Equipment-as-a-Service – Necessary Changes for Service-Based Business Models

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ABSTRACT

Equipment as a Service (EaaS) business models have a usage or outcome based value proposition. To convince customers from the reliability of the EaaS offer trust mechanisms should be applied. Those trust mechanisms are manifold, based on technical-, organizational- or insurance-oriented solutions which usually are suitably combined with the focus on the customers' needs and requirements. For many traditional machine builder and factory suppliers those trust mechanisms pose many challenges. Therefore cooperations are brought to life which connect business partners from different disciplines and complementary offers, i.e., technology providers such as IT, (I)IoT, telecommunication, sensory and AI as well as insurances and banks. Thus, when creating and delivering an EaaS business model a service vendor has to face substantial changes. This work focuses on elaborating and showing the necessary changes in organizations who head towards newly built or improved EaaS business models whilst considering to increase the customers' trust in the service offerings and the building up of cooperative structures. To identify the necessary changes, a literature review has been conducted which led to a taxonomy of changes with five core topics. This was evaluated with companies which aim to add a value-based business model to their traditional transaction-based business model. The results of the literature review and the qualitative evaluation of the taxonomy are presented in this publication.

Keywords: Equipment as a Service (EaaS), Everything as a Service (XaaS), Value proposition, Risk, Change

EVERYTHING AS A SERVICE (XAAS) IN THE MANUFACTURING INDUSTRY

Everything as a Service (XaaS) is the paradigm in which all resources of an ecosystem are offered as services (Riasanow and Krcmar, 2020). If this approach is applied in the manufacturing industry with physical goods such as machines or equipment, we talk about Equipment as a Service (EaaS) (Stojkovski et al., 2021). Depending on the value proposition of the EaaS, a distinction can be made between availability, utility, outcome and

success-based EaaS business models. In availability-based EaaS business models, the value proposition consists of the availability of a service with defined performance standards, with the billing parameter being the time in which it is made available. Usage-based value propositions have an identical value proposition, with the billing parameter being the usage intensity of the equipment. In outcome-based EaaS business models the value proposition consists of the production of an outcome of a defined quality. The billing parameter here is the amount of outcome which meets the defined quality. The value proposition of success-based EaaS business models consists of the economic advantage that the service user receives when he cooperates with the service provider. For example, the cooperation could result in a higher process efficiency, which is linked to an economic metric that also represents the billing basis for the service provider (Roth and Stoppel, 2014). At the core of these value propositions there are different risks that are transferred from the service user to the service provider. However, in order to be able to adequately assess the various risks, many traditional production companies do not have the necessary resources and competencies (Schuh et al., 2015). That's when strategic partnerships, in particular with banks, insurance companies (Stojkovski et al., 2021) and IT vendors (Relayr GmbH, 2022) become necessary.

EQUIPMENT AS A SERVICE (EAAS) – RISKS AND PARTNER

The risk transfers associated with an EaaS business model can be differentiated into:

- **Investment risk**: The service provider must secure the financing of the equipment. He has to bridge the initial income gap resulting from the lack of one-off payments from traditional equipment sales (Lah, 2016) and also has to take the risk of insolvent customers.
- **Availability risk**: The service provider must maintain the agreed availability level of the equipment.
- **Market risk**: The less orders the service user receives the lower the utilization of the equipment is, which forms the billing basis for the service provider.
- **Process risk**: Incomplete or incorrect processes on the side of the service user lead to inefficient operation of the equipment (Roth and Stoppel, 2014).
- **Quality risk**: The service provider guarantees a certain quality of the outcome of the equipment.
- **Value risk:** If the billing basis of an EaaS business model is linked to the economic success of the service user, the service provider takes a part of the business risk from the service user, since, for example, company profits can fluctuate over time.

These risk transfers represent the core of the value proposition of an EaaS business model (Stich et al., 2022) with increasingly more risks being transferred to the service provider from availability-based to success-based

business models. While the service provider takes the investment and availability risk in availability-based EaaS business models, he also must take the market risk in usage-based EaaS business models. If a outcome-based EaaS business model is pursued, the process risk and the quality and productivity risk are also becoming part of the responsibility of the service provider. In success-based EaaS business models, the service provider also takes part of the service user's value risk (Roth and Stoppel, 2014). These risks can be lowered with the use of appropriate strategic partnerships. While a strategic partnership with banks can help bridging the initial income gap and thus reduce the investment risk (Stojkovski et al., 2021), insurances can not only help the service provider to cushion their risks but also to identify unproductive customers (Stich et al., 2022) and thus better assess the market and value risk. Further partnerships in the IT sector play another key role as service providers can reduce the quality and productivity risk as well as the availability risk, for example, by analyzing equipment data. The results of the analysis then form the basis for further optimizations, which can reduce the process or availability risk (Monitor Deloitte, 2021). To deliver the promised value, the service provider needs to continuously monitor the data of the equipment and evaluate the results produced by it (Dorka et al., 2017). As the risk transfers and thus the value proposition of an EaaS business model increase, more data must be transmitted to the service provider. Figure 1 shows the different types of EaaS business models, the associated risks, and the potential benefits of different strategic partnerships.
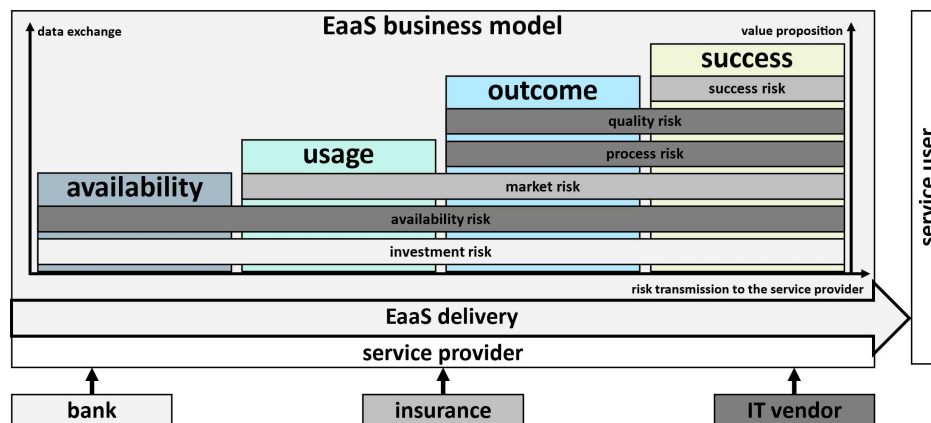

Figure 1: Different types of EaaS business models, risks and support through strategic partnerships. Modified from (Evcenko et al., 2022).

To convince the customer of the performance of the EaaS business model and to build up trust, a service vendor can express the value proposition as performance guarantees or via service level agreement (SLA). While strategic partnerships with banks, insurances and IT vendors can help the service provider to reduce EaaS related risks, certain technical and organizational conditions must be met in the company of the service vendor, for him to be

able to offer and deliver an EaaS business model initially. If a service vendor is used to offer only transactional business models so far, he is faced with substantial technical and organizational changes, which is the focus of this work.

METHOD

To identify the organizational and technical need for change we want to answer the research questions summarized in Table 1.

Table 1. Overview of the research questions.

RQ 1: Which peculiarities arise when developing the configuration of an EaaS offer?
RQ 2: Which technical and organizational needs for change exist for companies who want to deploy EaaS?
RQ 3: Which role do strategic partnerships with banks, insurances and IT vendors play when considering the technical and organizational needs for change?

To answer these questions, we first conduct a literature review. Based on this we define a procedure for developing EaaS which consists of three phases and to which we assign five core topics of change. This serves as taxonomy of changes. Following this we conduct workshops with 7 small and medium-sized enterprises (SME) from the field of mechanical and plant engineering to evaluate and specify the taxonomy with more detail. The companies are manufacturers of wearables for recording process steps in the manufacturing industry, small and larger machine components, location infrastructures and providers of holistic logistics solutions. In the workshops for each company at least one person representing the business and one person representing the technical view of point is present. A workshop consists of three individual sessions, while each sessions lasts around 120 minutes and focuses on one specific phase when developing an EaaS business model. Between the sessions there is a break of one to two weeks so that the companies can clarify questions which could not be answered during a session.

THREE PHASES TO DEVELOP EAAS AND FIVE CORE TOPICS OF CHANGE

Based on findings from the literature review we identify three phases when developing EaaS. Using these phases, we then define a taxonomy of changes, consisting of five core topics.

Target Group Orientation

EaaS focuses no longer on selling the equipment but on the associated value propositions of availability and/or results (Uhlmann and Meier, 2017). If the value propositions are fulfilled by the service provider and the user's needs do not change, more sustainable and intensive customer relationships are

established, compared to the traditional sale of the equipment. EaaS consists of physical and digital service components (Schöllhammer et al., 2020), such as a machine and a related predictive maintenance application as well as usage-based billing, as it is common in XaaS business models (Henzel and Herzwurm, 2018). It therefore requires profound knowledge of the **target group** and its needs to configure the value proposition in the best feasible way, especially if the conditions, in which the EaaS is used, change permanently. This is the only way to create an offering that meets the increasing and more and more complex customer needs (Kolagar et al., 2022) without being cancelled by the customer beforehand.

EaaS and Its Delivery

The **EaaS configuration** consists of the equipment associated with it, the services required for EaaS delivery, such as onboarding or support, the digital service components required for the equipment access such as digital tools and the value propositions associated with it (Monitor Deloitte, 2021). In addition to an (I)IoT connection (Relayr GmbH, 2022) of the equipment, technical structures like IT systems and IT infrastructure must also be implemented. With that the equipment can be monitored and controlled (Dorka et al., 2017) as there will be contractual penalties if the value propositions are not fulfilled, as it is common with SLA (Kohne, 2018). In addition, EaaS comes along with changes of the organizational **internal structures**, which, for example, take care of the integration of the EaaS into the service user's organization with the goal of efficient service delivery (Schnaars et al., 2022) by providing appropriate human resources. Since different, special competencies are absolutely necessary for EaaS provision and optimization and since these are normally not present in a company (Herzog et al., 2017) or cannot be built up on the short run (Farhadi, 2019), cooperations with appropriate partner companies are a promising option (Kolagar et al., 2022) to compensate these deficits. With the establishment of **co-operative structures**, the above-mentioned strategic partnerships with banks, insurances and IT vendors emerge.

Benefit and Pricing Model

The design of the pricing model for subscription-based business models such as EaaS (Stojkovski et al., 2021) is complex, so that the **benefit** of the EaaS, like the availability of the equipment (Schuh et al., 2019), must be taken into account when defining the **price**. At the same time, however, the operating cash flow must also be included in the calculation, which requires a change in previously applied application systems due to smaller, recurring payments, especially for service providers with high-priced equipment (Stich et al., 2022). Finally, the risk transmission to the service provider and participating partners, such as the transmission of the market risk, play a key role when calculating the price.

core topic	target group	EaaS configuration	internal structures	co-op. structures	benefit and price
development phases	1. Target group orientation	2. EaaS and its delivery			3. Benefit and pricing model

Figure 2: Three phases for developing EaaS and five core topics of change.

KEY RESULTS

The following is a qualitative summary of the key findings (KF), resulting from the workshops based on the three phases for developing an EaaS business model and the five core topics of change described above.

Target Group Orientation

Companies with an already functioning, transactional business model possess a sound understanding about their target groups and can define their EaaS value proposition clearly. In contrast, companies that want to define an EaaS offering from scratch, especially with target groups that are yet not known very well, find it difficult to work out their value propositions. A **profound understanding of the user (KF 1.1)** is necessary for a demand-oriented adaptation of the EaaS for most of the target groups. Compared to transactional business models in EaaS the customer relationships last longer but can also be cancelled easier due to a shorter contract period. While the equipment of an EaaS offer can remain unchanged in many cases or undergo only marginal modifications, **knowledge of the pains and gains of the user groups (KF 1.2)** means that the services, digital tools and value propositions associated with the EaaS offer can be specifically configured for the interests and the "jobs to be done" (Christensen et al., 2010) of a user group by means of product accompanied services, guarantees and SLA and adapted over time to the constantly changing needs. With this, **new user groups (KF 1.3) can be identified**, both in already targeted but also in until now untargeted companies.

EaaS and Its Delivery

The second phase is divided into the EaaS configuration, the internal and the co-operative structures.

EaaS Configuration

When defining an EaaS offer, the companies with an existing and functioning business model and a profound understanding of their target groups were also able to clearly name the EaaS configuration. They were thus able to **develop extensive services around the equipment (KF 2.1)**, adapted to the different companies and user types. These include configuration services, assistance systems and maintenance services. As the service vendor takes over certain risks and responsibilities the service user loses control over the equipment. Therefore, **trust should be built through performance guarantees (KF 2.2)** and **transparency about their fulfillment through monitoring (KF 2.3)**. **Supporting digital tools (KF 2.4)** have been detailed for both customized services and transparency in EaaS delivery, which include access to

the equipment. In line with the vaguer notion of the target audience, the companies that wanted to define an EaaS offer from scratch were able to name the elements that belonged to it, but not in detail. What all the companies had in common, however, was that the **new potential arising from integration with other EaaS offerings within an EaaS service value network (KF 2.5)** enabled new design options for their own EaaS offer. For example, the integration of multiple EaaS services could be as follows: While one EaaS service records the movement of a worker's manufacturing activities in the production process, the second transmits the location data of the semi-finished products to a third EaaS service, which preconfigures a system to suit these semi-finished products that are soon to be processed.

Internal Structures

In terms of internal structures, a distinction must be made between technical (**T**) and organizational (**O**) measures required for the delivery of an EaaS offer. While here, too, the companies with a functioning business model have at least partially implemented an **(I)IoT connectivity of the equipment (KF 3.1)**, all companies were still at the beginning when it came to the digital **support of administrative processes** such as licensing or billing and their **integration into existing IT systems (KF 3.2)** of the service user like an enterprise resource planning system (ERP system). However, both the connectivity and the necessary digital tools are prerequisites when it comes to the controlling of the equipment or delivering further services such as predictive maintenance. Furthermore if an EaaS should be integrated into a **service value network**, it also needs to be **integrated technically (KF 3.3)** through defined interfaces and data formats. The organizational measures reflect this. For example, all companies had structures for sales, support and financing of an EaaS. However, these structures were not scalable. Thus, in the event of greater demand for the EaaS offering, **scalable structures (KF 3.4)** will be needed that focus, for example, on changing the sales incentive structures or the creation of dedicated positions for EaaS product management and development. Finally, prerequisites must be created to **coordinate** and administer the **organizational integration of the EaaS offering into a service value network (KF 3.5)**. As the EaaS offering scales up, the question of how to finance the organizational and technical measures required for the EaaS delivery must also be answered anew.

Co-Operative Structures

If a company cannot or will not fulfill the prerequisites for developing or delivering EaaS within its organization, it can enter strategic cooperations with banks, insurance companies or IT vendors. Those companies that had not yet implemented an (I)IoT connectivity to their equipment can benefit from **cooperations with IT vendors (KF 4.1)** that are able to, for example, provide them with this connectivity or with digital tools necessary for monitoring or billing or they can support them when integrating their EaaS offer into existing systems like ERP systems. However, as soon as the scaling up of the EaaS offering becomes relevant, all companies would need to seek out to appropriate partners: **banks for financing, insurances for a better assessment**

and hedging of market and value risks and IT vendors for scaling up existing IT systems and IT infrastructure (KF 4.2).

Benefit and Pricing Model

In line with their precise ideas about their target groups, some companies were able to describe the benefits and price model of their EaaS offering in concrete terms for each company and user group. This was not easy for those companies without a clear understanding of their target audience and the value their EaaS offering should provide. In general, **new incentive mechanisms were identified as a means of controlling usage behavior (KF 5.1)**, since, for example, careful equipment usage is reflected in a lower price. It became clear that the **new value propositions provided with an EaaS offering require new pricing models (KF 5.2)**. These are not only dependent on production costs, margins or the risks transferred to the service provider. Here **new methods for pricing are required that consider the service user's usage assessment (KF 5.3)**. By transferring the availability and market risk to the service provider, he must assess the usage intensity and frequency to be able to take this into account when calculating the price.

NEED FOR CHANGE

With the workshops we evaluated the three phases for developing EaaS and specified the five core topics of change. The findings complete our results from the literature review and can be seen as success factors for a service vendor who wants to offer EaaS. They are summarized in Figure 3.

target group	EaaS configuration	internal structures	co-op. structures	benefit and price
•**KF 1.1:** Profound understanding of the user •**KF 1.2:** Knowledge of the pains and gains of the individual user groups •**KF 1.3:** Identification of new user groups in already and until now not targeted industries	•**KF 2.1:** Development of extensive services around the equipment •**KF 2.2:** Build up customer trust through performance guarantees •**KF 2.3:** Transparency about the fulfillment of the guarantees through monitoring •**KF 2.4:** Develop supporting digital tools •**KF 2.5:** New potential from integration into a EaaS service value network	•**KF 3.1:** (I)IoT connectivity of the equipment **(T)** •**KF 3.2:** Digital support of administrative process and integration in existing systems **(T)** •**KF 3.3:** Technical integration into service value networks **(T)** •**KF 3.4:** Scalable structures for sales, support and financing **(O)** •**KF 3.5:** Coordination of the organizational integration into service value networks **(O)**	• **KF 4.1:** If technical prerequisites shall not be fulfilled, entering strategic partnerships with IT vendors can be an alternative • **KF 4.2:** When scaling up EaaS, cooperations with banks (financing), insurances (risk assessment) and IT vendors (scaling up IT systems and infrastructures) become neccessary	•**KF 5.1:** New incentive mechanisms as a means of controlling usage behaviour •**KF 5.2:** New value propositions require new pricing models •**KF 5.3:** New methods for pricing which take into account the user's usage assessment
1. Target group orientation	2. EaaS and its delivery			3. Benefit and pricing model

Figure 3: Need for change when developing and delivering EaaS.

As Table 2 shows, the key findings can be used to answer the research questions.

Table 2. Overview of the research questions and assignment of the key findings.

RQ 1: Which peculiarities arise when developing the configuration of an EaaS offer? – The knowledge of the target group is key (KF 1.1-1.3) as it is the base for a suitable EaaS configuration – equipment, extensive services, digital tools, guarantees and a possible integration into a service value network (KF 2.1-2.5) – which is the base when defining its benefit and price (KF 5.1-5.3).

RQ 2: Which technical and organizational needs for change exist for companies who want to deploy EaaS? – The equipment connectivity, digital support of administrative processes and the technical integration into existing systems and service value networks are technical prerequisites for EaaS (KF 3.1-3.3). Organizational need for change arises when considering scalable structures and the coordination of the integration into service value networks (KF 3.3-3.5).

RQ 3: Which role do strategic partnerships with banks, insurances and IT vendors play when considering the technical and organizational needs for change? – If a service provider cannot/will not fulfil the technical prerequisites or wants to scale up his EaaS offering in general, strategic partnerships become necessary (KF 4.1-4.2).

CONCLUSION

In this work we identified both a taxonomy of changes for EaaS business models and a procedure for the development of EaaS consisting of three phases which we assigned to the elements of the taxonomy. We then evaluated and specified this taxonomy of changes based on multiple workshops. The key findings from the workshops result in several organizational and technical need for change, which can be seen as success factors for a EaaS service vendor. The next step would consist of the design of a cross-phase methodology that allows the creation of EaaS business models in a methodologically structured manner.

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