

Rimbeck, Marlen; Stumpf-Wollersheim, Jutta; Richter, Alexander

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Unfolding IoT Adoption: A Status Quo Bias Perspective

Marlen Rimbeck · Jutta Stumpf-Wollersheim · Alexander Richter

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Abstract Internet of Things (IoT) solutions are still far from using their enormous potential, partly because misconceptions lead employees to avoid using IoT solutions and stick to established working routines. To shed light on the non-rational perspective of users, which allows for inference on the emergence of cognitive misconceptions, 489 respondents' perceptions of benefits and costs of IoT solutions were analyzed. Using the perspective of “status quo bias”, the qualitative analysis reveals that the perceptions of experienced and inexperienced users partly overlap on benefits such as the reduction of errors and relief of personnel. However, the perceptions also diverge in part, as inexperienced users consider IoT solutions to be gimmicky, fostering mistrust. In addition, inexperienced users overestimate learning phases for interacting with IoT solutions, leading to loss aversion and consequently to cognitive misperceptions. Hence, the study examines the gap between experienced and inexperienced users as a neglected aspect in IoT adoption. Further, identifying relevant drivers for the implementation of IoT solutions at the individual level helps to extend the hitherto technical view

of IoT solutions towards a multi-layer approach that includes a holistic, behavioral perspective.

Keywords Internet of Things · Status quo bias · Perception · Adoption behavior

1 Introduction

The Internet of Things (IoT) represents a cornerstone of the future generation of the Internet and a novel technology paradigm (Atzori et al. 2017; Ben-Daya et al. 2019; Lu and Neng 2010; Mishra et al. 2019). As the adoption of IoT solutions enables the intelligent cross-linking of multiple devices and the real-time collection of information (Mishra et al. 2019; Xia et al. 2012), organizations see opportunities to reduce costs (Sandu and Gide 2017), to improve customer satisfaction (Vermanen and Harkke 2019) and to structure workflows more efficiently (Scuotto et al. 2017). However, at the individual level, IoT solutions are considered to be complex and heterogeneous, requiring specific tools and profound expertise for adoption and maintenance (Mishra et al. 2019). Many employees do not have a clear understanding of the potential of IoT solutions and the extent to which their implementation affects organizational and procedural conditions (Leyer et al. 2017). Previous studies have identified the need to study enterprise-based IoT adoption at the individual level (Hsu and Lin 2016), false perception of IoT solutions (Laumer and Eckhardt 2012), as well as algorithm aversion towards automated information systems (IS) (e.g., Heßler et al. 2022). These misconceptions let employees face IoT solutions reluctantly, leading to slow adoption speed, workarounds and reversions to old working tools and routines (Venkatesh 2006). From a “status quo bias”

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M. Rimbeck · J. Stumpf-Wollersheim
Chair of International Management and Corporate Strategy,
Technical University of Freiberg, Freiberg, Germany
e-mail: Marlen.Rimbeck@bwl.tu-freiberg.de

J. Stumpf-Wollersheim
e-mail: Jutta.Stumpf-Wollersheim@bwl.tu-freiberg.de

A. Richter (✉)
School of Business and Government, Victoria University of
Wellington, Wellington, New Zealand
e-mail: Alex.Richter@vuw.ac.nz

perspective, employees' preference to remain in current situations or working practices leads to increased demands on time and costs, along with adverse reactions to the implementation of new information systems (Kim and Kankanhalli 2009; Kim 2011).

Previous research concerning users' adoption behavior regarding the IoT primarily focused on IoT services, smart home or healthcare industries (Hsu and Lin 2016; Pal et al. 2018; Williams et al. 2017). Further studies (e.g., Sievers et al. 2021) examined the impact of IoT solutions at the individual and the team level, contributing to an enhanced understanding that IoT-specific attributes may lead to employee empowerment and dynamic team structures. However, thus far, no study has investigated users' non-rational, relative perceptions of costs and benefits as well as potential cognitive misperceptions regarding IoT solutions. Moreover, no study has addressed the differences in perception between experienced users (i.e., employees who have used or are currently using IoT solutions in their working environment) and inexperienced users (i.e., employees who have never used IoT solutions in their working environment). Previous research on inexperienced users explains the reluctance to adopt new information systems with isolation, lack of education, or nostalgic feelings (Kahma and Matschoss 2017). As we assume that inexperienced users tend to stick to their established routines due to cognitive misconceptions, we focus on both experienced and inexperienced users equally. By examining both groups to uncover whether specific benefits or costs are consistently over- or underestimated at different levels of experience, we address an important research gap. Specifically, the exploration of employee perceptions offers a highly relevant complement to research that examines adoption behavior at the organizational level for several reasons. First, addressing reactions and feelings at the individual level contributes to psychological identification (Leso et al. 2022). Second, understanding employees' behavioral intention regarding the implementation of IoT solutions is crucial for the adoption process to proceed as envisioned by management. Third, understanding individual perceptions facilitates the establishment of new routines (Venkatesh 2006). By considering both ends of the experience spectrum, this study aims to provide a comprehensive understanding of the factors influencing IoT adoption, moving beyond a one-size-fits-all perspective. Furthermore, the increasing diffusion of technology as a cultural and organizational phenomenon can be studied more effectively by considering non-use (Satchell and Dourish 2009). Consequently, understanding users' perception of costs and benefits as well as cognitive misperception means overcoming a fundamental hurdle to achieve greater adoption at the individual level (Boonstra and Broekhuis 2010).

We aim to (1) empirically capture IoT users' non-rational perceptions of costs and benefits of IoT solutions in industry and (2) to identify cognitive misperception and potential differences in perception that may lead to different individual adoption behavior. We surveyed 489 employees about their use of the IoT with primarily open-ended questions and a focus on IoT solutions in industry, considering both applications in office and production environments. On the basis of the constructs of the status quo bias theory (SQBT), we analyzed the data through an inductive content analysis, allowing for the capture of users' non-rational perspectives. Within the groups (i.e., experienced and inexperienced users), we also differentiated between employees at the operational and management level to generate in-depth insights related to our research question. Our results, first of all, show that the respondents consider the reduction of errors, improved process management, and the relief of personnel to be the key benefits of IoT adoption. However, while experienced users see the IoT as a long-term challenge to interpersonal exchange, inexperienced users tend to consider IoT solutions as a pointless gimmick that only fuels mistrust. Inexperienced users also overestimate the amount of time it takes to become familiar with IoT solutions. Particularly in this aspect, it is striking that solely employees at the operational level overestimate the familiarization period with IoT solutions. This overestimation is due to the fact that IoT solutions are often seen as complex and non-transparent.

Our study provides two highly relevant theoretical contributions: First, based on our empirical qualitative observations, we contribute to an explanation of users' preference regarding the integration of IoT solutions in their working routines. In doing so, we contribute to a broader understanding of the implications for the use of IoT solutions (Beck et al. 2022), focusing in particular on non-rational perceptions and potential misconceptions that emerge from algorithmic decision making, along with relevant insights for managers. We analyzed our results through the lens of SQBT according to Samuelson and Zeckhauser (1988) and Kim and Kankanhalli (2009), adding that bridging the gap between experienced and inexperienced users is a neglected aspect in examining IS adoption and user perception. As we identify major differences in perceptions, we further contribute to an improved and in-depth understanding for behavioral attitudes and (negative) adoption decisions towards IoT solutions. Specifically, our research contributes to the validation and extension of existing findings in IS research, especially in relation to SQBT. Our results suggest that uncertainty costs and sunk costs have a significant impact on resistance and, as a result, slower adoption of IS, as previously shown by Hsieh and Lin (2020) and Kim

(2011). Moreover, our study indicates that the majority of inexperienced users have no intention to adopt the IoT. In contrast to previous findings suggesting reasons such as isolation, lack of education, or nostalgia (Kahma and Matschoss 2017), we propose that cognitive misconceptions are a central factor leading inexperienced users to stick to their habitual patterns. Second, we determine relevant drivers for the implementation of IoT solutions at the organizational level and thus extend the hitherto technical view of the IoT. Specifically, in reference to well-known multi-layer approaches (e.g., Al-Fuqaha et al. 2015), we extend in particular the application and business layer, by including a holistic, behavioral perspective. Hence, we contribute considerably to a broader conceptual understanding of IoT solutions. Additionally, our study comes along with important practical implications: First, by addressing real-world cases, potential benefits and costs of IoT adoption are particularly emphasized for inexperienced users. Second, both experienced and inexperienced users can benefit from making strategic decisions at different management levels.

2 Theoretical Foundation

2.1 IoT Solutions in Industry and the Impact at the Organizational Level

The term “IoT” describes the global interconnection of small independent sensors, complex devices or system environments, representing a generic term for a range of advanced information systems. Linking to the Internet, the devices are able to gather in data from their environment and communicate with other devices (Atzori et al. 2017). Despite different orientations of previous studies (Mihovska and Sarkar 2018), the commonalities converge on the following key attributes: (1) the presence of a specific number of physical objects in the (working) environment, (2) the collection and simultaneous transmission of information to applications for users to access and evaluate, and (3) an enhanced degree of automation regarding human–machine interaction. Unlike user-centric information systems (Butala and Mpofu 2014; Martins et al. 2020), IoT systems communicate directly with each other and autonomously conduct similarly structured routine activities. Accordingly, the IoT provides high volumes of data (Sievers et al. 2021), improving accuracy and efficiency (Luthra and Mangla 2018).

In an industrial context, in particular interconnected systems in the production process are receiving increasing attention. For instance, additive manufacturing provides a flexible approach to digitally capture inventory and automatically initiate manufacturing tasks on demand (Haleem

and Javaid 2019). In addition, the concept of a smart factory includes real-time monitoring and control of the entire production process through IoT devices, covering production lines, warehouses and distribution hubs (Khan et al. 2020). As a result, fundamental organizational and process-related changes occur (Brous et al. 2020), which massively interfere with established working routines at the individual level (Ellis and Morris 2015; Hytha et al. 2019; Sherif and Al-Hitmi 2017). Concretely, the management and interpretation of the generated data as new components in established working routines as well as changes in productivity, internal control, self-regulation, and security aspects are becoming increasingly critical at the organizational level (Abera et al. 2016; Chang et al. 2020; Patel and Patel 2016). Due to the object-centric nature of IoT solutions, employees at the individual level are thus involved with process-triggering interactions with objects (e.g., scanning RFID tags) as well as handling interfaces that report the acquired data (e.g., navigating through the system, interpreting data, dealing with visual analytics) (Koren and Klamma 2018). Consequently, a high level of stress and fears to new IoT solutions are expected at the individual level (Reil et al. 2020).

2.2 Behavioral Responses at the Individual Level

Considering the three key attributes of the IoT and its deployment in industry, behavioral responses towards IoT solutions from employees can be derived in more depth. First, the presence of a specific number of physical objects massively interferes with existing working routines by capturing a variety of information from the working environment and providing subsequent feedback. In this context, Laumer et al. (2016) indicate that, in addition to the attributes of the IoT itself, the perception of altered working routines induces resistance behaviors. Moreover, IoT objects may be considered as surveillance mechanisms, causing employees to establish invisibility practices toward management (Anteby and Chan 2018). Second, modified or new applications and interfaces, presenting the collected data to users, may reinforce the cognitive loading. Learning and navigating through new interfaces creates changes in the user experience, emerging into a prevalent phenomenon in the industry context, and consequently may lead to resistance behaviors (Hutanu 2021). Third, an enhanced degree of automation may disrupt the psychological balance (Newcomb 1953) of employees. This occurs, for instance, when automated instructions for action (e.g., when errors appear in the production process) conflict with established routines of employees. Consequently, systems are perceived as a threat and trigger resistance (Schein and Rauschnabel 2021). Thus, various forms of resistance behavior are to be expected during the adoption of new IoT

solutions, which is often the case in the context of IS (Basyal and Seo 2017).

Resistance behaviors include apathy (e.g., disinterest, inaction), passive resistance (e.g., maintaining established behavior, excuses), active resistance (e.g., expressing dissenting positions, grumbling), or aggressive resistance (e.g., destructive sabotage, threats) (Chreim 2006; Coetsee 1999; Lapointe and Rivard 2005; Laumer et al. 2014). At the beginning of the adoption process, resistance is particularly evident in relation to new IS itself; in later stages of adoption, resistance becomes politicized and tends to target the substance of the IS (Lapointe and Rivard 2005). Critical drivers of resistance include perceived usefulness, ease of use, and threats or risks (Bhattacharjee and Hikmet 2007; Laumer et al. 2016; Maier et al. 2013; Schein and Rauschnabel 2021). It is immensely crucial for companies to detect impelling factors for negative reactions at an early stage, as resistance behaviors are a central reason for not using IS solutions (Basyal and Seo 2017; Laumer and Eckhardt 2012). Further studies emphasize the reluctance of employees to engage with IoT solutions, due to concerns about their inability to adapt and fears of increasing automation and autonomy (Ahmetoglu et al. (2022) and highlight the social dimensions of IoT implementation, citing privacy concerns, surveillance, and distrust as critical challenges that organizations encounter (Birkel and Hartmann 2019). Similarly, de Vass et al. (2021) shed light on the challenges faced by organizations in deploying IoT technologies, including resistance from stakeholders, reluctance to share data, and interoperability issues. Furthermore, Ancarani et al. (2020) contribute insights into the varying degrees of IoT readiness and technological capabilities within organizations. By identifying different clusters of IoT projects, the study emphasizes the diverse nature of IoT solutions and the corresponding impacts on organizational processes and capabilities. In light of these findings, it becomes evident that understanding and addressing employee concerns and resistance behaviors are essential for successful IoT adoption. In addition, studies indicate that risks towards new IS are rated higher by inexperienced users (Schein and Rauschnabel 2021), impeding the individual adoption behavior (Shahbaz et al. 2019).

2.3 Framework for Adoption Behavior at the Individual Level

Adoption at the organizational, team, and individual level plays a major role in the field of IS and contains a broad knowledge base, as the process of IS adoption is essential to realize its resulting benefits (Venkatesh 2006; Xia and Lee 2000). For this reason, researchers investigated the adoption process and factors determining adoption decision

of IS in organizations to a considerable extent (Hameed and Arachchilage 2020). The examination of individual-level IS adoption raised several theoretically grounded models, exploring the underlying mechanisms of user adoption behavior. These include the SQBT, which aims to explore non-rational decision making (Samuelson and Zeckhauser 1988) and provides an explanation for employees' preference to remain in current situations or routines (Kim and Kankanhalli 2009). To address the emergence of the status quo bias, three categories are considered (Kim and Kankanhalli 2009; Samuelson and Zeckhauser 1988). First, rational decision making involves weighing the costs (i.e., transition costs and uncertainty costs) and benefits that arise from deviating from the current status for the end user (Samuelson and Zeckhauser 1988). Second, cognitive misperception of potential losses leads to a stronger perception of potential (insubstantial) losses caused by deviating from the current status than potential benefits, thus creating a bias (Kahneman and Tversky 1979; Novemsky and Kahneman 2005). Third, sunk costs relative to prior commitments, social norms toward change in the working environment, and efforts to maintain a feeling of control create a psychological commitment toward the change (Samuelson and Zeckhauser 1988). The perceived value of the change is determined by switching benefits (i.e., increase in outcome while decrease in input) and switching drawbacks (i.e., increase in input while decrease in outcome) (Kim and Kankanhalli 2009). Accordingly, the categories incorporate not merely rational criteria, which primarily include a price dimension, but also non-rational aspects at the psychological level, which cause a status quo bias.

The SQBT is used in IS research and is particularly suitable for investigating mandatory IS implementation (i.e., decisions made at management level). In this regard, studies reveal that uncertainty costs, sunk costs, and perceived value of IS-based change have a significant impact on user resistance (Hsieh and Lin 2020; Kim 2011). In addition, transition costs and perceived loss negatively affect perceived value and thus indirectly impact user resistance to change (Kim 2011). Transition costs and perceived sunk costs, along with the associated habitual use of familiar systems, also reinforce inertia to adopt new IS (Polites and Karahanna 2012; Shankar and Nigam 2022). Accordingly, status quo bias significantly influences user resistance and slower adoption to change, which are reflected, for example, in grumbling among employees (Alzahrani et al. 2021), conflict, and increased resource consumption (Kim 2011).

Despite the rich abundance of research on IS adoption at the individual level through the lens of SQBT, some aspects have remained largely unconsidered so far. First, it requires further research that considers the specific nature

group the categories under the terms “benefits” and “costs” for ease of understanding. We would like to emphasize that we include both the rational and non-rational aspects that may cause a status quo bias under the two terms.

First, to query whether IoT solutions are currently used by the respondents, we used a 5-point Likert scale to determine the degree to which they define working devices as IoT-objects, i.e., objects that are equipped with sensor technology and intelligently connected (1 = no objects of this type are intelligently connected; 5 = all objects of this type are intelligently connected). We provided the respondents with a pre-defined list of IoT solutions typical for industry to select from (see Appendix 1; available online via <http://link.springer.com>). We identified the single items (e.g., office desk, printer, garbage can) and interconnected systems (e.g., building infrastructure, machines, production objects) based on a literature review that revealed the most commonly used IoT solutions in an industrial context. According to the question of use, we divided the participants into experienced users and inexperienced users: In the case that participants stated that none of the objects in their working environment was intelligently connected, they were identified as an inexperienced user. In the case that participants stated at least once that they use these items, they were identified as an experienced user. Incorrect assumptions about their IoT use were avoided by asking about the interconnection of working devices in their immediate working environment, which can be well evaluated by the respondents. Inexperienced users were then asked open questions about the intended use, potential areas of application as well as perceived benefits, and costs (see Appendix 2, Questions 1–5). Simultaneously, we asked experienced users about the duration of use, existing areas of use as well as benefits, and costs (Questions 6–9). Here we have adapted the wording of the questions slightly. We decided to formulate the questions in an open manner in order to obtain a wide range of diverse, unbiased answers. Fourth, we asked the respondents personal questions about the industry, companies, and tasks.

3.2 Sample and Data Collection

To ensure that only persons participate, who can evaluate the presence (or absence) of IoT solutions in an organizational context, we excluded non-employees from the further survey prior to data analysis ($n = 74$). The final target population of the survey included employees of organizations in Germany ($N = 489$), including managers ($n = 155$) and employees without a manager position ($n = 334$). Overall, the proportion of female ($n = 266$) and male participants ($n = 219$) was relatively equal, with an average

age of 45.90 years ($SD = 11.24$). We recruited participants through an access panel, which was provided by consumer fieldwork. The respondents covered various functional areas: A high proportion of respondents were involved in primary activities, with persons from service ($n = 67$) as well as marketing and sales ($n = 58$) being particularly prominent as compared to employees from operations ($n = 30$) and logistics ($n = 19$). Employees from secondary activities were mainly engaged in firm infrastructure and management ($n = 64$) and technology development ($n = 35$). Persons from the functional areas of procurement ($n = 12$) and human resources management ($n = 14$) were barely represented. In addition, there was a relatively high number of respondents classified in the category “other” ($n = 132$). Of those surveyed, more than half worked in small and medium-sized enterprises ($n = 275$); 42.90%, however, in companies with more than 250 employees ($n = 210$). The companies have been assigned to different industries. In reference to the Global Industry Classification Standard, depicting 11 sectors, mainly employees from industrials ($n = 134$) and consumer discretionary ($n = 142$) were included. Besides medium (e.g., service, $n = 69$; health and social care, $n = 47$; financials, $n = 26$; information technology, $n = 15$) and low represented sectors, a relatively high number of participants assigned to ‘other’ ($n = 102$). Tables 1, 2, and 3 indicate the descriptive statistics in detail.

3.3 Coding Procedure

In qualitative research, coding refers to the process of organizing and categorizing data to identify patterns, themes, and concepts (Mayring et al. 2004). Thus, coding allows for the identification of similarities and differences within the data set and helps to structure the data in a way that facilitates analyses and interpretation. We used MAXQDA (version 18.2.4) to conduct a qualitative content analysis (Mayring et al. 2004). Using the program, we calculated the Brennan-Prediger coefficient (Brennan and Prediger 1981) since this predictor is robust to the frequency distribution of the codes to be rated (Quarfoot and Levine 2016). To ensure an objective coding of the participants’ answers, we followed a stepwise inductive procedure. After we separated the answers depending on the users’ experience with IoT solutions, we identified perceived benefits, costs, and psychological commitment for the adoption of IoT solutions. From the aggregated results, we determined subsequent cognitive misperception and attitude towards using.

First, for the development of the coding scheme ‘differences in IoT perception’, the first author of the article and one additional coder independently analyzed the questionnaires and coded the open questions (Questions 4–5; 8–

Table 1 Frequencies and distributions

	<i>N</i>	<i>p</i>
<i>Gender</i>		
Male	219	44.8
Female	266	54.4
No answer	4	0.8
<i>Level of responsibility</i>		
Management level	155	31.7
Operational level	334	69.3
<i>Area of expertise</i>		
Service	67	13.7
Marketing and sales	58	11.9
Operations	30	6.1
Logistics	19	3.9
Firm infrastructure	12	2.5
Management	52	10.6
Technology development	35	7.2
Procurement	12	2.5
HR management	14	2.9
Other	132	27.0
<i>Company size</i>		
≤ 9	90	18.4
≤ 49	81	16.6
≤ 249	104	21.3
250 and more	210	42.9
<i>Internationality</i>		
International	179	36.6
Domestic	305	62.4
No answer	5	1.0

Table 2 Descriptive statistics

	<i>N</i>	<i>Min</i>	<i>Max</i>	<i>M</i>	<i>SD</i>
Age	487	18	68	45.90	11.24
Duration in company	451	1	45	11.67	9.53
Duration in working environment	447	1	47	14.68	10.26

9; see Table 4). Differences in coding were then discussed, and an initial coding scheme was created. Second, we passed the coding scheme as well as coding descriptions and guidelines on to two subsequent coders, who re-analyzed the open questions. Due to the insufficient intercoder agreement in some of the categories ($\kappa_{\min} = 0.20$, $\kappa_{\max} = 0.72$), we modified the coding scheme for these particular categories. Concretely, we combined some categories to a more aggregated level. For example, when benefits were reviewed, the categories ‘improved

information flow’ and ‘location and time-independent data access’ were summarized into a new category. In addition, we added the previously separately listed category ‘increased efficiency and effectiveness’ and ‘time recording and time savings’ to the category ‘process management’. Claims that there is no understanding of benefits or costs were each assigned an additional category. Although this category is not valuable in terms of content, it serves the purpose of completeness.

Based on these revisions, we created a final coding scheme containing 11 categories for experienced users (seven for net benefits, two for costs, and two for psychological commitment) and 15 categories for inexperienced users of IoT solutions (two additional categories for assumed net benefits, one additional category for assumed costs, one additional category for assumed psychological commitment). The resulting intercoder agreement in the third round was higher than 0.75 for all codes ($\kappa_{\min} = 0.89$, $\kappa_{\max} = 0.99$, $M = 0.95$, $SD = 0.04$), which is tolerable for an inductive content analysis (Landis and Koch 1977). In Table 4, the final coding scheme for differences in IoT perception is shown, which includes the code descriptions, the coding frequencies (*n*), and the intercoder agreement (κ). The coding frequency represents the number of codings that occurred among all participants. The lowered numbers indicate the corresponding groups; i.e., $_1$ represents experienced users and $_2$ represents inexperienced users.

To examine perceptions with regard to IoT solutions in further detail, we compared perceptions at the management and the operational level in the next step. For this purpose, we calculated the relative codings for participants with and without management responsibility in relation to the absolute number of codings. The letters in brackets indicate the operational level (o) and the management level (m).

4 Findings

The results are structured as follows: First, we analyze net benefits, costs, and psychological commitment of IoT adoption, differentiated into experienced users (k_1) and inexperienced users (k_2), considering operational and management level. Second, we examine cognitive misperception and attitude towards using.

4.1 Net Benefits

In total, we identified 595 codes for net benefits of IoT adoption. Useful factors that were equally described by experienced and inexperienced users can be classified into seven categories, specifically (1) functionality and error reduction ($k_1 = 109$, $k_2 = 56$), (2) process management

Table 3 Differentiation between experienced and inexperienced users according to the questionnaire

		Experienced users		Inexperienced users	
		<i>n</i>	<i>p</i>	<i>n</i>	<i>p</i>
1	Office desk/chair (e.g., automatic adjustment to user data)	62	12.7	424	86.7
2	Printer (e.g., automatic reordering when toner is empty)	203	41.5	281	57.5
3	Trash can (e.g., disposal order, when it is full)	45	9.2	439	89.8
4	Filing systems (e.g., reminder if something has been stored for too long)	90	18.4	396	81.0
5	Robots (e.g., vacuum cleaner robots, logistics robots)	88	18.0	394	80.6
6	Key fobs (e.g., automatic working time recording)	118	24.1	368	75.3
7	Building infrastructure (e.g., automatic blinds, thermostats)	181	36.9	305	62.4
8	Machines (e.g., automatic maintenance, order forwarding)	143	29.3	344	70.3
9	Production objects (e.g., automatic status notification, commissioning of activities)	127	25.9	359	73.4
10	Other objects	97	19.8	387	79.1

Participants had the option to select only those IoT solution options that applied to them. Therefore, the distribution of responses across the options varies; the division between experienced and inexperienced users was the primary criterion for subsequent data evaluation

($k_1 = 89$, $k_2 = 77$), (3) relief of personnel ($k_1 = 69$, $k_2 = 35$), (4) networking and data ($k_1 = 36$, $k_2 = 19$), (5) cost reduction ($k_1 = 22$, $k_2 = 22$), (6) resources and sustainability ($k_1 = 21$, $k_2 = 16$), and (7) modernity ($k_1 = 10$, $k_2 = 14$). Comparing the two groups, it is remarkable that the expectations of inexperienced users correspond largely with the perception of IoT experienced users. However, it is apparent that the perceptions of employees at the operational and management levels differ considerably in some categories.

Regarding the most mentioned category (1) functionality and error reduction, respondents stated that the implementation of IoT solutions leads to a reduction in failures, as IoT systems provide automatic solutions, especially for orders, re-orders, and schedules (see Table 5). By eliminating the necessity of manual resubmissions, errors are avoided at an early stage, thus reducing the error rate. In this context, IoT systems are considered to be transparent, accurate, functional and reliable. While these benefits are perceived to be relatively similar in strength by IoT-experienced employees at the operational and management levels, inexperienced employees at the management level in particular are much less likely to perceive the opportunity to increase functionality and reduce errors, potentially leading to a reduced willingness to implement IoT solutions in their departments.

In category (2) process management, respondents were positively impressed by how workflows run faster, more effectively and without idle time, bottlenecks and waiting times as a result of adopting the IoT. In addition, IoT solutions enable a more flexible and faster response to changing requirements, which results in improved coordination and delivery procedures. A similar pattern emerges

here as in the previous category, namely that IoT inexperienced managers may underestimate the potential with regard to process management.

In addition to the two most frequently mentioned categories, the (3) relief of personnel is named as a positive aspect regarding the net benefits of IoT solutions. In particular, the elimination of routine activities, which are often perceived as time-consuming and burdensome, is commonly reported. Furthermore, the respondents indicate that fewer routine activities and fewer work interruptions, reduces effort and allow them to concentrate on essential work content. Again, perceptions in this category are relatively similar among the subgroups of experienced users, whereas inexperienced users at the management level have a substantially weaker perception of the impact of IoT solutions on relieving personnel. Since this group of employees makes strategic decisions relating to the implementation of IoT solutions, these results must be considered rather critical (Tables 6, 7, 8).

4.2 Transition and Uncertainty Costs

Regarding the transition and uncertainty costs, a total of 286 statements were coded and allocated to the following categories: (1) employees and emotions ($k_1 = 96$, $k_2 = 47$), and (2) financial and personnel expenses ($k_1 = 85$, $k_2 = 58$). We identified similarities between experienced and inexperienced users in (2) financial and personnel expenses, representing transition costs. Financial efforts arise in particular from the acquisition, continuous service and data maintenance, support services and contractual obligations. From the perspective of the inexperienced users, personnel expenditure is caused in particular

Table 4 Coding scheme for differences in IoT perception

Category	Description	k_1	n_1	k_2	n_2
<i>Net benefits</i>		0.99		0.97	
1. Functionality and error reduction	Easy use of systems; better traceability, clarity and reliability; provision of a reminder function; monitoring for errors, improved control and independence		109		56
2. Process management	Automation of processes; prevention of idle time; simplified, trouble-free processes; shorter work paths, faster reaction to changes and feedback loops; resulting time savings		89		77
3. Relief of personnel	Work facilitation, simplification of work processes; support especially for routine activities; flexible deployment		69		35
4. Networking and data	Linking of objects, enabling access for all from any place and at any time, permanent availability; summarizing information from networked objects in digital files; improved data acquisition and analysis, optimized information flow		36		19
5. Cost reduction	Reduction of running costs by introducing IoT solutions		22		22
6. Resources and sustainability	Increased cost and resource efficiency, enhanced energy-saving potential, sustainability		21		16
7. Modernity	Creation of competitive advantages through innovation, modernity and the latest systems		10		14
8. Communication	Improved communication between departments and faster information retrieval		0		10
9. No benefits mentioned	There are no benefits stated and/or no understanding of potential benefits of IoT solutions		0		25
<i>Transition and uncertainty costs</i>		0.88		0.99	
1. Employees and emotions	Increased feeling of loss of individuality, changes in interpersonal skills and (digital) competences; fear of staff reduction		96		47
2. Financial and personnel expenses	Financial expenses due to costs incurred for purchase, care, maintenance; personnel expenses due to additional work and increased complexity; necessary external support		85		58
4. No costs mentioned	There are no costs stated		0		4
<i>Psychological commitment</i>		0.87		0.99	
1. System dependency	Dependency on electricity and Internet; dependency in terms of too much reliance on technology and lack of influence; susceptibility to errors		141		80
2. Privacy concerns	Outward concerns about potential vulnerability to cyber-attacks and data theft; inward concerns about employee monitoring; potentially immature solutions		51		33
3. Time expenditure	Long training periods and starting difficulties due to complex, cumbersome IoT applications; high data volumes		0		31

by a lack of expertise, which initially has to be acquired. Considering the differences between the operational and the management level, it is remarkable that particularly inexperienced employees at the operational level perceive the financial and personnel expenses for the implementation of IoT solutions as rather substantial.

Differences in perception, however, are found in the category (1) employees and emotions, addressing uncertainty costs. Experienced users express concern that workplaces, employee relationships and self-determination will be sacrificed in the long term through IoT adoption. Inexperienced users, on the other hand, share similar doubts but perceive IoT solutions as nonsensical gimmicks which creates distrust and overstrain. Furthermore, the respondents repeatedly emphasized that new skills are required to successfully handle IoT solutions. In particular, the know-how of internal or external experts is required for a better understanding of the IoT, especially in the initial

phase of the adoption process. At the same time, respondents also expressed concern that increasing IoT adoption will lead to personnel reductions, which will reduce existing teams in the long term. In this category, it is apparent that both IoT-experienced and inexperienced employees at the operational level assess the impact of the IoT on emotional aspects more strongly. Overall, it is striking that employees at the operational level perceive the transition and uncertainty costs of IoT solutions to a greater extent. On the one hand, these results indicate a higher level of resistance within employees at the operational level. On the other hand, it might be interpreted that employees at the management level systematically underestimate the transition and uncertainty costs and refrain from adopting appropriate strategic measures.

Table 5 Differentiation of IoT perception in relation to management and operational level

Category	$k_1(o)$		$k_1(m)$		$k_2(o)$		$k_2(m)$	
	<i>n</i>	<i>p</i>	<i>n</i>	<i>p</i>	<i>n</i>	<i>p</i>	<i>n</i>	<i>p</i>
<i>Net benefits</i>								
1. Functionality and error reduction	70	64.2 ⁺⁺	39	35.8	44	78.6 ⁺⁺⁺	12	21.4
2. Process management	49	55.1 ⁺	40	44.9	54	70.1 ⁺⁺⁺	23	29.9
3. Relief of personnel	40	58.0 ⁺⁺	29	42.0	28	80.0 ⁺⁺⁺	7	20.0
4. Networking and data	31	86.1 ⁺⁺⁺	5	13.9	12	63.2 ⁺⁺	7	36.8
5. Cost reduction	9	40.9 ⁺⁺	13	59.1	19	86.4 ⁺⁺⁺	3	13.6
6. Resources and sustainability	17	81.0 ⁺⁺⁺	4	19.0	13	81.3 ⁺⁺⁺	3	18.7
7. Modernity	8	80.0 ⁺⁺⁺	2	20.0	7	50.0 ⁺	7	50.0
8. Communication	0	00.0	0	00.0	10	1.0 ⁺⁺⁺⁺	0	00.0
9. No benefits mentioned	0	00.0	0	00.0	14	56.0 ⁺	11	44.0
<i>Transition and uncertainty costs</i>								
1. Employees and emotions	60	62.5 ⁺⁺	36	37.5	31	65.9 ⁺⁺	16	34.0
2. Financial and personnel expenses	46	54.1 ⁺	39	45.9	44	75.9 ⁺⁺⁺	14	24.1
3. No costs mentioned	0	00.0	0	00.0	3	75.0 ⁺⁺⁺	1	25.0
<i>Psychological commitment</i>								
1. System dependency	96	68.1 ⁺⁺⁺	45	31.9	56	70.0 ⁺⁺⁺	24	30.0
2. Privacy concerns	29	56.9 ⁺	22	43.1	19	57.6 ⁺	14	42.4
3. Time expenditure	0	00.0	0	00.0	31	1.0 ⁺⁺⁺⁺	0	00.0

The markers indicate the degree of divergence in perceptions between management and operational levels. ⁺indicates minor deviations (i.e., > 15%); ⁺⁺indicates moderate deviations (i.e., 35%); ⁺⁺⁺indicates major deviations (i.e., 75%); ⁺⁺⁺⁺indicates total deviations (i.e., 100%)

Table 6 Sample codes for ‘net benefits’

Category	Sample codes
<i>Net benefits</i>	
1. Functionality and error reduction	‘Automatic material re-ordering, does not have to be monitored and initiated by the employee’ (<i>k1</i>); ‘damages occur less frequently’ (<i>k1</i>); ‘warnings and reminders are no longer forgotten’ (<i>k1</i>)
2. Process management	‘Several projects can be brought in line at the same time and adjusted to each other again and again’ (<i>k1</i>); ‘no interruption of work processes’ (<i>k1</i>); ‘large quantities can be tracked’ (<i>k1</i>)
3. Relief of personnel	‘Employees can be relieved of routine activities’ (<i>k2</i>); ‘eliminate clutter of responsibilities’ (<i>k2</i>); ‘better access to data from anywhere’ (<i>k2</i>); ‘flexibility in terms of work time’ (<i>k2</i>)
4. Networking and data	‘Intelligent data acquisition/ data transmission/data networking’ (<i>k1</i>); ‘control of devices/processes from any location worldwide’ (<i>k1</i>)
5. Cost reduction	‘Once installed and ready for use – > cost-effective’ (<i>k1</i>); ‘for minor tasks that can be automated, there is no need to keep personnel available’ (<i>k1</i>)
6. Resources and sustainability	‘Intelligent saving and use of energy’ (<i>k1</i>); ‘paper savings’ (<i>k1</i>); ‘toner is only replaced when it is entirely empty’ (<i>k1</i>)
7. Modernity	‘Competitive advantages over the competition’ (<i>k2</i>); ‘increase employee motivation through innovation’ (<i>k2</i>); ‘attraction for young employees’
8. Communication	‘Faster information retrieval’ (<i>k2</i>); ‘improved communication’ (<i>k2</i>)
9. No benefits mentioned	‘Benefit not apparent’ (<i>k2</i>); ‘that is the big question’ (<i>k2</i>)

Table 7 Sample codes for ‘transition and uncertainty costs’

Category	Sample codes
<i>Transition and uncertainty costs</i>	
1. Employees and emotions	‘Interpersonal contacts disappear’ (k2); ‘there are no nice conversations to solve problems’ (k1); ‘many employees are not sufficiently qualified to deal with it’ (k1); ‘fewer employees are required – dismissals’ (k1)
2. Financial and personnel expenses	‘Additional costs by electricity, maintenance, repair, acquisition’ (k1); ‘only one supplier, so no price comparisons possible’ (k2); ‘training costs/costs for instruction’ (k1)
3. No costs mentioned	‘No risks’ (k2); ‘none’ (k1)

Table 8 Sample codes for ‘psychological commitment’

Category	Sample codes
<i>Psychological commitment</i>	
1. System dependency	‘If the Internet goes down, almost the entire work process is blocked’ (k1); ‘if IoT does not work, there is a lot at stake (failure of systems/devices that would then no longer be operable manually) (k1); ‘laziness and dependence on the employees’ side’ (k1)
2. Privacy concerns	‘Potential vulnerabilities for attackers’ (k2); ‘danger of hacker manipulation’ (k2); ‘comprehensive control’ (k2)
3. Usability and time expenditure	‘Employees must be trained for the new technology’ (k2); ‘complicated handling for older colleagues’ (k2); ‘difficult to use, training period’ (k2)

4.3 Psychological Commitment

For psychological commitment, we identified a total of 336 statements, including (1) system dependency (k1 = 141, k2 = 80), (2) privacy concerns (k1 = 51, k2 = 33), and (3) usability and time expenditure (k1 = 0, k2 = 31). Similarities between experienced and inexperienced users can be found in two categories in particular: In the first category, more than a third of the respondents perceive (1) system dependency as a controlling factor of the IoT, reducing capabilities to intervene in the system. In particular, the dependence on the Internet and electricity, as well as the associated risk of downtimes and resulting additional effort, is considered critical (see Table 4). The respondents also state that IoT solutions leave limited individual autonomy and thus lead to increased heteronomy and control of systems. In addition, employees’ laziness tends to intensify and personal responsibility for functioning work processes decreases. Concerns about system dependency are perceived considerably higher by IoT experienced and inexperienced employees at the operational level. As a second consistent category, (2) privacy concerns might be mentioned as another controlling factor. Both experienced and inexperienced users express concerns about security gaps for hacker attacks and data theft from outside. However, the monitoring and control of employees by the company itself, as well as the associated

decline in privacy, is also a major drawback for respondents.

A difference between the two groups lies in the perception of the (3) usability and time expenditure to adopt the IoT, addressing sunk costs. Inexperienced users tend to consider IoT solutions to be complicated and cumbersome in design, so that adoption involves a lot of effort, training, and overwork. Experienced users of IoT solutions did not report about these sunk costs. In this category in particular, a strong divergence of perception between IoT inexperienced employees at the operational and management level is apparent, as exclusively employees at the operational level identify the time expenditure as a potential risk in relation to psychological commitment. This result might be considered critical, as especially employees at the management level decide on training needs.

4.4 Cognitive Misperception and Attitude Towards Using

To draw inferences about cognitive misconceptions, we define loss aversion as a loss cost, in line with Kim (2011), and relate it to the behavioral intention to use IoT solutions. Given our study design, it seems reasonable to use data from inexperienced users for this purpose. First, we summed the coding frequencies for benefits (i.e., net benefits) and costs (i.e., transition costs, uncertainty costs, sunk costs, efforts to feel in control) and calculated the

difference. Here, the absolute count of frequencies provides an indication of the weighting of each category. Interestingly, benefits ($n = 249$) and costs ($n = 249$) are in balance. Second, to obtain insight into behavioral intention, we evaluated questions 2 and 6. Of the inexperienced users in our survey, only 11.71% reported that they intend to use IoT solutions in the future (in the near future, $n = 6$; in the next 2–3 years, $n = 14$; in the next 5–10 years, $n = 6$). Accordingly, the vast majority of inexperienced users indicated that they had no intention of adopting IoT, although a tendency for a proper balance between benefits and costs is apparent. Consequently, we assume a loss aversion and, as a result, a cognitive misconception regarding IoT solutions.

With regard to attitude towards the using, a comparison of benefits and costs depending on the IoT experience reveals that experienced users mention essential net benefits more frequently and accordingly seem to perceive them more strongly (i.e., functionality and error reduction, relief of personnel). At the same time, the perception of uncertainty costs and efforts to feel in control also differ insofar as they are more strongly perceived by experienced users (i.e., employees and emotions, system dependency). In a direct comparison of coding frequencies, it is observed that while inexperienced users have a balanced ratio, experienced users have a slightly negative ratio of benefits and costs. To enrich our conclusions about attitudes toward IoT solutions, we asked inexperienced users ($n = 222$) about potential use cases of the IoT (question 1) and experienced users about recent use cases of the IoT in their working environment (question 7). Comparing the (potential) use cases mentioned, it is noticeable that inexperienced users have a restricted perception of meaningful IoT use cases. With regard to an administrative working environment, inexperienced users identify IoT solutions for optimizing processes in offices (e.g., automatic reordering of printer cartridges) and for improving internal communication. Experienced users continue to specify use cases in customer service and finance. With regard to executive working environments, inexperienced users only mention IoT solutions in production as meaningful use cases (e.g., interconnection of multiple machines). Experienced users also list use cases in research and development, materials and logistics. Both groups also mention smart building infrastructure as a key use case. Overall, those statements ($k_1 = 195$, $k_2 = 85$) suggest a positive attitude, as the respondents identified meaningful use cases for IoT solutions. However, almost half of the inexperienced users' statements suggest a negative attitude, as they fail to identify any cases but reject the potential deployment of IoT solutions for a variety of reasons.

5 Discussion

Our study identified how IoT solutions are perceived by experienced and inexperienced users. A broad survey with open questions enabled us to identify both net benefits, costs, and psychological commitment of IoT solutions as well as similarities and differences in perception. Concerning some aspects, experienced and inexperienced users agree to a large extent and indicate, in particular, the reduction of errors and the improvement of process management. In contrast, the perception of costs of IoT implementation differs. For instance, IoT solutions themselves, as well as the time required for the training, is assessed significantly differently by experienced users and inexperienced users. Regarding the distinction between the operational and the management level, we have partly found strong deviations in perception. Overall, we infer from the results, first, that the net benefits of IoT solutions are perceived less strongly by inexperienced employees at the management level, implying that this group may tend to decide against strategically implementing IoT solutions. Second, the risks related to transition and uncertainty costs as well as psychological commitment are perceived more strongly by employees at the operational level, which might reinforce resistance behavior. First, we contributed to the examination of secondary barriers of IoT adoption by integrating two levels of experience equally. Second, we considered IoT solutions from a perception-based and behavioral perspective, complementing the predominantly technical perspective. In the following, we will discuss the implications in more detail.

5.1 Theoretical Contributions

According to Downs and Mohr (1976), innovation studies consider both primary (i.e., objective) and secondary (i.e., perception-based) attributes but do not sufficiently examine their distinction. Our study contributes to the differentiation by examining how contrasting groups of users perceive net benefits, costs, and psychological commitment, using SQBT to ground our results. Investigating and raising awareness of these secondary barriers is important to identify potential issues related to adoption and change processes (Boonstra and Broekhuis 2010). With our results, we contribute to the validation of already existing correlations with regard to SQBT in IS research, such as that uncertainty costs and sunk costs have a significant impact on resistance and a decelerated adoption process of IS (see Hsieh and Lin 2020; Kim 2011). In this context, our study complements previous findings, particularly with regard to the perceived benefits and risks of experienced users in the field of management (see Valmohammadi 2016). While Valmohammadi (2016) focused on the perceptions of

Iranian experts and executive managers in the context of IoT solutions implementation, our study extends this examination to include both experienced and inexperienced users. By analyzing perceptions across a broader spectrum of users, we provide insights into the emergence of cognitive misconceptions and the gap between experienced and inexperienced users in adopting IoT solutions. Furthermore, our study reveals that the vast majority of inexperienced users does not plan the adoption of the IoT at all. The reasons do not lie in isolation, a lack of education, or a nostalgic feeling as Kahma and Matschoss (2017) previously found in their study about technology diffusion. Rather, we assume that inexperienced users prefer to remain in their habitual pattern due to cognitive misconceptions. Thus, our study contributes to the characterization of inexperienced users and illustrates their relevance in the adoption process at the individual level. Furthermore, with the qualitative approach, based on our underlying framework, we contributed to an in-depth analysis of the relevant factors on perceived benefits and costs of IoT solutions. In this context, our study serves as a useful and relevant complement to previous research that addressed user adoption behavior towards IoT solutions using quantitative survey methods (see Hsu and Lin 2016).

Three different aspects (i.e., technical, economic, social) are addressed to describe the state of knowledge on the IoT (Nicolescu et al. 2018). Current research indicates that primarily the technical aspects of IoT adoption are investigated (Del Giudice 2016). For example, researchers are examining IoT architectures and theoretical framework models for increased security, trust, and privacy (Fortino et al. 2020; Nord et al. 2019). From this technical perspective, challenges arise in particular from issues related to standardization, interoperability, scalability, visualization, and data storage (Čolaković and Hadžialić 2018). However, the management of IoT solutions is becoming increasingly important. This also brings organizational and social aspects to the fore, as the creation of appropriate links between technology, organization, and humans is crucial for successful adoption. Our study addresses this point, as it raises awareness of the opportunities and risks of IoT solutions and gives advice on how to implement it, not at a technical level, but at an individual and organizational level. The results further provide the opportunity, aside from our underlying framework, to build conceptually grounded connections between the various categories.

For instance, we noticed that specific phrases describe a modification in team structures. Both experienced and inexperienced users specify the risk or concern that during IoT adoption (1) personnel is reduced due to the progressive elimination of routine activities and (2) deployed flexibly according to time and place, due to constant data availability. At the same time, it is often mentioned that

both (3) internal and external know-how, temporary or permanent, is required in existing teams to cope with change successfully. The identified aspects of dynamic team structures are consistent with the theoretical concept of “fluid teams”. Concretely, we describe three out of at least seven situations that promote the necessity of fluid teams in organizations (i.e., rapid downsizing, different skills and flexible allocation desired). Fluid teams that are characterized by an unstable membership are formed, explicitly or implicitly, for efficiency reasons and becoming increasingly relevant (Bushe and Chu 2011). So far, fluid teams have mostly been investigated in turbulent environments, such as ambulances, hospitals or police departments. Our study reveals that new technologies, such as IoT solutions, might be another trigger for changes in the fluidity of teams. In consequence, we lay the initial path to combine two previously independently studied research fields, i.e., IoT and team research, and to an integrated understanding of how IS relates to team-level impacts.

5.2 Practical Implications

In addition to the aforementioned theoretical contributions, various practical implications can be drawn. First, our study highlights perceived net benefits, costs, and psychological commitment through the lens of SQBT. A specific characteristic of the study here lies, first, in surveying employees in Germany, which provides in-depth insights into the current perception of IoT solutions in a specific geographic and work-related context. As a result, the findings obtained are applicable to the specific challenges of the German market and countries with similar conditions. Our results enable organizations to make well-founded decisions about investments in IoT technologies and to allocate resources effectively. Second, the study initiates an exchange between users and provides information on how organizational conditions can be restructured to enhance adoption of IoT solutions at the individual level. In particular, we emphasize the importance of the behavioral component in IoT adoption, which is often neglected so far. Besides the concern of establishing a strong dependency on intelligent devices and electricity, the respondents report the fear of losing competencies and interpersonal contacts. Accordingly, managers may derive various recommendations for action. More precisely, we initiate the consideration of involving users early in the implementation of IoT solutions to reduce misconceptions and guide activities in a way that creates higher psychological identification (Leso et al. 2022). Here, managers can leverage the results to gain a greater understanding of the specific needs and requirements of different user groups and how to address these. More concretely, the identified differences between experienced and inexperienced users

offer insights into tailoring communication strategies and training programs. Understanding the specific misconceptions or concerns prevalent in each group allows for more targeted interventions aimed at fostering a more positive attitude toward IoT adoption. Third, we provide valuable advice for inexperienced users, as we identify which positive and negative factors of IoT adoption are over- or underestimated. Thus, the study provides the opportunity to consider the prerequisites for successful implementation and strategic orientation as well as to evaluate the decision for adopting IoT solutions at the individual level. As a result, organizations can improve their training and deployment programs for IoT solutions, helping to fully realize the potential for usage and overcome potential barriers.

5.3 Limitations and Future Research

Our study offers initial evidence that the perception of IoT-solutions differs significantly among experienced and inexperienced users. However, the results leave questions unanswered, which offer fruitful areas for future research. First, company sizes, industries, and work context as external variables should be considered more differentiated to enhance the generalizability of our results. Although we asked for these characteristics, the sample was too small to identify differences and, thus, may not be generalizable for all organization types. More precisely, it can be assumed that employees in SMEs perceive the adoption of IoT solutions differently than in large companies owing to other conditions (i.e., flatter hierarchies, shorter communication channels, fewer resources). Here, a status quo bias in small companies with a fixed customer base may be assumed. Some organizations may not prioritize business expansion if they are satisfied with their current position. This bias can particularly affect inexperienced managers who may lack the perspective or experience to recognize the benefits of IoT for business growth. The industry affiliation also influences the perception of technology such as the IoT, given that employees in a technology-oriented industry are likely to have a more realistic and concrete imagination, even if they do not apply the technology for themselves. Similarly, their familiarity with technical concepts might lead to a more positive perception of IoT solutions, recognizing their potential benefits. On the other hand, employees from non-technical industry fields may exhibit a lack of understanding or even skepticism towards IoT solutions. The perceived complexity or the novelty of IoT technology could contribute to misconceptions towards IoT solutions. In addition, the work context should be examined more closely in the future, as the inexperienced users may include people whose work environment simply does not allow its use. Moreover, we considered the socio-

demographic characteristics of the participants only to a limited extent. For instance, employees with higher (technical) education levels may possess analytical skills that allow them to comprehend the potential benefits of IoT solutions more readily. Conversely, employees with lower (technical) education levels might face challenges in understanding the intricacies of IoT solutions, leading to misconceptions and hindering their willingness for IoT adoption. Specifically, employees with lower (technical) education levels may be more prone to the sunk cost fallacy and avoid adopting IoT due to the perceived investment required to learn new technologies. This reluctance could be due to a fear of wasting resources on the unfamiliar or challenging. Future research should accordingly conduct quantitative analyses to investigate the relationship between socio-demographic characteristics and the perception of IoT solutions.

Further, incorporating other theoretical approaches in IS research, future research should consider social influence. Specifically, the social environment, including interpersonal and digital interactions, may have a significant impact on inexperienced users' beliefs about using the IoT. For example, social influence, norms and social pressure, emotional support, and perceptions of relevance affect IS use intentions positively or negatively (e.g., Jaques et al. 2019; Wang et al. 2013; Yang et al. 2009). In relation to the organizational context, the organizational culture in particular can influence the perception and implementation of IoT solutions. More specifically, organizations with a proactive and innovative culture may be more inclined to embrace new technologies to enhance their operations and competitiveness. Our findings of medium to strong deviations between operational and management levels suggests potential challenges in communication or alignment of goals. Thus, it is important to consider that the influence of the social environment may vary depending on individual characteristics such as personality traits, previous experiences, and the specific context of the information system under examination. In sum, future research should address the perception of technology, specifically IoT solutions, in relation to company size, industry, work context, and social influence through an individual lens to determine if they coincide with our findings or if differences emerge. For instance, surveys or assessments designed to capture cultural dimensions and their impact on IoT perception as well as longitudinal studies to observe the influence of organizational culture over time on the long-term adoption of IoT solutions appear to be meaningful for future research.

Second, because we have qualitatively analyzed the open questions of our survey, we cannot draw conclusions about causal effects or the actual impact of user perception of the IoT on adoption decision or resistance behavior at the individual level. Hence, future research could gather

quantitative (experimental) data to investigate both perception and current adoption behavior in order to make causal predictions about whether a positive (negative) perception of the IoT leads to a positive (negative) adoption decision, considering the distinction between experienced and inexperienced users. Based on the empirical results from various IoT industries, our study confirms that the perception of net benefits, costs, and psychological commitment are relevant when implementing IoT solutions. Furthermore, with our methodological design, we cannot fully exclude that respondents might not have been aware of their use of IoT devices in their working environment and, accordingly, may have inadvertently delivered incorrect responses. However, based on an observation from a pretest suggesting that a considerable proportion of participants were unaware of the IoT concept, we decided to ask indirectly about experience with IoT solutions in order to prevent respondents from unintentionally giving incorrect answers. A plausible explanation for this observation might be that the survey focused on German employees and that IoT implementation in companies in Germany is relatively low. Accordingly, future research may use experimental designs to provide distinct inferences regarding the impact of varying levels of the deployment of the IoT. Third, more research is required to investigate the relationship between IoT adoption and the resulting consequences at the organizational, team, and individual level. For instance, to what extent the increasing diffusion of IoT solutions fosters changes in the fluidity of teams and what impacts are to be anticipated at the organizational and at the team level should be subject to future research. In this context, it is crucial to consider that the positive or negative consequences of implementing IoT solutions depend largely on various parameters and thus cannot be generalized for all types of organizations. These parameters include, in particular, financial and personnel aspects, covering procurement, commissioning and maintenance as well as consulting services by internal or external experts. Accordingly, future research might consider conducting case studies in companies of different sizes and industries to analyze how different economic factors influence the decision-making process and outcomes of IoT adoption. In addition, frameworks for performing comprehensive cost–benefit analyses specific to IoT adoption can be developed to help organizations evaluate the tangible and intangible costs and benefits associated with integrating IoT into their operations.

6 Conclusion

In our study, we highlighted the relevance of considering user perceptions through the lens of SQBT and revealed

how IoT solutions are perceived by experienced and inexperienced users. In addition to the similarities and differences, we also found that IoT solutions may change team structures and lead to so-called fluid teams. In general, the compulsive increase in flexible working forms is forcing a growing number of managers to allocate personnel flexibly and to exploit the increasing level of automation, virtual platforms and data analysis to a greater extent. To remain competitive in both the ongoing digitalization process and the prevailing uncertain market situation, it is even more important to overcome misconceptions, reduce resistance and adopt IoT in the long term.

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References

- Abera T, Asokan N, Davi L, Koushanfar F, Paverd A, Sadeghi A-R, Tsudik G (2016) Invited - things, trouble, trust: on building trust in IoT systems. In: Proceedings of the 53rd annual design automation conference (DAC), Austin. <https://doi.org/10.1145/2897937.2905020>
- Ahmetoglu S, Che Cob Z, Ali NA (2022) A systematic review of internet of things adoption in organizations: taxonomy, benefits, challenges and critical factors. *Appl Sci* 12(9):4117. <https://doi.org/10.3390/app12094117>
- Al-Fuqaha A, Guizani M, Mohammadi M, Aledhari M, Ayyash M (2015) Internet of Things: a survey on enabling technologies, protocols, and applications. *IEEE Commun Surv Tutor* 17(4):2347–2376. <https://doi.org/10.1109/comst.2015.2444095>
- Alzahrani A, Mahmud I, Thurasamy R, Alfarraj O, Alwadain A (2021) End users' resistance behaviour paradigm in pre-deployment stage of ERP systems: evidence from Bangladeshi manufacturing industry. *Bus Proc Manag J* 27(5):1496–1521. <https://doi.org/10.1108/BPMJ-08-2019-0350>

- Ancarani A, Di Mauro C, Legenvre H, Cardella MS (2020) Internet of Things adoption: a typology of projects. *Int J Oper Prod Manag* 40(6):849–872. <https://doi.org/10.1108/IJOPM-01-2019-0095>
- Anteby M, Chan CK (2018) A self-fulfilling cycle of coercive surveillance: workers' invisibility practices and managerial justification. *Organ Sci* 29(2):247–263. <https://doi.org/10.1287/orsc.2017.1175>
- Atzori L, Iera A, Morabito G (2017) Understanding the Internet of Things: definition, potentials, and societal role of a fast evolving paradigm. *Ad Hoc Netw* 56:122–140. <https://doi.org/10.1016/j.adhoc.2016.12.004>
- Basyal DK, Seo J-W (2017) Employees' resistance to change and technology acceptance in Nepal. *J Univ Grants Commiss* 6(1):1–15
- Beck R, Dibbern J, Wiener M (2022) A multi-perspective framework for research on (sustainable) autonomous systems. *Bus Inf Syst Eng* 64(3):265–273. <https://doi.org/10.1007/s12599-022-00752-0>
- Ben-Daya M, Hassini E, Bahroun Z (2019) Internet of things and supply chain management: a literature review. *Int J Prod Res* 57(15–16):4719–4742. <https://doi.org/10.1080/00207543.2017.1402140>
- Bhattacharjee A, Hikmet N (2007) Physicians' resistance toward healthcare information technology: a theoretical model and empirical test. *Eur J Inf Syst* 16(6):725–737. <https://doi.org/10.1057/palgrave.ejis.3000717>
- Birkel HS, Hartmann E (2019) Impact of IoT challenges and risks for SCM. *Supply Chain Manag Int J* 24(1):39–61. <https://doi.org/10.1108/SCM-03-2018-0142>
- Boonstra A, Broekhuis M (2010) Barriers to the acceptance of electronic medical records by physicians from systematic review to taxonomy and interventions. *BMC Health Serv Res* 10(1):231. <https://doi.org/10.1186/1472-6963-10-231>
- Brennan RL, Prediger DJ (1981) Coefficient Kappa: some uses, misuses, and alternatives. *Educ Psychol Measur* 41(3):687–699. <https://doi.org/10.1177/001316448104100307>
- Brous P, Janssen M, Herder P (2020) The dual effects of the Internet of Things (IoT): a systematic review of the benefits and risks of IoT adoption by organizations. *Int J Inf Manag* 51:101952. <https://doi.org/10.1016/j.ijinfomgt.2019.05.008>
- Bushe GR, Chu A (2011) Fluid teams: solutions to the problems of unstable team membership. *Organ Dyn* 40(3):181–188. <https://doi.org/10.1016/j.orgdyn.2011.04.005>
- Butala P, Mponfu K (2014) Assembly systems. In: *CIRP Encyclopedia of production engineering*, Springer, Heidelberg. https://doi.org/10.1007/978-3-642-35950-7_16789-1
- Chang S-I, Chang L-M, Liao J-C (2020) Risk factors of enterprise internal control under the internet of things governance: a qualitative research approach. *Inf Manag* 57(6):103335. <https://doi.org/10.1016/j.im.2020.103335>
- Chreim S (2006) Managerial frames and institutional discourses of change: employee appropriation and resistance. *Organ Stud* 27(9):1261–1287. <https://doi.org/10.1177/0170840606064106>
- Coetsee L (1999) From resistance to commitment. *Publ Admin Q* 23(2):204–222
- Čolaković A, Hadžialić M (2018) Internet of Things (IoT): a review of enabling technologies, challenges, and open research issues. *Comput Netw* 144:17–39. <https://doi.org/10.1016/j.comnet.2018.07.017>
- De Vass T, Shee H, Miah S (2021) IoT in supply chain management: opportunities and challenges for businesses in early industry 4.0 context. *Oper Supply Chain Manag Int J* 14(2):148–161
- Del Giudice M (2016) Discovering the Internet of Things (IoT) within the business process management: a literature review on technological revitalization. *Bus Proc Manag J* 22(2):263–270. <https://doi.org/10.1108/bpmj-12-2015-0173>
- Downs GW, Mohr LB (1976) Conceptual issues in the study of innovation. *Admin Sci Q* 21(4):700–714. <https://doi.org/10.2307/2391725>
- Ellis S, Morris H (2015) IoT-enabled analytic applications revolutionize supply chain planning and execution. International Data Corporation (IDC), White Paper
- Fortino G, Fotia L, Messina F, Rosaci D, Sarné GML (2020) Trust and reputation in the Internet of Things: state-of-the-art and research challenges. *IEEE Access* 8:60117–60125. <https://doi.org/10.1109/ACCESS.2020.2982318>
- Haleem A, Javaid M (2019) Additive manufacturing applications in Industry 4.0: a review. *J Ind Integr Manag* 4(4):1930001. <https://doi.org/10.1142/S2424862219300011>
- Hameed MA, Arachchilage NAG (2020) A conceptual model for the organizational adoption of information system security innovations. In: Joshi RC, Gupta BB (eds) *Security, privacy, and forensics issues in big data*. IGI Global, pp 317–339. <https://doi.org/10.4018/978-1-5225-9742-1.ch014>
- Heßler PO, Pfeiffer J, Hafenbrädl S (2022) When self-humanization leads to algorithm aversion. *Bus Inf Syst Eng* 64(3):275–292. <https://doi.org/10.1007/s12599-022-00754-y>
- Höller J, Tsiatsis V, Mulligan C (2017) Toward a machine intelligence layer for diverse industrial IoT use cases. *IEEE Intell Syst* 32(4):64–71. <https://doi.org/10.1109/MIS.2017.3121543>
- Hsieh P-J, Lin W-S (2020) Understanding the performance impact of the epidemic prevention cloud: an integrative model of the task-technology fit and status quo bias. *Behav Inf Technol* 39(8):899–916. <https://doi.org/10.1080/0144929X.2019.1624826>
- Hsu C-L, Lin JC-C (2016) An empirical examination of consumer adoption of Internet of Things services: network externalities and concern for information privacy perspectives. *Comput Hum Behav* 62:516–527. <https://doi.org/10.1016/j.chb.2016.04.023>
- Hutanu A (2021) Do users hate redesign? A literature review on user resistance to interface changes. *Rev Econ* 73(1):53–63
- Hytha D, Aronson J, Eng A (2019) Technology innovation and the rebirth of self-regulation: how the Internet of Things, cloud computing, blockchain, and artificial intelligence solve big problems managing environmental regulation and resources. *Int J Commun* 13(5)
- Jahanmir SF, Cavadas J (2018) Factors affecting late adoption of digital innovations. *J Bus Res* 88:337–343. <https://doi.org/10.1016/j.jbusres.2018.01.058>
- Jagues N, Lazaridou A, Hughes E, Gulcehre C, Ortega P, Strouse DJ, De Freitas N (2019) Social influence as intrinsic motivation for multi-agent deep reinforcement learning. In: *International conference on machine learning*, pp 3040–3049
- Kahma N, Matschoss K (2017) The rejection of innovations? Rethinking technology diffusion and the non-use of smart energy services in Finland. *Energ Res Soc Sci* 34:27–36. <https://doi.org/10.1016/j.erss.2017.05.024>
- Kahneman D, Tversky A (1979) Prospect theory: an analysis of decision under risk. *Econom* 47:263–291. https://doi.org/10.1142/9789814417358_0006
- Khan WZ, Rehman MH, Zangoti HM, Afzal MK, Armi N, Salah K (2020) Industrial internet of things: recent advances, enabling technologies and open challenges. *Comput Electr Eng* 81:106522. <https://doi.org/10.1016/j.compeleceng.2019.106522>
- Kim H (2011) The effects of switching costs on user resistance to enterprise systems implementation. *IEEE Trans Eng Manag* 58(3):471–482. <https://doi.org/10.1109/TEM.2010.2089630>
- Kim H-W, Kankanhalli A (2009) Investigating user resistance to information systems implementation: a status quo bias perspective. *MIS Q* 33(3):567–582. <https://doi.org/10.2307/20650309>

- Koren I, Klamma R (2018) Enabling visual community learning analytics with Internet of Things devices. *Comput Hum Behav* 89:385–394. <https://doi.org/10.1016/j.chb.2018.07.036>
- Landis JR, Koch GG (1977) An application of hierarchical Kappa-type statistics in the assessment of majority agreement among multiple observers. *Biomet* 33(2):363–374. <https://doi.org/10.2307/2529786>
- Lapointe L, Rivard S (2005) A multilevel model of resistance to information technology implementation. *MIS Q* 29(3):461–491. <https://doi.org/10.2307/25148692>
- Laumer S, Maier C, Eckhardt A, Weitzel T (2016) Work routines as an object of resistance during information systems implementations: theoretical foundation and empirical evidence. *Eur J Inf Syst* 25(4):317–343. <https://doi.org/10.1057/ejis.2016.1>
- Laumer S, Eckhardt A (2012) Why do people reject technologies: a review of user resistance theories. In: Dwivedi YK, et al (eds) *Information systems theory: explaining and predicting our digital society*, vol 1. Springer, New York, pp 63–86. https://doi.org/10.1007/978-1-4419-6108-2_4
- Laumer S, Maier C, Eckhardt A, Weitzel T (2014) Why are they grumbling about my new system? Theoretical foundation and empirical evidence of employee grumbling as a user resistance behavior. In: *Proceedings of the 35th international conference on information systems*, Auckland. <https://aisel.aisnet.org/icis2014/proceedings/HumanBehavior/45>
- Leso BH, Cortimiglia MN, ten Caten CS (2022) The influence of situational involvement on employees' intrinsic involvement during IS development. *Bus Inf Syst Eng* 64(3):317–334. <https://doi.org/10.1007/s12599-021-00719-7>
- Leyer M, Stumpf-Wollersheim J, Pisani F (2017) The influence of process-oriented organisational design on operational performance and innovation: a quantitative analysis in the financial services industry. *Int J Prod Res* 55(18):5259–5270. <https://doi.org/10.1080/00207543.2017.1304667>
- Lu T, Neng W (2010) Future internet: the Internet of Things. In: 3rd international conference on advanced computer theory and engineering, V5–376–V5–380. <https://doi.org/10.1109/ICACTE.2010.5579543>
- Luthra S, Mangla SK (2018) Evaluating challenges to Industry 4.0 initiatives for supply chain sustainability in emerging economies. *Proc Saf Environ Prot* 117:168–179. <https://doi.org/10.1016/j.psep.2018.04.018>
- Maier C, Laumer S, Eckhardt A, Weitzel T (2013) Analyzing the impact of HRIS implementations on HR personnel's job satisfaction and turnover intention. *J Strateg Inf Syst* 22(3):193–207. <https://doi.org/10.1016/j.jsis.2012.09.001>
- Martins L, Varela FN, Carmo-Silva S, Machado J (2020) Literature review on autonomous production control methods. *Enterp Inf Syst* 14:1–13. <https://doi.org/10.1080/17517575.2020.1731611>
- Mayring P (2004) Qualitative content analysis. In: Flick U et al (eds) *A companion to qualitative research*. Sage, pp 159–176
- Melby L, Toussaint P (2016) “We walk straight past the screens”: the power of the non-users of a hospital information system. In: Hyysalo S et al (eds) *The new production of users: changing innovation collectives and involvement strategies*. Routledge, London, pp 249–272
- Mihovska A, Sarkar M (2018) Smart connectivity for Internet of Things (IoT) applications. In: R. R. Yager R, Pascual Espada J (eds) *New advances in the Internet of Things*. Springer, pp 105–118. https://doi.org/10.1007/978-3-319-58190-3_7
- Mishra P, Puthal D, Tiwary M, Mohanty SP (2019) Software defined IoT Systems: properties, state of the art, and future research. *IEEE Wireless Commun* 26(6):64–71. <https://doi.org/10.1109/MWC.001.1900083>
- Newcomb TM (1953) An approach to the study of communicative acts. *Psychol Rev* 60(6):393–404. <https://doi.org/10.1037/h0063098>
- Nicolescu R, Huth M, Radanliev P, De Roure D (2018) State of the art in IoT-beyond economic value. London. <https://iotuk.org.uk/wpcontent/uploads/2018/08/State-of-the-Art-in-IoT-Beyond-Economic-Value2.pdf>
- Nord JH, Koohang A, Paliszkievicz J (2019) The Internet of Things: review and theoretical framework. *Expert Syst Appl* 133:97–108. <https://doi.org/10.1016/j.eswa.2019.05.014>
- Novemsky N, Kahneman D (2005) The boundaries of loss aversion. *J Mark Res* 42(2):119–128. <https://doi.org/10.1509/jmkr.42.2.119.62292>
- Pal D, Funiikul S, Charoenkitkarn N, Kanthamanon P (2018) Internet-of-Things and smart homes for elderly healthcare: an end user perspective. *IEEE Access* 6:10483–10496. <https://doi.org/10.1109/ACCESS.2018.2808472>
- Patel KK, Patel SM (2016) Internet of things-IOT: definition, characteristics, architecture, enabling technologies, application & future challenges. *Int J Eng Sci Comput* 6(5)
- Polites GL, Karahanna E (2012) Shackled to the status quo: the inhibiting effects of incumbent system habit, switching costs, and inertia on new system acceptance. *MIS Q* 36(1):21–42. <https://doi.org/10.2307/41410404>
- Quarfoot D, Levine R (2016) How robust are multi-rater inter-rater reliability indices to changes in frequency distribution? *Am Statist* 70:373–384. <https://doi.org/10.1080/00031305.2016.1141708>
- Reil H, Rimbeck M, Leyer M, Stumpf-Wollersheim J (2020) Understanding the consequences of adopting the Internet of Things. In: *Proceedings of the Pacific Asia conference on information systems*, Dubai, 227. <https://aisel.aisnet.org/pacis2020/227>
- Samuelson W, Zeckhauser R (1988) Status quo bias in decision making. *J Risk Uncertain* 1(1):7–59. <https://doi.org/10.1007/BF00055564>
- Sandu R, Gide E (2017) Investigation of challenges and opportunities for the adoption of cloud-based Internet of things (IoT) in Australian agricultural SME. *Glob J Inf Technol Emerg Technol*. <https://doi.org/10.18844/gjit.v7i3.2833>
- Satchell C, Dourish P (2009) Beyond the user: use and non-use In: *HCI Proceedings of the 21st annual conference of the Australian computer-human interaction special interest group: design: Open 24/7*, Melbourne. <https://doi.org/10.1145/1738826.1738829>
- Schein KE, Rauschnabel PA (2021) Augmented reality in manufacturing: exploring workers' perceptions of barriers. *IEEE Trans Eng Manag*. <https://doi.org/10.1109/TEM.2021.3093833>
- Scuotto V, Santoro G, Bresciani S, Del Giudice M (2017) Shifting intra- and inter-organizational innovation processes towards digital business: an empirical analysis of SMEs. *Creat Innov Manag* 26(3):247–255. <https://doi.org/10.1111/caim.12221>
- Shahbaz M, Gao C, Zhai L, Shahzad F, Hu Y (2019) Investigating the adoption of big data analytics in healthcare: the moderating role of resistance to change. *J Big Data* 6(1):6. <https://doi.org/10.1186/s40537-019-0170-y>
- Shankar A, Nigam A (2022) Explaining resistance intention towards mobile HRM application: the dark side of technology adoption. *Int J Manpower* 43(1):206–225. <https://doi.org/10.1108/IJM-03-2021-0198>
- Sherif KS, Al-Hitmi M (2017) The moderating role of competition and paradoxical leadership on perceptions of fairness towards IoT monitoring. In: *Proceedings of the 23rd Americas conference on information systems*, Boston
- Sievers F, Reil H, Rimbeck M, Stumpf-Wollersheim J, Leyer M (2021) Empowering employees in industrial organizations with

- IoT in their daily operations. *Comput Ind* 129:103445. <https://doi.org/10.1016/j.compind.2021.103445>
- Valmohammadi C (2016) Examining the perception of Iranian organizations on Internet of Things solutions and applications. *Ind Commer Train* 48(2):104–108. <https://doi.org/10.1108/ICT-07-2015-0045>
- Venkatesh V (2006) Where to go from here? Thoughts on future directions for research on individual-level technology adoption with a focus on decision making. *Decis Sci* 37(4):497–518. <https://doi.org/10.1111/j.1540-5414.2006.00136.x>
- Vermanen M, Harkke V (2019) Findings from multipurpose IoT solution experimentations in Finnish SMEs: common expectations and challenges. In: Proceedings of the 52nd Hawaii international conference on system sciences (HICSS), Hawaii
- Vogelsang K, Steinhüser M, Hoppe U. A (2013) A qualitative approach to examine technology acceptance. In: Proceedings of the international conference on information systems, Milano
- Wang Y, Meister DB, Gray PH (2013) Social influence and knowledge management systems use: evidence from panel data. *MIS Q* 37(1):299–313
- Williams M, Nurse JR, Creese S (2017) Privacy is the boring bit: user perceptions and behaviour in the internet-of-things. In: Proceedings of the 15th annual conference on privacy, security and trust (PST), Auckland
- Wyatt S, Thomas G, Terranova T (2002) They came, they surfed, they went back to the beach: conceptualizing use and non-use of the internet. In: Woolgar S (ed) *Virtual society? Technology, cyberspace, reality*. Oxford University Press, Oxford, pp 23–40
- Wyatt S (2014) Bringing users and non-users into being across methods and disciplines. Refusing, limiting, departing. In: CHI 2014 workshop considering why we should study technology non-use, Toronto. http://nonuse.jedbrubaker.com/wp-content/uploads/2014/03/Wyatt_Toronto_April_2014.pdf. Last Accessed 03 July 2015
- Xia F, Yang LT, Wang L, Vinel A (2012) Internet of Things. *Int J Commun Systems* 25(9):1101–1102. <https://doi.org/10.1002/dac.2417>
- Xia W, Lee G (2000) The influence of persuasion, training and experience on user perceptions and acceptance of IT innovation. In: ICIS 2000 proceedings 34:371–384. <https://aisel.aisnet.org/icis2000/34>
- Yang HD, Moon YJ, Rowley C (2009) Social influence on knowledge worker's adoption of innovative information technology. *J Comput Inf Syst* 50(1):25–36