Digitally connected services: Improvements through customer-initiated feedback

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Published in:
European Management Journal

DOI:
10.1016/j.emj.2020.03.008

Publication date:
2020

Document Version
Peer reviewed version, als known as post-print

Post-Print

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European Management Journal

https://doi.org/10.1016/j.emj.2020.03.008

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Highlights:

- Digitally connected services entail new requirements regarding quality improvements
- A key source of these improvements is customer-initiated feedback
- Feedback through provider-customer interactions is continuous rather than discrete events
- Customer-initiated feedback entails both digital and human dimensions
- Scope of service improvement extended into “quality in use” by three components:
- (1) Channeling – Entry of customer feedback into the organization
- (2) Processing – Use of customer feedback within the organization for improvements
- (3) Knowledge conversion – Turning customer feedback into organization-wide knowledge

Abstract

A growing number of manufacturers advance their offerings by providing digitally connected services that require companies to revisit quality improvements based on customer feedback. This paper explores how firms use customer-initiated feedback for quality improvement of digitally connected services (DCS). DCS entail a human-to-digital interface that enables on-going provider-customer interaction. Based on a case study of a manufacturer that offers DCS, we conclude that the scope of improvements extends into the use-phase of services, and customer-initiated feedback is both codified and personalised. In particular, systematic use of customer-initiated feedback for improving DCS requires three distinct efforts. First, channelling aims to capture feedback provided by large number of customers through various entries into the organisation. Second, processing refers to utilizing this feedback within the organisation for service improvements. Third, knowledge conversion seeks to turn the learning from the feedback into knowledge that is dealt effectively across various functions such as quality management and customer services. Further research should investigate further quality improvement and customer feedback of services that are digitally configurated by customers themselves.

Keywords: Digitally connected services; improvements; customer-initiated feedback

Digitally connected services:
Improvements through customer-initiated feedback

1. Introduction

New service offerings based on digital solutions, such as digitally connected services, require companies to revisit the way in which they work with quality improvements based on customer feedback. The ability to use customer feedback has been key to generate quality improvement ideas (Wirtz, Tambyah, & Mattila, 2010; Linderman, Schroeder, Zaheer, Liedtke, & Choo, 2004) and enhance learning (Caemmerer & Wilson, 2010). Furthermore, customer-driven data play an important role in companies' creation of new value propositions (Bustinza, Parry, & Vendrell-Herrer, 2013). Due to digitalization and servitization, the amount of customer feedback, often referred to as 'data', that enters a firm has increased greatly (Rymaszewska, Helo, & Gunasekaran, 2017). However, using such data as a means for quality improvements is a challenge (Cohen, 2018), and much of the data from customers remain unused by the provider firms (Stone, Aravopoulou, Gerardi, Todeva, Weinzierl, Laughlin, & Stott, 2017).

Digitalization enables an abundance of data provided to the firm that can result in a "novel layer of added-value" (Opresnik & Taisch, 2015, p. 180) or improve "value in use" (Lim, Kim, Kim, Kim, & Maglio, 2019). Such customer data can be sensor-driven, provided in codified form, and requested by the firm (Ondemir & Gupta, 2014; Parry, Brax, Maull, & Ng, 2016). Sensor-driven data may offer valuable insight into the needs for services (e.g. Parry et al., 2016); enable offerings that are based on data provided by consumers (Bustinza et al., 2013); and potentially lead to offerings that are better tailored to customers' needs (Morgan, Anderson, & Mittal, 2005). The ability to use this type of digitized data is therefore becoming increasingly important (Iansiti & Lakhani, 2014). However, even when offerings are based on digitalization, the data provided to the firm from its customers may also be customer-initiated and built on human-to-human interactions (Wünderlich, von Wagenheim, & Bitner, 2013).

Similar to digitalization, servitization also serves as a driver for advancing customer understanding and use of customer data (Opresnik & Taisch, 2015). The term servitization was originally coined by Vandermerwe and Rada (1988) and refers to "the process of creating value by adding services to products" (Baines, Lightfoot, Benedettini & Kay, 2009, p. 547). Servitization is commonly operationalized by an extended value proposition of manufacturing firms, advancing through various types of offerings described, for example, as services supporting the product and services supporting the customer (Mathieu, 2001), basic and advanced services (Oliva & Kallenberg, 2003), or relieving and enabling services (Lusch, Vargo, & Tanniru, 2010). For more advanced services that support the customer, customers' use-processes need to be understood continuously, as quality is co-created in an interaction between customers and providers (Grönroos, 2011) with the power to determine perceived quality being in the hands of the customer (Macdonald, Kleinaltenkamp, & Wilson, 2016). In other words, the "significance [of customer experiences] increases in servitization while service intensiveness of the offering increases requiring more customer interaction" (Hakanen, Helander, & Valkokari, 2017, p. 169). This is true also for services based on digital technologies, where the subjective customer perceptions and personal interaction is still critical to the quality of the services (Neuhüttler, Ganz, & Spath, 2019).

Combining digitalization and servitization (Coreynen, Matthyssens, & Van Bockhaven, 2017) has resulted in smart, connected products that are able to deliver different types of digital services (Porter & Heppelmann, 2014), in this paper referred to as *digitally connected services* (DCS). DCS refer to a distinct category of services where the resources of a service provider and customer are digitally configured and inter-operated. DCS have strong references in extant literature; for example, solutions that are combinations of goods and services (Tuli, Kohli, & Bharadwaj, 2007) and offerings not only focusing on "technical integration but also on the total usage context" (Nordin & Kowalkowski, 2010, p. 442). DCS possess novel characteristics compared to traditional products and services; for example, regarding user interface (Rowley, 2006), and service delivery systems (Hiraoka, 2009). The service co-

creation and delivery does not rely solely on personal contact; it can also be performed remotely (Hsu & Spohrer, 2009; Grubic & Peppard, 2016; Pagani & Pardo, 2017). Furthermore, digitalization has also created new platforms and channels for customer feedback, such as e.g. users sharing quality information through social media (Iankova, Davies, Archer-Brown, Marder, & Yau, 2018). With the challenges and changes imposed by DCS on the processes of collecting, processing, and using customer feedback, there is a risk that existing practices and tools will fall short of helping managers comprehend customers' needs and quality-related problems. Thus, the purpose of this paper explores how firms use customer-initiated feedback for quality improvement of digitally connected services.

This paper contributes to the area of quality improvements by focusing on customer feedback as a process where feedback can arise continuously throughout the use phase, as a result of digitally connected services. The processual view and focus on the use phase further respond to customers' wishes for speedy and personalized response to their feedback (Aksoy, Guilloux, Duneigre, & Keita, 2019). Moreover, this paper contributes by focusing on the human interfaces through which feedback is channelled, an interface that is shown to impact users' trust in digitally connected services interactions (Wünderlich et al., 2013). Finally, the paper addresses the questions on how to organize for the use of customer-initiated feedback as a basis for improvements, hence not focusing on functions or organizational silos but focusing on an improved customer experience by emphasizing interorganizational cooperation (Aksoy, et al., 2019).

2. Conceptual background

Digitalization has provided new opportunities for offering simple online services (such as language tutoring), as well as platforms and marketplaces for professional services (Täuscher & Laudien, 2018), but also entails new requirements for quality improvements (Hsu & Spohrer, 2009) to advance a firm's service offering (Coreynen et al., 2017). Previous research on quality improvements in regard to digital services has given attention to matters such as e.g. the evaluation of online retailing (Collier & Bienstock, 2006), and provided input to the discussion on the concept of e-service quality (Ladhari, 2010). Service advancements of a firm's offering build on value-in-use (Petri & Jacob, 2016; Pohlmann & Kaartemo, 2017), and the scope of quality improvement extends from the product itself into the provider-customer interaction, following the emerging customer-dominant logic of the service literature (Heinonen & Strandvik, 2018). One part of a provider-customer interactions concerns feedback processes. The criticality of such processes for learning and quality improvements has been addressed for a long time (Crossan, Lane, & White, 1999; Fundin & Bergman, 2003; Lenfle & Midner, 2009). Moving from a focus on the delivered product towards a focus on different types of services opens the way for more intense and continuous customer feedback. This is especially the case for DCS, which allow for continuous feedback that is not restricted to a particular time or place.

2.1. Advancing DCS through quality improvements

Quality improvement of DCS requires firms to understand how DCS differ from other offerings. A distinct feature of DCS is the customer-firm interface, through which the service is delivered. With DCS, service interfaces are "gradually evolving to become technology-dominant [...] rather than human-driven" (Larivière, Bowen, Andreassen, Kunz, Sirianni, Voss, Wünderlich, & De Keyser, 2017, p. 239). However, technology-driven services like DCS require "significant human-to-human interaction" (Wünderlich, von Wagenheim, & Bitner, 2013). The need for such interaction is further amplified for DCS, where the digital interface is often a mobile phone, always accessible to customers who expect quick response to any inquiries.

Mathieu (2001, p. 40) suggested services that support the supplier's product (services supporting the product, SSP) or services that support the "client's action in relation to the supplier's product" (services supporting the customer, SSC). In this regard, SSP and SSC differ in (1) the direct recipient of the service, (2) the intensity of the relationship between supplier and customer, (3) the degree of service customization, and (4) the predominant variables at play during the service process (Mathieu, 2001). For SSP, the physical product is the center of the firm's value proposition, whilst SSC put the customer's needs at the center (Kowalkowski et al., 2013). SSC entail intense customer interaction, allowing for a high degree of customer involvement and co-creation (Sousa & Da Silveira, 2017). These attributes of SSC are well aligned with the principles of quality management, which are customer focus, continuous improvement,

and teamwork (Dean & Bowen, 1994). Since the intensity of the relationship and the degree of customization of DCS is potentially higher than that for other SSC due to the changed user interface (Rowley, 2006) and remote delivery of the service (Hsu & Spohrer, 2009), the practices of how to use customer feedback for quality improvement need to be aligned.

The quality of DCS can be understood in terms of technical and functional quality. Whereas technical quality encompasses the *outcome* of the service – that is, what the customer receives − functional quality describes the service delivery, which is how the service outcome is delivered (Grönroos, 1982). Thus, the functional quality of a service concerns the customer's *perception* of the service, often highly impacted by the provider-customer interaction of the service delivery (Kang, 2006).

In summary, the characteristics of DCS call for an approach to quality improvement that advances both the technical components of the DCS and the delivery of a high-quality experience for the service user; that is, the functional quality of the DCS. Further, DCS extend the actors involved in service delivery and improvement efforts. Finally, the channels between the provider and customers, through which input from customers is traditionally generated, change.

2.2. Customer-initiated feedback as input for quality improvement

Product-service solutions are continuous in that they are "an ongoing relational process of defining, meeting, and supporting a customer's evolving needs" (Tuli et al., 2007, p. 5). DCS enable continuous and intensive provider-customer interactions that could serve as an input to quality improvement processes. In order to learn from customer-initiated feedback, it is critical to have processes in place that support the use of the feedback for quality improvement (Lervik Olsen, Witell, & Gustafsson, 2014). However, the link between the firm's quality management efforts and its learning processes has been found to be weak, calling for more research on the matter (Fundin, Bergquist, Eriksson, & Gremyr, 2018).

Improvements and learning based on customer-initiated feedback can be challenging as the feedback is often communicated to frontline employees rather than being filed as formal complaints, at the risk of not being made available to other parts of the firm (Wirtz et al., 2010). A customer feedback system must "reflect both formal and informal complaints, and it is vital that the feedback is assigned to designated teams" (Fundin & Elg, 2006, p. 990). Moreover, customer feedback should be presented so that it is perceived as "valid and reliable, timely, relevant, and actionable" (Morgan et al., 2005, p. 140). Customer feedback systems can be systematic and formalized, containing standardized processes for converting and channeling feedback throughout the organization, or they can be informal and unstructured, where feedback is delivered by service personnel having visited customer sites (Fundin & Elg, 2006). Customer feedback can be handled either by (1) codification, which involves "data or information transferred in databases", or (2) personalization, where information is transmitted between people (Fundin & Elg, 2006, p. 990). Furthermore, customer feedback systems can be either active, i.e. handling firm-initiated customer feedback, or passive, handling customer-initiated feedback (Fundin & Elg, 2006).

2.3 Customer feedback as a process rather than discrete events

To understand the challenges of feedback systems for DCS, there is a need to look beyond the properties of the feedback (passive–active, personalized–codified) and towards the knowledge conversions needed to learn from the feedback. This can be supported by "effective deployment of quality management [which] should result in a set of practices that support each of the knowledge creation processes" (Linderman et al., 2004, p. 602), or more specifically, through four types of knowledge creation processes: socialization, externalization, internalization, and combination (Nonaka, 1994; Nonaka, Takeuchi, & Umemoto, 1996; Forkmann, Ramos, Henneberg, & Naudé, 2017). Conversion from tacit to tacit knowledge takes place through *socialization*; it requires interaction between persons. In contrast, moving from tacit to explicit knowledge requires *externalization*. This process is supported by dialogues and reflections through which tacit knowledge can become explicit by use of analogies or concepts (Nonaka et al., 1996). *Internalization* is reversed compared to externalization, as it is a process by which explicit knowledge is used and becomes tacit knowledge for one individual. One means of internalizing the customer's knowledge is the use of

customer feedback to communicate customer stories (Linderman et al., 2004). Finally, *combination* is a knowledge creation process in which existing explicit knowledge is combined, synthesized, and re-contextualized into new explicit knowledge (Linderman et al., 2004).

A challenge of knowledge conversion processes within firms is that knowledge sharing between employees possessing different professional backgrounds is complex (Easterby-Smith & Lyles, 2011). Thus, it is critical to convert customer feedback into explicit and codified knowledge to avoid individual employees becoming knowledge carriers. However, the contextual nature of certain types of knowledge [ibid] makes this difficult; arguably, the high intensity and continuous customer interaction of DSC is an example. Therefore, it is vital for organizations to have means to create and manage *codified* knowledge, which is knowledge that can be stored, shared, built upon, and accessed by any employee (Easterby-Smith & Lyles, 2011).

Conclusively, Figure 1 presents a conceptual framework where the traditional service-exchange process between a provider and a customer is conceptualized as feedback interfaces (digital or human), connecting the customer's perception of quality and the provider's improvement work. Due to the variety of feedback received on the different services, the increased emergence of DCS calls for research which addresses the impact this type of service delivery has on firm's quality improvement processes.

- *Insert Figure 1 in here, please –*

3. Research method

While research on digitalization and services is growing, research on DCS remains limited, particularly regarding customer-initiated feedback processes. It has been argued that a nascent level of theory in a certain field calls for an exploratory, qualitative approach (Edmondson & McManus, 2007), allowing the researcher to be sensitive to the context in order to understand critical concepts and their interrelations (Flick, 2014). The choice of an exploratory and qualitative research approach is further supported by the purpose of the paper: *exploring* how firms use customer-initiated feedback for quality improvement of digitally connected services. To achieve such proximity and depth (Voss et al., 2002), the present study is based on a single case study (Stake, 2005). Moreover, the case study design allows for the study of "interactivity" (Stake, 2005), which is informed by the purpose of the study and the nature of key concepts, namely "DCS" and "feedback processes".

3.1. Sampling and case selection

The case selection was guided by Eisenhardt and Graebner (2007) in that the studied organization allowed for the exploration of customer-initiated feedback with respect to DCS as an emerging practice. The case study is instrumental in nature (Stake, 2005) in its facilitating role for understanding a phenomenon, feedback processes, and their role in DCS improvements. The company that provides the setting for the study operates in a manufacturing sector that has undergone a major transformation through industrialization, e.g. by implementing lean management, both at a plant level but also in the extended enterprise (Womack, Jones, & Roos, 2007). The context can be characterized as high-volume, with a broad range of complex product offerings mainly sold through retailers. The sampling was purposive, considering the case's unique context (Miles, Huberman, & Saldaña, 2020) and high experience level (Van de Ven, 2007). The company is regarded amongst the leaders in their sector with respect to quality improvements and servitized offerings through e.g. DCS. Product variety is created both through attributes of the physical product and to an increasing extent DCS. In this respect, the firm is evolving from a traditional B2B-setting towards having more direct interaction with end users. The sampling is purposive in that it is likely to be evident that the current way of working with customer feedback will be challenged by DCS, and the case chosen is regarded as relevant for theory development (Flick, 2014). Being a single case study, the rationale for the sampling was more specifically guided by a representation of an unusual and rare case (Yin, 2014), but with a relatively high experience level (van de Ven, 2007).

3.2. Data collection

The focus on customer-initiated feedback of DCS as the unit of analysis determines the scope of data collection (Yin, 2014). Being an emerging phenomenon, the data on DCS was collected over time and from various individuals. Data were collected from multiple sources: focus groups (n=2), interviews (n=11), and non-participant observation (see Table 1). Employing the different types of data collection methods helped to triangulate the findings, and ensured comprehensiveness (Mays & Pope, 2000).

- *Insert Table 1 in here, please –*

The data collection process started with a focus group, which introduced the investigators to the current experienced challenges of working with DCS, helped identifying respondents, and highlighted which aspects to consider moving forward. Gathering individuals from different parts of the quality function into a focus group made it possible to capture and process signals of service failures, which were addressed through a cross-functional, interactive setting within the organization. Next, interviews were conducted within the quality management and customer service functions to capture insights from frontline staff and the quality management staff. The first interview was open and sought to understand the challenges and scope of the problem. The subsequent interviews were informed by themes identified in the first focus group and in the open interview. This was followed by two semi-structured interviews with a customer-facing unit. Finally, eight interviews were conducted in a structured fashion with quality management staff in various functions, concerning challenges, requirements, and competencies of the profession. All interviews were conducted face-to-face, recorded and transcribed. Examples of interview questions used in this phase were: “Through which channels do you receive customer feedback regarding DCS?”, “In what ways is the DCS feedback used in your work?”, and “What are the greatest challenges of working with DCS improvements?”.

Non-participant observation (Ostrower, 1998) was used to complement the retrospective nature of interview data by capturing the process perspective and interactive nature of feedback. One member of the research team followed a quality manager responsible for DCS for two full days and recorded observations through field notes. The observations included meetings where the manager was observed interacting with other professionals in a cross-functional setting. The researcher’s level of involvement in the meetings was limited to observations only, and field notes were written down after the meetings to minimize any potential influence on the studied phenomenon. This method turned out to be valuable in terms of gaining contextualized information and exploring actions performed in a real-time setting, as well as understanding the managerial complexity of the task and creating a detailed map of how feedback was processed. The iteration of these multiple sources of data was intended to make the empirical evidence more comprehensive, and then, triangulate the data (Flick, 2014; Yin, 2014).

The interviews and observations revealed that customer-facing units in the organization were playing an increasing role in transferring customer feedback to quality management professionals. Therefore, a second focus group was arranged to provide more depth to these issues by observing the interaction of representatives from both customer-facing and centralized quality management units, thus building on the strength of focus groups in capturing the dynamics of participants’ conversations (Flick, 2014). Another purpose of this focus group was to validate results from early phases of the study by presenting a synthesis of the results for further scrutiny, thus serving as a form of respondent validation (Mays & Pope, 2000).

3.3. Data analysis and research quality

With an iterative process of data collection, data analysis began at an early stage (e.g. Flick, 2014). Analysis of the interview data was performed with the support of the NVivo11 software. At the beginning of the analysis, two of the authors individually read the interview transcripts looking for themes and keywords. The following analysis made use of the principles of thematic analysis, where themes and patterns capture important aspects of the data that

relate to the research questions without attempting to fit the data into a pre-existing coding framework (Braun & Clarke, 2006). The emerging patterns became the NVivo codes, which then through an iterative process involving all authors were merged into first order categories, allowing the identification of the second order themes *Channeling*, *Processing*, and *Knowledge conversion* used in the discussion of the findings (see Table 2).

- *Insert Table 2 in here, please* -

Enhancing trustworthiness was guided by Shenton (2004) and Creswell (2007). Credibility was established through a flexible and multi-stage research design that sought to reflect the contemporary and emerging nature of the phenomena studied. This was further strengthened by efforts to create familiarity with the case firm, iterative questioning during data collection, and a respondent check through the structure laying technique (Flick, 2014). Non-participant observations not only allowed for data collection, but also offered an opportunity to learn the culture and validate data from focus groups and interviews. Use of overlapping methods and in-depth descriptions of the method also supported the dependability of the results. Communicative validity was enhanced by involving managers at an early stage (first focus group) to help understand challenges and case-specific vocabulary. Triangulation of methods and respondents was used to reduce the risk of investigator bias, which underpins the confirmability of the results. To allow for complementary insights and increase confidence in the findings, at least two authors jointly analyzed the data (Meredith, 1998). In addition, one of the authors was not involved in data collection and can therefore be regarded as an external investigator of the empirical material (Eisenhardt, 1989). Transferability was furthered through the staged research approach; for example, the de-briefings at the focus groups, as well as during the non-participant observations, entailed an external check of processes. Finally, a validation focus group was set up with one quality manager and one customer service manager to validate the maps of feedback processes for products and services.

4. Results

4.1. DCS entail new requirements for quality improvements

The introduction of DCS entail changes in the process of working with customer feedback. The findings identify five areas that make this a challenging task: (1) DCS extend into the in-use-phase of products, which creates additional organizational functions responsible for quality improvements; (2) DCS increase the number of customer interactions; (3) current feedback routines fall short to capture the variety of feedback in DCS; (4) the need for organizational alignment to keep up with DCS; and (5) the pace of improvement work varies across organizational units.

First, while the firm's interactions with its end users have become more important, the responsibility for quality improvements of DCS has also had organizational implications:

> *"Quality for the traditional bolts-and-bearings people has been a done job as soon as all the components have been assembled and the product has left the factory, whilst the people at the IT department are frantically waving their hands saying, 'we have [connectivity] issues that we got phone calls for in the middle of the night – our job here has only gotten started'. It's like two different worlds"* [DCS quality director]

Traditionally, quality improvements were primarily made before the product left the factory, but to a large extent DCS improvements take place in the *in-use-phase* of the products. In other words, quality improvements become more about the customer-side of the service exchange than the firm-side, and a *new organizational unit* is involved, namely the IT department. However, in the effort to accommodate this change, a new cross-functional unit has been established, which deals exclusively with the development and maintenance of DCS.

Second, a further indicator of changed conditions for quality improvements in the organization is the *increase in customer interactions* that the customer service function has faced during the last couple of years: *"The number of customer interactions has absolutely skyrocketed since DCS became a standard component of our product, increasing from 47,000 last year to 62,000 this year [...] Next year I expect somewhere around 80,000 contacts"* [customer

service director]. The organization had neither anticipated nor prepared for this increase neglecting to add resources to handle the growing amount of customer-initiated feedback directed to the customer service function.

Third, current *feedback routines are built around codified data* and fall short of addressing the new context of DCS. Traditionally, the central quality organization handling customer feedback relied heavily on codified warranty data and a system called the customer satisfaction directory (CSD), through which the local sales office reports quality issues. Although the system formally has the customer as the point of reference, the operational scope has turned out to be narrower, namely the local sales office. Within the central quality organization, the CSD is unofficially called the local sales satisfaction directory, as the local sales offices themselves decide which quality issues to raise. These issues do not always correspond to the issues experienced by customers as most severe:

> *"The local sales office might not suffer from this particular quality issue, maybe it's a good deal for them, they know how to solve the issue, and they earn a lot of money of it. Will they channel it back into the organization as an issue then? However, if there is an issue where the customer maybe doesn't suffer that much, but it is a problem for the local sales office, then they will channel that issue into the organization"* [corporate quality manager].

Based on this, customer feedback risks being distorted by operational practices.

Fourth, the need for *organizational alignment* due to new DCS offerings has become apparent. The firm appears to be fairly good at providing DCS to customers but struggles with adapting internally: *"We are fairly good at marketing our new digital services, selling our product through our websites for example, but when it comes to internally mirroring that change, we are struggling" [business development director, R&D].* Moreover, the traditional approach to quality improvements, developed and honed over decades, is being challenged by both digitalization and servitization:

> *"Our greatest challenge is our legacy. We live with a legacy that is built on producing mechanical products with limited complexity – and all that is changing fast. The complexity of our offering has exploded and will continue to do so exponentially"* [business development director, R&D].

Fifth, *quality improvement work has become more pervasive* because of DCS. It appeared that the various *organizational units operate at different paces*, which has implications for employees working with the quality of DCS. There are vastly different clock-speeds at which the functions involved in developing, producing, and controlling DCS work: *"IT works with seconds, whilst R&D talk in terms of years – naturally challenges arise" [DCS quality director].* The different clock-speeds, educational backgrounds of employees within the different functions (mainly engineers in the R&D department, while marketing and sales predominantly employ business graduates), and the different vocabularies can sometimes lead to heated discussions in the cross-functional DCS-quality meetings. Understanding the customer's journey when using DCS and understanding "the voice of the customer" have been identified as important challenges that the firm is facing today but will face even more so in the future. During one of the focus groups, a corporate quality manager said, "*We don't even know if we are selling the physical product tomorrow, maybe we will only be selling services*"; this stresses the importance of having processes and tools in place to (1) understand the customer's experience, (2) transfer that knowledge into the organization, and (3) improve the quality of the customer's experience.

4.2. Customer-initiated feedback

A rapid increase in customer-initiated feedback directed to the customer service department came as a surprise for the case firm, according to the customer service director:

> "*When the [DCS feedback] volume suddenly exploded [...] the organization appeared to be quite lost; who owns this issue? Who should we direct this feedback to? Initially, when we tried to channel the feedback to the central quality function, we received the answer that this was not their job: 'We work with the product, we don't work with DCS'"'*

The notion that the firm's central quality function mainly focuses on product-related issues is reiterated by a corporate quality manager who stated that the predominantly utilized feedback within the quality function comes

from codified feedback, mostly warranty statistics. Hence, there are changes both in the ways feedback is initiated and the amount of it, as well as the use of this data for quality improvements.

4.2.1. Initiating feedback

DCS feedback is primarily gathered in a passive manner, meaning that customers initiate the feedback process without any prompting from the firm. Active feedback processes exist within the organization, as in the R&D function, where surveys are sent out to customers regarding potential and existing product features, thus utilizing codified feedback information from customers. However, the active feedback processes employed by R&D are product-centric and do not take service quality or softer aspects of the customer's experience into account. A schematic illustration of the feedback processes for the physical product (left) and DCS (right) can be seen in Figure 2, which displays feedback channels and the organizational units involved. The feedback processes differ in terms of (1) predominant channels into the organization and (2) functions utilizing the feedback.

- *Insert Figure 2 in here, please* -

First, regarding channels of feedback into the organization, the introduction of DCS as an integrated component of physical products has meant that customers provide an exponentially increasing share of their feedback through the customer service (CS) function. As shown in Figure 2, customer-initiated feedback concerning DCS is received by the *local sales office* or the *customer service function*. If the local sales office cannot solve the customer's problem, the problem is escalated to the centralized technical helpdesk. However, there are no formalized channels for transmitting the customer-initiated feedback regarding DCS, in contrast to the standardized, formalized, and highly codified feedback processes for quality issues related to the physical product. Customer-initiated feedback regarding product issues is either received by the local sales office when a customer visits the office with their product to get an issue fixed, or by the CS function over the phone. If there is a technical issue with the product that cannot be solved remotely, the customer is redirected to the local sales office if he or she calls customer services. When the local sales office receives a product issue, they enter the quality feedback into a codified computer system. If the local sales office cannot fix the issue, they channel the information in a codified manner to the technical helpdesk, which will either (1) solve the issue at hand or (2) escalate it to the central quality organization.

Second, with respect to utilizing the feedback on DCS, quality issues related to DCS are most often shared from customer to CS employee over the phone and resolved in the first or second instance of contact. Once the issue is resolved, the CS employee can add information regarding the customer's problem into the customer service wiki, a digital encyclopedic platform where CS employees can search for information to help them solve customer issues. However, only the CS function utilizes the wiki, and the isolation of DCS feedback was frequently mentioned during the interviews and focus groups:

> "*We have a long way to go regarding gathering information about 'what does the customer think?' [...] We have knowledge about product problems, and we are starting to gather some knowledge regarding problems with specific services, but what about what the customer thinks? There are many aspects of the customer's experience which are hard to channel back into our system"* [customer service director].

4.2.2. Using customer feedback

Customer feedback for DCS occurs mainly between the customer and customer service function, or between the customer, local sales office, and technical helpdesk. There is a lack of formal processes that connect these various functions in the firm to the central quality function. Consequently, customer-initiated DCS feedback remains isolated within the organization:

> *"We can solve problems right here, right now, but we are facing difficulties to channel information and knowledge regarding all the issues which our customers are experiencing into the organization. There is a barrier between us and the rest of the organization, between technical quality problems and all the other*

issues customers are experiencing. Last year we had more than 50,000 interactions with customers ... we [the firm as a whole] should be better at utilizing all that information regarding what the customers experience" [customer service director]

This situation has been blamed on the absence of formal processes for sharing this feedback across organizational units, and the lack of understanding of the value of this feedback. With respect to the question if there are any informal channels to bridge this barrier (such as personalized feedback channeled between customer service employees and internal quality management employees), the answer was negative.

In comparison, feedback on physical products is well-structured and reaches the central quality function. For example, product feedback moves between the local sales office and product-follow-up function (PF), and from the PF function to quality-of-current-offering function (QC). By contrast, customer-initiated DCS feedback is only handled by the CS function:

"The central quality organization should work with the quality of the whole offering, so it is strange that we don't have quality functions such as 'Customer Follow Up' [compared to the 'Product Follow Up'-function]. The division between DCS-matters and the central organization should not be there, it should all be integrated" [customer service director]

Within the central quality function, a response to this concern is the establishment of a cross-functional unit that aims to incorporate all functions involved in the delivery and improvement of DCS.

The customer service director voiced a need for development of feedback processes for DCS, similar to the existing processes for product feedback, and stressed the need for a data gathering and transforming function, such as PF tailored to DCS: "*The PF-function can accumulate the feedback regarding product quality issues from all of our markets, but when it comes to feedback regarding quality issues concerning DCS, we don't have any way of doing that"* [customer service director]. Furthermore, both the customer service director and a corporate quality manager highlighted the non-existent link between the customers' interaction with the CS function and the central quality function as an issue. Regarding the issue of acquiring knowledge related to DCS quality issues, a DCS quality manager points to informal, personalized feedback channels as processes that should complement automated error systems: "*I often hear about quality issues from colleagues, who come up to me by the coffee machine and tell me about how the mobile application was not functioning properly that morning."*

5. Discussion

This study explores how firms make use of customer feedback in order to support quality improvement of DCS. The findings show that customer-initiated feedback increases when the firm developed its service offering into DCS. However, the findings also show that current practices are insufficient to process this feedback into quality improvements. From the analysis of the findings we derived three key components for using customer feedback for quality improvement of DCS: *channeling*, *processing*, and *knowledge conversion* (Figure 3).

- *Insert Figure 3 in here, please* -

Channeling presents an outside-in perspective of customer feedback of DCS into the organization. This is impacted by the distinct features of DCS as well as the interfaces through which (1) the DCS is delivered to the end-customer, and (2) the customer feedback regarding the DCS is initiated. *Processing* refers to utilization of customer feedback for DCS improvements, entailing the intra-organizational interfaces of the customer feedback received inside the firm, as well as the activities and processes dealing with making use of the customer feedback. *Knowledge conversion* denotes conversion of the information received from channeling and processing into organizational knowledge.

5.1. Channeling

Channeling refers to the way in which customer feedback enters into the organization from the end-user. Previous studies suggest that service advancements in terms of, for example, SSP and SSC (Mathieu, 2001) entail a commitment to increased *interactions with the market* during the in-use-phase of products. Table 3 compares DCS with the typology of services developed by Mathieu (2001).

- *Insert Table 3 in here, please –*

DCS stands out from current service classifications (that is, SSP and SSC) by (1) emphasizing direct contact with the user as the recipient); (2) increasing the intensity of provider–customer relations; (3) increased service customization, which builds on the possibilities of digitally configuring the services, such as users remotely activate or alter a product and/or service feature; and (4) because process variables are not either physical products or people, but both − the social and the material are seen as inherently inseparable (cf. socio-materiality, Cecez-Kecmanovic et al. (2014)).

New feedback channels are needed to support the use of DCS feedback (more than 50,000 interactions yearly with the CS function in the case examined). These channels should align with the dispersed and decentralized nature of DCS customer feedback, implying that improving the quality is increasingly becoming an inter-organizational concern. Simultaneously, DCS enable automated collection of customer data in the form of codified data. This combined increase in both personalized and codified data (Fundin & Elg, 2006) through different channels calls for multiple feedback systems built upon elements of both firm- and customer-initiated feedback. Furthermore, feedback has different entries into the organization. Personalized feedback appears to enter at CS functions which is detached from the quality function in the case firm, whereas codified data often enters directly in the quality function. Hence, attention must also be given to prerequisites and processes for dealing with different types of feedback internally in the organization.

5.2 Processing

Where channeling serves an interfacing role to external users, processing concerns intra-organizational aspects of managing customer-initiated feedback: *interfaces* for feedback processes, the need for an extended *scope* of quality improvements, and an *ability* to operate within that scope.

5.2.1. Human-digital customer-feedback interfaces

The first dimension of processing is the human–digital interface between provider and users. Service interfaces from the provider's side are increasingly technology-dominant (Larivière et al., 2017), but also require a human-to-human interface (Wünderlich et al., 2013). Derived from this, a schematic diagram of four different types of customer feedback interfaces is depicted in Table 4.

- *Insert Table 4 in here, please -*

D-D: Sensor-driven customer feedback, often associated with 'big-data'. *D-H*: Automated customer feedback from DCS usage that is received and handled by the provider. Whilst D-D and D-H are largely provider-centric, the H-D and H-H are more customer-centric (Heinonen & Strandvik, 2018), capturing the channeling of both codified and personalized customer-initiated feedback. *H-D:* Users interact with the provider's digital interface, such as the provider's social media or smart-phone app during DCS usage. Here, the large increase in user interactions as consequence of DCS becomes apparent. *H-H*: Feedback initiated by the customer and the user-centric nature of DCS suggests that the human-to-human interface is critical. This is an understudied interface in the context of DCS, as research on digitally enabled services often focuses on the use of digitized data (Iansiti & Lakhani, 2014). In the

examined firm, human–human feedback has increased exponentially since the introduction of DCS, underlying the importance of not only using abundance of codified customer feedback, but also utilizing personalized feedback.

5.2.2 DCS require a new scope for quality management

Compared to the conventional view that the main responsibility for quality improvement efforts rests with a central quality function, DCS makes quality improvements more *external* and *dispersed.* First, DCS entail that the customer assesses the quality of the offering (Macdonald et al., 2016) in relation to the value added to the customer in the use phase (Mathieu, 2001; Sousa & Da Silveira, 2017). Second, the feedback is dispersed and handled through various channels between the customer and the provider. Moreover, DCS improvements require the quality management organization to build bridges and new constellation of intra- and inter-organizational functions (such as IT, customer service, and end-users).

5.2.3 Ability to process both personalized and codified feedback

Current organizational structure and processes fall short in coping with the new requirement of DCS, which limits both the sharing and usage of customer-initiated feedback. The ability to do so must be understood with respect to the nature of the feedback; customer-initiated feedback of DCS should be regarded as a *combination* of personalized and codified feedback, rather than being either/or, as extant literature has suggested (Fundin & Elg, 2010). The underlying idea of this combination is derived from the nature of DCS, examined here as an advanced, customized service with a high degree of digitalization. To this end, customer-initiated feedback of DCS becomes a combination of both personalized *human-to-human* feedback, which is typical for services supporting the customer, and codified *digital-to-digital* and *human-to-digital* feedback.

5.3 Knowledge conversion of customer-initiated feedback

The use of customer feedback aims to generate improvement ideas (Wirtz et al., 2010; Linderman et al., 2004), and learning about customers and their needs (Caemmerer & Wilson, 2010). Current literature points out that servitization and digitalization have triggered a need to re-evaluate existing service improvement processes (Porter & Heppelmann, 2014; Bustinza et al. 2013), in which feedback processes are a vital component (Fundin & Elg, 2010). DCS entail a firmer focus on customer-initiated feedback, rather than provider-driven collection and processing of feedback. Accordingly, it becomes crucial to convert personalized and often tacit feedback into explicit knowledge available throughout the organization. For customer feedback focusing on products, the feedback is channeled through several different functions before ending up within the central quality function. By contrast, a common knowledge conversion for customer-initiated DCS feedback is socialization, which encompasses a tacit-to-tacit knowledge conversion (Nonaka et al., 1996). Moreover, there seems to be only one function involved in the knowledge conversion for customer-initiated DCS feedback; sharing of knowledge beyond the individual CS employee is limited.

The lack of knowledge conversion for DCS feedback − especially externalization and combination resulting in explicit knowledge, shareable to many in a formal language or through artifacts (Nonaka et al., 1996) − limits the possibility for learning, and hence, improvements of DCS. For example, the knowledge conversion mode of combination (that is, explicit-to-explicit knowledge) is utilized to a considerably larger extent in the product feedback processes than in the DCS feedback processes. The lack of knowledge conversion processes that result in codified customer feedback for DCS makes individual employees knowledge carriers and thus makes the firm more vulnerable for employee turnover, as the knowledge is residing in individuals rather than within the organization (Easterby-Lyles & Smith, 2011).

The challenges in enabling knowledge conversion based on DCS feedback are further accentuated by an organizational disconnect between the CS function and the central quality function. The knowledge conversion process regarding DCS feedback is limited to isolated parts of the organization, with no knowledge conversion occurring between the different receivers of customer feedback (that is, the central quality function and the CS function). Bridging different parts of the organization is challenged by the difficulty of facilitating knowledge sharing

between employees with different professional backgrounds (Easterby-Lyles & Smith, 2011), in this case quality management and CS.

Conclusively, for DCS, the predominant channels of customer-initiated feedback into the firm are short and focus on systematic information processing (Morgan et al., 2005), such as collecting, aggregating, and analyzing data; however, there is a lack of systematic action-taking. The customer-initiated feedback is handled in the individual customer relationship and does not lead to aggregated analysis or systematic improvements.

6. Conclusions and implications

Overall, offering DCS entails requirements on handling customer feedback that cascade through new internal and external boundaries. DCS entail the extension of the boundaries of provider–customer interaction from discrete events to continuous provider–customer interactions, thus posing new possibilities for firms to continuously manage and improve their offering. We argue that firms need a better understanding of how to organize and manage customer-initiated feedback processes.

First, the provider-customer interface was investigated in relation to DCS. It has been suggested that, due to the user-centric nature of DCS, the improvement of these require an ability to manage *quality-in-use*. DCS create a new arena for improvements that must be responded to both in scale and scope. DCS entail that companies must be able to deal with customer interactions at a much larger scale than for other services. Moreover, in terms of scope, feedback on DCS takes place continuously through both digital-to-human and human-to-human interfaces.

Second, DCS have attributes that enhance both technical and social dimensions of feedback systems. Numerous service users can initiate and deliver feedback to multiple recipients in the organization and cross various organizational boundaries. Within the organization, new organizational units become involved in handling customer feedback and, by extension, quality improvements.

Third, codified customer feedback must be complemented by processes that allow for the utilization of personalized feedback. By this, the feedback processes must be regarded as knowledge conversion processes, where quality improvement based on customer-initiated feedback depends upon the ability to learn. This learning departs from a combination of codified and personalized feedback.

6.1. Theoretical implications

The conceptualization of this research is based upon DCS as service resulting from both servitization and digitalization. The intersection between these two has recently gained increasing interest (see, e.g., Coreynen et al., 2017), especially since the service interface is usually technology-dominant from the provider's side (Larivière et al., 2017). DCS follow a firmer customer-centric logic (Heinonen & Strandvik, 2018) and operationalize the 'connected' part of DCS through three dimensions: channeling, processing, and knowledge conversion.

The first contribution is a proposed extension of the current product-service typology in that DCS can be regarded as being a customer-centric (Heinonen & Strandvik, 2018), advanced service offering that aims to support the customer (Mathieu, 2001) while simultaneously being highly digitalized and delivered through a digital interface. Accordingly, with regard to value delivery, technology and the user are regarded as inseparable (Cecez-Kecmanovic et al., 2014).

The second contribution relates to the type of interfaces between providers and customers, through which customer-initiated, human-human feedback grows in importance in the age of digitalization and big data. Research on digital services tends to focus on the evaluation of online retailing (Collier & Bienstock, 2006), e-service quality (Ladhari, 2010), the use of digitized data (Iansiti & Lakhani, 2014), and customers providing feedback in social media (Iankova et al., 2018). These studies are primarily concerned with the digital-to-digital, or human-to-digital interface,

whilst the human-to-human interface as in DCS has received little attention. This paper showcases how DCS can trigger an increase in human-to-human feedback, which, if not utilized systematically, represents a missed opportunity for quality improvements.

Finally, whereas abundant data and feedback can be gathered from a digital-digital feedback interface, DCS move quality improvement into the use-phase with an increasing amount of personalized feedback provided through an interface that combines digital and human attributes. To this end, customer-initiated DCS feedback needs knowledge conversion modes to analyze and codify personalized feedback, especially externalization and combination (Nonaka et al., 1996).

6.2. Managerial implications

Providers of service offerings need to adapt to DCS as current customer-feedback processes fall short in terms of capturing the unique characteristics of DCS. Although the connectivity in the actual service delivery is enabled by digital technology, the processes through which customer experience is channeled are currently characterized by high degree of human intervention. Different clock-speeds in the improvement efforts due to organizational discrepancies must be dealt with. Customer-initiated feedback of DCS arises from the individual customer's experience, and since they are not willing to wait long for response to their inquiries, improvement processes must be personalized to the individual case. However, they must also be aggregated to a higher level so the solution and principles for improved practices can be spread across organizational functions other than the one receiving the customer feedback. Accordingly, managers must be able to both address quick improvements through channeling and processing as well as work with more long-term knowledge creation.

Responding to long withstanding call from practitioners to breaking from silos when integrating customer experience into improvements (Aksoy et al., 2019), this paper presents three distinct components to better support customer feedback as a basis for quality improvements of DCS. First, with respect to the interface between the provider of service offering and customers, there is a need to develop feedback channels for personalized feedback from customers into the organization. Second, internally, service providers need to establish practices for assessing quality of DCS in the use phase. Processes that connect the CS function to the firm's central quality function are needed in order to be able to utilize customer feedback as a basis for improvements and developments of DCS.

Third, also taking place at firm level, knowledge conversion must occur between receivers and users of customer feedback to turn this data into actual improvements. At a more societal level, the results assist in bridging the gap between the potential which technology is offering and the practices needed to release that potential. The suggested components help exploiting the potential of technology in order to understand the customers better and potentially in the future be able to provide better services which ultimately can change the customers' behavior in order to drive a more sustainable society.

The present study is based upon a single case, which limits the possibility to compare and contrast results across firms and sectors. Despite such limited generalizability, the explorative nature of the problem advocates a single-case study approach (Voss et al., 2002). This was also considered appropriate as DCS can be considered a nascent concept, not previously well investigated (Edmondson and McManus, 2007). As response to this limitation, analytical generalizability of the results (Yin, 2014) was enhanced by discussing the three components for enhancing customer-initiated feedback of DCS, namely channeling, processing and knowledge conversion with respect to the domain literature in the study. The framework in which these are displayed in Figure 2 allows the growing literature on Internet of Things and smart services to be analyzed with respect to both intra- and inter-organizational features of customer-initiated feedback. Further research is required to understand the configurations of human and digital interfaces with respect to the three components. Moreover, the study departed from customer feedback initiated by individuals, i.e. a human dimension, but future research should seek to combine this with digital-digital feedback interface by including sensor data collected from the items in-use. The use of sensor data for quality improvements is expected to grow fast, and as connectivity becomes automated, this must also be investigated as an emerging feature of DCS. Further research should also revisit the classification presented by Mathieu (2001) of SSP and

SSC and explores these linkages with respect to feedback channels. Finally, future research should compare servitized manufacturing settings with other services contexts in which connectivity is of great concern, for example healthcare and logistics.

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Table 1. Overview of data collection

	Focus group I (n=1)	Open interview (n=1)	Non-participant observation	Semi-structured interviews (n=2)	Structured interviews (n=8)	Focus group II (n=1)
Informant(s)	- DCS Quality Manager - VP Global Consumer Experience Quality - VP Corporate Quality - Acting Quality Director	- DCS Quality Manager	- DCS Quality Manager	- Customer Service Director	- Senior Director Quality - Quality Audit Manager - Business Development Director R&D - Senior IT Director - Internal Audits and Assessments Expert - Senior Manager Quality Methods - Senior Advisor Quality - VP Corporate Quality	- Customer Service Director - Acting Quality Director
Aim	To get a broad perspective on current challenges and activities related to DCS.	To obtain in-depth understanding of the challenges and scope of the problem identified in the focus group.	To capture the processes and organizational aspects of DCS improvement work.	To capture insights from the customer facing unit regarding DCS improvement work.	To get an understanding of DCS improvement work and how different actors are involved in DCS improvement processes.	To validate findings.
Insights	An overview of different types of challenges regarding the work with improving DCS. Identification of relevant interviewees.	An understanding of the type of DCS quality feedback that reaches the DCS Quality Manager and the processes and activities used in the improvement work. Input to semi-structured and structured interviews. Identification of relevant interviewees.	Contextualized information of the processes, activities and organizational aspects surrounding customer feedback. Input to semi-structured and structured interviews.	Insights into the organizational disconnect between the customer facing function and the centralized quality function. A map over customer-initiated feedback channels reaching, and entering, the firm.	Further in-depth understanding of the improvement processes, combined with validation and clarification of previous findings.	Validation and clarification of findings.

Table 2. Example of data coding categories and progression

Raw data (examples)	NVivo codes*	First order categories	Second order themes
"I often hear about quality issues from colleagues, who come up to me by the coffee machine and tell me about how the mobile application was not functioning properly that morning." [DCS quality director]	Customer – firm interfaces	Inter-organizational interfaces	Channelling
	DCS – firm interfaces		
	*DCS feedback channels (passive/active, personalized/codified)	Feedback channels	
	Product feedback channels (passive/active, personalized/codified)		
"The local sales office might not suffer from this particular quality issue, maybe it's a good deal for them, they know how to solve the issue, and they earn a lot of money of it. Will they channel it back into the organization as an issue then? However, if there is an issue where the customer maybe doesn't suffer that much, but it is a problem for the local sales office, then they will channel that issue into the organization" [Corporate quality manager]	Intra-organizational DCS feedback interfaces	Organizing for DCS improvements	Processing
	Interfaces between functions working with DCS		
	*Organizational challenges when working with DCS		
	Formalized, codified customer feedback processes	Processes for working with customer feedback	
	Informal, personalized customer feedback processes		
"When the [DCS feedback] volume suddenly exploded [...] the organization appeared to be quite lost; who owns this issue? Who should we direct this feedback to? Initially, when we tried to channel the feedback to the central quality function, we received the answer that this was not their job: 'We work with the product, we don't work with DCS'" [Customer service director]	*Customer feedback received and transferred by customer service function	Customer feedback information transfer between organizational functions	Knowledge conversion
	Customer feedback received and transferred by centralized quality function		
	Applying and transferring product-feedback information	Converting customer feedback regarding products and DCS into knowledge	
	Applying and transferring DCS-feedback information		

*The NVivo code against which the example in column 1 was coded

Table 3. Comparison of DCS with other types of advanced services

	Type of service		
	SSP	SSC	DCS
Recipient	Product	Person (buyer)	Person (user)
Intensity of the supplier–customer relationship	Low	High	Medium; customer highly involved in co-creation, but feedback process is multifaceted, possessing elements of both SSP and SSC relationships
Degree of service customization	Low	High	Medium (digital configuration)
Predominant service process variables	Physical evidence - process	People (direct)	People and digital technology (remote)

Table 4. Types of provider–user interfaces for customer feedback processes

Digital-Digital (D-D)	**Digital-Human** (D-H)	**Human-Digital** (H-D)	**Human-Human** (H-H)
Sensor-driven	Digital monitoring Automated feedback	Social media Smart-phone app	Personal contact Dialogue
Unilateral	Bilateral	Unilateral	Bilateral

Digitally connected services:
Improvements through customer-initiated feedback

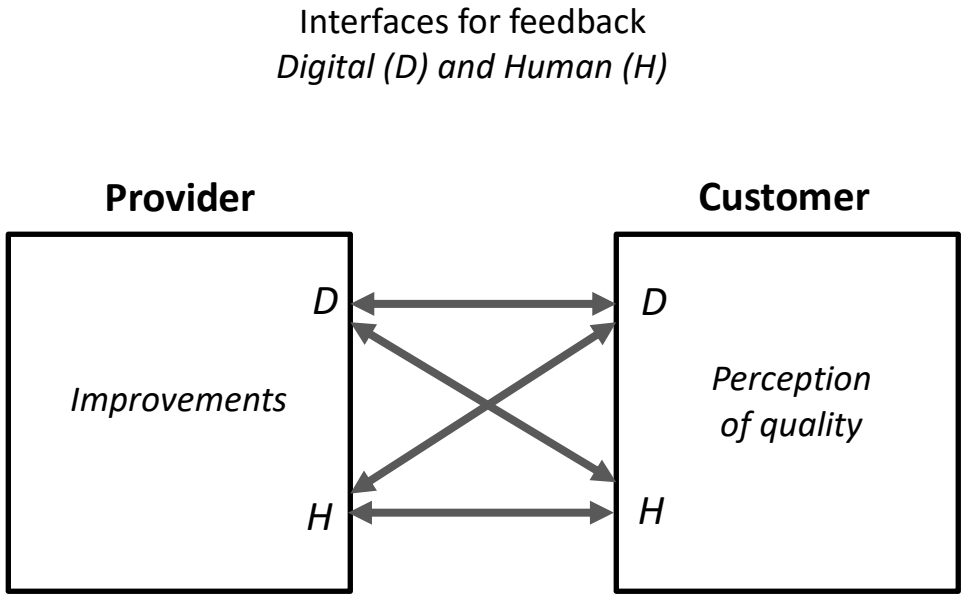

Figure 1. A conceptual framework: Feedback interfaces connecting the customer's perception of quality and the provider's improvement work.

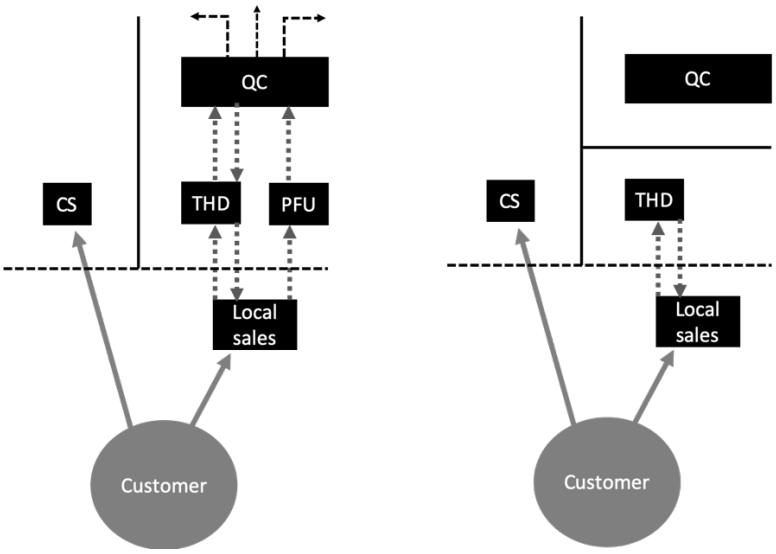

Figure 2. Customer-initiated feedback processes for quality issues regarding products versus DCS.

QC: Quality of Current offering, the central quality function at the firm

CS: Customer Service function

PFU: Product Follow Up function, gathers statistics of all product quality issues and develops 'cases' of them which are sent to QC

THD: Technical Helpdesk, helps the local sales office with issues they cannot fix themselves. THD handles single cases, whilst PFU handles 'volumes'

——→ : personalized feedback (i.e. the customer comes to the local sales office and voices the quality issue, or calls the customer service function)

·····→ : codified feedback through computerized systems

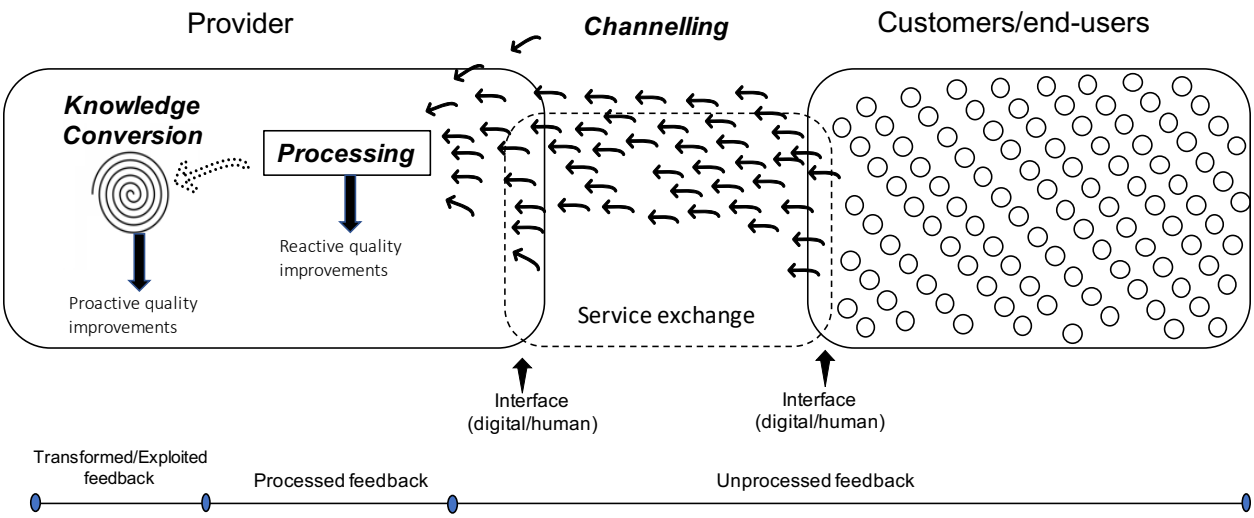

Figure 3. A proposed framework for customer-initiated feedback for quality improvement of DCS.