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Process quality matters: investigating the inherent characteristics of quality and performance in digital, physical and omnichannel services

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Abstract

Purpose – In the literature, quality and performance have primarily been analyzed at a micro level, particularly within individual service channels. This study aims to explore the meta-level differences between service channels in terms of quality relevance and performance in service organizations.

Design/methodology/approach – Quality relevance was measured using meta-level quality factors from the TIHPS framework and assessed by their impact on the performance of service organizations while exploring differences between digital, physical and omnichannel services through a partial least squares structural equation model.

Findings – This exploratory study reveals the high relevance of process quality on performance in physical, digital and omnichannel services. Notably, the transition from physical or digital services to an omnichannel service amplifies the importance of process quality. This finding aligns with the theoretical understanding of the relevance of process quality in service organizations. Furthermore, the study shows that quality relevance and performance vary significantly depending on the service channel.

Practical implications – Service providers should prioritize lean and efficient processes in omnichannel services. The outcome of an omnichannel service is significantly influenced by the quality of employees' work, emphasizing the essential nature of employee training in omnichannel services. Digital services should focus on the quality of technologies, and information quality should be given particularly high priority in physical services.

Originality/value – The meta-level differences between service channels in terms of inherent quality and performance characteristics have not yet been explored in the literature. This paper addresses this research gap.

Keywords Service quality, KPIs, Omni-channel, Digital service, Traditional service, TIHPS framework

Paper type Research paper

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1. Introduction

The impact of context on organizational behavior (e.g. service organizations) is not sufficiently recognized by researchers (Johns, 2006). The few studies conducted so far on the topic of context and service indicate that context influences value co-creation through its influence on service (Chandler and Vargo, 2011). The context of a service is shaped by the given channel of a service, such as the environment of a physical (e.g. onsite interaction) and a digital service channel (e.g. interaction on a website). Digital and physical service channels can be combined and are classified as multichannel services, omnichannel services or hybrid services. This classification depends on whether the focus is on the design, deployment, coordination and evaluation of different channels (Thaichon *et al.*, 2022); the seamless experience across all integrated channels (Verhoef *et al.*, 2015); or on the mix of technology (digital online channels) and human interaction (physical offline channels) (Ganguli and Roy, 2010). The literature suggests that services move from multichannel to omnichannel service conditions (Verhoef *et al.*, 2015). For this reason, we refer to the term "omni" regarding multiple service channels, with effective omnichannel activities as the desirable goal and as a possible underlying parameter for service quality and performance results of service organizations. Recent literature on omnichannel services has investigated service recipient attachment to service providers (Natarajan and Veera Raghavan, 2023), as well as the integration of services and its impact on customer experience (Quach *et al.*, 2022).

Changing the service channel from physical to digital or to omnichannel services also changes the characteristics involved in measuring service quality, which in turn can also lead to different results in the performance of service organizations. In previous decades, the SERVQUAL instrument (Parasuraman *et al.*, 1988) was frequently used to measure the quality of traditional physical services (Ladhari, 2009; Hartwig and Billert, 2018). Many models and scales have been developed to measure digital service interactions (Ladhari, 2010). Less research has been done related service quality measurements in the private sector, which combine physical and digital service channels (Hartwig and Billert, 2018), and the public sector has not been taken into account at all (Walke and Winkler, 2022). It is already apparent here that there are gaps in research concerning the measurement of service quality in relation to various service channels.

Service science literature differentiates between micro, meso, macro and meta-levels of context (Chandler and Vargo, 2011). In this paper, we differentiate these individual levels based on their varying degrees of abstraction. The existing literature has primarily focused on service quality at a micro level, specifically by investigating the measurability of service quality in individual channels (digital, physical and omnichannel; e.g. Barnes and Vidgen, 2000; Parasuraman *et al.*, 1988; Zhang *et al.*, 2019) within certain domains (e.g. private banking; Jayawardhena, 2004; Chauhan *et al.*, 2022). What is lacking in the current literature is a study that delves into the inherent characteristics of service channels concerning the relevance of quality and its impact on the performance of service organizations at a higher meta-level. This meta-level analysis aims to be independent of micro, meso and macro context conditions and refers solely to the inherent quality and performance characteristics of distinct service channels. At this service channel meta-level, it becomes evident that there is a pressing need for a more fundamental understanding of the conditions associated with these channels in terms of quality relevance and performance.

The identification of these needs led to the research question of this paper: "*Which meta-level quality and performance characteristics are inherent in distinct service channels?*" This paper is based on the following objective: assessing the relevance of quality and its impact on the performance of service organizations in three different types of service channels: digital, physical and omnichannel. The results of this study are particularly

intended to contribute to the understanding of the fundamental differences between service channels, with the aim of providing guidance for improving the quality and performance of service organizations.

2. Theoretical framework and background

To find a suitable instrument and theoretical framework for this study, a total of 67 service quality measurement models were considered from the literature, which are related to the measurement of physical, digital or omnichannel service quality. The TIHPS framework (Walke and Winkler, 2022; Walke *et al.*, 2023; Walke and Winkler, 2024; Walke, 2024; Walke *et al.*, 2024) is an instrument that has already been used to measure service quality in a context-independent manner and in different types of service channels. In comparison, other measurement models would not be suitable for the paper's examination because of their context-dependency (e.g. measuring only digital service channel quality in private banking). Because of its applicability in different service channels, we consider the TIHPS framework, with its five quality factors technology, information, human, process and system, suitable for the study of this paper. TIHPS is furthermore suitable because the aim of our study is to achieve the greatest possible generality on a meta-level in examining differences between service channels. The TIHPS quality factors seem suitable because they are particularly generic, can be applied to different channels and consider quality from a meta-level perspective. The literature shows that the single TIHPS factors already have been used for benchmarking purposes (Dorsch and Yasin, 1998) and as relevant categories in determining the success or failure of services (Abdullah *et al.*, 2016; Michel, 2001; Wood-Harper *et al.*, 2004). Previous studies have particularly shown the significant impact of process quality on perceived service quality, however, without considering the performance results of service organizations (Walke and Winkler, 2024, 2022; Victor Chen *et al.*, 2013). Based on the significant impact of process quality on service quality, a high impact on the performance of service organizations is expected, which could be especially present in a complex omnichannel environment. Therefore, the following is hypothesized:

H1. Performance results of service organizations are mainly affected by process quality, compared to technology, information, human and system quality.

To assess the relevance of the TIHPS quality factors, we analyze their impact on key performance indicators (KPIs) of service organizations. Performance measures generally relate to the extent to which goals relevant to the specific organization are attained (Lim, 1995). The term "key performance indicator" has often been used to refer to an indicator used to measure relevant performance results in different contexts, such as industrial services in the private sector (Meier *et al.*, 2013) or performance management in the public sector (Wall and Martin, 2003). Because our paper particularly relates to service quality, we have selected KPIs that are particularly important for services (Table 1).

We divide the KPIs according to their type of effect (i.e. objective and subjective effects). For the purposes of this paper, KPIs with objective effects included time costs (TC) and outcome (OC), while KPIs with subjective effects were satisfaction (SF) and trust increase (TI). Additionally, we create a fifth KPI in the form of a formative construct called organizational performance (OP), consisting of TC, OC, SF and TI. Previous studies of OP have stressed that OP is not a unifactoral construct but includes many different factors (George *et al.*, 2019). The factors of OP are often related to organizational effectiveness in both the private and public sectors (Parhizgari and Gilbert, 2004) but can also include other concepts, such as governance or societal outcomes (George *et al.*, 2019).

Table 1. Key performance indicators (KPIs)

KPIs	Type of effect	Items	Description	Related contributions
Organizational performance (OP)	Objective and subjective	Four items – (formative construct)	Formative construct, consisting of the four KPIs: time costs, outcome, satisfaction and trust increase	Lim (1995); George *et al.* (2019); Parhizgari and Gilbert (2004)
Time costs (TC)	Objective	The time spent on the service was overall . . .	Compares the expected time spent with the actual time spent on the service (disconfirmed expectancy)	Lovelock (2001); Tam (2004)
Outcome (OC)	Objective	The final outcome of the service was overall . . .	Compares the expected outcome with the actual outcome of the service (disconfirmed expectancy)	Powpaka (1996); Grönroos (1982); Grönroos (1990)
Satisfaction (SF)	Subjective	Carrying out my concern with the service provider was a satisfying experience	Measures the satisfaction of the service recipient with the service provider regarding his/her concern	Lee *et al.* (2000)
Trust increase (TI)	Subjective	The service experience has increased my trust in the service provider	Measures the increase in trust of the service recipient in the service provider based on his/her service experience	Nyhan and Marlowe (1995)

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TC could be considered as an outlay to obtain a service (Tam, 2004; Lovelock, 2001). OC was previously used as a measure in the field of service quality (Powpaka, 1996), and it refers to the result of the service (Grönroos, 1990, 1982). In the case of TC, we compared the expected time spent with the actual time spent for the service, while OC was used to compare the expected outcome with the actual outcome of the service (disconfirmed expectancy). Trust appears in the previous literature as a performance measurement among others in the public sector (Nyhan and Marlowe, 1995). Satisfaction of the service recipient is an often used indicator in the field of service quality (e.g. Lee *et al.*, 2000).

Previous literature examining differences between service channels focuses on channel quality inconsistency (Liao *et al.*, 2011) and quality perception in omnichannel retailing (Akter *et al.*, 2019). Furthermore, previous literature focuses on the measureability of individual channels (digital, physical, omnichannel; e.g. Barnes and Vidgen, 2000; Parasuraman *et al.*, 1988; Zhang *et al.*, 2019) and is context-specific in the sense that they are dependent on the domain (e.g. health), organization (e.g. university) or service (e.g. online clothing shopping). Context is distinguished in the service science literature at the micro, meso, macro and meta levels, which are used to explore various aspects of a service ecosystem (Chandler and Vargo, 2011). The idea of a service ecosystem outlines a comprehensive framework for examining interactions and co-creation of value across multiple levels (Chandler and Vargo, 2011). It suggests that researchers adopt a broad perspective, encompassing not just the immediate or relational aspects but also the broader micro, meso and macro contexts that influence value creation, and it introduces a meta-level that integrates these various layers, providing a holistic view of how different levels interact

(Akaka and Parry, 2019; Chandler and Vargo, 2011). We differentiate these individual levels based on their varying degrees of abstraction.

In contrast to previous literature, this paper aims to examine the meta-level of a service to find out the inherent characteristics of quality relevance and performance in distinct service channels. The basis for the examination of the differences between the service channels are service quality measurements and KPIs, while the service channels are divided in this paper into digital, physical and omnichannel services. This three-category typology of services, which distinguishes services according to their channel, has already been used in the literature (Walke and Winkler, 2022; Hartwig and Billert, 2018; Walke and Winkler, 2024). The hybrid form of a service (a mixture of digital and physical services) is referred to as "omni" (Latin for "all") in this paper. Omnichannel services are described as a seamless experience across all integrated channels (Verhoef *et al.*, 2015) and can consist of a mixture of digital (online) and physical (offline) service channels (Kemppainen and Uusitalo, 2022). In this paper, we conceptualize the hybridity of an omnichannel service not as a dichotomous characteristic of a service but as a degree of balance between physical and digital service components in a given service, in which the seamless experience between channels is characterized by an increased level of perceived service quality.

Physical and digital channels are in practice often considered independently of each other, and an integration of multiple channels can create a competitive advantage (Herhausen *et al.*, 2015). Physical services inherently involve a higher degree of physical contact compared to digital service channels, where service recipients primarily interact with technologies. Consequently, it can be assumed that different service channels exhibit varying levels of quality relevance on the technology, information, human, process and system dimensions in relation to the resulting performance of service organizations. Therefore, the following is hypothesized:

H2. Distinct service channels affect the meta-level relationship between quality relevance and performance results in service organizations.

In summary, there is a knowledge gap in the literature about whether distinct service channels have an impact on the relevance of multiple quality factors (technology, information, human, process and system quality) and KPIs of service organizations on a meta-level.

3. Methodology

We used the TIHPS framework as a basis for our study, containing the five quality factors such as technology, information, human, process and system, which includes 35 quality indicators in total. Our empirical data collection is based on $n = 365$ service recipients, using a TIHPS-based survey. We measured the 365 service experiences across 41 different types of service organizations (among others, police, city administration, universities, hospitals and tax offices) in Germany, Austria and Italy. The majority of service experiences took place in the public sector. For the survey, we chose seven-point Likert scales, ranging from "completely agree" to "completely disagree" for each item. The middle point of the Likert scale "neither nor" could be selected if the item was not suitable for the respondent. Our design followed a recommendation by Oaster (1989) showing that a seven-point Likert scale has the highest test-retest reliability compared to lower and higher numbers of alternatives per choice. The survey was administered online between May and December 2021 and was distributed through participants of a research seminar at our university. The inclusion criteria for participation in the survey was a recent critical service experience, while the critical service experience selection followed the critical incident technique (Flanagan, 1954),

wherein both positively and negatively perceived service experience can be recorded. A critical case can be defined as having strategic importance in relation to the general problem and results in information that permits a logical deduction of the type (Flyvbjerg, 2006). The survey is based on an external service quality perception from the customer's/citizen's perspective.

As our aim is to explore the differences between digital, physical and omnichannel services, we also measured with a seven-point Likert scale the level of digitalization of the given service. This level of digitalization was used to identify physical, digital and omnichannel services. Our measurement of the level of digitalization was based on whether the information, initiation and completion of the service process, service outcome and communication with the service provider were completely digital, ranging from "completely agree" to "completely disagree" for each item. The middle point of the seven-point Likert scale was "neutral." The distribution of physical, digital and omnichannel services was made by evenly distributing the seven-point values from the Likert scale to form three groups (Group1_Physical, Group2_Omni and Group3_Digital). A mean value for every service experience was formed out of the five measurements (information, initiation, completion, outcome, communication) of the level of digitalization. Mean values of less than 2.3 were categorized as primarily physical (offline) services and grouped in the physical group (Group1_Physical). Mean values that were higher than 4.6 were classified as primarily digital (online) services and grouped in the digital group (Group3_Digital). Finally, mean values between 2.3 and 4.6 were categorized as omnichannel services, which have a balanced mix regarding hybridity of physical and digital service components. Hybridity of services is considered in this paper as the degree of balance between physical and digital service components in omnichannel services.

Based on our empirical data, we built a partial least squares structural equation model (PLS-SEM) in the form of a formative measurement model, following the guidelines from Hair *et al.* (2021, 2022), based on the TIHPS framework. PLS-SEM is the preferred approach when formatively specified constructs are included in a PLS path model (Hair *et al.*, 2019). We used a bootstrapping procedure (PLS-SEM) to test the significance of the indicator weights and examined the relevance of the indicator based on their weights. Bootstrapping also facilitates deriving standard errors from the data without relying on any distributional assumptions (Hair *et al.*, 2014). A percentile bootstrapping algorithm was applied in our PLS-SEM to present the analytical results regarding the relevance of multiple quality factors and their relationship to KPIs of service organizations. Finally, we performed a bootstrap multi-group analysis to assess the differences between the three service channels (physical, omni and digital) by comparing three different groups in our sample. The distribution of the subjects in our sample regarding the three service channels (physical, omni and digital) was as follows: Group1_Physical = 141; Group2_Omni = 168; and Group3_Digital = 56.

Figure 1 presents the research model of our paper. Our research model includes quality factors (left half), in which five quality factors and seven quality indicators per factor are given. Additionally, the model shows the KPIs as performance results (right half) of the given service organization. This research model includes the link between quality factors and performance results to allow us to assess the relevance of quality factors by analyzing the impact on KPIs of service organizations. As we aim to explore the differences between physical, digital and omnichannel services, we categorized the service experiences in our sample into the previously mentioned three groups (Group1_Physical, Group2_Omni and Group3_Digital; Figure 1: service channel).

We developed a PLS-SEM based on our research model (Figure 1) using the SmartPLS software 4.0.8.5 (Ringle *et al.*, 2022). The convergent validity was assessed by correlating

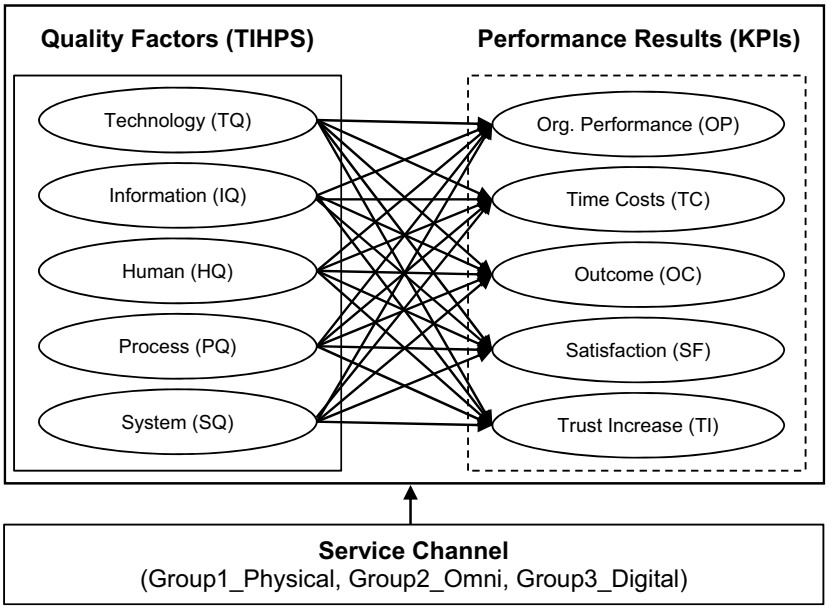

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Figure 1. Research model

the factor constructs with five single items that provided alternative quality measures, while the correlations of the formative and alternative measures indicate that the highest correlation of the measures is present between the formative and the alternative single-item measure of the same construct. For the collinearity diagnosis, we used the VIF value, while Hair *et al.* (2021) assumed a VIF value ≥ 5 as the critical threshold that should not be exceeded. All indicators in our formative measurement models are below this threshold. Significance testing of the indicator weights relied on the bootstrapping procedure (PLS-SEM). The significance testing of our formative measurement model revealed that all indicator weights of our model are statistically significant ($p < 0.001$; 0.1% probability of error), which indicates that none of the indicators should be removed from the measurement model.

4. Analytical results

In this section, the relevance of the quality factors in relation to performance results is assessed. Relevance is assessed through weights (Hair *et al.*, 2021). We used two control variables for our model (C1 = age and C2 = gender). In our measurement model, we found moderate to substantial R^2 values for OP ($R^2 = 0.635$), along with values that are moderate for TC ($R^2 = 0.463$), low to moderate for OC (R^2=0.372), moderate for TI ($R^2 = 0.492$) and moderate to substantial for SF ($R^2 = 0.596$). Accordingly, the predictive power of our model is highest for OP and SF.

The results for the five KPIs (TC, OC, SF, TI, OP) and how they are influenced by the quality factors (technology [TQ], information [IQ], human [HQ], process [PQ] and system quality [SQ]) are displayed in Table 2. The results demonstrate that PQ has the highest relevance for all KPIs. With regard to SF and OP, SQ has the second highest relevance. HQ

Table 2. Analytical results regarding quality factors and KPIs

TC $R^2 = 0.463$	PS	T-value	OC $R^2 = 0.372$	PS	T-value	SF $R^2 = 0.596$	PS	T-value	TI $R^2 = 0.492$	PS	T-value	OP $R^2 = 0.635$	PS	T-value
PQ → TC	0.606****	10.821****	PQ → OC	0.505****	9.683****	PQ → SF	0.439****	8.165****	PQ → TI	0.312****	5.146****	PQ → OP	0.505****	9.683****
SQ → TC	0.051 ^{ns}	0.897 ^{ns}	HQ → OC	0.169***	2.981***	SQ → SF	0.202****	3.930****	HQ → TI	0.176***	3.352***	SQ → OP	0.147***	3.151***
IQ → TC	0.034 ^{ns}	0.589 ^{ns}	SQ → OC	0.072 ^{ns}	1.142 ^{ns}	HQ → SF	0.143***	2.901***	SQ → TI	0.164***	2.922***	HQ → OP	0.143***	2.993***
TQ → TC	0.027 ^{ns}	0.498 ^{ns}	IQ → OC	0.058 ^{ns}	1.081 ^{ns}	IQ → SF	0.102**	2.225**	TQ → TI	0.099*	1.752*	IQ → OP	0.085*	1.857*
C1 → TC	0.011 ^{ns}	0.274 ^{ns}	C2 → OC	0.014 ^{ns}	0.341 ^{ns}	TQ → SF	0.024 ^{ns}	0.493 ^{ns}	IQ → TI	0.093 ^{ns}	1.616 ^{ns}	TQ → OP	0.046 ^{ns}	1.047 ^{ns}
HQ → TC	0.005 ^{ns}	0.091 ^{ns}	TQ → OC	0.003 ^{ns}	0.057 ^{ns}	C1 → SF	−0.006 ^{ns}	0.159 ^{ns}	C2 → TI	0.023 ^{ns}	0.614 ^{ns}	C2 → OP	−0.008 ^{ns}	0.237 ^{ns}
C2 → TC	−0.010 ^{ns}	0.248 ^{ns}	C1 → OC	−0.074 ^{ns}	1.630 ^{ns}	C2 → SF	−0.046 ^{ns}	1.341 ^{ns}	C1 → TI	−0.068*	1.669*	C1 → OP	−0.038 ^{ns}	1.125 ^{ns}

Notes: *$p < 0.10$; ** $p < 0.05$; ***$p < 0.01$; ****$p < 0.001$; ns = not significant; PS = path strength; percentile bootstrapping with 10,000 subsamples; results are ordered by weight; C1 = age; C2 = gender
Source: Authors' own work

has the second highest relevance with regard to OC and TI. The IQ and the HQ factors have a significant influence on SF and OP, while SQ and TQ have a significant influence on TI. We also found a weak negative impact regarding the age of the subjects on TI. The relevance of the quality factors regarding performance results and its KPIs is visualized in Figure 2.

In the previous analyses, we examined the complete sample. In the next step, we assessed the differences between the three service channels (physical, omni and digital) by comparing the three groups Group1_Physical, Group2_Omni and Group3_Digital (see Figure 1). To compare these groups, we performed a bootstrap multi-group analysis to find significant differences between the three groups. The previous bootstrapping settings were not changed. The results are presented in Table 3.

Significant differences between the service channels (Table 3) were found in the OC of the service regarding TQ, SQ and the HQ factor. The relevance of HQ is highest in omnichannel services with regard to OC and significantly lower in digital services. The relevance of TQ in terms of OC is highest in digital services and significantly different from that for omnichannel and physical services, with SQ indicating an opposite direction of effect.

With regard to SF, a significant difference is observable in IQ between omnichannel and physical services, with IQ being significantly more relevant in physical services. Significant differences were also found in the OP regarding TQ and IQ, whereby the relevance of TQ is significantly higher in digital services compared to physical and omnichannel services, and IQ relevance is highest in physical services and significantly lower in omnichannel services.

To illustrate the relevance of the quality factors across different service channels, Figure 3 also shows the nonsignificant differences in relation to OP ("G" stands for Group; HQ → OP G1 = 0.158, G2 = 0.157, G3 = 0.055; SQ → OP G1 = 0.219, G2 = 0.167, G3 = −0.03; PQ → OP G1 = 0.406, G2 = 0.565, G3 = 0.493).

The results in Figure 3 indicate that PQ has the highest relevance in all three service channels. As the digitalization of the service increases, the relevance of PQ decreases slightly, while the relevance of TQ increases. Switching from physical or digital services to an omnichannel service makes process quality more important. The relevance of SQ is highest in physical services and decreases with increasing digitalization. The relevance of HQ also decreases with increasing digitalization. The IQ relevance decreased with

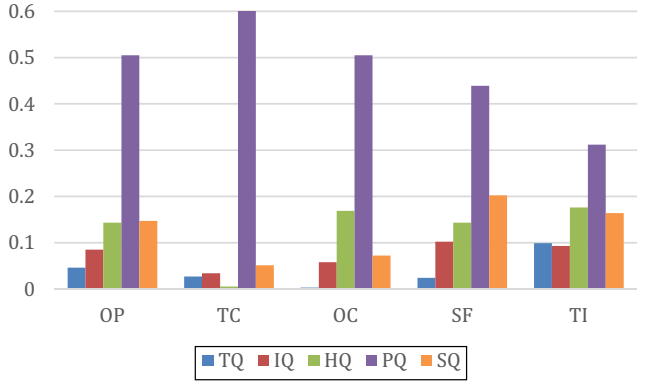

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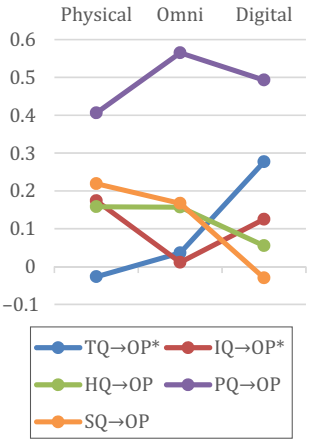
Figure 2. Quality factor relevance regarding KPIs

Table 3. Significant differences between physical, digital and omnichannel services

Path	Digital PS	*t*-value (DvsP)	Physical PS	*t*-value (PvsO)	Omni PS	*t*-value (OvsD)	Digital PS (repeated)
TQ → OC	*0.381*	*2.725***	*−0.118*	1.139 ns	0.021	2.131**	0.381
TQ → OP	*0.277*	*2.279***	*−0.027*	0.687 ns	0.036	1.760*	0.277
IQ → OP	0.125	0.278 ns	*0.174*	*1.759**	*0.011*	0.710 ns	0.125
IQ → SF	0.187	0.070	*0.199*	*1.728**	*0.032*	0.916	0.187
HQ → OC	−0.057	1.154 ns	0.162	0.520 ns	*0.226*	*1.830**	*−0.057*
SQ → OC	*−0.306*	*2.208***	*0.195*	0.649 ns	*0.107*	*2.289***	*−0.306*

Notes: *$p < 0.10$; **<0.05; ***$p < 0.01$; ns = not significant; bootstrapping multi-group-analysis with SmartPLS V.4.0.8.5 and percentile bootstrapping with 10,000 subsamples; OvsD = omni vs digital; PvsO = physical vs omni; DvsP = digital vs physical; PS = path strength
Source: Authors' own work



Note: *Significant differences between service channels
Source: Authors' own work

Figure 3. Quality factor relevance regarding organizational performance in physical, digital and omnichannel services

increasing hybridity in omnichannel services and is more relevant in physical and digital services.

5. Discussion, implications and future research

The research question of this paper, which investigates the inherent quality and performance characteristics of distinct service channels on a meta-level, was addressed by assessing the relevance of quality and its impact on the performance of service organizations in three different types of service channels: digital, physical and omnichannel. The results of this study are intended to contribute to the understanding of the fundamental differences between service

channels, aiming to provide guidance for improving the quality and performance of service organizations. This addresses a gap in the current literature related to the inherent characteristics of service channels regarding the relevance of quality and its impact on the performance of service organizations at a higher meta-level. *H2* was confirmed by the data, indicating that distinct service channels affect the meta-level relationship between quality relevance and performance results in service organizations. The assessment of the differences between digital, physical and omnichannel services regarding quality and performance of service organizations was realized by analyzing the relevance of meta-level quality factors and their impact on KPIs of service organizations in three channel-based groups using the TIHPS framework.

5.1 Theoretical contributions

Our explorative study reveals the high relevance of process quality to KPIs in physical, digital and omnichannel services. In fact, switching from physical or digital services to an omnichannel service makes process quality more important. The results support *H1*, which posited that performance results of service organizations are mainly affected by process quality compared to technology, information, human and system quality. As a theoretical contribution, it can be stated that the importance of process quality in relation to perceived service quality, as acknowledged in earlier research studies (Victor Chen *et al.*, 2013; Hui *et al.*, 2004; Rhee and Rha, 2009), is affirmed. Therefore, the relevance of process quality conditions grows with the increasing physical-digital hybridity of an omnichannel service. The study results also reflect the definition of Verhoef *et al.* (2015) for omnichannel services, which are intended to enable a seamless experience across all integrated channels. This seamless experience is especially given through high process quality. Process quality shows the highest relevance in our data regarding OP in omnichannel services, compared to physical and digital services.

The results regarding OP reveal the inherent characteristics of quality and performance in digital, physical and omnichannel services. As the digitalization of the service increases, the relevance of process quality decreases slightly, while that of technology quality increases. The relevance of system quality is highest in physical services and decreases with increasing digitalization, explaining why the technology quality is in focus and systemic conditions are thus more likely to be perceived in physical services than in digital services. The relevance of human quality decreases with increasing digitalization, which shows that technologies are displacing human service employees. Notably, the information quality relevance decreases with increasing hybridity in an omnichannel service and is more relevant in physical and digital services. As a further theoretical contribution, we can therefore state that the hybridity of omnichannel services may distract from the relevance of information quality.

A further theoretical contribution is the opposing effect related to digital service outcomes concerning technological and systemic quality conditions. In digital services, technology quality exhibits significantly higher relevance compared to physical and omnichannel services with respect to the service outcome. Conversely, an opposing effect was observed for systemic conditions in the realm of digital service outcomes. From a theoretical perspective, this highlights a potential effect that underscores the quality of technologies and relegates systemic conditions around digital service outcomes to the background. It is possible that positive systemic influences, like the attractive appearance of a service, become negative influencing factors if the technology quality is comparably inadequate.

5.2 Practical and managerial implications

The relevance of human quality is highest in omnichannel services and significantly lower in digital services related to the service outcome. Related to OP, the relevance of technology

quality is significantly higher in digital services compared to physical and omnichannel services, and information quality relevance is highest in physical services and significantly lower in omnichannel services. With regard to satisfaction with a service, a significant difference is observable in information quality between omnichannel and physical services, with information quality being significantly more relevant in physical services. Several practical and managerial implications can be derived from these results:

- The outcome of omnichannel services appears to be significantly influenced by the quality of employees' work. Therefore, the training of service employees in omnichannel services is crucial.
- When delivering digital services, it is imperative to maintain high technology quality, as evidenced by the notable difference between physical and omnichannel services. This is especially crucial for enhancing OP.
- The management of high-quality information, available to the service recipient, should hold a particularly high priority in physical services.
- Given the high importance of process quality across all channels, service providers should particularly emphasize lean and efficient processes in all types of service channels.

5.3 Future research and limitations

In future research, further investigations must follow with a focus on the private sector and other countries, as the sample was collected mainly in the public sector in Germany, Austria and Italy. Our approach classified omnichannel services through their hybridity, while the degree of hybridity of services was based on the level of digitalization of the service. There may alternatively be other ways to classify and to go into hybridity in more detail. Concerning KPIs, we primarily referred to TC, OC, TI and SF, which were additionally summarized in the construct OP. Other indicators may be potentially useful in examining performance results, especially in omnichannel services. Future research may also look more closely at the interplay and transitions between service channels.

In summary, it can be stated that the analytical results of our exploratory study provide insightful guidance about quality- and performance-oriented service design, especially with regard to the distinct service channels. These insights can be used for further research as well as practical application for organizations, governments and researchers alike.

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