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Article

Shake Hands with a Robot – Understanding Frontstage Employees' Adoption of Service Robots in Retailing

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Marketing Review

St.Gallen

Store of
the Future



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Shake Hands with a Robot

Understanding Frontstage Employees'
Adoption of Service Robots in Retailing

The use of service robots in retailing has been steadily gaining momentum over the past decade. Research has primarily focused on customer adoption. However, without addressing the reservations of frontstage employees, an effective adoption of service robots will not happen. This study presents a measurement instrument for the drivers of and barriers to adoption by frontstage employees and derives success factors.

Dr. Patrick Meyer, Dr. Philipp Spreer, Prof. Dr. Klaus Gutknecht

Within the organizational frontline, frontstage employees (FSEs) serve as the face to customers (Larivière et al., 2017) and are key for recognizing and resolving predominant service-related issues (Haller & Wissing, 2020; Subramony et al., 2017). Although fully automated robot-controlled retail stores are already proclaimed in literature as the future of intelligent retailing (Heinemann, 2021), greater relevance must be attached to understanding FSEs' adoption of service robots (SRs) and the design of hybrid constellations in which both SR and FSE interact (Paluch et al., 2020). However, the FSEs' perspective is hardly taken into account. Subramony et al. (2017) assume that the underexploited potential of research on FSEs results from a lack of awareness that they are crucial for the overall success of the implementation of SRs in retail. It seems especially fruitful to further explore the FSEs' perspective, as FSEs have frequent and direct contact with customers and are responsible for executing services (Alam, 2006; Jonas et al., 2016; Meyer et al., 2018).

An in-depth understanding of how to measure FSEs' adoption of SRs seems necessary as SRs affect the FSEs' work routine on a daily basis (Wirtz, 2020). Moreover, it is necessary to understand the emotional state of FSEs, which is why Paluch et al. (2020) call for research exploring not only customers' but also FSEs' antecedents to the adoption of SRs in retailing. The specific research question posed is:

How can frontstage employees' drivers of and barriers to SRs' adoption in retail systems be quantitatively measured?

The goal of this study is to develop an instrument to allow for a quantitative measurement of qualitatively uncovered FSEs' drivers of and barriers to SR adoption and to create a solid foundation for further investigations. It was conducted as part of the first author's dissertation (Meyer, 2022).

Theoretical Background: Service Robots in Retail Systems

New types of service interactions are only some of the many changes produced by SRs (cf. Figure 1); as Parasuraman and Colby (2015, pp. 59–60) note, "robots will open a revolutionary frontier that could upset traditional customer–employee relationships." Physical SRs—mobile, system-based, autonomous, adaptable, physical machines that serve organisations as well as their customers and FSEs by interacting and communicating at an emotional-social level (Meyer et al., 2020a)—are said to have significant potential for innovation in brick-and-mortar retailing (De Gauquier et al., 2021; Meyer et al., 2022; Singh et al., 2019).

Previous studies have examined technology adoption related to FSEs' sales interactions (Ahearne & Rapp, 2010). FSE-specific



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aspects are of particular interest in this regard as FSEs facilitate the interaction between an organization and its customers; thus, spanning boundaries (Ahearne & Rapp, 2010). Customers appreciate pleasant relationships with FSEs who create social and emotional value propositions within the retail system, which is sometimes described as rapport, engagement or trust (Wirtz et al., 2018).

The terms technology adoption and technology acceptance/resistance are often used interchangeably in literature (cf. Lai, 2017; Maier et al., 2021). According to Maier et al. (2021), technology acceptance/resistance is an overarching construct that addresses questions of adoption, usage, discontinuation, and resumption. Following this, questions of SR adoption arise at an early stage of SR diffusion to non-users who are more or less willing to adopt SRs.

SR adoption depends on the organizations' abilities to accurately respond to FSEs' needs (Pantano & Dennis, 2019). Therefore, SR adoption may fail if this response is inadequate. This might be the case if FSEs perceive an SR's role within service interactions differently than the retail organization adopting it. Accordingly, Ahearne & Rapp (2010) conclude that

Figure 1: Service Robots in Different Retail Sectors



Source: Photos taken during empirical data collection efforts at various German point of sales conducted as part of the first author's dissertation (Meyer, 2022).

technology adoption by FSEs can be fostered by the awareness of the benefits of SRs and, in consequence, improve their performance.

As SRs have increasingly been piloted in service organizations, scholars have begun to develop distinct acceptance models for SRs. Stock and Merkle (2017) developed a theoretical social frontline robot acceptance model (SFRAM) to examine customers' expectations regarding an interaction with a frontline social robot during a service encounter, based on Solomon et al.'s (1985) role theory and Davis' (1989) technology acceptance model (TAM). Furthermore, Wirtz et al. (2018) conceptualized

the service robot acceptance model (SRAM), which includes customers' social-emotional needs, perceived humanness, perceived social interactivity and perceived social presence, relational needs, trust and rapport.

The complex nature of technology infusion and associated changes in the work environment require organizations to focus on the psychological well-being of frontstage employees.

Management Summary

The use of service robots in retailing has been steadily gaining momentum over the past decade. Research has primarily focused on customer adoption. However, without addressing the reservations of frontstage employees, an effective adoption of service robots will not happen. This study presents a measurement instrument for the drivers of and barriers to adoption by frontstage employees and derives success factors. Retail organizations should involve FSEs in SR adoption from the onset to co-create effective hybrid service delivery systems. Retail organizations are encouraged to use the developed measurement tool to quantify potential barriers to SR adoption by FSEs a priori.

However, both SFRAM and SRAM focus primarily on customers, although FSEs' adoption should also be evaluated to effectively orchestrate the use of SRs in a retail system: "Addressing only the primary user in service robotics is unsatisfactory [...] the focus should be on the setting, activities and social interactions of the group of people where the robot is to be used" (Severinson-Eklundh et al., 2003, p. 223). In addition, the complex nature of technology infusion and associated changes in the work environment require organizations to focus on the psychological and emotional well-being of FSEs to avoid poor job performance (Harris & Ogbonna, 2002). Organizational changes can, above all, fuel fears and uncertainties, which can lead to resistance from FSEs and adversely affect the organization's endeavors (Shah et al., 2017).

Preliminary Scale Development

In particular, a quantitative evaluation and factorial assessment of the previously uncovered drivers and barriers (Meyer et al., 2020b) is required to assess whether they can be validated empirically.

A five-step scale development process was applied according to Moore and Benbasat (1991) (cf. Figure 2) and the items' content validity was assessed with one index as suggested by Hinkin's (1998) pre-test methodology. In step 1, following a deductive approach, the existing literature was reviewed to identify existing scales (Hinkin, 1995) (cf. Figure 2). Three established scientific databases (ProQuest, EbscoHost and Scopus) were searched for tests or scales.

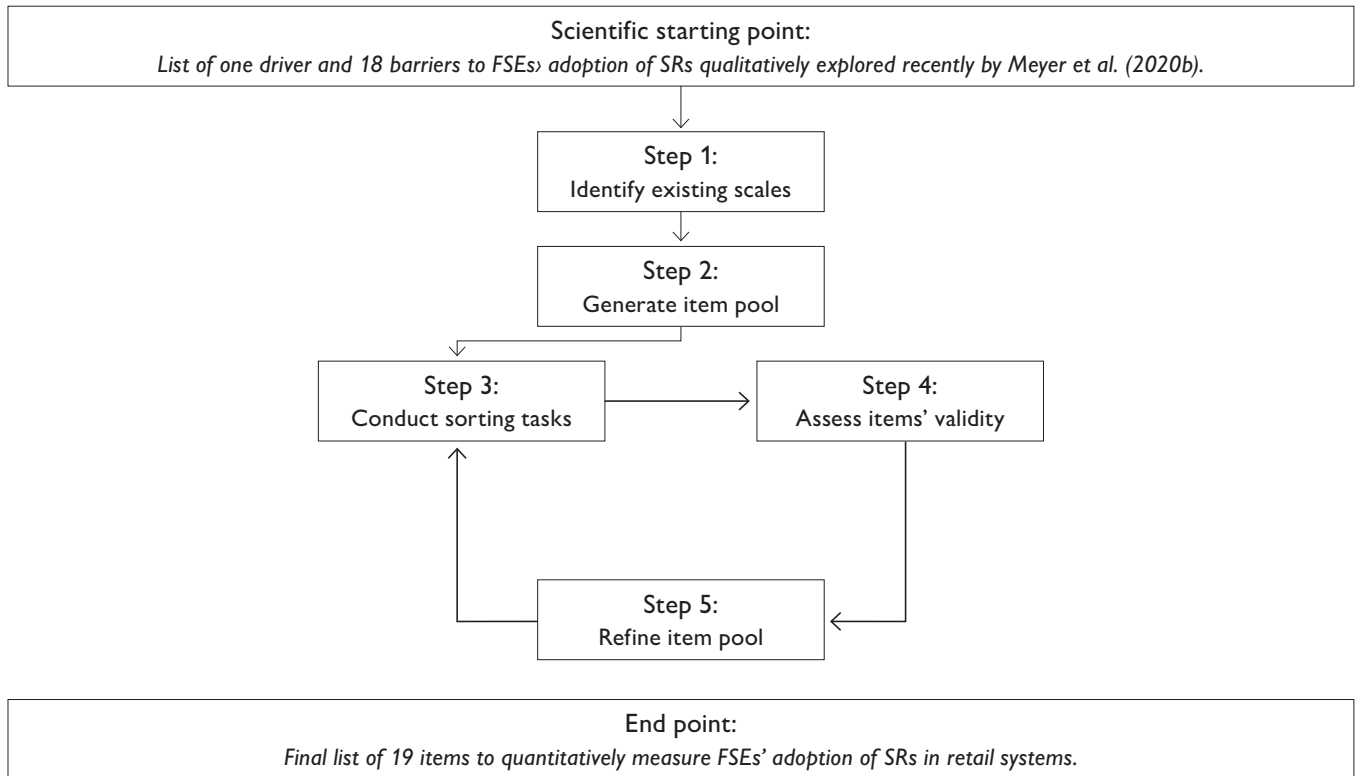
In step 2, the scales identified in 29 papers were reviewed and 19 papers were selected as most appropriate (Moore & Benbasat, 1991). After extraction of the items, they were adapted to the

present context and transferred to a list of final items for web-based item sorting.

A five-step approach was followed to develop a 19-item instrument to measure drivers of and barriers to SR adoption by FSEs.

In step 3, two rounds of web-based item sorting tasks were conducted to allow for a quantitative assessment of the generated items later on (Anderson & Gerbing, 1991). For the sorting tasks, items were randomly chosen from the final list and complemented by two fictitious items as trap questions ("Self-driving cars are a danger to road traffic" and "Physical activity prevents health risks") (Liu & Wronski, 2018). Master students in information systems and related disciplines were

Figure 2: Scale Development Process



Source: Authors' illustration based on Moore & Benbasat (1991).

recruited for the task. According to Hinkin (1998, p. 111), for sorting tasks it is possible “to use a small sample of students as this is a cognitive task not requiring an understanding of the phenomena under examination”. Additionally, this approach was applied because conducting sorting tasks with FSEs only, while aiming for a sample size of not fewer than 40 respondents each, seemed hardly feasible, as SRs were piloted only sporadically at the time of data collection. In sum, 40 respondents (round 1) and 43 respondents (round 2) fully completed the survey, representing a sufficient number of respondents (cf. Tullis & Wood, 2004).

In step 4, the items’ content validity was assessed using the proportion of substantive agreement, PSA, (cf. Anderson & Gerbing, 1991), defined as “the proportion of respondents who assign an item to its intended construct” (Hinkin, 1998, p. 734). Values range from 0 to 1, with larger values indicating higher substantive validity. This allows to achieve adequate psychometric properties of the generated items and to identify ambiguous items (PSA values < 0.50; Anderson & Gerbing, 1991).

In step 5, to ensure substantive validity and lack of ambiguity of individual items, items with PSA values below the recom-

Table 1: Final 19-Item Instrument to Measure Drivers of and Barriers to the Adoption of SRs by FSEs

Driver (+) / barrier (-)	Items tested	Scale	Test 1 P _{SA}	Test 2 P _{SA}	Original source
Functional Level					
Hurdles in everyday interaction with SRs					
Functional incapability	Service robots seem to lack the necessary requirements to perform their tasks.	N/A	0,23	N/A	Okazaki et al. (2010)
	Service robots do not appear to have any specialized capabilities that could increase the performance of our store.	1)	N/A	0,53	
Physical appearance	The design of the service robots gives them an unattractive character.	N/A	0,25	N/A	Wakefield & Blodgett (1996)
	The design of the service robots worsens the atmosphere of the store.	1)	N/A	0,65	
Operational imperfection	Service robots perform worse than human frontstage employees and are therefore not suitable for use in the store.	N/A	0,15	N/A	Jo (2007)
	Service robots look unreliable and breakable and are therefore not suitable for use in the store.	1)	N/A	0,53	
Required commitment					
Disruption of routines	Problems with service robots interrupt me from getting my job done.	N/A	0,23	N/A	Karr-Wisniewski & Lu (2010)
	(I am often distracted by the service robots from performing my job duties.)	1)	N/A	0,4	
Increase in responsibilities	I feel busy or rushed due to service robots.	N/A	0,20	N/A	Ayyagari (2007)
	Time spent resolving problems of service robots takes time away from fulfilling my work responsibilities.	1)	N/A	0,86	
Time efforts	I have too much work to do to deal with service robots in addition.	1)	0,55	N/A	Boxall & Macky (2014)
	Since the implementation of service robots, the amount of work I am asked to do is not fair.	N/A	0,50	N/A	
Relational Level					
Emotional burden					
Mental strain	The functions of service robots are not easy to use.	N/A	0,35	N/A	Lee et al. (2016)
	It is not easy to get the results that I desire when using service robots.	N/A	0,23	N/A	
	Through the use of service robots, I often feel too fatigued to perform other tasks as well.	1)	N/A	0,93	
Technostress	I feel uncomfortable in the presence of service robots.	1)	0,53	N/A	Sinkovics et al. (2002)
	I feel frustrated when I work with service robots.	N/A	0,50	N/A	
Fear of public failure	I feel ashamed when I have problems handling service robots while customers are watching.	N/A	0,28	N/A	Spreer & Rauschnabel (2016)
	(I am afraid of not being able to operate service robots properly when others are around.)	1)	N/A	0,30	
Lack of plausibility	I have doubts that the use of service robots will achieve its objective.	N/A	0,28	N/A	Stanley et al. (2005)
	(I question management’s motives for the implementation of service robots.)	1)	N/A	0,40	

mended threshold of 0.50 (Anderson & Gerbing, 1991) were replaced by new items for the second round of sorting tasks conducted subsequently (cf. Table 1).

Findings

The final list of items provides a valid instrument to quantitatively measure drivers of and barriers to the initial adoption of SRs by FSEs in retail service systems. Table 1 displays specific drivers or barriers in the first column, followed by the tested

items associated with each driver or barrier in column two. Proposed items that passed the tests are highlighted in gray. These may be used to quantitatively measure FSEs' adoption of SRs in retail systems. The third column shows the proposed Likert-scale for each item, following DeVellis' (2016) recommendations. Columns four and five display the calculated PSA values. Column six lists the original reference upon which each item is based. All but three final items' calculated PSA values are above the threshold of 0.5, indicating their validity (Anderson & Gerbing, 1991). Three PSA values are below the threshold of 0.5. Yet, since most of the values exceed the

Driver (+) / barrier (-)	Items tested	Scale	Test 1 P _{SA}	Test 2 P _{SA}	Original source
Relational Level (continued)					
Encouragement					
Inclusion in creation	My organization listens to my ideas and suggestions regarding service robots.	N/A	0.43	N/A	Arnold et al. (2000)
	My organization gives all employees a chance to voice their opinions on the use of service robots.	1)	0.63	N/A	
Training	My organization provides training on service robots to meet the changing needs of the workplace.	1)	0.63	N/A	Hanaysha (2016)
	Overall, I am satisfied with the amount of training I receive on service robots.	N/A	0.63	N/A	
Mastery	I feel uncertain about how to use service robots properly.	N/A	0.53	N/A	Dong et al. (2008)
	Directions are vague regarding how to use service robots.	1)	0.91	N/A	
Organizational Level					
Loss of status					
Substitution risk	I am concerned about losing my job due to the use of service robots.	1)	0.68	N/A	Blau et al. (2004)
Uncertainty of future	With the implementation of service robots, future career opportunities in the retail sector are unfavorable.	N/A	0.60	N/A	Hellgren et al. (2002)
	With the use of service robots, my organization will not need my skills in the future.	1)	0.68	N/A	
Degradation	I would try to avoid situations where service robots told me what to do.	N/A	0.38	N/A	Gaudiello et al. (2016)
	I would prefer to lead a service robot rather than following instructions of a service robot.	1)	N/A	0.74	
Role congruency					
Social-emotional callousness	I can't deal with service robots in the same way that I would with human beings.	1)	0.55	N/A	Kamide et al. (2014)
Deterioration of interaction	I lack companionship due to the implementation of service robots.	N/A	0.50	N/A	Hays & Dimatteo (1987)
	I cannot find companionship in service robots.	1)	0.65	N/A	
Mistrust	Frontstage employees can solve problems more effectively than service robots.	N/A	0.38	N/A	Parasuraman (2000)
	There should be caution in replacing frontstage employees with service robots because service robots can break down.	1)	N/A	0.70	

1) 5-point Likert-scale, ranging from «1 = fully disagree» to «5 = fully agree». Source: Authors' illustration.

recommended threshold, it may be assumed that the items are sufficiently adapted and reflect the targeted drivers and barriers to a certain extent.

Regarding the scaling of measuring items, the Likert-scale is among the most widely used response formats for measuring perceptions, beliefs, and experiences (DeVellis, 2016; Hinkin, 1998). It is used by presenting a statement (item) and offering possible response options ranging from fully disagree to fully agree, allowing for subsequent statistical analysis of the responses (DeVellis, 2016). The items extracted are statements to

which respondents express either disagreement or agreement. A 5-point Likert-scale is proposed for all 19 items, given that Lissitz and Green (1975) point out that the coefficient alpha (measure of reliability) reaches its maximum when applying a 5-point scale.

Discussion and Implications

The findings of this study contribute to the scientific knowledge base by proposing a preliminary instrument consisting of 19

Table 2: Potential SR Use Cases

Driver/barrier	Exemplary consideration for more revolutionary service robot use cases
Functional Level	
<ul style="list-style-type: none"> • <i>Hurdles in everyday interaction</i> • <i>Required commitment</i> 	Profiling services provided by SRs in conjunction with FSE as a functionally complementary hybrid team. <i>Example:</i> Reconfiguration of a beverage market or wine store. SR assembles beverage crates as requested, loads into car, transfers to FSE if necessary. Acceleration of the service process, cost improvement and relief from physical work for FSEs and customers.
Relational Level	
<ul style="list-style-type: none"> • <i>Emotional burden</i> • <i>Encouragement</i> 	More cost-effective creation of additional services and relief of FSEs. <i>Example:</i> Novel floral business, gift wrapping. FSE specifies customer request and product/service combination, SR compiles, facilitates, accelerates, and improves the service process as a learning hybrid system (e.g. by more elaborate, possibly even spectacular gift wrapping or personalization)
Organizational Level	
<ul style="list-style-type: none"> • <i>Loss of status</i> • <i>Role congruency</i> 	Creation of new, improved consulting situations and consulting formats in the interaction of FSE and SR, thereby upgrading classic sales. <i>Example:</i> Specialized high-tech/high-touch consulting for sports equipment (running shoes, golf clubs, bicycles, etc.). FSE and SR as a learning consulting system. SR takes customer measurements, suggests configurations and products. FSE gives immediate feedback so AI system learns (integrating the learning perspective into the service process).

Source: Authors' illustration.

Main Propositions

- 1 It seems fruitful to investigate FSE' perspective on SRs as they are responsible for service provision to customers.
- 2 An in-depth understanding of how to measure FSEs' adoption of SRs seems necessary as SRs affect the FSEs' work routine on a daily basis.
- 3 The developed measurement tool can help improve SR implementation as reasons for rejection or acceptance are understood.

Lessons Learned

- 1 Retail organizations need to understand not only the adoption of SRs by customers, but also by their FSEs.
- 2 Retail organizations should involve FSEs in SR adoption from the onset to co-create effective hybrid service delivery systems.
- 3 Retail organizations are encouraged to use the developed measurement tool to quantify potential barriers to SR adoption by FSEs a priori.

items that can be used to quantitatively measure the drivers of and barriers to the adoption of SRs by FSEs in retail systems (as previously identified in an exploratory study by Meyer et al., 2020b). For retail practitioners, table 1 provides all ingredients to create an easy-to-use feedback form for their FSEs.

While this can serve as a solid starting point for further research efforts (cf. Barth & Rudolph, 2022), it is recommended that further items are identified and their substantive validity is re-measured in follow-up studies. The substantive validity values, as measured by PSA, of three of the 19 items appear to


It is recommended to involve frontstage employees from the outset to understand and consider their needs and thus increase their adoption of service robots.

be only conditionally sufficient, as described in the findings section above. Moreover, it seems a promising endeavor to explore how FSEs' acceptance of SRs changes over time.

From a managerial point of view, there are manifold implications from both an evolutionary and a more revolutionary perspective (Grewal et al., 2020). From an **evolutionary perspective**, the developed measurement tool can be used to improve the implementation of SRs, since reasons for rejection or acceptance can be identified. FSE training and other measures can subsequently be implemented to gradually create improved service systems with SRs. For existing retail organizations, considerable barriers are to be expected if existing processes are altered by SRs. Only the factor "inclusion in creation" was identified as a driver (Meyer et al., 2020b), strongly indicating that barriers will dominate the introduction of SRs.

From a **more revolutionary perspective**, SR adoption by FSEs can be increased if the point of sale is thought of as a hybrid service system (Shankar et al., 2021). SRs are already used in back-stage processes that mostly do not involve cooperation with FSEs, for example at the e-commerce market leader Amazon or the Ocado company in food shipping (Rudolph, 2021). However, few robust SR use cases have been identified in frontstage processes that require a smooth cooperation with FSEs.

Researchers see vast opportunities in frontstage processes that require smooth cooperation between SR and FSE, which is why they call for a stronger revolutionary perspective on how to

innovate the points of sale (Pantano & Dennis, 2019; Shankar et al., 2021). New robot-involving sales formats can pop up that improve service provision for customers. For instance, FSEs may advise customers in fashion showrooms and hand over to an SR that brings the desired product size and color from the warehouse to the fitting room (cf. Heinemann, 2021). To increase service provision by SRs, smooth cooperation with FSEs is key (Paluch et al., 2020). Thus, it is recommended to involve FSEs from the outset to understand and consider their needs and thus increase their SR adoption. For the identification of more revolutionary SR use cases, table 2 narrows down the field of interest for retail management. It reflects the drivers and barriers and should provide valuable hints and examples for retail management. 

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