Digital and service transformation of business models - the case of ATM Recyclingsystems

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ABSTRACT: Several challenges like shorter technology cycles or the need for customization force companies to transform towards higher digitalization and servitization. The transformation towards Industry 4.0 has an impact on the overall company. Smart connected products allow companies to gather data, for example, about customers and their demands, and to use this information for developing offerings that are tailored to customers' needs. These offerings tend to integrate a higher share of (digital) services, leading to a transformation of the companies' product-oriented business model to a service-oriented business model. With the case of ATM Recyclingsystems, we were able to show how a recycling machine manufacturer transforms its business model by implementing an IoT platform from t-matix.

1 INTRODUCTION

Industrial companies nowadays face many challenges, like increasingly shorter technology cycles, the need from customers for customization, or cost pressure, to name a few. Companies therefore require higher flexibility, reactivity and individualization while at the same time maintaining at least the same or increasing efficiency. This drives the digitalization, the exploitation of digital opportunities (Rachinger et al. 2019) in industrial companies, also known as Industry 4.0 (I4.0) – the integration of digital technologies and services in manufacturing. The increasing digitalization in manufacturing results in a "completely intelligent, connected, and autonomous factory" (Kagermann et al. 2013; Kiel et al. 2017). Besides the integration of digital technologies, servitization changes the market from

"product consumption to result-oriented demand" (Frank et al. 2019a). Customers expect some kind of service when dealing with the product. Both, digitalization and servitization, change the business model of the firm. This was confirmed by a study of Ernst & Young (2015), where 76% of the companies interviewed perceive an increasing impact of digital technologies on the business model, whereas 32% perceive a high increasing impact.

The trend of increasing digitalization and servitization affects all industrial companies in all sectors including the waste and recycling industry, as we will present in our case study. In this case, the company ATM Recyclingsystems implemented an IoT platform from t-matix with the goal, to provide customers with products that deliver the best efficiency and optimal cycle times. We further show in our case study, how the company has implemented the solution and how the business model has changed to be able to provide customers the new digital services.

2 DIGITALIZATION AND ITS INFLUENCE ON THE BUSINESS MODEL

In this section, we provide an overview of the digitalization of industrial companies and highlight especially the I4.0 and servitization concept. Furthermore, changes of the business model due to I4.0 and servitization are explained.

2.1 Industry 4.0 and servitization

I4.0, also known as *fourth industrial revolution*, *industrial internet of things* (Arnold et al. 2016) or *smart industry* (Metallo et al. 2018) describes how industrial companies change due to the integration of digital technologies and services. Frank et al. (2019a) describe I4.0 as "a new industrial maturity stage of product firms, based on the connectivity provided by the industrial internet of things, where the companies' products and processes are interconnected and integrated to achieve higher value for both customers and the companies' internal processes". With the aid of I4.0, companies in mature industries are able to connect machines, devices and products. This allows a quick and flexible adaptation to changes on the market. (Frank et al. 2019a; Wei et al. 2017)

There are a few technologies that build the basis for I4.0: Internet of things (IoT), cloud services, big data and analytics (Frank et al. 2019b). IoT means

the “integration of sensors and computing in an internet environment through wireless communication” (Tao et al. 2018). Cloud services allow the storage of data by an internet provider that enables an on-demand access to them. IoT and cloud services together have the possibility to collect a vast amount of data, which results in Big Data storage, where data is gathered from different sources (systems, objects) and builds the basis for digital service offering. Together with analytics (e.g. data mining, machine learning), important information can be retrieved that may be a source of competitive advantage. (Frank et al. 2019a; Frank et al. 2019b; Porter & Heppelmann 2015)

The I4.0 concept changes the role of the human being in the production process, allows a flexible adjustment of production lines, enables an information exchange and integration along the supply chain and increases the implementation of digital technologies in products to smart, connected products (Porter & Heppelmann 2015). Smart, connected products enable companies to gain data that provide new information about customers, their demands, and so on. This data can build the basis for a competitive advantage. Therefore, companies need the capabilities in data analytics, that develop new business functions within the organization.

Smart, connected products and the possibilities that arise from the newly available data require companies to transform across the whole value chain. This affects product development (e.g. rethinking of the product design, integration of software and hardware, integration of service components), manufacturing (smart, connected products go beyond the production of physical products), logistics (tracking of products), marketing and sales (e.g. data gathering about product use and customer preferences, development of tailored services), after-sales activities (preventive, proactive and remote services) and also human resources (e.g. new skills are required). (Porter & Heppelmann 2015)

Digital technologies enable companies to offer digital services, like remote monitoring, big data or predictive analytics. Thus, industrial companies are able to gather data about customer needs and “provide new hybrid services for the clients”. (Frank et al. 2019a) With servitization, the company’s’ business model transforms from a “product-centric to a service-oriented business model”, offering a so called product-service-system (PSS) (Kowalkowski et al. 2017). Various classifications of servitization exist in the

context of I4.0 - from complementing the physical product with services, having a low level of digitalization (e.g. maintenance, training, technical support via apps), to services with a high level of digitalization that substitute the transaction of the product with a service (e.g. pay-per-use model) (Frank et al. 2019a). Due to the increasing digitalization and share of services in the value proposition, a change of the business model becomes necessary, as several aspects (e.g. revenue model) have to be changed as well. This is explained in the next section.

2.2 Business model innovation based on Industry 4.0 and servitization

Following the definition of Teece (2017), "a business model describes an architecture for how a firm creates and delivers value to customers and the mechanisms employed to capture a share of that value". Due to the origins of the business model topic in different scientific disciplines, there is no uniform definition of this concept to date. Despite the diverse understandings of the business model, elements like value proposition, value creation and value capture developed toward the main elements when discussing business models (Rachinger et al. 2019).

With the emergence of the Internet and eCommerce, companies from the "old economy" tried to integrate aspects of eCommerce into their traditional business models, thereby changing their existing business model (Zollenkop 2006). Thus, the business model has become a source of innovation and competitive advantages.

The opportunities that digital technologies provide for the business model includes "the entire process of value creation and appropriation" (Langley et al. 2020). The share of software and services in the business model will continue to increase, whereas the share of mechanics and hardware in the value of the overall product will decrease. Internal and external processes and interdependencies are affected by a change or reconfiguration of internal capabilities, pricing models, revenue models, as well as cost structures and also how the company collaborates with external partners. This enables complete new business models in terms of value propositions, value creation and value capture (Burmeister et al. 2016; Geisberger & Broy 2012; Kiel et al. 2017; Langley et al. 2020; Paiola & Gebauer 2020; Porter & Heppelmann 2015).

The *value proposition* is changing more and more towards the provision of individual products and services or a combination of them as a solution package. This requires companies to gather and analyze data to enhance the offering. The *value creation* changes towards being more cooperative and customer centric. I4.0 provides a platform that facilitates cooperation with external partners thereby leading to the emergence of business ecosystems. An important aspect is to find a distribution of earnings between market participants, which results in a change in *value capture*, the revenue model in the business model. Existing payment models are changed, or new ones are created (e.g. “pay per value”, “pay per hour”) (Fraunhofer IPA 2014).

Depending on the intensity of changes conducted in the different elements, business model changes can be incremental adaptations or a radical business model change. The business model is *enhanced* if IoT technologies are used for services of the companies’ products (e.g. maintenance). Thus, the company is able to differentiate from competitors and provide a better customer experience through content, information insight and engagement. Furthermore, the business model can be *extended* by using IoT technologies that provide new services in order to increase the efficiency of customer’s products and services (e.g. preventive maintenance, spare parts optimization). Companies develop from a transactional approach towards a relationship-based approach in order to provide the end-user the appropriate services. The most radical change encompasses a *redefinition* of the business model, where the company changes the value proposition in such a way that IoT technologies are used to support customers in reaching a specific business outcome (e.g. Overall Equipment Efficiency). Physical products and services are replaced by digital elements or fully integrated value by combining the digital and physical elements and thus, generating new revenues. (Bauernhansl et al. 2015; Berman 2012; Paiola & Gebauer 2020)

3 CASE STUDY – DIGITALIZATION AT ATM RECYCLINGSYSTEMS

The case study describes how the company ATM Recyclingsystems implements the IoT platform and transforms towards a service-oriented provider.

2.3 ATM Recyclingsystems and t-matix

ATM stands for Arnold Technology for metal recycling. The company has more than 80 years of experience in metal-recycling systems and is a leading company of the ASCO Group. ATM engineers, plans, produces and services metal-recycling-systems for the treatment of secondary raw materials. The basis of the integrated solutions is ATM`s market leading engineering knowledge, the in-house-production of recycling machines and the worldwide spare parts and service support. The companies' mission is to develop long-term relationships with their customers and supply the best technology and service solutions to contribute to the customers' success.

t-matix offers an IoT platform with which IoT applications can be implemented without the need for programming. Leading companies in various industries rely on the t-matix IoT platform to digitize their products, develop new digital services, and innovate their business models. The modular principle of the platform enables the professional implementation of tailor-made applications and significantly shortens the implementation time as well as the market launch of IoT solutions.

2.4 Implementing an IoT Platform at ATM

The purpose of the project was to support ATM Recyclingsystems with the t-matix IoT platform in their digitization process. ATM intended using an IoT platform that is oriented towards the customers' requirements, responds flexibly to change requests, and covers powerful application enabling functionality. With this platform, the company intends to pursue its mission to provide its customers with products that have maximum efficiency and optimal cycle times. Aligned with this overall objective, t-matix implemented an IoT portal and a mobile app for visualising the parameters of the recycling machines, as well as monitoring and evaluating the machines' operating data.

An implementation of an IoT platform requires three areas: the portal infrastructure, the user concept or structure of the portal, and the desired portal design. In the portal infrastructure, the technical requirements as well as the data acquisition from the machines, devices, interfaces, other data sources, etc. are specified. The user concept determines the portal structure with the individual authorization structures, authorization groups

and required functions. The design module ensures that the IoT portals are implemented according to the corporate design of the customer. Companies have different requirements regarding data storage. A distinction is made between the cloud variant, the on-premise variant and the hybrid variant. The cloud solution was realized with an own ATM instance reachable under a specific domain. Within the instance – an instance is a customer installation where the data is physically separated from each other – ATM has the possibility to create additional portals (individual customer portals with individual functionality and design).

2.5 Added value for ATM and its customers

The implemented IoT platform generates value for both ATM and its customers. Due to the new platform and thereby the connectivity of devices and machines, ATM is able to generate valuable data. The company can determine how customers use the products, which error messages will occur, how heavy the load on the machines is and whether maintenance is carried out on time. These data provide important information for the company in terms of product innovation and product and service improvements. Overall, ATM can offer new digital services (Smart Services) with the IoT portal as well as the app. Subsequently, these services are explained in slightly more detail.

- *Remote monitoring:* The user gets an overview of the current/last status of the selected machine. The last received data for the defined parameters are displayed in the report as well as operating data and static master data for the machine. In addition, all important information regarding remote monitoring will be displayed, e.g., oil temperature, cycle times, mode, operating hours, production in pieces, etc. Furthermore, the response time to fix occurring errors on the machines will be presented. Via the app, the user receives push notifications in case of an error on the machine. Warnings can also be set via the app.
- *Productivity measures:* The user has the possibility to compare different machines to each other concerning operating hours in automatic mode and total produced pieces. A pivot table will be displayed showing the daily aggregated data for operating hours and pieces. Furthermore, a bar chart for operating hours as well as for pieces will be displayed for the user.

- *Maintenance intervals:* The user is presented with an overview of the services and due dates for services on the selected machines. The user selects the required machines and a table is displayed informing them about the last and next service date as well as the hours until the next service, the service interval, and the total operating hours of the machine. These values are based on the values of the yearly service which needs to be carried out for each machine.
- *Wear parts documentation via App:* The user has an overview on when the last wear parts service took place and which parts were maintained or replaced during the last service. Furthermore, the user can start the documentation of a wear parts service on the machine directly from that screen. When a user does a wear parts service on the machine, the maintained parts should be documented via the app. The user can select the desired machine type by clicking on the "start wear parts service" button. After finishing the documentation, the list is sent to the portal.

2.6 ATM's business model innovation through servitization

ATM is changing and expanding its business model and is tapping new revenue streams through servitization. The servitization strategy allows the company to shift from selling a product to selling an integrated product/service offering. Regarding value proposition, ATM is now offering its customers a digitally enriched product by means of value adding digital services. With the IoT portal and the mobile app, customers of ATM can operate the recycling machines more productively and in a more resource-saving manner. Through maintenance and wear parts management, machine uptime is enhanced. In terms of value capture, ATM is monetizing these newly created digital services via monthly subscription resulting in a new recurring revenue stream for ATM. The partnership between ATM and t-matix provides the basis for value creation, as the newly created digital services are enabled by the IoT platform.

4 CONCLUSION

The transformation towards I4.0 and increased servitization changes the business model of industrial companies. Companies can use digital technologies to enrich their business model by adding digital services to traditional product offerings. In its most distinctive form, the business model is

redefined – companies transform from product-oriented to service-oriented providers. With the case study of ATM Recyclingsystems and implementing the IoT platform from t-matix, we have shown how a traditional recycling machine manufacturing company transforms into a service-provider that offers its customers smart services in terms of productivity measures, maintenance intervals or wear parts documentation via App, for example. In turn, ATM is able to generate valuable data to determine machine usage, errors and maintenance cycles. This further helps the company to innovate and offer new products and services.

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