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Abstract

Purpose – The purpose is to understand how the role of quality functions might evolve amidst digitalisation and an increased focus on services. This study focuses on customer feedback and how it can function as activation triggers for developing absorptive capacity, as well as how it relates to the value creation processes.

Design/methodology/approach – Following a qualitative research design, the authors gathered primary data from interviews with quality managers at 17 UK and Swedish firms and triangulated it with secondary information from the firms' web pages.

Findings – The findings show that customer feedback-based activation triggers can support development of absorptive capacity in the quality function if there are established processes for acting on customer feedback. This is often the case for codified feedback, which normally concerns products. However, digitalisation offers new opportunities of engaging in value co-creation, and firms need to develop digital capabilities to manage new technologies and data analytic tools. For personalised feedback (the main category of service-related feedback), established processes are missing.

Originality/value – This study work contributes to knowledge about how quality functions respond to customer feedback on both products and services. It clarifies why the quality function sometimes struggles to contribute to service quality as much as to product quality. From a theory development perspective, the authors contribute to understanding customer feedback-based activation triggers, how they lead to development of absorptive capacity and their relation to value co-creation on a functional level.

Keywords Quality function, Absorptive capacity, Activation triggers, Customer feedback,
Value creation process

Paper type Research paper

Introduction

In manufacturing firms, efforts to manage quality are often performed by a well-established quality function (Sousa and Voss, 2002). As manufacturing firms continue to expand their

offerings to include services (Kohtamäki *et al.*, 2020; Li *et al.*, 2020) and digital offerings (Kohtamäki *et al.*, 2021), the roles and practices to support improvements in products are challenged (Baines *et al.*, 2020). Customer feedback becomes even more important (Kohtamäki *et al.*, 2021), as it is a vital component for service improvements (Caemmerer and Wilson, 2010). Gunasekaran *et al.* (2019) argue that in the Industry 4.0 era, the quality function needs to transition from a policing role to a proactive role, collaborating internally with other functions and externally with customers.

Offering both products and services increases pressure on the quality function to thoroughly understand the subjective value created for customers during product usage (Wen *et al.*, 2020). However, recent studies show that the quality function does not fully exploit customer feedback (Elg *et al.*, 2020; Kumar *et al.*, 2020). As interest in services increases, the use of customer feedback, ranging from personalised to codified, increasingly challenges quality function to identify customers' feedback earlier and use it to focus on value creation (Birch-Jensen *et al.*, 2020; Gunasekaran *et al.*, 2019; Sjödin *et al.*, 2019). This evolution in the digital era forces quality functions to not only act on passively generated customer feedback, but also actively collect and act on the customer feedback during the product usage stage (Fundin and Elg, 2006).

Organisations offering products and services face several paradoxes, including that of "organising for product and service integration vs separated service and product organisations" (Kohtamäki *et al.*, 2020), that result in suboptimal behaviour due to less effective collaboration between different divisions or units. Integrating end-to-end operations, clarifying roles and responsibilities in different organisational levels and units, and sharing information about bottlenecks in the end-to-end process represent coping mechanisms used to promote organisations' effective integration of product and service units for increased value creation (Kohtamäki *et al.*, 2020, 2021; Rabetino *et al.*, 2021).

As Industry 4.0 technologies aim to achieve end-to-end integration in supply chains, the role of quality function in facilitating provider–customer integration has become increasingly relevant. Building on the aforementioned coping strategies (Kohtamäki *et al.*, 2021), we shifted focus in our study from firm-level to the quality function as the unit of analysis for understanding their role in achieving better integration between manufacturing and service units of the firm. The quality function faces several challenges to stay relevant in the era of Industry 4.0. Within Industry 4.0, the concept of *Quality 4.0* is defined as "a customer-centric and digitally enabled approach to the integration of people with process and technology across the value chain (including vertical, horizontal, and end to end integration) for taking evidence-based decisions in collaboration with internal and external stakeholders in the value chain" (Chiarini and Kumar, 2021, p. 14).

In an attempt to transition towards Quality 4.0, the quality function needs to redefine its roles and develop new practices, including customer interactions, to better support new types of offerings (Birch-Jensen *et al.*, 2020; Sony *et al.*, 2020) and enhance value creation. To understand the potential of enhancing value creation, we applied Grönroos and Voima's (2013) framework of the value creation process, in which value is understood to be created by customers in the customer sphere. In the provider sphere, providers can facilitate value creation by creating or assembling different types of resources. Manufacturing firms tend to focus more on the provider sphere, wherein value creation is facilitated when products are produced (Wen *et al.*, 2020). However, that focus persists even if offerings are extended to include services (Martin *et al.*, 2019), which potentially limits quality function in acting on customer feedback from the joint and customer spheres of value creation. Thus, the potential for the function to play a key role in provider–customer integration is not fully exploited and the joint sphere is not expanded. Provider-customer integration could help quality functions

contribute more towards value co-creation by proactively dealing with customer-generated feedback (Fundin and Elg, 2006).

To fully benefit from customer feedback, focusing on the provider sphere is arguably problematic. Based on the argument above and consistent with Galbraith (2002), product-based structures for using customer feedback need to be complemented by the ability to respond to such feedback related to services. An important ingredient is the capacity to absorb and use new knowledge to be able to respond to the feedback with improvements (Lervik Olsen *et al.*, 2014; Nagati and Rebolledo, 2012; Sony *et al.*, 2020). That capacity is often described as *absorptive capacity*, or the firm's ability to "recognise the value of new, external information, assimilate it, and apply it to commercial ends" (Cohen and Levinthal, 1990, p. 128). Research has demonstrated that constant investment in developing absorptive capacity allows firms to keep abreast of technological opportunities (Arcidiacono *et al.*, 2022) and changing requirements of customers, thus enhancing the likelihood of spillover between internal and external sources of knowledge (Cohen and Levinthal, 1990; Rothaermel and Alexandre, 2009).

The development of absorptive capacity is stimulated by *activation triggers*, defined as "events that encourage or compel a firm to respond to specific internal or external stimuli" (Zahra and George, 2002, p. 193). Many practices the quality function use – such as conducting satisfaction surveys and managing customers' complaints – can act as *activation triggers*, and have been shown to positively impact the absorptive capacity of firms (Perez Arostegui *et al.*, 2013). This shows that quality functions can act as an interface through which knowledge from external sources can be absorbed, and underscores the function's potential to contribute to value creation by responding to customer feedback-based activation triggers (CFAT). Inspired by Zahra and George (2002), CFAT are here defined as customer feedback that compels a firm to respond by developing their absorptive capacity.

With the purpose to understand how the role of quality functions might evolve amidst digitalisation and an increased focus on services, the following research questions are posed for this study:

RQ1. How can different types of customer feedback function as activation triggers for developing absorptive capacity of the quality function?

RQ2. How does CFAT relate to the value creation process for manufacturing firms offering products and services?

Our work contributes to research on quality function by exploring CFAT, absorptive capacity and the value creation process. It also clarifies why the quality function sometimes struggles to contribute to service quality as much as to product quality. Contributions to the literature on absorptive capacity derive from our focus on activation triggers and the functional level, rather than the more commonly focused firm (Gluch *et al.*, 2009) or individual (Enkel *et al.*, 2017) levels. Whereas large, external market changes (Zahra and George, 2002) are often studied as activation triggers, we focus on CFAT. A typology of CFAT is developed and different types of customer feedback and their influence on the quality function's absorptive capacity for value creation are explored.

Theoretical background

As manufacturing firms continue expanding their product offerings to include services and digital offerings (Baines *et al.*, 2020; Kohtamäki *et al.*, 2020), how customer feedback reaches quality functions have changed (Birch-Jensen *et al.*, 2020) and opportunities for interacting with customers have increased (Brax and Jonsson, 2009; Grönroos and Ravald, 2011). In turn,

those changes have enhanced opportunities for quality function to contribute to value creation (Birch-Jensen *et al.*, 2020; Eriksson *et al.*, 2016; Sony *et al.*, 2020) – for example, by pinpointing the need to absorb new knowledge to enhance value creation (Sony *et al.*, 2020).

Absorptive capacity and customer feedback-based activation triggers
Absorptive capacity describes a firm's capacity to recognise new external knowledge and exploit it in a value-adding way (Cohen and Levinthal, 1990). Zahra and George (2002) have divided absorptive capacity into four capabilities: two concern *potential absorptive capacity*, or the ability to capture new knowledge, and two concern *realised absorptive capacity*, or applying knowledge to create more value or enhance competitiveness.

Potential absorptive capacity represents two capabilities: acquisition and assimilation (Zahra and George, 2002). *Acquisition* concerns the ability to identify and capture new knowledge external to the firm, whereas *assimilation* refers to the practices through which new knowledge is processed and analysed. Further, realised absorptive capacity is based on two capabilities: transformation and exploitation. *Transformation* refers to the firm's ability to combine new knowledge with existing practices and routines into new schemata, whereas *exploitation* means to refine and/or extend existing practices or to create new ones owing to new knowledge.

For firms to truly benefit from new knowledge their activities for generating potential absorptive capacity need to be followed by activities for generating realised absorptive capacity (Camisón and Forés, 2010). Learning skills is crucial for realised absorptive capacity, especially amongst individuals operating as *boundary persons*, defined as actors who interact with a firm's customers or suppliers (Kohtamäki and Partanen, 2016), for example, customer-facing service employees who receive the most customer feedback (Wirtz *et al.*, 2010) and employees in the quality function with competencies in managing customers' needs (Ponsignon *et al.*, 2019). The information they gather from customers requires integration into collective action to transform that information into knowledge (Nonaka, 2007). The result of both potential and realised absorptive capacity constitutes a source of value creation and can be used to turn organisational resources into a competitive advantage (Fink *et al.*, 2017).

Along with research on firms' overall absorptive capacity, another stream of research focusing on individuals' absorptive capacity (Cohen and Levinthal, 1990; Enkel *et al.*, 2017; Ter Wal *et al.*, 2017) underscored the importance of individuals in making organisations innovative by increasing their absorption of knowledge from the environment (Cohen and Levinthal, 1990; Enkel *et al.*, 2017; Ter Wal *et al.*, 2017). By contrast, our research peered beyond organisations and individuals to showcase absorptive capacity of quality functions. In that light, this paper contributes to the rather limited literature on absorptive capacity at the functional level (Table 1).

Researchers have called for more empirical studies within operations management that employ absorptive capacity (Walker *et al.*, 2015) to focus on the "content and mechanisms of knowledge transfer" in the interactions between manufacturing firms and customers (Nagati and Rebolledo, 2012, p. 625), as well as antecedents for absorptive capacity at various organisational levels (Volberda *et al.*, 2010). One such mechanism or antecedent is activation triggers (Zahra and George, 2002). Although the studies in Table 1 addressed the functional-level, they did not probe how activation triggers support the development of absorptive capacity. This paper addresses the research gap on absorptive capacity at a functional level, and on activation triggers, by positioning customer feedback as a potential activation trigger arising in customer–firm interactions with the potential to inform the quality function that new external knowledge needs to be absorbed. Hence, we focus on antecedents of potential absorptive capacity in terms of CFAT.

Source	Type of study and sample	Focus of study	Function(s) studied	Key findings	Customers' role in relation to absorptive capacity
Bogers and Lhuillery (2011)	Survey of 659 respondents in manufacturing firms	Absorption of external knowledge from R&D, manufacturing and marketing functions	R&D, manufacturing and marketing	Different functions have different roles to play in absorbing external knowledge. R&D absorbs knowledge for product innovation from public research, manufacturing supports the absorption of knowledge about suppliers and competitors for product and process innovations, and marketing absorbs knowledge about customers and competitors for product and process innovations	Activation triggers are not mentioned or studied. Customer knowledge is positioned as something to be absorbed, foremost by the marketing function
Lin et al. (2016)	Survey of 191 students and respondents from service and manufacturing firms	Impact of knowledge loss on the MIS Department's absorptive capacity and performance	Management Information System (MIS) Department	Knowledge loss due to high turnover impacts the MIS Department's absorptive capacity and performance, which can be mitigated via information systems (IS) and IS employees' internal and external partnerships	Main focus on the internal organisation, no mention of absorption of customer knowledge or of activation triggers
Patrucco et al. (2017)	Survey of 524 respondents in service and manufacturing firms	Role of purchasing functions' absorptive capacity in supporting collaborative product development with suppliers	Purchasing	Purchasing departments' absorptive capacity enables collaboration with suppliers. Absorptive capacity increases along with the status of purchasing in the firm	Focus on business-to-business relations where suppliers provide knowledge through competencies and resources to be acquired by their customers. No mentioning of activation triggers or activities that spur the acquisition of new knowledge

(continued)

Table 1.
Studies on absorptive capacity at a functional level

Source	Type of study and sample	Focus of study	Function(s) studied	Key findings	Customers' role in relation to absorptive capacity
Setia and Patel (2013)	Archival data and a multi-respondent survey of 153 manufacturing firms	How information system design facilitates operational absorptive capacity, how both potential and realised absorptive capacity relate to market valuation, and how that relationship can be enhanced by business environments	Operations Management (OM) Department	The potential operational absorptive capacity indirectly influences a firm's market valuation via realised operational absorptive capacity, namely by linking IS design to Operations Management Departments' absorptive capacity (e.g. strategic IS design catalyses potential operational absorptive capacity)	Focus organisations' internal activities but positions that an OM department "identify, gather and develop knowledge from other organizational functions, customers, suppliers and third parties" (p. 411). No mentioning of activation triggers
Difrancesco et al. (2022)	Survey of 305 procurement executives in four European countries	How the availability of information interplays with Purchasing realised absorptive capacity (PRAC) to positively impact performance	Purchasing Department	Transforming PRAC through better exploitation and transformation of external knowledge from the suppliers and identify opportunities to improve in the environmental and social areas of performance metrics. Information sharing between buyer–supplier. This is among very few studies that propose PRAC as a key factor to positively impact on operational performance	Focus mostly on information sharing mechanisms with suppliers to influence realised absorptive capacity of purchasing departments. Focus limited to the provider sphere- no discussion on how external knowledge can be assimilated from customers for value creation. No mentioning of activation triggers
Arcidiacono et al. (2022)	Qualitative study involving 37 in depth interviews across 12 firms from Automotive Supply Chain in Northern Italy	The study investigates how absorptive capacity (AC) impact smart manufacturing (SM) advancement and how managerial antecedents support the capacity to absorb SM-related knowledge at different stages of SM adoption	Participants mostly from Operations, Quality, Sales and Senior management	AC is crucial dynamic capability for SM adoption and required co-evolvement along with SM. Managerial capabilities (i.e. integrative capacities, cognition and knowledge development capabilities) need to be developed in organisation to support AC and to progress from lower to higher levels of SM	Limited data and focus on how external knowledge search and acquisition can influence different stages of SM. The study mostly focuses on intra-firm antecedents and neglected external characteristics, especially how knowledge is accumulated from external environment. No mention of activation trigger

Table 1.

As displayed in Table 1, all but one of the included studies use a survey methodology to establish causal links between the function's absorptive capacity and performance (e.g. Difrancesco *et al.*, 2022; Lin *et al.*, 2016) or to evaluate how external information availability impacts a function's absorptive capacity (e.g. Bogers and Lhuillery, 2011; Patrucco *et al.*, 2017; Difrancesco *et al.*, 2022). The studies in Table 1 neglected the role of activation triggers, and in the cases where customers were considered, it was the customers' knowledge that was positioned as the external knowledge to be absorbed. Hence, the antecedents of absorptive capacity in terms of CFAT were neglected (Volberda *et al.*, 2010). In line with this, Arcidiacono *et al.* (2022) state that research on absorptive capacity fall short in explaining how external environment antecedents (such as CFAT) impact the development of absorptive capacity in the firms.

Customer feedback
Customer feedback can reach the quality function in various forms, including measurements of satisfaction (Hallencreutz and Parmler, 2021), experiments or tests (Fundin and Elg, 2006), or complaints (Bosch and Enríquez, 2005). For example, customer feedback gathered from complaints submitted to customer-facing employees is a common channel generating activation triggers for providers. However, that channel risks ceasing to disseminate throughout the firm (Wirtz *et al.*, 2010).

A firm's ability to identify and act on customer feedback-based activation triggers can be augmented by using sensors in products. Generating big data for informed decision-making is an area prioritised by Quality 4.0 (Sony *et al.*, 2020), which has consequently supported the development of big data analytics tools (Marshall *et al.*, 2015). Such development is further enhanced by the increase in digital products and services in which customer feedback has emerged as a potential goldmine (Kohtamäki *et al.*, 2021; Rabetino *et al.*, 2021; Schroeder *et al.*, 2020).

In operationalising customer feedback, Fundin and Elg (2006) outlined a classification based on two dimensions: codified–personalised feedback and active–passive feedback. *Codified feedback* is data acquired and transmitted digitally, as in a formal database, whereas *personalised feedback* is generated and transmitted between people. Beyond types of data, another dimension concerns whether providers actively solicit feedback, referred to as *active feedback*, or initiated by customers, referred to as *passive feedback* (Kumar *et al.*, 2020).

When manufacturing firms extend their service businesses, direct customer–provider interaction possibilities expand (Grönroos and Ravald, 2011; Kohtamäki *et al.*, 2021). The emergence of digitally connected products and services has further impacted the development and delivery of firms' offerings, as well as customer interactions and feedback (Baines *et al.*, 2020; Birch-Jensen *et al.*, 2020; Elg *et al.*, 2020; Kohtamäki *et al.*, 2021). However, insights into the customer sphere and customers' processes are crucial for value creation through service offerings (Kohtamäki and Partanen, 2016). When a manufacturing firm begins offering services, it arguably expands the provider–customer interaction and creates new opportunities to identify and act upon customer feedback. However, studies on customer feedback have often focused on the firm as the unit of analysis; for instance, to explicate the processes for using customer satisfaction information (Lervik Olsen *et al.*, 2014) and identify drivers of customer satisfaction (Hallencreutz and Parmler, 2021). By contrast, we focused on CFAT and the quality function.

Value creation process
Both direct and indirect interactions are important throughout the value creation process (Grönroos and Voima, 2013) because through those interactions customer feedback is conveyed (Birch-Jensen *et al.*, 2020; Eriksson *et al.*, 2016; Valentina and Passiante, 2009).

Customers create value as products and services are used, and this can be understood according to three spheres of value creation: the provider, joint and customer spheres (Grönroos and Voima, 2013). The *provider sphere*, where providers offer resources that can facilitate customers' value-in-use, includes all areas that involve only providers. Potential customer value is created in the provider sphere, and no customer–provider interaction occurs. Direct customer–provider interaction occurring in the *joint sphere* can involve customers in providers' production processes as co-producers or providers in customers' value creation as value co-creators (Grönroos and Voima, 2013). There is no direct customer–provider interaction in the *customer sphere*, and value is created as value-in-use. However, despite the lack of direct interaction, providers need to clearly understand the processes in the customer sphere to be able to understand customers' needs (Brax and Jonsson, 2009).

Becoming co-creators of value and engaging in customers' value creation can be challenging for manufacturing firms if focusing primarily on the provider sphere. To co-create value with customers in the context of services and digital offerings, manufacturing firms need to manage the increased complexity of their offerings and pay attention to customer-generated activation triggers (Bolton *et al.*, 2018; Kohtamäki *et al.*, 2021). As feedback collected in the joint sphere becomes increasingly important (Caemmerer and Wilson, 2010), new demands on quality function arise regarding identifying, capturing and using customer feedback. As creators of value, customers are key stakeholders (Grönroos and Voima, 2013) and provider–customer interactions like customer feedback processes are forms of stakeholder pressure that can act as activation triggers for absorptive capacity development by the quality function.

Research method
To fulfil the purpose we adopted a qualitative research design given its usefulness in studying phenomena that remain poorly understood (Meredith, 1998; Yin, 2014), including challenges for quality functions in manufacturing firms that offer services and digital offerings. Qualitative designs are also suitable when adding elements to the literature (Meredith, 1998; Yin, 2014) – in our case, combining absorptive capacity (e.g. Zahra and George, 2002) with empirical insights into CFAT, and analysing this combination through the theoretical lens of the value creation process (Grönroos and Voima, 2013). Our overall approach was abductive, meaning that we iteratively combined our empirical findings with the literature to continuously inform our analysis (Dubois and Gadde, 2002).

Sampling
Empirical data were collected from 17 UK and Swedish manufacturing firms, sampled based on three criteria:

(1) Being a manufacturing firm;

(2) Offering services and solutions, including digital, maintenance, after-sales or educational services; and

(3) Having an established organisational unit for quality (i.e. a quality function).

Although operating in different industries, all 17 firms have a manufacturing background, including medical devices, packaging and construction equipment. Second, the firms have all started to offer services, which enabled our exploration of how customer feedback about both products and services reaches quality function. Third, in having an established quality function with practices originally developed to support product quality, the firms could be expected to have added service offerings that influence their quality-oriented practices.

To ensure that all participating firms met the criteria, we used purposive sampling (Miles *et al.*, 2020).

Data collection
The unit of analysis was the use of customer feedback by the firms' quality function. Although customer feedback can be acquired by multiple functions, including customer service, marketing and quality, we focused on the quality function and data collection focused on managers therein. The respondents at the firms were sampled because they held senior managerial positions related to quality, with titles that varied slightly depending on the focus of the firm's quality function. Table 2 lists all respondents and their industry, title, country and identifier (i.e. QM1–QM17).

The use of semi-structured interviews, lasting 40–90 min, afforded us rich, contextual insights and the flexibility to adjust some questions to capture respondents' perceptions and experiences (Rowley, 2012). Interview questions included "How do you receive customer feedback about your products and/or services?" and "What triggers the flow of that information to you?" The interviews were recorded and transcribed with the respondents' permission.

Interviews were complemented with data from secondary sources, predominantly digital customer–provider interfaces (e.g. firms' websites), with a focus on identifying customer feedback channels. To use firms' websites as sources of secondary data (e.g. Rouquet *et al.*, 2017), we visited each firm's website and identified channels and interfaces for customer feedback therein.

Data analysis
Two co-authors first read the interview transcripts to identify mentions of customer feedback during data analysis. This first step was focused on getting an overview of the data and

Industry	Title	Country	Identifier
Aviation	Senior quality leader	UK	QM1
Medical devices manufacturing	Quality manager	UK	QM2
Appliances manufacturing	Quality assurance executive engineer	UK	QM3
Industrial vehicles manufacturing	Quality director	UK	QM4
Food processing and packaging	Head of quality, environment, health and safety	UK	QM5
Furniture manufacturing	Manager of quality, environment, health and safety	UK	QM6
Electrical components manufacturing	Director of quality	UK	QM7
Industrial components manufacturing	Head of quality	Sweden	QM8
Workplace solutions	Chief quality officer	Sweden	QM9
Construction equipment manufacturing	Quality manager	Sweden	QM10
Forest products	Quality manager	Sweden	QM11
Photography equipment manufacturing	Quality manager	Sweden	QM12
Bearing manufacturing	Industrial sales quality manager	Sweden	QM13
Food packaging	Quality and sustainability director	Sweden	QM14
Warehouse solutions	Quality director	Sweden	QM15
Medical devices manufacturing	Quality and aftermarket manager	Sweden	QM16
Food packaging and processing	Quality manager	Sweden	QM17

Table 2.
Overview of respondents

identifying as many instances as possible, resembling a first-order analysis (Gioia *et al.*, 2013). Second, using NVivo 12, we conducted a thematic analysis of the primary and secondary data (Boyatzis, 1998), focusing on customer feedback in relation to activation triggers, absorptive capacity (Zahra and George, 2002) and the value creation process (Grönroos and Voima, 2013). Thus, it was a second-order analysis that moved into the theoretical realm (Gioia *et al.*, 2013). To aid analysis, we developed Table 3 to support a consistent view on the central concepts throughout coding. Table 3 was developed to describe how the key theoretical concepts were used in our study and to clearly state the inclusion and exclusion criteria to be used in the coding (Boyatzis, 1998). In line with the abductive approach, the first round of the thematic analysis was followed by a second round of coding of all transcripts to get an indication of how common various types of customer feedback were used as an input to the quality function.

Third, we analysed the identified types of customer feedback (Fundin and Elg, 2006) to develop a typology of activation triggers. The transcripts were analysed with a focus on elucidating the relationships between customer feedback types and absorptive capacity.

Research quality
We triangulated our data to enhance research quality and trustworthiness (Yin, 2014). First, combing primary data collected through interviews and secondary data from firms' websites allowed triangulation of data sources and a more holistic picture of the phenomenon (Calantone and Vickery, 2009). It also provided external corroboration of respondents' internal accounts of customer feedback channels. Although secondary data made available by firms are criticised as potentially biased and lack non-biased auditing (Ellram and Tate, 2016), data about channels for customer feedback that are publicly available can be assumed

	Provider sphere	Joint sphere	Customer sphere	Activation triggers
Description	Centred on the quality function and its interface with other firm functions and other internal processes and operations with the potential to serve as or facilitate activation triggers	Direct customer–provider interaction or customer–third-party reseller or dealer interaction that triggers the quality function's absorptive capacity	Customers' exclusive sphere without any direct interactions with providers but where triggers can eventually cause the quality function to react	Events that encourage the quality function to develop its absorptive capacity and the function's employees to take action
Inclusion criteria	Internal events in which the quality function is either the sole actor or interacts with other functions within the provider firm	Events with direct customer–provider interaction or customer–third-party reseller or dealer interaction	Events in which the customer is the sole actor but value creation relates to the provider's offering as a resource	Events that directly compels the quality function to act (e.g. product or service tests and customers' calls to customer service)
Exclusion criteria	Events with direct customer–provider contact or interaction and external events outside the provider's processes or scope	Events without direct customer–provider interaction or customer–third-party reseller or dealer interaction	Events that do not entail direct customer–provider contact	Macro-level triggers that do not cause the quality function to take direct action

Table 3.
Key concept and their interpretation

to be objective. Second, during several interviews, internal documents describing responses to different types of customer feedback (e.g. warranty issues) were presented. Those documents contained confidential information and were thus excluded from data analysis, but nevertheless served to validate the respondents' accounts.

To strengthen trustworthiness, two co-authors jointly analysed the interview data (Meredith, 1998) and frequently discussed definitions and codes. In those discussions, Table 3 served to ensure consistent coding and well-grounded discussions when drawing conclusions from the analysis. Moreover, one of the co-authors did not participate in data collection and was free to act as an external investigator, this served to enhance the trustworthiness of the analysis (Eisenhardt, 1989).

Findings

The findings are presented with a focus on the different types of customer feedback and their potential to serve as CFAT for developing quality function's absorptive capacity. These first two parts of the findings relate to RQ1. To address RQ2 the last part of the findings focus on the activation triggers' relation to value creation.

Different types of customer feedback

Table 4 presents different types of customer feedback, the firms where this type of feedback is identified, exemplary quotes, the focal type of offering, entry point to the quality function and the value creation sphere from which the feedback emanates.

In summary, eight firms report that quality functions work with personalised passive customer feedback, five with personalised active, 16 with codified passive and six with codified active. Further, Table 4 shows that respondents from quality functions mostly work with codified feedback and that this type of feedback concerns products. A type of feedback that enters the quality functions in all but two firms is complaints logged in a formal complaint system. The second most reported type of customer feedback comes from after-sales employees conveying feedback to the quality functions, often through a formal internal process. In the following, each of the four types of customer feedback will be further elaborated on and illustrated by additional quotes.

Personalised passive customer feedback was identified both regarding products and services. Although most of the service-related feedback was personalised passive, little service-related feedback of that type was conveyed to the quality function. One reported example was customers' posts on social media: *"[Our process] is very manual. It's nothing automatic. We have colleagues [in another function] just scouting those groups [on Facebook] and trying to read what's happening. . . . They email us directly when something begins to brew somewhere. But those processes are not formalised at all. It's panic mode every time"* [QM12]. That example captures the quality function's reliance on colleagues to report issues with service quality.

Unlike passive feedback, which reaches the quality function in an unplanned manner, *personalised active customer feedback* is a provider-initiated collection of customer feedback that can still be open and personal. Some respondents highlighted the disparity between products and services and the need for more personalised active customer feedback to capture service experiences. In one example a customer provided feedback directly to the quality function: *"I can just describe how it went when I visited a customer [. . .], they expressed that they had some smaller product related claims, but the biggest issue that they experienced was the actual assembly of the product. [. . .] I would never have received this info if I had not actually visited the customer"* [QM9]. Another example of personalised active feedback highlighted the importance of face-to-face interactions: *"When I visit a customer, it's often*

Type of customer feedback	Label	Identified in firm (identifier from Table 2)	Exemplary quotes	Focal type of offering	Entry point to the quality function	Value creation sphere
Personalised passive	Social media entries	QM1, QM3, QM12	"We are starting a project called customer care to actually focus more on Facebook. A lot is happening on Facebook, a lot of complaints. People just write on Facebook and it goes fast and it's huge. So I have a colleague just looking at Facebook and Twitter. It is a challenge, because it is so much, and also a lot of fake issues. It's not factual. You know, you put up a picture of our product vs a competitor's product and you just put some arrows on it and say this is really shit, this just broke. And then when we start checking and see that it has been used for two years or something. And then the guy is pissed off cause it broke. Or they have contacted us before and we have said that this is not warranty. And then they put it up on Facebook" [QM12]	Product and service	Social media	Customer sphere
	Sales visit feedback	QM4, QM9, QM11, QM13, QM16	"You'll have a sales guy who is relaying a message from the customer and it's normally a negative message and normally with some leverage. So, the urgency is high, the accuracy is low, and the importance is hard to tell" [QM4]	Product and service	Sales department	Joint sphere
	Customer call	QM1, QM4, QM11, QM12, QM13	"It's difficult to do a good job, for example when we get a phone call from a customer and if the customer is not clear what the issue is but they know they've got a machine not functioning, we have to interpret what they tell us. If they say we've got a problem with the water system, we can guess what that might be, we might need to repair a water pump, we might need to repair a water filter. But, if we get there and we find that actually it is the hydraulic system that is broken, then we did not have enough information and we did not have the right parts to do a first-time fix. That's frustrating for us and it's frustrating for the customer, they did not get a repair, and we've got to make a second visit. So, it depends very heavily on that first conversation with the customer. We need to make sure we're talking to somebody who's close to the machine, not somebody in a remote office, and who has some knowledge about how the machine works and obviously how it does not more importantly" [QM4]	Product	Customer	Joint sphere

(*continued*)

Table 4.
Different types of
customer feedback

Table 4.

Type of customer feedback	Label	Identified in firm (identifier from Table 2)	Exemplary quotes	Focal type of offering	Entry point to the quality function	Value creation sphere
Personalised active	Customer experience interview	QM13	"The traditional customer surveys do not tell us that much, what does it even mean to go from 5.2 to 6? That does not create enough awareness and momentum. But we are now doing a pilot where we try to target customer experience, so we sit down with the customers and talk to them about specific parts related to their experience" [QM13]	Service	Customer	Joint sphere
	Customer visits	QM6, QM9, QM10, QM15	"When I visit a customer, it's often because something really bad has happened. But if I arrive and manage to solve the problem constructively, [. . .] we actually have a lot to gain in those situations" [QM15]	Product and service	Customer	Joint sphere
Codified passive	Complaint system	QM1, QM2, QM3, QM4, QM5, QM6, QM8, QM9, QM10, QM11, QM12, QM13, QM15, QM16, QM17	"If our sales organization receives a customer complaint, then they according to routine should always visit the customer. If it's a known failure, then they address it back to their back office who registers a claim. And this claim is then sent to my part of the organization. We screen the claim and if we approve it then we can register it in our ERP system. And this is done every day in the morning. The summary of all claims that are registered today is sent out tomorrow to the responsible individuals. For example, all supervisors, all production engineers, and all fault engineers. So basically everybody internally receives the info of how many claims we registered yesterday. And this is sent out mostly to trigger actions" [QM9]	Product	Sales department	Joint sphere
	After sales employee feedback	QM1, QM3, QM5, QM6, QM9, QM12, QM13, QM14, QM15, QM16, QM17	"We have an after sales department, which is for our own service stations. They report to our after sales when they see an issue, for example 'this smokes when this happens' and similar things. So they make a claim then towards us" [QM12]	Product	After sales department	Joint sphere
Codified active	Sensor alarms	QM1, QM4, QM7, QM8, QM13, QM14	"electronic data that is continually flowing at you, the urgency is much lower because you can tap into whatever you want to, but the accuracy is phenomenally high" [QM4] "If we see a trend on an engine, for example any shift in vibrations during use, then we'll pick that up and talk to the customer" [QM1]	Product	Sensor data	Customer sphere

because something really bad has happened. But if I arrive and manage to solve the problem constructively, [. . .] we actually have a lot to gain in those situations" [QM15]. Although few established processes to capture such feedback about services seemed to exist, one respondent described a pilot project to move from traditional closed-question customer surveys to experience interviews: *"We sit down with the customers and talk about specific parts related to their experience: what do you feel about our ordering system? Product quality set? So they have a number of topics, and this is actually ongoing right now where we learn from that pilot"* [QM13].

In further contrast, *codified passive customer feedback* is mostly related to products and can be exemplified by customer portals that several firms maintain on their websites. Such portals allow customers to initiate warranty claims at any time by describing who they are, what their problem is, how they discovered it, etc. The portals' focus is on issues with product quality. Recent enhancements to the portals have also afforded digital functionality that enables customers to add photos and/or videos to visually show damages. Naturally, this feedback cannot be planned for in advance; thus, forums to react on the feedback are needed, e.g. *"a weekly quality meeting, or complaints meeting, [. . .], which is based around all the issues we've had from the customer that are outstanding. And then we'll try and get people to come to the meeting and assign tasks [to relevant functions]"* [QM3].

Last, *codified active customer feedback* related to both products and services in the firms. In one example, such feedback was transmitted via sensors: *"We are connected to a number of customers through lots of sensors on the machines, which we can follow in real-time in our performance centres [. . .] and we can stop the machines and send out our service technicians before anything breaks"* [QM14]. In another example, customer surveys on services were gathered after every transaction or at a certain time each year and analysed quarterly or yearly. Because digitalisation increases the number of ways that customers can provide feedback, it affects both products and services. Feedback driven by digitalisation is mostly codified in the firms studied and can arrive as sensor data (e.g. QM1, QM4, QM13, QM14) and data from digitised processes (e.g. using an app to log quality errors).

Customer feedback as activation triggers for absorptive capacity
Based on the different types of customer feedback, four types of CFAT were identified: non-active, designed activation triggers (DATs), designed and connected activation triggers (DCATs), and designed, connected, and resourced activation triggers (DCRATs) (Table 5).

First, personalised passive customer feedback – *non-active activation trigger* – normally ended up informally in the quality or other function. It did not trigger collection of more data and thus did not activate the development of absorptive capacity. One example of how a firm dealt with personalised passive feedback is by individual employees responding to individual customers and solving the reported problem without documentation. In these cases, because a customer's problem seemed to require urgent attention, the feedback did not prompt any structured analysis and thus represents a non-active activation trigger. The results being a (hopefully) happy customer; but if a firm *"lose one of those people, you just lose 50% of everything we know. [. . .] It's in the emails, it's in the laptops, and it's in their head"* [QM12]. Another challenge is that it is difficult to evaluate which feedback requires action as

	Passive	Active
Personalised	Non-active activation triggers	Designed activation triggers (DATs)
Codified	Designed and connected activation triggers (DCATs)	Designed, connected and resourced activation triggers (DCRATs)

Table 5.
Categories of
activation triggers
related to customer
feedback

the established means of prioritisation are not designed to evaluate personalised feedback. One example is prioritisation tools for improvement initiatives, which are used for both products and services. However, those aspects are difficult to relate to personalised passive customer feedback, where magnitudes of problems, cost related to the problem, etc., are unknown: *"We also have a third priority and that's basically described as everything else, so it's not safety, it's not high cost, it's not high occurrence, it's priority three. And priority three might never get looked at"* [QM4]. Several quality managers highlighted a lack of understanding about how to assess personalised passive service-related feedback with standardised prioritisation tools, which limits the possibility for this feedback to function as CFAT.

Second, actively collected personalised customer feedback is referred to as *designed activation triggers* (DATs). The DATs examples in our studied firms were not used to develop potential absorptive capacity. Our findings indicate a struggle to understand how to collect and act on personalised feedback. The example of customer experience interviews described in the previous section was exceptional in that the firm actively sought personalised feedback in a systematic way. However, for DAT – in this case collected from customer experience interviews – there is no connected, formalised process to act on the feedback, e.g. by triggering acquisition of new knowledge:

> What we have not figured out yet is how to translate these interviews into something that the manufacturing and engineering units can work on [. . .] but we are moving in that direction: how can we transfer this information from these customers [. . .] back to our manufacturing units, or engineering departments? [QM13].

Third, *designed and connected activation triggers* (DCATs) represent codified customer feedback that is collected passively and designed to prompt acquisition of new knowledge via a process for continuously handling feedback. An example of such feedback is claims reported by customers through a website, through dealers or other intermediaries. Compared to DATs, this feedback is connected to a formalised process. As described by one firm:

> Warranty and claims are automatic, they go through a database, [. . .], so then we [quality function] get the information. And that depends on how serious it is, who gets involved. Normally the local sales quality takes care of the regular flow, but if there is something more critical then it gets escalated to me [quality manager] through the system; there's a setup for that [QM8].

There is a process and designated responsibilities to act on DCAT, for example the firm acquiring new knowledge to judge the severity and using the database to analyse whether the issue is reoccurring. Thus, it has the potential to influence the development of realised absorptive capacity in this firm if this new knowledge is transformed and exploited. However, DCAT is not related to active feedback, but enters the firm irregularly and unplanned. Thus, the firms are still challenged by having resources in place to not only address the specific claim but also take time to exploit the new knowledge into improvements.

Fourth, customer feedback codified in nature and collected actively is termed *designed, connected and resourced activation triggers* (DCRATs). For these triggers there is not only a process with planned activities and responsibilities connected, but it is also planned in time, meaning that the firm can also set aside resources to analyse and act on DCRATs. In one firm the product-related DCRATs are based on combination sensor data from equipment connected to a performance database with real time monitoring. In a planned activity to establish priorities for proactive improvement work this sensor data is combined with other knowledge from a problem database (historical data) and knowledge about cost of poor quality. Thus, in response to DCRAT the firm *"used different bases to establish the priority for developments, to help prioritise actions that improve the [reported] problems"* [QM14]. DCRAT has potential in supporting both potential and realised absorptive capacity, by ensuring access to needed resources for analysis and, if needed, acquisition, assimilation,

transformation and exploitation of new knowledge. In summary, Figure 1 illustrates the four types of CFAT and their relation to the development of the quality functions' absorptive capacity.

Customer feedback-based activation triggers and the value creation process
Our results reveal that CFAT can emanate from all value creation spheres and have different implications for the development of absorptive capacity and consequently the value creation process. Non-active triggers occur due to an incapacity to identify customer feedback as triggers and act in response. At the same time, this type of feedback is desired to advance quality work: *"it would be very useful for us to have more information about how people are actually using devices. Like via complaints you get one story, but it might not be the correct story, not the full story"* [QM16]. Also, when offering services, employees visiting the customers are central to collect feedback. However, in the firms studied, customer feedback seldom reaches the quality function directly, but instead through intermediaries such as the sales function. Such circuitousness complicates designing the format of customer feedback and can result in the filtering of information, which can limit the possibility of responding adequately to the feedback and have a negative impact on value co-creation. Indeed, several studied firms have third-party actors (e.g. dealers) between themselves and end customers. Such actors sometimes control the information conveyed to the provider:

> There are dealers who want to do their own repairs. [. . .] Large dealers in the USA have their own service stations, and they just want manuals on how to repair our products and say: "let's just agree on a 5% failure rate", and if it goes up to 6%, then they start shouting. But it's not at the level I want. I want details on each product [QM12].

DATs are strongly associated with customer–provider interaction and thus likely to emanate from the joint sphere. One respondent reported that digitalisation had enriched their firm's
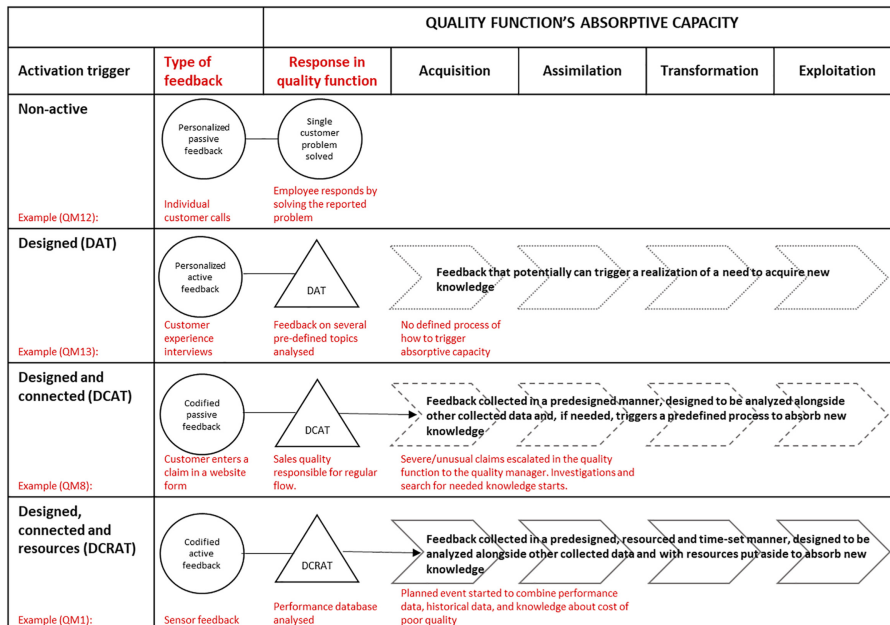

Figure 1.
Customer feedback-generated activation triggers and their relation to quality functions' absorptive capacity

potential for enhancing value co-creation in that sphere through new forms of customer feedback about products:

> When we want to demonstrate for our customers how our solutions will look, you cannot always provide them with a mock-up of how the physical furniture will look in their office. So these design tools help us visualise how it will look. [. . .] with these design tools, it's much easier to clarify and hopefully exceed the needs and demands of the customer [QM9].

Thus, feedback provided in such demonstrations gravitates towards personalised active feedback that can act as DATs. As such, the different types of parameters guiding the collection of feedback can be designed to support the identification of new knowledge that needs to be acquired. In that way, feedback collection is designed to contribute to knowledge acquisition and potential absorptive capacity.

In the firms studied, DCATs were primarily related to products and found in either the provider sphere or the joint sphere. In the provider sphere, they can arise through the interaction – or lack thereof – between the quality function and other internal functions: *"Our sellers are supposed to put all of this type of feedback into the customer-relationship-management system. Unfortunately, it's mostly used by our sales organization towards our customers. Internally, the customer-relationship-management system isn't used as it could have"* [QM9]. In the joint sphere, by contrast, DCATs stemmed from customer–provider interactions. Although such feedback can be related to services – for example, by a customer calling a firm's aftersales function – several respondents highlighted challenges due to the increased focus on digitalisation, which can direct the quality function to focus on codified feedback on products: *"Sometimes, for us, it's stepping back from all of the technical complexity, because engineers sometimes just analyse and analyse and analyse. Just get lost in it"* [QM7].

Value creation through DCRATs was demonstrated in QM1, where the use of sensors and predictive maintenance allowed remote monitoring to optimise the performance of the asset by either advising customers or sending engineers from the provider for actions. The digital platform and dedicated resources allowed QM1 to bring the provider and customer sphere very close. It also implies that DCRATs could prove effective in the era of digitalisation to enhance value co-creation between providers and customers.

Discussion

Previous research has highlighted that the quality functions are in a position to become more relevant and strategic as a consequence of digitalisation (Chiarini and Kumar, 2021) and expanded service offerings (Caemmerer and Wilson, 2010; Kohtamäki *et al.*, 2021; Rabetino *et al.*, 2021). To support improvements of both products and services, the firm's quality functions need to adopt new practices (Zhang *et al.*, 2012). Our study shows that personalised feedback (non-active activation triggers or DATs), do not lead to the development of absorptive capacity in the studied firms, but for codified feedback (DCATs and DCRATs), established processes are in place to analyse the customer feedback and, if needed, to begin acquiring and assimilating new knowledge (i.e. develop potential absorptive capacity). Moreover, the potential absorptive capacity needs to be linked to realised absorptive capacity (Zahra and George, 2002) to support action that transforms and exploits the knowledge into value-in-use (Nonaka, 2007). However, to convert as much newly absorbed knowledge as possible into enhanced value creation (Fink *et al.*, 2017), the actively collected feedback generated through combined DATs and DCRATs appears to support realised absorptive capacity and hence value co-creation better. This actively collected feedback is both personalised and codified, and for DCRAT, resources to acquire and absorb new knowledge (potential absorptive capacity) are available. Eventually, the quality function is thus enabled

to transform and exploit the new knowledge (realised absorptive capacity) to enhance value co-creation via improved products and/or services.

Proposition 1. For CFAT to lead to development of absorptive capacity, the quality function needs to have established processes for feedback.

In most of the firms studied, customer feedback mainly concerns products and the small amount of feedback related to services represents non-active activation triggers. In other words, they are not connected to established processes that support the development of the quality functions' absorptive capacity. However, developing support only for CFAT related to codified feedback cannot sufficiently contribute to service quality as services are relational and most service-related feedback is personalised. Our study has shown that quality function potential CFAT is seldom positioned in the customer or joint spheres, where these relations take place. If new practices related to collecting personalised feedback are developed, as one studied firm did with customer experience interviews, then those can also be connected to processes that develop absorptive capacity, as is the case for codified feedback.

Proposition 2. Established processes for collecting personalised feedback are needed to develop absorptive capacity for services.

Having discussed that services are relational and these relations take place in the customer and joint spheres, this traditional focus on product and on the provider sphere needs to be expanded because the interaction is central for a value co-creation perspective (Grönroos and Ravald, 2011). This observation aligns with Chen *et al.*'s (2022) view of applying novel combinations of resources at hand to resolve problems, while at the same time updating the firm's current resource base to tackle resource constraint issues that impede servitisation. This paper, through focus on CFAT and absorptive capacity, lends further evidence to Chen *et al.*'s (2022) findings by explaining how combining different CFAT in all three spheres can help organisations develop absorptive capacity for enhancing value creation and improving products and services. In Quality 4.0, the quality function is envisioned as an integrator between providers and customers (Chiarini and Kumar, 2021); however, that envisioned role is slowly exhibited by the quality functions we studied. In fact, our findings indicate limited proficiency in responding to customer feedback by knowledge absorption, with CFAT having limited impact on the development of absorptive capacity. Our findings confirm that the work within quality functions often remains product-based instead of customer-focused (Galbraith, 2002).

Proposition 3. CFAT should be placed in all three spheres of the value creation process to improve development of absorptive capacity.

Previous research shows that quality functions still focus mainly on internal processes (Elg *et al.*, 2020; Martin *et al.*, 2019; Watkins, 2006) in the provider sphere and most of the firms studied are still learning how to expand their joint spheres. As manufacturing firms expand their service businesses, their quality functions need to be more closely integrated with customers to exploit the opportunities that the services entail for becoming co-creators of value (Sony *et al.*, 2020; Chiarini and Kumar, 2021) and consequently expanding the joint sphere (i.e. through better management of DATs, DCATs and DCRATs). This is further corroborated by a recent publication by Cho *et al.* (2022) that equally argues the importance of shared responsibilities and cooperation between customers and providers, and how it can result in greater efficiency and high quality of service.

The typology of CFAT (Table 5) further extends the findings of Cho *et al.* (2022) by explaining how shared responsibilities could be enhanced to help firms to act upon CFAT and to improve their potential absorptive capacity. For example, if sensor alarms installed in products reach the quality function, processes are in place to respond to those alerts

(e.g. QM1). If the feedback becomes a DCRAT, the feedback is actively collected at a specific time so that resources are set aside to analyse and act on the feedback. However, the small amount of feedback related to services limits the firms' realisation of the potential to exploit increased customer–provider interactions when services are offered (Brax and Jonsson, 2009; Grönroos and Ravald, 2011).

> *Proposition 4.* Expanding the joint sphere of value creation will lead to an increased exploitation of customer feedback.

A prerequisite for CFAT to influence the development of the quality function's absorptive capacity is that it reaches the function. Indirect customer interactions can take place via sales functions or third-party actors. Many quality functions hold regular cross-functional meetings with other functions to obtain information, which can serve as CFAT. A mentioned challenge, however, is the lack of control over which information is relayed during cross-functional meetings, in which feedback that does not directly relate to product quality tends to not reach the quality function (e.g. Kumar *et al.*, 2020). There is a risk to rely on individual relations through which customer feedback reaches the quality function. Despite the criticality of individuals' contributions to absorptive capacity (Enkel *et al.*, 2017; Ter Wal *et al.*, 2017), this risk negatively impacts development of absorptive capacity in cases with high staff turnover (Lin *et al.*, 2016).

> *Proposition 5.* For as much customer feedback as possible to reach the quality function the number of intermediaries should be as few as possible.

If information is transmitted directly to the quality function, then the reported challenge of intermediaries between customers and providers can be circumvented. Real-time activation triggers combined with data analytics tools have been highlighted as enabling firms to quickly transform external information into improvements (Marshall *et al.*, 2015; Sony *et al.*, 2020; Chiarini and Kumar, 2021; Arcidiacono *et al.*, 2022). Handling codified feedback directly from the customers is identified as the chief opportunity, as well as challenge, of adapting to Industry 4.0 by developing Quality 4.0 (Sony *et al.*, 2020).

Meanwhile, services and digital offerings establish continuous connections and potential interactions between customers and providers (Lenka *et al.*, 2017; Li *et al.*, 2020; Kohtamäki *et al.*, 2021). The increased potential for probing deeper into the joint and customer spheres drives the development of codified feedback; that is, DCATs and DCRATs. Therefore, activation triggers for product quality, which are fairly easy to codify, often benefit from digitalisation and the transition into Quality 4.0 (Gunasekaran *et al.*, 2019), whereas DATs based on personalised feedback, often related to services, are reported by the studied firms to be overlooked.

> *Proposition 6.* Digitalisation leads to increased opportunities of CFAT in the joint and customer spheres that can support codified feedback in reaching the quality function without intermediaries.

Moreover, developing quality function's digital capabilities is required as offerings increasingly consist of solutions (Bolton *et al.*, 2018; Kohtamäki *et al.*, 2020, 2021; Kopalle *et al.*, 2020; Sony *et al.*, 2020). For example, new practices are needed for analysing and acting on big data (Chiarini and Kumar, 2021; Gunasekaran *et al.*, 2019; Sony *et al.*, 2020), as evidenced in the case of QM1, QM4, QM7, QM8, QM13 and QM14. Further, Srinivasan *et al.* (2020) highlighted how employees' roles might change in the era of Industry 4.0 as they will be expected to respond quickly to external stimuli from digitally connected devices. Similarly, Arcidiacono *et al.* (2022) stated that the adoption of smart manufacturing technologies is dependent upon the absorptive capacity of managers to absorb smart manufacturing-related knowledge. This implies that quality functions will need to become

more externally oriented and customer-centric in the era of Quality 4.0 (Chiarini and Kumar, 2021), meaning that they will need to manage new and different types of CFAT. For example, if connected products at multiple customer sites signal changed user behaviour (e.g. as evidenced in QM1 and QM14), practices need to be in place that support development of absorptive capacity by swiftly scanning for new knowledge that could ultimately be exploited for an improved product or service.

Proposition 7. Digitalisation requires new practices for managers and employees to identify and act upon CFAT.

Conclusions and implications

To understand how the role of quality functions might evolve amidst digitalisation and an increased focus on services, we address the call on more empirical research on absorptive capacity within operations management (Walker *et al.*, 2015) by posing the two research questions. To answer RQ1, a typology of CFAT (non-active, DATs, DCATs and DCRATs) was presented (Table 5) that provided and elaborated on the terms of their impact on absorptive capacity (Figure 1). To address RQ2, the typology was discussed based on the value creation process (Grönroos and Voima, 2013). The discussion of the findings resulted in a number of propositions from which theoretical and managerial implications will be derived.

Theoretical implications

Our results extend research on absorptive capacity and activation triggers (Zahra and George, 2002) making five key theoretical contributions. The first three contributions are linked to RQ1, whereas the fourth and fifth are connected to RQ2. First, by focusing on absorptive capacity on a functional level (i.e. quality functions) we add to the more commonly focused firm (Gluch *et al.*, 2009) or individual (Enkel *et al.*, 2017) levels. The focus on the functional level points to the necessity of established practices and processes for supporting CFAT.

Second, we contribute with knowledge on how antecedents (CFAT) impact the development of absorptive capacity, something often neglected in previous research (Volberda *et al.*, 2010; Arcidiacono *et al.*, 2022). In addition, the results show how customers not only can be a source of external knowledge to be absorbed (Bogers and Lhuillery, 2011; Setia and Patel, 2013), but that their feedback can also act as a trigger to spur development of absorptive capacity (Nagati and Rebolledo, 2012), making firms realise the need to search for, and absorb, new external knowledge.

Third, this study responds to a need to further the understanding of what is required to move from potential to realised absorptive capacity (Volberda *et al.*, 2010). Focusing on the functional level and customer feedback, the results underscore the need to deliberately design activation triggers and to connect them to established processes to support both potential and realised absorptive capacity.

Fourth, by adding the perspective of the value creation process (Grönroos and Voima, 2013) we address the call for more research on the interactions between manufacturing firms and customers (Nagati and Rebolledo, 2012). As manufacturing firms expand their service business, it becomes increasingly important for the quality function to engage in value co-creation and take advantage of new types of customer feedback. By including the value creation spheres in our analysis, we recognised how the quality function could use CFAT to engage in value co-creation. However, our results also reveal that customer feedback about services often represents non-active activation triggers that do not develop absorptive

capacity, which clarifies why the quality function sometimes struggles to contribute to service quality as much as to product quality.

Finally, the ability of the quality function to use the new knowledge requires further skills and capabilities for transforming that knowledge into actions linked to improvements and value creation, as identified in our study and previous research (Chiarini and Kumar, 2021; Sony *et al.*, 2020; Valentina and Passiante, 2009). We agree that digitalisation provides an opportunity to expand the joint sphere, allowing the provider to interact with customers to co-create value. Our findings suggest that CFAT in customer or joint spheres are indeed critical, but the subsequent steps where the quality function actually engages in acquiring new knowledge and taking new knowledge into actions is a key differentiator for developing absorptive capacity.

Managerial implications

The study finds a general lack of CFAT initiating the acquisition of new knowledge supporting service quality, thereby explaining the quality function's struggles to support service improvements. A typology of CFAT can aid in the analysis of processes needed to support full use of value-creation potential inherent in customer feedback. The typology highlights that moving from passive to active customer feedback can influence the quality function's absorptive capacity. The collection of personalised active feedback, especially linked to services, is important in the digital age as it provides information that could be missed if relying solely on codified feedback.

Further, the boundary between firms' product and service units may blur as firms embrace digitalisation to enhance integration between functions. The boundary also has implications for the roles of quality function as different parts of the business become integrated. Real-time information sharing via digital tools requires more coordination and collaboration between functions to make joint decisions, which may consequently impact both job roles and processes. Achieving more vertical and end-to-end integration within supply chains may also blur the boundaries of the provider and customer, which requires the quality function to adapt practices and processes, thereby enhancing their customer interactions.

Limitations and future research

Among the limitations inherent in our study's design, we focused on the quality functions and their absorptive capacity. Other organisational functions, including product and/or service development functions, also benefit from CFAT. Future research could study challenges in such functions by adopting a similar focus. The relationship between CFAT on a functional level and a market-level could be interesting to explore; for example, how market-level shifts towards increased digitalisation or a focus on sustainable development impacts customers' interactions with providers and the type of feedback they deliver.

References

Arcidiacono, F., Ancarani, A., Di Mauro, C. and Schupp, F. (2022), "The role of absorptive capacity in the adoption of smart manufacturing", *International Journal of Operations and Production Management*, Vol. 42 No. 6, pp. 773-796, doi: 10.1108/IJOPM-09-2021-0615.

Baines, T., Bigdeli, A.Z., Sousa, R. and Schroeder, A. (2020), "Framing the servitization transformation process: a model to understand and facilitate the servitization journey", *International Journal of Production Economics*, Vol. 221, 10746, doi: 10.1016/j.ijpe.2019.07.036.

Birch-Jensen, A., Gremyr, I. and Halldórsson, Á. (2020), "Digitally connected services: improvements through customer-initiated feedback", *European Management Journal*, Vol. 28 No. 5, pp. 814-825, doi: 10.1016/j.emj.2020.03.008.

Bogers, M. and Lhuillery, S. (2011), "A functional perspective on learning and innovation: investigating the organization of absorptive capacity", *Industry and Innovation*, Vol. 18 No. 6, pp. 581-610, doi: 10.1080/13662716.2011.591972.

Bolton, R.N., McColl-Kennedy, J.R., Cheung, L., Gallan, A., Orsingher, C., Witell, L. and Zaki, M. (2018), "Customer experience challenges: bringing together digital, physical and social realms", *Journal of Service Management*, Vol. 29 No. 5, pp. 776-808, doi: 10.1108/JOSM-04-2018-0113.

Bosch, V.G. and Enríquez, F.T. (2005), "TQM and QFD: exploiting a customer complaint management system", *International Journal of Quality and Reliability Management*, Vol. 23 No. 8, pp. 986-1001.

Boyatzis, R.E. (1998), *Transforming Qualitative Information: Thematic Analysis and Code Development*, Sage, Thousand Oaks.

Brax, S.A. and Jonsson, K. (2009), "Developing integrated solution offerings for remote diagnostics", *International Journal of Operations and Production Management*, Vol. 29 No. 5, pp. 539-560, doi: 10.1108/01443570910953621.

Caemmerer, B. and Wilson, A. (2010), "Customer feedback mechanisms and organisational learning in service operations", *International Journal of Operations and Production Management*, Vol. 30 No. 3, pp. 288-311, doi: 10.1108/01443571011024638.

Calantone, R. and Vickery, S.K. (2009), "Special topic forum on using archival and secondary data sources in supply chain management research", *Journal of Supply Chain Management*, Vol. 45 No. 3, pp. 68-70, doi: 10.1111/j.1745-493X.2009.03160.x.

Camisón, C. and Forés, B. (2010), "Knowledge absorptive capacity: new insights for its conceptualisation and measurement", *Journal of Business Research*, Vol. 63 No. 7, pp. 707-715, doi: 10.1016/j.jbusres.2009.04.022.

Chen, M., Pu, X., Zhang, M., Cai, Z., Chong, A.Y.L. and Tan, K.H. (2022), "Data analytics capability and servitization: the moderated mediation role of bricolage and innovation orientation", *International Journal of Operations and Production Management*, Vol. 42 No. 4, pp. 440-470, doi: 10.1108/IJOPM-10-2021-0663.

Chiarini, A. and Kumar, M. (2021), "What is Quality 4.0? An exploratory sequential mixed methods study of Italian manufacturing companies", *International Journal of Production Research*, Vol. ahead-of-print, pp. 1-12, doi: 10.1080/00207543.2021.1942285.

Cho, H.E., Jeong, I, Kim, E. and Cho, J. (2022), "Achieving superior performance in international markets: the roles of organizational agility and absorptive capacity", *Journal of Business and Industrial Marketing*, ahead-of-print.

Cohen, W.M. and Levinthal, D.A. (1990), "Absorptive capacity: a new perspective on learning and innovation", *Administrative Science Quarterly*, Vol. 35 No. 1, pp. 128-152, doi: 10.2307/2393553.

Difrancesco, R.M., Luzzini, D. and Patrucco, A.S. (2022), "Purchasing realized absorptive capacity as the gateway to sustainable supply chain management", *International Journal of Operations and Production Management*, Vol. 42 No. 5, pp. 603-636, doi: 10.1108/IJOPM-10-2021-0627.

Dubois, A. and Gadde, L.E. (2002), "Systematic combining: an abductive approach to case research", *Journal of Business Research*, Vol. 55 No. 7, pp. 553-560, doi: 10.1016/S0148-2963(00)00195-8.

Eisenhardt, K.M. (1989), "Building theories from case study research", *Academy of Management Review*, Vol. 14 No. 4, pp. 532-550, doi: 10.5465/amr.1989.4308385.

Elg, M., Birch-Jensen, A., Gremyr, I, Martin, J. and Melin, U. (2020), "Digitalisation and quality management: problems and prospects", *Production Planning and Control*, Vol. 32 No. 12, pp. 990-1003, doi: 10.1080/09537287.2020.1780509.

Ellram, L.M. and Tate, W.L. (2016), "The use of secondary data in purchasing and supply management (P/SM) research", *Journal of Purchasing and Supply Management*, Vol. 22 No. 4, pp. 250-254, doi: 10.1016/j.pursup.2016.08.005.

Enkel, E., Heil, S., Hengstler, M. and Wirth, H. (2017), "Exploratory and exploitative innovation: to what extent do the dimensions of individual level absorptive capacity contribute?", *Technovation*, Vol. 60 No. 1, pp. 29-38, doi: 10.1016/j.technovation.2016.08.002.

Eriksson, H., Gremyr, I., Bergquist, B., Garvare, R., Fundin, A., Wiklund, H., Wester, M. and Sörqvist, L. (2016), "Exploring quality challenges and the validity of excellence models", *International Journal of Operations and Production Management*, Vol. 36 No. 12, pp. 1201-1221, doi: 10.1108/IJOPM-12-2014-0610.

Fink, L., Yogev, N. and Even, A. (2017), "Business intelligence and organizational learning: an empirical investigation of value creation processes", *Information and Management*, Vol. 54 No. 1, pp. 38-56.

Fundin, A. and Elg, M. (2006), "Exploring routes of dissatisfaction feedback: a multiple case study within a machine industry segment", *International Journal of Quality and Reliability Management*, Vol. 23 No. 8, pp. 986-1001, doi: 10.1108/02656710610688176.

Galbraith, J.R. (2002), "Organising to deliver solutions", *Organizational Dynamics*, Vol. 31 No. 2, pp. 194-207, doi: 10.1016/S0090-2616(02)00101-8.

Gioia, D.A., Corley, K.G. and Hamilton, A.L. (2013), "Seeking qualitative rigor in inductive research: notes on the Gioia methodology", *Organizational Research Methods*, Vol. 16 No. 1, pp. 15-31, doi: 10.1177/1094428112452151.

Gluch, P., Gustafsson, M. and Thuvander, L. (2009), "An absorptive capacity model for green innovation and performance in the construction industry", *Construction Management and Economics*, Vol. 27 No. 5, pp. 451-434, doi: 10.1080/01446190902896645.

Grönroos, C. and Ravald, A. (2011), "Service as business logic: implications for value creation and marketing", *Journal of Service Management*, Vol. 22 No. 1, pp. 5-22, doi: 10.1108/09564231111106893.

Grönroos, C. and Voima, P. (2013), "Critical service logic: making sense of value creation and co-creation", *Journal of the Academy of Marketing Science*, Vol. 41 No. 2, pp. 133-150, doi: 10.1007/s11747-012-0308-3.

Gunasekaran, A., Subramanian, N. and Ngai, W.T.E. (2019), "Quality management in the 21st century enterprises: research pathway towards Industry 4.0", *International Journal of Production Economics*, Vol. 207, pp. 125-129, doi: 10.1016/j.ijpe.2018.09.005.

Hallencreutz, J. and Parmler, J. (2021), "Important drivers for customer satisfaction – from product focus to image and service quality", *Total Quality Management and Business Excellence*, Vol. 32 Nos 5-6, pp. 501-510, doi: 10.1080/14783363.2019.1594756.

Kohtamäki, M. and Partanen, J. (2016), "Co-creating value from knowledge-intensive business services in manufacturing firms: the moderating role of relationship learning in supplier-customer interactions", *Journal of Business Research*, Vol. 69 No. 7, pp. 2498-2506, doi: 10.1016/j.jbusres.2016.02.019.

Kohtamäki, M., Einola, S. and Rabetino, R. (2020), "Exploring servitization through the paradox lens: coping practices in servitization", *International Journal of Production Economics*, Vol. 226, 107619, doi: 10.1016/j.ijpe.2020.107619.

Kohtamäki, M., Rabetino, R., Einola, S., Parida, V. and Patel, P. (2021), "Unfolding the digital servitization path from products to product-service-software systems: practicing change through intentional narratives", *Journal of Business Research*, Vol. 137, pp. 379-392, doi: 10.1016/j.jbusres.2021.08.027.

Kopalle, P.K., Kumar, V. and Subramaniam, M. (2020), "How legacy firms can embrace the digital ecosystem via digital customer orientation", *Journal of the Academy of Marketing Science*, Vol. 48 No. 1, pp. 114-131, doi: 10.1007/s11747-019-00694-2.

Kumar, M., Rich, N., Kumar, M. and Liu, Y. (2020), "Creating highly reliable health care organisations through reverse exchanges", *Supply Chain Management: An International Journal*, Vol. 26 No. 3, pp. 371-384, doi: 10.1108/SCM-03-2020-0123.

Lenka, S., Parida, V. and Wincent, J. (2017), "Digitalisation capabilities as enablers of value co-creation in servitizing firms", *Psychology and Marketing*, Vol. 34 No. 1, pp. 92-100, doi: 10.1002/mar.20975.

Lervik Olsen, L., Witell, L. and Gustafsson, A. (2014), "Turning customer satisfaction measurements into action", *Journal of Service Management*, Vol. 25 No. 4, pp. 556-571, doi: 10.1108/JOSM-01-2014-0025.

Li, A.Q., Kumar, M., Claes, B. and Found, P. (2020), "The state-of-the-art of the theory on product–service systems", *International Journal of Production Economics*, Vol. 222, 107491, doi: 10.1016/j.ijpe.2019.09.012.

Lin, T.-C., Chang, C.L.-H. and Tsai, W.-C. (2016), "The influences of knowledge loss and knowledge retention mechanisms on the absorptive capacity and performance of a MIS department", *Management Decision*, Vol. 54 No. 7, pp. 1757-1787, doi: 10.1108/MD-02-2016-0117.

Marshall, A., Mueck, S. and Shockley, R. (2015), "How leading organisations use big data and analytics to innovate", *Strategy and Leadership*, Vol. 43 No. 5, pp. 32-39, doi: 10.1108/SL-06-2015-0054.

Martin, J., Elg, M. and Gremyr, I. (2019), "Fit for purpose? Exploring competence in quality management", *International Journal of Quality and Service Sciences*, Vol. 11 No. 3, pp. 317-333, doi: 10.1108/IJQSS-06-2018-0054.

Meredith, J. (1998), "Building operations management theory through case and field research", *Journal of Operations Management*, Vol. 16 No. 4, pp. 441-454, doi: 10.1016/S0272-6963(98)00023-0.

Miles, M.B., Huberman, M.A. and Saldana, J. (2020), *Qualitative Data Analysis: A Methods Sourcebook*, 4th ed., Sage, Thousand Oaks.

Nagati, H. and Rebolledo, C. (2012), "The role of relative absorptive capacity in improving suppliers' operational performance", *International Journal of Operations and Production Management*, Vol. 32 No. 5, pp. 611-630, doi: 10.1108/01443571211226515.

Nonaka, I. (2007), "The knowledge-creating company", *Harvard Business Review*, Vol. 85 Nos 7-8, pp. 162-171.

Patrucco, A.S., Luzzini, D. and Ronchi, S. (2017), "Achieving innovation through supplier collaboration: the role of the purchasing interface", *Business Process Management Journal*, Vol. 23 No. 6, pp. 1270-1289, doi: 10.1108/BPMJ-10-2016-0202.

Perez Arostegui, M.N., Sousa, R. and Lllorens Montes, F.J. (2013), "Quality management practices: absorptive capacity an innovation performance", *Paper presented at the 20th EurOMA Conference*, Dublin, 7-12 June.

Ponsignon, F., Kleinhans, S. and Bressolles, G. (2019), "The contribution of quality management to an organisation's digital transformation: a qualitative study", *Total Quality Management and Business Excellence*, Vol. 30 No. Suppl. 1, pp. S17-S34, doi: 10.1080/14783363.2019.1665770.

Rabetino, R., Kohtamäki, M., Brax, S.A. and Sihvonen, J. (2021), "The tribes in the field of servitization: discovering latent streams across 30 years of research", *Industrial Marketing Management*, Vol. 95, pp. 70-84, doi: 10.1016/j.indmarman.2021.04.005.

Rothaermel, F.T. and Alexandre, M.T. (2009), "Ambidexterity in technology sourcing: the moderating role of absorptive capacity", *Organization Science*, Vol. 20 No. 4, pp. 759-780, doi: 10.1287/orsc.1080.0404.

Rouquet, A., Goudarzi, K. and Henriquez, T. (2017), "The company–customer transfer of logistics activities", *International Journal of Operations and Production Management*, Vol. 37 No. 3, pp. 321-342, doi: 10.1108/IJOPM-01-2015-0049.

Rowley, J. (2012), "Conducting research interviews", *Management Research Review*, Vol. 35 Nos 3-4, pp. 260-271, doi: 10.1108/01409171211210154.

Schroeder, A., Naik, P., Bigdeli, A.Z. and Baines, T. (2020), "Digitally enabled advanced services: a socio-technical perspective on the role of the internet of things (IoT)", *International Journal of Operations and Production Management*, Vol. 40 Nos 7/8, pp. 1243-1268, doi: 10.1108/IJOPM-03-2020-0131.

Setia, P. and Patel, P.C. (2013), "How information systems help create OM capabilities: consequents and antecedents of operational absorptive capacity", *Journal of Operations Management*, Vol. 31 No. 6, pp. 409-431, doi: 10.1016/j.jom.2013.07.013.

Sjödin, D., Frishammar, J. and Thorgren, S. (2019), "How individuals engage in the absorption of new external knowledge: a process model of absorptive capacity", *Journal of Product Innovation Management*, Vol. 36 No. 3, pp. 356-380, doi: 10.1111/jpim.12482.

Sony, M., Antony, J. and Douglas, J.A. (2020), "Essential ingredients for the implementation of Quality 4.0: a narrative review of literature and future directions for research", *The TQM Journal*, Vol. 32 No. 4, pp. 779-793, doi: 10.1108/TQM-12-2019-0275.

Sousa, R. and Voss, C.A. (2002), "Quality management re-visited: a reflective review and agenda for future research", *Journal of Operations Management*, Vol. 20 No. 1, pp. 91-109, doi: 10.1016/S0272-6963(01)00088-2.

Srinivasan, R., Kumar, M. and Narayanan, S. (2020), "Human resource management in an industry 4.0 Era: a supply chain management perspective", in Choi, T.Y., Li, J.J. and Rogers, D. (Eds), *The Oxford Handbook of Supply Chain Management*, Oxford University Press.

Ter Wal, A.L., Criscuolo, P. and Salter, A. (2017), "Making a marriage of materials: the role of gatekeepers and shepherds in the absorption of external knowledge and innovation performance", *Research Policy*, Vol. 46 No. 5, pp. 1039-1054, doi: 10.1016/j.respol.2017.03.003.

Valentina, N. and Passiante, G. (2009), "Impacts of absorptive capacity on value creation", *Anatolia: An International Journal of Tourism and Hospitality Research*, Vol. 20 No. 2, pp. 269-287, doi: 10.1080/13032917.2009.10518909.

Volberda, H.W., Foss, N.J. and Lyles, M.A. (2010), "Absorbing the concept of absorptive capacity: how to realize its potential in the organization field", *Organization Science*, Vol. 21 No. 4, pp. 931-951, doi: 10.1287/orsc.1090.0503.

Walker, H., Chicksand, D., Radnor, Z. and Watson, G. (2015), "Theoretical perspectives in operations management: an analysis of the literature", *International Journal of Operations and Production Management*, Vol. 35 No. 8, pp. 1182-1206, doi: 10.1108/IJOPM-02-2014-0089.

Watkins, D. (2006), "Reflections on the future of quality", *Quality Progress*, Vol. 39 No. 1, pp. 23-28.

Wen, D., Sun, X. and Yan, D. (2020), "The quality movement: where are we going? Past, present and future", *Total Quality Management and Business Excellence*, Vol. 33 Nos 1-2, pp. 92-112, doi: 10.1080/14783363.2020.1801342.

Wirtz, J., Tambyah, S.K. and Mattila, A.S. (2010), "Organisational learning from customer feedback received by service employees", *Journal of Service Management*, Vol. 21 No. 3, pp. 363-387, doi: 10.1108/09564231011050814.

Yin, R.K. (2014), *Case Study Research Design and Methods*, 5th ed., Sage, Thousand Oaks.

Zahra, S.A. and George, G. (2002), "Absorptive capacity: a review, reconceptualization, and extension", *Academy of Management Review*, Vol. 27 No. 2, pp. 185-203, doi: 10.5465/amr.2002.6587995.

Zhang, D., Linderman, K. and Schroeder, R.G. (2012), "The moderating role of contextual factors on quality management practices", *Journal of Operations Management*, Vol. 30 Nos 1-2, pp. 12-23, doi: 10.1016/j.jom.2011.05.001.

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