexibility since capital expenditures (CAPEX) for the purchasing of machines are turned into operational expenditures (OPEX).

Risk Sharing In order to establish a trustful long-term relationship with the customers, successful subscription providers take upon more risks than in traditional business models [14]. At the same time, risk sharing creates an intrinsic motivation for providers to improve their performance continuously. The risks and potential benefits for the providers need to be reflected in a smart pricing strategy. Also, providers must not offer subscription model to any customer, but select the promising ones with care [15].

Convenience Company processes are often distinguished between core, support and management processes [16]. M&E manufacturers can create additional value by helping customers to focus on their core processes [17]. This can be done by either simplifying the customers' non-core processes or by carrying out the processes for them. However, M&E providers need to find ways to deliver this core value proposition by digital means in order to maintain an economic cost structure.

Based on these core value propositions, a more adequate definition for subscription models in the M&E industry was developed (see Fig. 2). It is worth mentioning that more value propositions and facets of value propositions were identified than described above. However, their transferability to the M&E industry was found hardly possible.

Subscription business models in the machinery and equipment industry describe a long-term relationship between suppliers and customers who receive recurring values for recurring payments. Based on consequent customer centricity, all generated values are designed towards the customers' problems and needs, especially to a continuous increase of their productivity. The values are transported not only by physical products, but also by all digital products and services that are required and desired by the customers.

Fig. 2. Definition of subscription business models in the machinery and equipment industry.

4 Subscription Offers for Customers

According to this definition, subscription providers need to develop customer offers with which the customers' problems and needs are met. In order to do so, M&E manufacturers can choose from a wide variety of potential offers to provide. These include both conventional offers, e.g. maintenance support, and modern offers by means of digitalization, e.g. analytics platforms. The challenge for the manufacturers is a missing overview and structure for the variety of potential offers. Fig. 3 shows the structure proposed by this work. The most significant offers that were identified in the case study are described for each category of the structure. They include traditional and subscription offers within as well as subscription offers outside of the M&E industry which were found transferable.

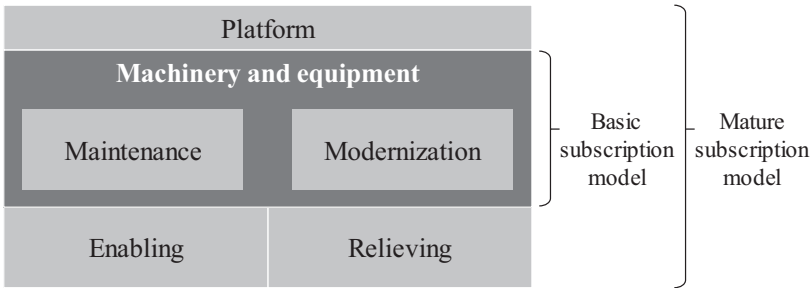

Fig. 3. Structure for subscription-based offers in the machinery and equipment industry.

Within this structure, all potential subscription offers are divided into six categories. Even though the paradigm *customer centricity* suggests that the productivity of machineries and equipment are more important to the customers than the possession of these, the physical products are still the foundation of any subscription model. The majority of all offers in the other categories are designed to increase their productivity. Therefore, excellent machine qualities towards a high productivity are still an important source of competitive advantage and thus indispensable. *Maintenance* is also considered indispensable not only for subscription models but for any business model. It achieves a constant level of productivity which is inherent to the machine and equipment itself, but does not contribute to a continuous productivity increase. In contrast, *modernization* of physical components, digital solutions and services allows a gradual productivity increase over time. Therefore, the combination of these three categories is required in order to form a minimum set of subscription offers in order to achieve the five core value propositions.

The level of fulfillment for the core value propositions can be enhanced by adding further subscription offers. With *enabling* offers, customers receive the required support, tools and knowledge in order to increase the overall performance by themselves. With *relieving* offers, subscription providers disburden their customers of non-core processes so the customers can focus on their core processes. In addition to these five categories, *platforms* are already commonly provided by many M&E manufacturers. It seems obvious to include them into subscription models as well. They can both include additional offers and support offers of the other categories, and are often designed modularly in order to reduce the customization effort. Platforms are essentially important to the economic success of providers. On the one hand, providers can reduce their operational costs by enabling customer self-services. On the other hand, platforms can significantly increase rate of upselling (increase the utilization of a product category), cross-selling (sale of additional product categories) and renewal of subscription contracts [7]. Together, all six categories form a “mature subscription model” which provides more opportunities to increase the customers’ performance and productivity. This way, providers can establish a strong customer relationship that is difficult for competitors to substitute.

An overview of some of the most significant offers that were identified in the case study are shown in Fig. 4. With the proposed structure, companies may identify specific offers with which their customers' problems and needs may be met. Providers may also identify offers which are desired but cannot be delivered today due to missing capabilities. Therefore, the structure may also serve as a basis for the company's future development of capabilities. However, it is worth mentioning that this collection only represents a snapshot of technologically available offers. With progressing technologies, further subscription offers may be developed in the M&E industry.

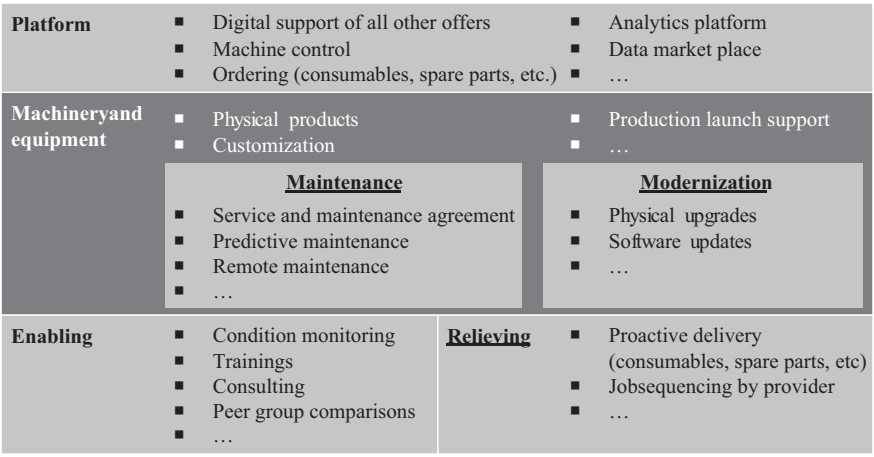

Fig. 4. Overview of most significant subscriptoin-based offers in the M&E industry.

5 Success Factors and Requirements

The value propositions and potential offers were identified from the customers' point of view. However, successful subscription models differ from others also from the providers' point of view. While success factors can increase the effect of the offers, necessary requirements would enable the offers in the first place.

5.1 Success Factors

Success factors can increase the level of fulfillment for the core value propositions. For subscription models in the M&E industry, seven success factors were identified.

Continuous Innovation As the core value proposition *continuous productivity increase* implies, providers need to generate innovations on a regular basis. Apart from competences that are required, providers need to establish organizational capabilities which support the internal development of innovations and incorporate external innovations systematically [18, 19].

Customer Integration Customers should be actively integrated into the providers' innovation processes. The goal is to identify both their explicit and implicit needs and to transfer them into product and service specifications. This way, a high level of fulfillment for the customers' needs can be achieved. However, not all customers are suitable for integration. They need to be carefully selected [7].

Customer Analysis Another way to identify implicit customer requirements are data-based analyses of the customers' interaction with the machines and of the machine performance. The derived insights can be used both to develop more targeted, customized solutions and to channel the development of general future machine generations.

Transparency M&E manufacturers establish a close partnership with their customers by focusing on solving their problems. In this partnership, a high level of trust is essential. This can be fostered by keeping all relevant information and decisions transparent, e.g. real-time machine data and reasons for maintenances. In subscription models which include outcome-based pricing mechanism, transparent billing structures are especially important.

Automated Processes By solving the customers' problems individually, the efficiency potentials of standardized offers and processes are partly eliminated. In order to keep a reasonable cost structure, a high level of automation for the provider's core and support processes by digital means is required. This may include for example processes in customer analysis and accounting, but also sales processes via the platform.

Value-Based Pricing The identification of a customer's willingness to pay is a major challenge for subscription providers. The case study shows that successful providers achieve higher profitability by following a value-based instead of cost-based approach in designing their pricing strategy. However, this change of mentality seems to be especially difficult for the M&E industry.

Customer Success Management Following the developed definition of subscription models, the provider's success highly depends on the customer's success. A constant evaluation of the customer's performance and its proactive support is required by the provider. This may even result in the formation of a specialized organization unit [7].

5.2 Requirements

Based on the previous results, four technical and four organizational requirements that subscription providers in the M&E industry need to fulfill could also be identified.

Modularity of Offers The continuous delivery of customized offers may cause excessive costs for providers and threaten the profitability of the overall business model. In order to maintain an economic cost structure, both physical and digital products as well as service offers need to be designed modularly. Nevertheless, the variance of the modules should be kept at a manageable range.

Real-Time Connectivity For some subscription offers, real-time capability is required, e.g. for condition monitoring, job sequencing by provider and interactions via the platform. Therefore, the machines and equipment need to be able to gather, process and transmit the relevant data in real-time.

Data Sharing Agreement Since the data can reveal the customers' performance and knowhow, some customers may be reluctant to share them. Therefore, successful subscription providers require a dedicated data sharing agreement with the customers. It forms the foundation for a trustful relationship.

Internet of Production The identification of improvement potentials may require customer analyses combining data from different domains. In order to do so, the concept of the Internet of Production, developed by the Laboratory for Machine Tools and Production engineering (WZL) of RWTH Aachen University, supports providers in developing an effective and efficient data infrastructure.

Digital Dynamic Capabilities The transformation to subscription models requires digital and data analytics competences which are sometimes scarce at M&E manufacturers. The acquisition or buildup of these competences may be a long-term task. At the same time, companies need to combine the digital capabilities with organizational dynamic capabilities in order to constantly generate new digital offers [20].

Specialized Sales Forces Traditional sales forces are experienced in selling one-off transaction contracts. Existing subscription providers have experienced great difficulties in training them for selling subscription offers. This may be due to the importance of value-based pricing instead of the traditional cost-based approach. Therefore, many subscription providers found it easier to hire subscription specialized sales agents. Furthermore, the evaluation system for the sales teams also needs to be adapted.

Adapted Organization Not only the sales forces, but the entire organization needs to be adapted to subscription business. The aforementioned definition of subscription models implies a process-oriented organizational structure which seems to be rare in the M&E industry. At the same time, the organization needs to be able to foster a customer-centered culture for leveraging the organizational dynamic capabilities.

Financial Resources Providers need to be able to afford the transition to subscription models financially. Subscription revenues are generated in regular small transactions. In comparison to traditional financial reports, revenues and profits will most likely experience a significant drop during the transition. At the same time, transition costs, e.g. new IT infrastructures and trainings, will further weigh down the financial results. In literature, this effect is often described in the so-called fish diagram [4, 6].

An aggregated overview of this work's results is shown in Fig. 5.

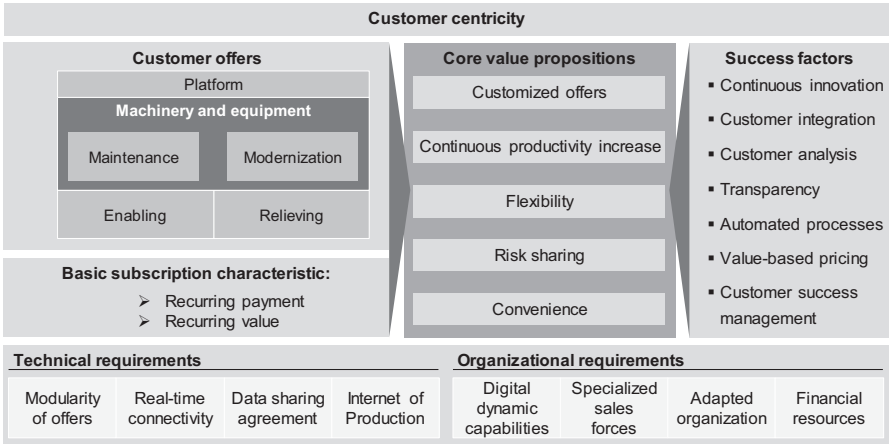

Fig. 5. Overview of aggregated results of the presented work.

6 Outlook

The presented work provides a guide for M&E manufacturers in designing their own tailored subscription models. It includes an adapted definition for subscription models in the M&E industry, an overview and structure for potential offers for customers, as well as success factors and requirements for manufacturers. The results were validated with four M&E manufacturers who have already introduced subscription models or are planning to do so. These manufacturers are well established companies for industrial electric tools, industrial printing machines, high-end medical devices and air compressor systems. The results were found generally valid and applicable. The structure enables M&E manufacturers to define a specific set of value propositions and corresponding offers which suit the company's strategy. By doing so, companies can design tailored subscription models. However, it was agreed that the results, especially the potential offers, depend on available technologies and may change over time. Furthermore, the significance of data analytics for both development and provision of the offers was found essentially important.

The results of this work reveal the necessity for further research in order to support M&E manufacturers in introducing subscription models successfully. While most of the aforementioned technical requirements can already be met with existing technologies, the organizational requirements still lack scientific insights. Researchers on the RWTH Aachen Campus are currently working on bridging some of these scientific gaps. At the same time, subscription models have already attracted companies from adjacent industries to enter the M&E industry. Component suppliers, e.g. for sensors, as well as service companies start to extend their businesses by introducing subscription offers in the categories maintenance, enabling, relieving and platform. Therefore, it is important for M&E manufacturers to take leadership on subscription models and defend their market positions against existing and upcoming competitors.

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