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EQUIPMENT USERS' EXPERIENCES OF A MANUFACTURER'S SMART SERVICES

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ABSTRACT

Purpose: The use of a manufacturers' equipment and industrial services is dependent on the users' readiness and capabilities. In a business-to-business context, different users may have different experiences with intelligent product features and related smart services, and the experiences need to be understood, when a manufacturer develops and delivers its industrial services. The goal of this study is to identify user experience patterns concerning intelligent product features and related smart services for industrial equipment. The focus is on the early phases of adopting the intelligent product features and related smart services.

Design/Methodology/Approach: A qualitative case study was implemented with two customers of a machine manufacturer. Data were collected through interviews, and user experiences were analysed concerning intelligent features, services, and the service supplier.

Findings: The cross-case analysis reveals that all users do not experience benefits from intelligent features and related smart services. Four different user experience patterns are reported: feature-centric, competence-centric, development-oriented, and decision-oriented.

Originality/Value: The study adopts a users' perspective to industrial services, thereby offering a more nuanced idea of customer experiences and potentially explaining why digital servitization proceeds slowly within customer firms.

KEYWORDS: Smart services, Equipment users, Customer experience, User experience, Digital servitization, Intelligent technology

1. INTRODUCTION

Manufacturing firms offer industrial services with an intent to create value for and with the customers and to gain business benefits for themselves. Research on industrial services and digital servitization tends to concentrate on the manufacturer's (i.e., supplier's) perspective to smart services and their enablers (Klein et al., 2018). While also the importance of customer-centricity has been acknowledged (Kamalaldin et al., 2020), the customer's role is treated primarily as something that the manufacturer has to consider (Abrell et al., 2016), instead of treating customers as the actual research focus. Business customers tend to include multiple different individuals in service procurement and use, and there is a need to understand the users' experience, when the manufacturer develops and delivers its services. Therefore, there is a need to distinguish between customer and user views. Customer represents the view of the organisation and especially its decision-making function responsible for buying the equipment in question, whereas users are the individuals who lead the equipment-related processes and operate the equipment in practice (Abrell et al., 2016; Mora & Johnston, 2016). This study concentrates on equipment users' experiences in connection with intelligent technologies and related industrial services.

User experience is among the key dimensions of managing digital product and service innovations (Nylén & Holmström, 2015), and it has become a top objective for managers to create a strong customer experience (Lemon and Verhoef, 2016). Abrell et al. (2016) point out the necessity for identifying the individual users as representatives of the customers and distinguishing them from the buyers, to understand the customer's needs and experiences toward digital innovations. As the importance of customer experience dimensions varies between different functional units (Witell et al., 2020), the actual users' experience cannot be understood by studying the customer firm or buyers only. Manufacturers will need information on the users' experiences in developing and delivering industrial services, but they may struggle to discover their latent needs.

This study is motivated by the need to understand equipment user's experiences in adopting intelligent product features and related smart services. Smart services are activities that the supplier carries out on customer's behalf by collecting and analysing data facilitated by intelligent technical systems (Klein et al., 2018). Equipment connected with information and communication technologies include intelligent features such as automated functionalities, safety measures, sensing environmental factors, and measuring production outputs and they, in turn, may enable various smart services. This emphasises the importance of user experiences as many of the service benefits stem from process improvements or changes from which only the users have first-hand knowledge. Understanding the intelligent features and related smart services and their possibilities necessitates deep, embedded, and tacit knowledge of the customer's processes and work practices.

The goal in this study is to identify user experience patterns concerning intelligent product features and related smart services for industrial equipment. The main research question is: How do equipment users experience the intelligent features and smart services associated with an equipment manufacturer's technologies? We intend to offer new information to guide industrial smart service development so that it acknowledges users' patterns of equipment use. The focus is on industrial business-to-business settings, and business-to-consumer contexts are purposely excluded. Moreover, the study focuses on early experiences of customer firms adopting intelligent product features and smart services, as opposed to more established experiences.

2. THEORETICAL BACKGROUND

2.1 User Experience as Part of Customer Experience

Customer experience has grown to be an important topic both for practice and research (Becker & Jaakkola, 2020). It is often viewed from a marketing perspective, as customer's responses to a supplier's stimuli (Becker & Jaakkola, 2020). Experiences are individual by nature, but they are influenced by personal expectations as well as corporate goals and requirements, and they are shared with others through interaction (Mora & Johnston, 2016). Experiences can also be viewed from the supplier's perspective (Mora & Johnston, 2016), often in terms of how a supplier can manage the customer experience. For example, some studies explore how the manufacturer can leverage information about the customers and their experiences in its operations (Abrell et al., 2016). The majority of customer experience studies takes place in business-to-consumer contexts (Witell et al., 2020) and research is still fragmented (Becker & Jaakkola, 2020). Few studies concentrate on customer experience in a business-to-business context (Lecoeuvre et al., 2021; Roy et al., 2019) and smart services in particular (Gonçalves et al., 2020). In business-to-business contexts, customer experience is formed differently as the offerings are often more complex and multiple individuals are involved with services in different roles (Witell et al., 2020). There is a need for more research on different types of customers (Gonçalves et al., 2020).

User experience is a particular form of customer experience that focuses on the perceptions of the person that uses a product, system, or service in practice. In industrial settings users are those individuals that operate the equipment or lead the related processes (such as production or in-house maintenance) and may be the first-hand recipients of the manufacturer's products and services. Users' perspective is necessary to understand as they may oppose a procurement done by a separate purchasing unit and even seek to bypass the arrangement (Witell et al., 2020) which would result in suboptimal benefits. Users also possess the embedded, tacit knowledge of the actual use context and the usability of the products and services (Abrell et al., 2016), and the contextual variables affect how people respond to stimuli (Becker & Jaakkola, 2020). In addition to the features of efficient use and easy learning, there is a need to understand the rich user experience in terms of usability, aesthetics and engagement (Nylén & Holmström, 2015).

Some studies have investigated user experience in industrial settings, and they express the necessity to clarify the user's position and perspective. Abrell et al. (2016) emphasise that delineating users from customers is particularly important when the role of customer/user knowledge is applied in digital innovation. Accordingly, understanding the users' latent needs and work context can help to envision future needs and usability criteria, whereas customers are often unable to express long-term expectations for technology development as they are not familiar with the specific use practices (Abrell et al., 2016). People in different positions and functional units may emphasise different components of the customer experience, and there may be even multiple simultaneous customer journeys going on within one customer company during a purchase (Witell et al., 2020; Zolkiewski et al., 2017). Due to the involvement of different people, user experiences are not formed in isolation, but users and suppliers are a part of a complex network that influences and constrains user experiences (Liinasuo et al., 2016). Also, part of the user experiences are found to be mediated and based on other users' experiences (Liinasuo et al., 2016).

The emergence and formulation of user experience occurs through various touchpoints (Witell et al., 2020) or journeys (Lemon & Verhoef, 2016) where users and suppliers interact. This implies that user experience is not static – it is iterative, dynamic, and evolving (Lemon & Verhoef, 2016; Witell et al., 2020; Zolkiewski et al., 2017). It varies across the organisational levels and functions, and it is relational: in business-to-business settings, users may interact differently with the suppliers' personnel and also its partners, when the supplier attempts to serve the customer's needs (Witell et al., 2020). Some of the touchpoints can be controlled by the supplier, whereas others cannot (Lemon & Verhoef, 2016; Witell et al., 2020). As the user experience accumulates through the touchpoints, customer may assess it not only through formal aspects of supplier attributes, functional benefits, and key performance indicators, but also through situation-specific reactions, responses, and help or lack thereof. This accumulated user experience may, then, influence the business relationship over the long term (Witell et al., 2020).

2.2 Users' Experiences of Intelligent Product Features and Smart Industrial Services

Smart services are provided through embedding intelligence (i.e., awareness and connectivity) into the products (Allmendinger & Lombreglia, 2005). Some examples of intelligent features in industrial equipment include status information and diagnostics, control and automation, profiling and behaviour tracking, replenishment and commerce, and location mapping (Allmendinger & Lombreglia, 2005). Smart services can be categorised based on the supplier's and users' activity levels into interactive service, self-service, provider-active service, and machine-to-machine service (Wunderlich et al., 2012). Some studies use the concept smart product-service systems in reference to the embedded digital technologies in products that enable digital services (Zheng et al., 2019; Zhou et al., 2022). Smart services are not only defined by their technological features, but also by their multi-dimensional and interconnected nature, which requires collaborative efforts between manufacturing firms and their networks, including customers (Momeni et al., 2023) and users.

In order to benefit from smart services, users first need to acknowledge and use the intelligent features. For example, Verdugo Cedeño et al. (2018) studied Internet-of-Things technologies in farming, where users tracked operation data, equipment failure, component condition, work progress, and resource consumption. The suppliers needed to understand these user needs when developing smart services. Only through the use of the intelligent features, smart services can enable customers to improve the efficiency of operations, optimisation, and digitally-enabled functionalities (Klein et al., 2018). While smart services are assumed to improve user experience by making the user journey predictable and optimisable, the firms face challenges in reaching a superior user experience (Zhou et al., 2022). Smart services bring new features and possibilities, but customers are not necessarily willing or able to use them (Vaittinen & Martinsuo, 2019) and, thereby, may fail to benefit from the value of such services (Kamp et al., 2023). Customers may experience various barriers, such as a fear of losing control over information, unwillingness to outsource, and the supplier becoming a competitor with customers, and such barriers may hinder the progress of smart services (Klein et al., 2018).

Some research has considered user attitudes, behaviours, and new technology acceptance, when users begin to gain their first-hand experiences from the intelligent features and related services. Technology acceptance literature often focuses on the innovation features, in terms of usefulness and ease of use as key influencers of technology use. The interactive nature of smart industrial services draws attention to the users' attitudes and behaviours as responses to smart services, including the perception of control, trustworthiness, social presence, and collaboration (Wunderlich et al., 2012). A recent study on the adoption of augmented reality for industrial services identified users as a key influential category where their age, digital skills, experience, and technology acceptance level were associated with the adoption of technology (Aquino et al., 2023). One study concentrated on customers' service readiness and highlighted the interdependency between different personnel groups and levels in the customer organisation, and between the customer organisation and the supplier (Vaittinen & Martinsuo, 2019). Suppliers need to understand the different user groups' service readiness, to develop and offer suitable service solutions to them (Vaittinen & Martinsuo, 2019). User experience of smart services is mainly studied from the perspective of service design in a business-to-consumer context. Several factors are relevant in designing smart services and smart product-service systems, including interaction, expectation, enjoyment, user context, personas, and user activity journeys (Zhou et al., 2022).

3. RESEARCH METHOD

We used a qualitative embedded-case research design to study two customer firms (C1 and C2) of MechCo (pseudonym), a large international manufacturer of mobile equipment and traditional and digital services. MechCo's new equipment has intelligent features that enable various smart services, but customers may have older generations of equipment in use. Both C1 and C2 have recently acquired modern-generation equipment, selected for their unique needs and used in specific contexts. Background information on the firms is summarised in Table 1.

We carried out 28 interviews (Table 1) with production and maintenance related persons on themes concerning the equipment use, experiences of intelligent features, and experiences of and expectations toward services and cooperation with the manufacturer.

Table 1: Background information on the firms and research data

	MechCo	**C1: Customer 1**	**C2: Customer 2**
Type of business	Complex systems (mobile equipment for industrial customers) and related services	Foodstuff (business-to-business)	Logistics involving large cargo (business-to-business)
Turnover	>2 BEUR	>10 MEUR	>100 MEUR
Personnel	>10.000	<100	>500
Nr of interviews (interviewees)	(2)	15 (14)	13 (13)
Interviewees' job profiles	Background information and contacts to customers from two directors involved in service business development	Production manager Production operators (11) Maintenance technicians (2)	Operative manager Unit manager Maintenance supervisor Operators (6) Foremen (2) Maintenance technician Production planner

In the analysis, we first mapped the use experiences separately for the intelligent features, smart services, and service supplier. We also considered the context of service use (features of the customer site), to understand its potential implications on user experiences. We created a cross-tabulation of the user experiences at C1 and C2, to compare their experiences. In the second analysis step, we clustered the user experiences according to their dominant pattern into feature-centric, competence-centric, development-oriented and decision-oriented user experience.

4. FINDINGS

4.1 Users' Experiences of Intelligent Features, Services, and the Service Provider

The two customers differ in their conditions of using the equipment and their intelligent features, and also their user experience patterns, as summarised in Table 2. We analysed the users' experiences of the intelligent features, services, and the equipment and service supplier.

Table 2: Cross-case comparison of use context and user experiences

	C1 experiences	**C2 experiences**
Use context	- Inside; light loads - Single location, lightly complex floorplan - No direct customer contact - One piece of equipment, with multiple users, in two work shifts - Hygiene requirement in core production - Fairly low use frequency for the use of the equipment - Users vary in the length of experience with using the equipment (many have just a short experience)	- Outside (susceptible to weather conditions); heavy loads - Multiple locations, dynamic context - Direct customer contact - Multiple pieces of equipment at the site, each with a single user in two shifts, user location rotates among equipment - Extreme safety requirements and risks at the site - High intensity for the use of the equipment (but varying) - Interviewed users were very experienced in equipment use
Experiences of intelligent features	- Low to medium use - Usability perceived as good - User induction necessary - Strengths: safety, ergonomics, efficiency, ease of use - Challenges: requires location-specific programming (not always done during equipment installation); automated features slightly slower than manual; variety in the use of the features, depending on operator	- Low use - Both old and modern equipment are in use, and old equipment do not have intelligent features - Intelligent features are not considered as relevant to work; operators prefer the sensation of control that they have without using the intelligent features - Strengths: good for equipment lifecycle, safety - Challenges: Experienced users do not perceive the need to use intelligent features; Loss of control for operators
Experiences of services and supplier	- Managers are aware of the supplier and services; equipment users are not. - Basic services function well and are appreciated (pre-sales consulting and information provision, installation, maintenance, technical problem solving). - Smart services would become useful, if volumes were higher. E.g., speeding up maintenance cycles, monitoring of production-related data.	- Managers are aware of the supplier and services; operators connect with them in basic spare parts and acute corrective maintenance tasks. - Basic services and ongoing cooperation with the service provider function well and are appreciated (pre-sales consulting and information provision, installation, maintenance, technical problem solving). - The slow spare part delivery due to the availability of parts (from third parties) is sometimes a problem. - Smart services would be interesting for managers, particularly from the perspective of business tracking. - Training and induction for intelligent features needed also later than during equipment purchase.

The findings portray intelligent features from the users' perspective as mechanisms to promote efficiency, better safety at the site, and increased user ergonomics. Whereas some operators in C1 used the intelligent features actively, all operators in C2 preferred manual use, even if some of them had experimented with the intelligent features during and after their equipment training. General services concerned basic trainings, installations, and maintenance, but also some smart services were offered by the supplier for accumulating real-time process knowledge, awareness of operator's competences, and performance in equipment use. Interviewees in both customer firms expressed that they were not very interested in smart services, even if they were partly already available.

There is a clear difference between the experiences of operators working with the equipment and managers involved in planning and purchasing the equipment and leading the operators' work. In C1, only the managers had visibility toward the services and equipment supplier, whereas operators did not speak much about services and the supplier at all, even when prompted. In C2, also operators were in touch with the services (when requesting acute maintenance and spare parts), whereas managers spoke about them primarily from the perspective of the contract and the negotiation process.

Users identified additional expectations toward service supplier's basic services and intelligent technology features, but not so toward smart services. While the experiences and expectations concerning the intelligent features and smart services were largely similar between the two customers, especially the expectations toward basic services and supplier's operations differed significantly between their operating contexts, due to the unique features of the customer site (inside vs. outside and indirect vs. direct customer contact). C2 interviewees explicated the urgency of some service needs, due to the direct customer involvement and significant cost effects of any delays in operations.

4.2 Four Types of User Experience Patterns

The interviewees pointed out various safety-enhancing, efficiency-enhancing, and efficiency-reducing properties of the intelligent features and smart services, and the need to integrate them with existing systems. We clustered the interviewees into four user experience patterns, depending on their dominating type of user experience. While many interviewees did not experience smart services as necessary or even interesting, the smart service features appeared as partly relevant for the customer firms' business.

Feature-centric user experience. The majority of operators especially in C1 explicated such user experiences that dealt merely with the intelligent features of the equipment. The operators did not acknowledge services or the service supplier separately, since they were not in direct contact with them. In that way, their user experience and connection to potential smart services stemmed only from the use or knowledge of the intelligent features. It depended on the operator's personal preferences and competences whether they in fact used the features or not.

Competence-centric user experience. The majority of operators in C2 and some operators and maintenance people in C1 preferred the manual use of the equipment (that is, not using the intelligent features at all). They appreciated the possibility to maintain their control over the equipment, despite knowing about the intelligent features. They also had some first-hand connection with the services and service provider. They were very experienced operators who understand the significance of their own competences in the demanding and varying conditions of equipment use.

Development-oriented user experience. Some individual operators and some maintenance technicians in both firms had had a chance to participate in the procurement of the equipment (in C2, the newer equipment). Consequently, they had a broader experience of the intelligent features and at least some connection with the (possible) services and service provider. During the procurement process they had gained some knowledge of what is possible with the smart features and services. Especially in C1, they saw potential in experimenting with the next technologies and possibly also adjusting the usage environment so that they could benefit more from the intelligent features. In C2, the interviewees actively expressed improvement possibilities to the equipment's basic features but were reluctant to use the intelligent features and smart services.

Decision-oriented user experience. Many of the interviewed managers and some maintenance technicians had participated in the procurement of the equipment and its decision making. They oversaw the production or maintenance and were also responsible for the business performance. They had first-hand experiences of the equipment service supplier, they engaged in repetitive or continuous cooperation, and some of them also ordered the services (especially in C1). The managers and technicians did not talk about the intelligent features of the equipment much, since they were not involved in operating the equipment, except from the perspective of comparing old and new equipment and their properties, and mechanisms to access real-time information about the performance of operations.

5. DISCUSSION

This study explored user experiences in two industrial customer firms of an equipment manufacturer and sought responses to the question of how equipment users experience the intelligent features and smart services associated with an equipment manufacturer's technologies. A central observation regarding user experiences relates to the users' readiness to use the intelligent features that are linked with the potential use of smart services. Our findings on the low to medium use of intelligent features indicates that the users' readiness for smart services may depend on the users' technology readiness (also Klein et al., 2018). This offers additional evidence to previous studies on service readiness and adoption (Vaittinen & Martinsuo, 2019; Wunderlich et al., 2012; Zhou et al., 2022) and reveals potential reasons for the limited progress of manufacturers' digital servitization. The empirical evidence with the two customers suggests three potential reasons underlying the low extent of intelligent feature use. Firstly, users perceived that manual operation allowed them to maintain greater control and that they felt more comfortable using familiar methods (supporting Wunderlich et al., 2012). Secondly, users may not see the immediate value or benefits of smart services, especially if they do not experience any significant problems with their equipment. This may lead to a lack of motivation to adopt new services or features and offers user-level evidence to support the firm-level study of Vaittinen & Martinsuo (2019). Thirdly there may be weak awareness or understanding of the potential benefits of smart services, as well as a lack of training or support for users in how to effectively use them. This may lead to users feeling uncertain or hesitant about adopting the new technology.

As a core finding, we revealed different patterns of user experience, differentiating the companies and users. The clustering into four user experience patterns — feature-centric, competence-centric, development-oriented, and decision-oriented — offers empirical evidence of how people in different positions and functions experience different aspects of intelligent features and related services differently (offering evidence to Witell et al., 2020; Zolkiewski et al., 2017). The patterns reflect differences in the operational context and user preferences, potentially following from the user's level of experience, the complexity of the tasks, and the perceived value of the features. Also, differences emerged in the visibility towards suppliers and the services, potentially following from such factors as organisational structure, communication channels, and the level of involvement of different stakeholders. Overall, the differences highlight the importance of considering the specific context and user needs in that context (following Abrell et al., 2016).

The patterns of user experience show how even people with exactly the same job profile in a firm can have clearly different user experiences. Thereby, our findings offer evidence about potentially diverging touchpoints with the supplier and diverging customer journeys (in line with Abrell et al., 2016; Witell et al., 2020; Zolkiewski et al., 2017). This highlights the equipment supplier's (i.e., service provider's) need to understand that some users do not have any touchpoints with them and, thereby, it may become almost impossible to control or even affect the customer experience comprehensively. Current literature highlights manufacturers' will and need to try to create positive customer experiences (Witell et al., 2020; Zolkiewski et al., 2017), which in light of our results requires new ways to connect with different user groups and serving their needs regarding the use of intelligent product features and smart services. If siloed customer experiences and lack of touchpoint control are among key challenges in industrial customer experience management (Witell et al., 2020), manufacturers need to treat their industrial customers in holistic ways, recognising the specific needs of their unique user groups.

6. CONCLUSIONS

The study contributes with the new categorisation of user experience patterns – feature-centric, competence-centric, development-oriented, and decision-oriented – concerning intelligent product features and smart services in an early phase of digital servitization, from the perspective of users in their unique operating environments. The findings complement the manufacturer-centric digital servitization research by emphasising the customer's viewpoint and diverse user experiences. In particular, the study revealed that smart service suppliers cannot take for granted that users experience the benefits of intelligent product features and smart services in a similar way as managers or buyers responsible for their procurement, or that the features would be regarded as beneficial by the users. This may impact and explain the rather slow adoption of smart services among industrial customer firms.

The validity of the study has some limitations due to the choice of firms and their phase of adopting intelligent technologies and smart services. The choice of the firms was limited through the access offered by the focal manufacturer and its clientele. We were extremely satisfied with gaining access to quite different firms and industries, but obviously the choices do not enable broader generalisations. The use of intelligent features and related smart services was in its early phases in these firms and, thereby, the data are limited to such a context and do not offer evidence on more established smart service use. Also, equipment users' experiences are limited to the immediate context of their own work and processes in which they are involved. To get a more comprehensive picture of the effects of smart services in the customer organisation as a whole, the user perspective could be balanced with the experiences of decision-makers such as directors and professional buyers.

More research on user experiences in industrial smart service settings is called for. Industrial services tend to be overlooked in customer and user experience studies, but when smart services are gradually becoming more prominent, research on their user experiences becomes possible. To continue from this research, the identified user experience patterns could be further developed and fine-tuned by adding further customer firms and individual users. Follow-up studies could replicate the research setting in similar and different contexts, thereby enabling the testing and elaboration of the initial findings. As the present study covered users in firms that were only taking their first steps in harnessing intelligent product features and related smart services, further studies could include customer firms that have more established experiences of smart services over longer period of time and among a larger group of users. Theoretically, user engagement could offer a novel analysis perspective in such contexts where smart services are widely adopted among users.

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