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We have a platform, but nobody builds on it – what influences Platform-as-a-Service post-adoption?

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Abstract:
When higher-level management of a company has strategically decided to adopt Platform-as-a-Service (PaaS) as a Cloud Computing (CC) delivery model, decision-makers at lower hierarchy levels still need to decide whether they want to post-adopt PaaS for building or running an information system (IS) – a decision that numerous companies are currently facing. This research analyzes the influential factors of this managerial post-adoption decision on the IS-level. A survey of 168 business and Information Technology (IT) professionals investigated the influential factors of this PaaS post-adoption decision. The results show that decision-makers' perceptions of risks inhibit post-adoption. Vendor trust and trialability reduce these perceived risks. While competitive pressure increases perceived benefits, it does not significantly influence PaaS post-adoption. Controversially, security and privacy, cost savings, and top management support do not influence post-adoption, as opposed to findings on company-level adoption. Subsamples constructed by the form of post-adoptive use (migration of IS, enhancement of IS, new IS development) exhibit better goodness-of-fit measures than the full sample. Future research should explore this interrelation of the form of post-adoptive use and the post-adoption influence factors.

Keywords:
Platform-as-a-Service; cloud computing; post-adoption; delivery model.

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1. Introduction

> *"So we [decided to] adopt Platform-as-a-Service (PaaS) [on a company-level]. We spent lots of time to meet technical requirements and established governance structures. After all, nobody used it. We figured that we need to do something to make our employees actually consider using PaaS on information system (IS) level when migrating or enhancing existing IS, or developing new IS."*

This opening vignette narratively describes a current topic identified in a precedent case study [1]. Most companies already adopted Cloud Computing (CC) [2], with the global CC revenue pool rising to USD 266 billion in 2020 [3]. However, innovations need to be extensively used within the value chain to exhibit impact [4]. The company-level adoption of CC, therefore, does not necessarily mean that individuals on lower hierarchy levels decide in favor of actually using CC on IS-level (post-adoption). For long, research considered post-adoption as continuance use or habit formation of IT use [5]. Research increasingly extended this understanding of post-adoption towards exploring how individuals make use of adopted technologies by using available features for current or additional tasks [5]. Now, that most companies adopted CC on a company-level, the question of how decision-makers make use of it in operational sourcing decisions becomes apparent and practically relevant. For the delivery model Platform-as-a-Service (PaaS) specifically, the post-adoptive use raised our interest: PaaS allows to source infrastructure combined with functionalities constituting a new form of sourcing decision, whereas Infrastructure-as-a-Service (IaaS) allows to source infrastructure and Software-as-a-Service (SaaS) software respectively.

All this motivated us to investigate the influential factors of PaaS post-adoption in our research questions (RQs). We focus on large-scale companies because we assume that small- and medium-sized companies involve fewer hierarchy levels, and, therefore, the decision-maker on adoption and post-adoption is likely to be the same individual. For large companies, we expect that PaaS post-adoption decisions occur at lower hierarchy levels than the initial adoption decision and, therefore, could be more decoupled from this initial company-level adoption decision.

RQ1: What influences PaaS post-adoption in large-scale companies?

The context of large-scale companies makes us adopt a multilevel perspective [6]–[9]: The IS-level post-adoption decision corresponds to the micro-perspective, whereas the initial adoption decision corresponds to the macro-perspective. Hence, we evaluate whether adoption and post-adoption are indeed distinct decisions, as argued above. Alternatively, decision-makers on IS-level could also simply mimic the initial adoption decision.

RQ2: Do decision-makers on IS-level decide autonomously on PaaS post-adoption?

Bagayogo et al. [5] differentiate post-adoptive use of information technology (IT) along the dimension of use for current tasks versus use for additional tasks. As this study is – to the authors' best knowledge – the first to investigate post-adoptive use of PaaS, we explore whether the influential factors of PaaS post-adoption vary for the post-adoptive use forms.

RQ3: Does PaaS post-adoption depend on the post-adoptive use forms?

The contribution of this research is to shift the focus of CC adoption research towards its post-adoptive use. The paper at hand provides managers, aiming to foster PaaS post-adoption in their companies, with an understanding of the factors influencing that decision.

The rest of the paper is structured as follows: Section 2 explains the post-adoptive use of PaaS in organizations, our theoretical grounding in Technological Frames of References (TFR), and the multilevel perspective. Section 3 conceptualizes our research model (representing a revised version of a research-in-progress publication [10]). Section 4 describes the data collection and cleaning process, the dataset, and the approach for our analysis. Section 5 describes our results. Section 6 discusses these results, while section 7 concludes the paper.

2. Research background

2.1 Platform-as-a-Service (PaaS) and post-adoption

Empirical research shows that organizations adopt CC not primarily for cost advantages but also to leverage CC as a standardized IT platform for innovating and optimizing business processes [11]. For the sake of innovativeness, organizations also aim to develop customer-facing digital solutions using IaaS and PaaS [1]. PaaS assigns the resources hardware, infrastructure, and the platform (software framework and storage) to be managed by the vendor, while the application layer is under the management of the client organization [12]. For PaaS, the vendor provides the application development stack (including run-time optimization) and the infrastructure [13]. PaaS allows client organizations to use all features provided by the vendor for software development, leaving more resources to focus on innovating the software on the application layer. Therefore, this study aims to investigate the post-adoption of PaaS because it enables the acquiring organization to leverage provided infrastructure and features while managing the applications to bring on this platform.

A pilot case-study conceptualized the transition from adoption to post-adoption of CC, exhibited in Fig. 1 [1]. First, companies decide to adopt CC, enter framework contract agreements with one or multiple vendors, and enable its usage (e.g., establishment of governance elements). Second, companies decide on IS-level upon post-adoption. In the previously mentioned pilot case study, we conceptualized this transition from adoption to post-adoption and integrate the notion of post-adoptive use forms [5] based on the task at hand: Migration of existing ISs to CC relates to using the technology for current tasks, developing new IS development relates to using CC for additional tasks, whereas the enhancement of existing IS using CC either enlarges the scope of the task or performs the same task at higher quality or performance.

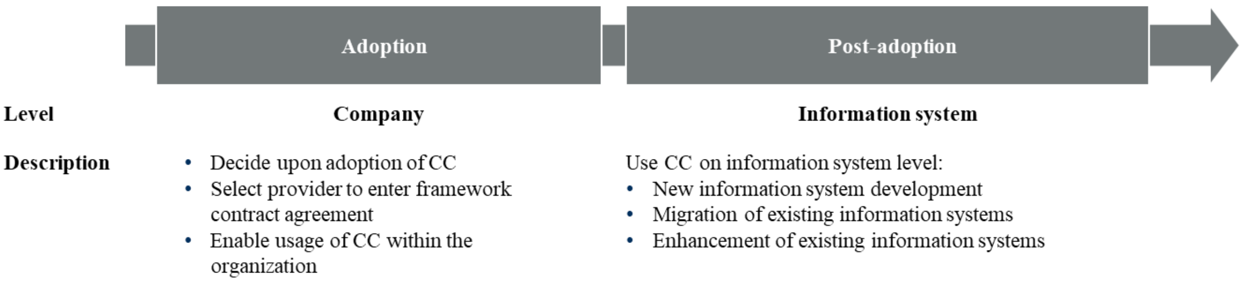

Fig. 1. Conceptualization of CC adoption and post-adoption

2.2 Technological Frames of References (TFR)

Prior research applied various theories to the context of CC adoption, depending on the focus of the investigation. One stream of research employed the technology acceptance model (TAM) [14] to CC in various studies [e.g., 15–17] or its extension, the Unified Theory of Acceptance and Use of Technology (UTAUT) [18]. Studies relying on TAM and UTAUT focus on the individual choice level without involving organizational behavior and managerial decision processes [19]. Additionally, UTAUT proved not always useful in empirically confirming anticipated relationships [18].

Another stream of research employs the Technology – Organization – Environment (TOE) model with the diffusion of innovation theory [e.g., 20–22], focusing on the organizational and environmental level [21]. TOE emphasizes, besides the technological characteristics, the influence of the organization and its environment on technology adoption [23]. However, TOE does not address the individual's perspective [24]. This observation motivated the authors to base the research approach in this paper on a theory that aims to integrate the individual's perception of technology while simultaneously acknowledging the importance of the organizational and the environmental level.

This paper is, therefore, grounded in the TFR theory, which has its roots in social cognitive research [25]. Technological frames are shared beliefs (interpretations of technological artifacts [25]) by members of a group regarding technology that "concern the assumptions, expectations, and knowledge they use to understand technology in organizations" [25, p. 179]. Prior research defined a technological frame as "a built-up repertoire of tacit knowledge that is used to impose structure upon, and impart meaning to, otherwise ambiguous social and situational information to facilitate understanding" [26, p. 56]. Hence, an individual's technological frame reflects the individual's perception of a technology's advantageousness. Additionally, the organizational and environmental triggers influence this perception in a systematic approach to social-cognitive research on IT [25]. Therefore, TFR theory enables an analysis of the decision-maker's perception of PaaS and acknowledges the influence of the organization and the environment, which offsets the shortcomings of TAM, UTAUT, and TOE.

The expectations, assumptions, or knowledge about key aspects of the technology may be different between individuals or groups, defined as incongruence [25]. This incongruence explains difficulties in technology implementation [25]. The process to reach congruence (i.e., consensus) on the respective technological frame is referred to as stabilization and closure [27], [28]. Stabilization occurs within a "relevant social group if members begin to talk and think about the technology increasingly uniformly" [28, p.32]. Closure implies that the interpretive flexibility regarding the technology diminished, and dominant meaning emerges [27], [28]. An individual's technological frame may change by a trigger, which can be either organizational or environmental [28]. Hence, this paper takes on a TFR perspective to examine whether congruence between the technological frame of the decision-makers, the organizational actors, and influencing actors from the environment exists when it comes to PaaS post-adoption in large-scale organizations. Congruence, with a positive perception of PaaS's associated benefits and risks, implies the post-adoption of PaaS. Incongruence between the actors, or a decision-maker's negative perception of benefits and risks would result in decision-makers choosing other sourcing options over PaaS. The proposed model investigates technological frames of potential applications of PaaS, which we classify into the domain of "frames related to the potential organizational applicability of IT" [28, p. 27]. Various other papers undertook research based on TFR in this domain [25], [28]–[30], however – to the best of our knowledge – none in the context of CC adoption.

2.3 A multilevel research perspective

Research in Information Systems (IS) can regard multiple levels of analysis, which stems from the notion that organizations are multilevel by nature [8]. Fundamentally, this paper differentiates research between the lenses of micro- or a macro-perspective [6]–[9]. The idea of multilevel research is to bridge the divide between micro and macro by integrating the perspectives of individuals, organizations, and the environment [31]. The micro-perspective focuses on individuals or groups, whereas the macro-perspective focuses on organizations, environments, or strategies [6], [7], [32], [33].

The requirement to integrate various levels of analysis also applies to the phenomenon of CC, precisely because researchers investigated multiple units of analysis in the past. Most of the previous research on CC analyzed the organizational level perspective of CC adoption obtaining a macro-perspective [e.g., 21, 34, 35] to which the paper at hand refers as company-level adoption. Fewer contributions analyzed the individual level, e.g., decision-makers' characteristics [36], [37] or the decisions related to a specific IS [20], [38], [39], obtaining a micro-perspective. Therefore, these analyses provide fragmented perspectives on the same phenomenon without bridging the micro and the macro-perspective.

Considering PaaS adoption specifically, requires a bridge between the micro and the macro-perspective: Senior (IT) managers decide on the number and vendors that are made available within the organization (adoption) [1]. The availability of frame contracts with vendors is a pre-condition for the usage within software development if organizations roll-out rogue adoption through business-managed IT [40].

The operational sourcing decisions are then made on IS-level (post-adoption). This actual migration towards the cloud is not sufficiently considered by prior research, which mainly focused on the company-level adoption phase [11]. TFR, in contrast to theories applied in previous research, provides such an integrative bridge between the levels, arguing that multiple actors are involved in the organizational employment of technology [25].

Various studies investigate not only the organizational factor for CC adoption but incorporate environmental factors as well [e.g., 20, 21, 41]. The environmental factors are also considered as essential for PaaS post-adoption because they can evoke a trigger to the decision maker's technological frame. Furthermore, various studies include technological factors in adoption models on an organizational level.

3. Research model

TFR theory suggests that technology will be adopted if a congruent view of its advantageousness persists. Post-adoption of PaaS occurs if the perceived benefits outweigh the perceived risks in a specific sourcing decision from the decision maker's perspective, which is influenced by organizational and environmental actors. Hence, the interactions within the organizations by knowledge transfer from colleagues, support of senior managers, and the interactions outside the organization with, e.g., trading partners, vendors, competitors trigger a shift in the technological frame of the decision-maker's initial perspective. Also, her own experience with CC may trigger this shift, e.g., trialability of PaaS.

Hence, we hypothesize that the decision-maker's ability to try PaaS, tacit knowledge sharing, top management support, trading partner pressure, vendor trust, and competitive pressure are the factors influencing perceived benefits and risks. Furthermore, we assume a moderating effect of the decision maker's voluntariness to post-adopt PaaS. Although we expect no influence on PaaS post-adoption, we control for security and privacy, cost savings, IT organization structure and size, and the year of the decision. Fig. 2 exhibits the research model.

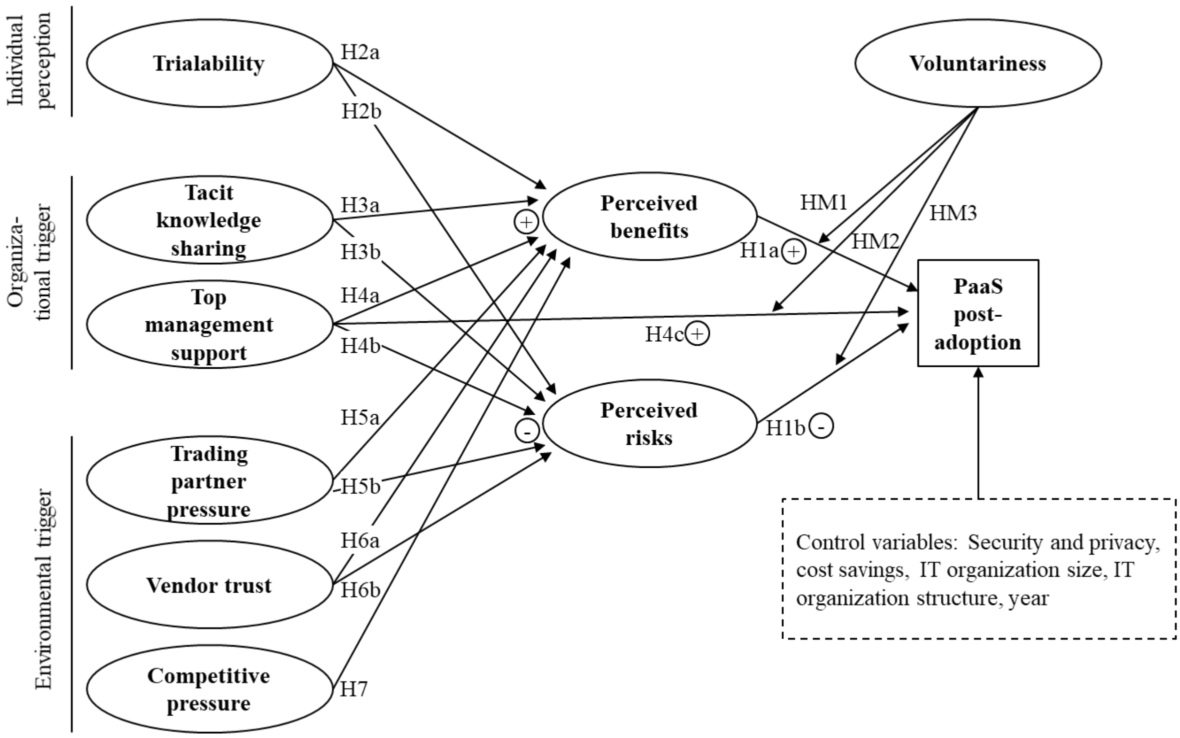

Fig. 2. Research model on PaaS post-adoption

The focus on PaaS post-adoption specifically, the integration of individual perception and organizational/environmental triggers, and the multilevel perspective are the differentiating factors of the model in terms of originality in comparison with prior research efforts.

3.1 Individual perception

The TFR defines the categories and content in which technology is perceived [25]. The most important success measures for decision-making are the positive and negative impacts of CC adoption [38]. The expected benefits and risks are the key factors for switching towards CC [42]. With this, risks infer the potential negative consequences of the sourcing decision (contrary to some definitions of risk implying uncertain positive or negative consequences). According to TFR, this analysis depends on the technological frame on PaaS, i.e., its perceived benefits and perceived risks.

H1a: *Perceived benefits* influence *PaaS post-adoption* positively.

H1b: *Perceived risks* influence *PaaS post-adoption* negatively.

Technological frames are defined as “tacit knowledge that is used to impose structure upon, and impart meaning to, otherwise ambiguous social and situational information to facilitate understanding" [26, p. 56]. Therefore, the formation of a technological frame is a dynamic interpretative process [28] in which tacit knowledge is built-up. Tacit knowledge is rooted in actions and experiences in a specific context [43]. Hence, technological frames emerge from work experiences [25] in the CC context. Additionally, empirical evidence suggests that individuals who try CC [22], or where pilot applications are present [39] are more likely to adopt CC: The innovativeness of CC becomes apparent when trying and using CC [1]. Therefore, decision-makers, who tried PaaS, gained experience with the technology. We argue that the gain of tacit knowledge through trying increases the decision-makers’ perception of benefits and decreases the perception of associated risks.

H2a: *Trialability* influences *perceived benefits* positively.

H2b: *Trialability* influences *perceived risks* negatively.

3.2 Organizational triggers

The lack of (tacit) knowledge on CC hinders the adoption of CC [44]. The knowledge management process by which an individual’s knowledge increases by involvement is knowledge transfer [43]. Therefore, we hypothesize that tacit knowledge sharing, as the involvement of an individual in someone else’s experiences, promotes PaaS post-adoption, analogously to trying PaaS oneself.

H3a: *Tacit knowledge sharing* influences *perceived benefits* positively.

H3b: *Tacit knowledge sharing* influences *perceived risks* negatively.

Based on the multilevel perspective, we argue that decision-makers regard the decision to adopt PaaS on company-level by top management (macro-perspective) when deciding in software development projects (micro perspective). Top management support increases the adoption of technology, specifically by the perception of CC benefits [42], [45].

H4a: *Top management support* influences *perceived benefits* positively.

H4b: *Top management support* influences *perceived risks* negatively.

3.3 Environmental triggers

Besides organizational triggers, environmental triggers may also result in interpretative shifts within an organization [28]. We include environmental triggers identified as relevant in prior research on CC adoption in the research model.

Organizations consider the experiences of trading partners when they decide on CC adoption [46]. Negative technological frames on CC by trading partners result in artifacts such as prohibiting contract clauses hindering adoption [1]. Positive technological frames on CC by trading partners positively influence the post-adoption decision because PaaS allows integration with the environment [1]. Therefore, the decision-maker's technological frame on PaaS is influenced by the pressure of the trading partners as a result of the trading partners' technological frame on PaaS.

H5a: *Trading partners' pressure* influences *perceived benefits* positively.

H5b: *Trading partners' pressure* influences *perceived risks* negatively.

The way the vendor markets the technology may affect the decision-maker's technological frame [25]. In the context of PaaS, organizations require a completely different mindset to rely on a vendor for IT services [21]. Trust is a fundamental factor for the acquiring organization to inform itself [47]. Further on, the presence of uncertainty related to CC requires trust to overcome these concerns (i.e., perceived risks) and adopt CC [35], [48].

H6a: *Vendor trust* influences *perceived benefits* positively.

H6b: *Vendor trust* influences *perceived risks* negatively.

Competitive pressure urges organizations to adopt technology to create a competitive advantage through innovation [41]. Competitive pressure is a strong driver of the adoption decision in the context of CC [49]. In the context of PaaS post-adoption, specifically, where the prospect of sourcing is the creation of new business models, competitive pressure will positively influence the perception of benefits.

H7: *Competitive pressure* influences *perceived benefits* positively.

3.4 Moderation and controls

The premise of the model, so far, is that the decision-making context is in an enabling control setting [50]. One might bring up that in some organizations or some circumstances, the decision-maker might not have the autonomy to decide by herself. In these cases, the decision-maker would need to follow the top management's adoption decision on a company level.

HM1: *Voluntariness* moderates the influence of *perceived benefits* on *PaaS post-adoption*.

HM2: *Voluntariness* moderates the influence of *perceived risks* on *PaaS post-adoption*.

H4c: *Top management support* influences *PaaS post-adoption* positively.

HM3: *Voluntariness* moderates the influence of *top management support* on *PaaS post-adoption*.

Furthermore, TFR does not lead us to derive hypotheses on the influence of security and privacy or cost savings, factors extensively considered in the company-level adoption decision [51]. Additionally, we control for potential technological factors' influence of the IT organization size and structure, as well as the year in which the decision took place, as PaaS is a rapidly developing technology.

C1: *Security and privacy* do not influence PaaS post-adoption.

C2: *Cost savings* do not influence *PaaS post-adoption*.

C3: *IT organization size* does not influence *PaaS post-adoption*.

C4: *IT organization structure* does not influence *PaaS post-adoption*.

C5: *Year* does not influence *PaaS post-adoption*.

An implicit assumption of the research model is that there are – apart from top management support – no direct effects of the antecedents of perceived benefits and risks on PaaS post-adoption. Thus, we claim full mediation of these factors via perceived benefits and risks.

4. Methods

4.1 Data collection

We operationalized the latent endogenous constructs based on measurement models previously applied in the context of CC adoption and the broader IT adoption information systems literature. We measure the indicators on 5 point (pt) and 7pt Likert scales. We chose to retain the scales used by other researchers and standardized the scores during the measurement model assessment. We operationalized PaaS post-adoption, and the controls for cost savings, year, IT organization size and structure as single items. Table A1 in the Appendix provides an overview of the measurement instruments.

We approached individuals employed at companies with more than one billion Euro revenue on the professional social network LinkedIn to find suitable candidates for the survey. We restricted the search to companies headquartered in Germany. We searched for the terms "cloud", "PaaS", "infrastructure", "digital", "project manager", "technology", "product owner", and combinations thereof. We presented participants a differentiation between the CC delivery models IaaS, PaaS, and SaaS to ensure that they can assess whether they have experience with the PaaS delivery model. We filtered the participants for PaaS experience and filtered-out participants employed at a company that did not yet adopt PaaS on the company-level or were not involved in decision-making on PaaS post-adoption on IS-level. The people participating in the survey answered it between March 2020 and early June 2020. We sent out around 3,000 invitations to users from German large-scale organizations. However, we additionally encouraged the individuals to share the link among colleagues within the company to extend our reach beyond the social network LinkedIn. This approach, however, inhibits us from reporting exact turnout statistics, as the survey was anonymous.

The approach ensured that all individuals answering the questionnaire are subject to the same legal regulation and reside in a developed economy. Moreover, the approach targeted IT and business profiles, as both are potentially involved in the decision to post-adopt PaaS. We acknowledge that we relied on the validity and correctness of the information provided in their profiles.

While the approach targets individuals that are potentially involved in PaaS post-adoption decisions, we needed to control for the factual ability to answer the questions reliably. In total, the survey link received 738 clicks. 47 participants answered that PaaS is not available at their company and were, therefore, filtered out. We filtered-out an additional 182 individuals that stated not to be involved in one or more PaaS post-adoption decision. 192 individuals stopped the survey before answering the first question, and 98 individuals broke off in between. Hence, we received 219 completed questionnaires as the starting point for the data preparation.

4.2 Data cleaning and preparation

We prepared the data for analysis based on the procedure described in Hair et al. [52]. We screened the commentary fields for input, alluding that the individual did not answer the survey in a context different from the intended context. By this, we deleted 14 responses that regarded providing IT-services as a vendor, where the individual answered from an external consultant's perspective, or the individual did not focus on a single sourcing decision.

We followed Hair et al. [51] for the procedures of missing data for the remaining responses, deleting four responses exhibiting more than 15 percent missing values (4 responses). We deleted the indicator "CMPR3" that exhibited more than 15 percent missing values, likewise. For indicators missing less than five percent of data, we replaced the missing values with the mean of the responses with non-missing data (VNDT2, TPPR1, TPPR2).

For VNDT1, VNDT3, TPPR3, TPPR4, CMPR1, and CMPR2 exhibited less than 15 but more than five percent of missing values. For such indicators, missing values should be replaced based on demographic-corrected means [52]. Hence, we replaced the values based on the subgroup mean of the individual's professional experience, as this represents the sole demographic information collected from the participants.

Additionally, we screened the responses for patterns and consistency [52]. Analyzing the responses for extreme values indicated that two responses selected the middle value of the scale in more than 50 percent of the answers. We analyzed the variance of the responses separately for 5pt- and 7pt-Likert-scale indicators without identifying further critical observations. Two respondents selected the highest value of the scale of more than 50 percent of the time, which we deleted. The maximum percentage of selecting the lowest value of the scale was 18 percent.

Additionally, we analyzed the difference between the item VLTN3 and the reverse coded item VLTN1 with similar content. We identified 29 respondents whose answers diverged by more than three on a 7pt-Likert-scale, which we consider as inconsistent. Hence, we excluded these 33 questionnaires from analysis, leading to 168 analyzable questionnaires.

4.3 Sample description

Fig. 3 describes the dataset of 168 analyzable responses. The most numerous industries in the dataset are industrial manufacturing and financial services, corresponding to the overall industry landscape in Germany. Most IT organizations have between 1,000 and 4,000 employees, exhibit a more centralized than decentralized structure, and a more heterogeneous than homogeneous IT landscape. The individuals mostly work on managerial, followed by an operational level in IT, and 60% have more than five years of professional experience. The decision on which the participants based their answers took predominantly place between 2018 and 2020. The sample includes post-adoptive use forms of migrations (50 responses), enhancements of existing IS (43 responses), and new IS developments (75 responses).

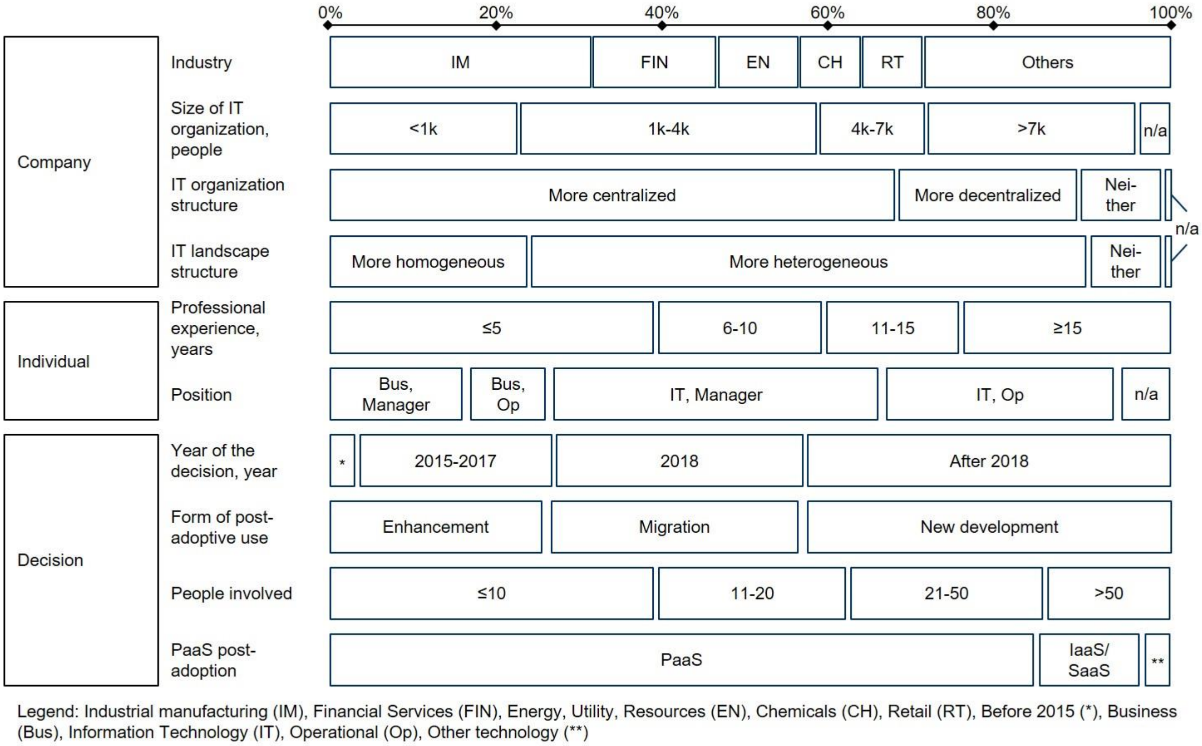

Fig. 3. Sample description

The majority of decisions involved 20 people or less. Most decisions in the sample post-adopted PaaS, which we coded with the value 1. Interestingly, responses that did not post-adopt PaaS for a specific IS, mostly chose either IaaS or SaaS (20 responses), rather than other technologies (five responses), both coded as 0. The finding that companies in parts decided more often for IaaS and SaaS rather than other technologies suggests that companies partially consider both IaaS and SaaS, in some cases, as substitutes of PaaS. Interviews of a consecutive study with survey participants revealed insight into this: One interviewee reported on the decision of a new human resource IS. The company considered whether this system is a differentiator from the competition (suggesting PaaS to develop the IS), or else source an SaaS. Another interviewee elaborated on an analytics implementation for product comparison. In this case, the company evaluated whether to build algorithms itself on IaaS, or whether the available off-the-shelf algorithms in PaaS are sufficient.

4.4 Data analysis

To test the hypothesis outlined in section 3, we combine partial least squares structural equation modeling (PLS-SEM) and logistic regression. PLS-SEM should be used for complex models aiming to identify main drivers and enables calculation of latent variable scores to be used in further analysis [52]. However, PLS-SEM is not recommended for the analysis of binary dependent variables [52], which is the case for PaaS post-adoption. Applying PLS-SEM for the hypotheses on PaaS post-adoption would change the interpretation of a linear probability model. Logistic regression models are a common choice to analyze binary dependent variables [53], as it does not minimize squared deviations but maximize the likelihood of (post-)adopting IS innovations [54].

Bodoff and Ho [55] provide a procedure on how to combine PLS-SEM with logistic regression: Step 1, assess and fit the measurement model of all latent variables. Step 2, estimate the structural model on non-binary endogenous dependent variables and retain the latent variable scores. Step 3, perform logistic regression on the binary dependent variable. In addition to this suggested approach, we, in step 2, control for the absence of direct effects of the antecedent constructs in a linear probability model. Thus, we split the analysis into these steps and adding a subsample analysis as step 4. We conduct steps 1 and 2 in SmartPLS 3 [56], and steps 3 and 4 in Stata 16. We organize the results section accordingly, along with these steps.

5. Results

5.1 Step 1: measurement model assessment

Indicator loadings. We drop indicators that exhibit outer loadings (all measurement models are reflective) below 0.4. We, therefore, drop TKLS1, TKLS3, TMGS3, and VLTN2 before re-running the PLS-SEM algorithm. For loadings between 0.4 and 0.707, we regard whether the average variance extracted (AVE) is below the cutoff value 0.5. Trading partner pressure exhibited an AVE < 0.5. Hence, we drop TPPR4 as an indicator with the lowest loading, resulting in an AVE above the threshold.

Table 1 exhibits the composite reliability and Cronbach’s Alpha to test the internal consistency reliability of the measurement models. For composite reliability, all constructs exhibit values above the 0.7 cutoff value [52]. For competitive pressure, the more conservative Cronbach’s Alpha is below 0.6, indicating a potential lack of internal reliability that is a limitation of this construct. To assess convergent validity, we report the AVE in Table 1 as well. We find convergent validity above the 0.5 cutoff value [52] for all constructs.

Discriminant validity and collinearity. We assess discriminant validity by the heterotrait-monotrait (HTMT) ratio, which should be below 1, which means the construct should better explain the variance of its indicators than other constructs’ variance [52]. The maximum heterotrait-monotrait ratio in the sample is 0.45, and therefore far below the critical values of 0.9 [57].

Table 1. Internal consistency reliability and convergent validity measures

Construct	Composite reliability	Cronbach's Alpha	Average variance extracted (AVE)
Perceived benefits	0.848	0.792	0.528
Perceived risks	0.832	0.703	0.624
Trialability	0.858	0.760	0.671
Tacit knowledge sharing	0.882	0.877	0.603
Top management support	0.861	0.765	0.759
Trading partner pressure	0.742	0.611	0.505
Vendor trust	0.792	0.651	0.562
Competitive pressure	0.762	0.552	0.517
Voluntariness	0.739	0.718	0.516
Security and privacy	0.864	0.773	0.683

5.2 Step 2: antecedent assessment and absence of direct effects

We carry out the PLS-SEM algorithm and bootstrapping with 5,000 subsamples to assess the hypotheses on perceived benefits and perceived risks as antecedents of PaaS post-adoption. Table 2 reports the results of the hypotheses on perceived benefits and risks. For both dependent variables, the R^2 values are low, but Stone-Geisser Q^2 values exceed zero. We find support in Hypothesis H2b, H6a, H6b, and H7, but not for H2a, H3a and b, H4a and b, and H5a and b.

Collinearity, indicated by variance inflation factors above 5 [52], is not present in the sample (maximum value is 2.656). Blind-folding to calculate Stone-Geisser Q^2 values should select an omission distance between five and ten [52], so we selected 9.

Table 2. PLS-SEM results for hypotheses on perceived benefits and risks

	Antecedent assessment model		Direct effect control model			
Construct/statistic	***Perceived benefits***	***Perceived risks***	***Perceived benefits***	***Perceived risks***	***PaaS post-adoption***	**Hypothesis testing**
R^2	0.124	0.125	0.117	0.115	0.136	
Q^2	0.023	0.034	0.023	0.016	-0.121	
Trialability	0.130	-0.162*	0.146	-0.179*	-0.092	H2a: Not supported
						H2b: Supported
Tacit knowledge sharing	0.054	-0.037	0.004	-0.004	0.081	H3a: Not supported
						H3b: Not supported
Top management support	-0.150	-0.093	-0.146	-0.106	-0.021	H4a: Not supported
						H4b: Not supported
Trading partner pressure	-0.042	0.184*	-0.064	0.161	-0.059	H5a: Not supported
						H5b: Not supported

Construct/statistic	Antecedent assessment model: *Perceived benefits*	Antecedent assessment model: *Perceived risks*	Direct effect control model: *Perceived benefits*	Direct effect control model: *Perceived risks*	Direct effect control model: *PaaS post-adoption*	Hypothesis testing
Vendor trust	0.170*	-0.155*	0.160	-0.143*	0.044	H6a: Not supported
						H6b: Supported
Competitive pressure	0.29**		0.287**		0.147	H7: Supported

*** p<0.001; ** p<0.01; * p<0.05; (one-tailed)

We run an auxiliary PLS-SEM on PaaS post-adoption to test the controls and to test that the antecedent constructs for perceived benefits and risks do not exhibit a direct effect on PaaS post-adoption. We do not evaluate our hypotheses on PaaS post-adoption, because the interpretation as a linear probability model challenges the evaluation of goodness-of-fit. In this auxiliary PLS-SEM, we find that most of the antecedent constructs exhibit no significant influence on PaaS post-adoption while controlling for indirect effects via perceived benefits and risks. The positive influence of competitive pressure on perceived benefits and the negative influence of trialability and vendor trust on perceived risks remains significant, supporting H2b, H6b, and H7. Solely the influence of vendor trust on perceived benefits turns non-significant, leading us to find no support for H6a. Stone-Geisser Q^2 of PaaS post-adoption is below zero, indicating that the linear probability model does not have predictive power. Hence, we find support for the approach to analyze the hypotheses on PaaS post-adoption via logistic regression, and therefore retain the latent variable scores of the antecedent model.

5.3 Step 3: full sample assessment of PaaS post-adoption

We report the results of the logistic regression to evaluate hypotheses on PaaS post-adoption in Table 3. We find that PaaS post-adoption is significantly negatively influenced by perceived risks (H1b), but not perceived benefits (H1a) and top management support (H4c). The influence of top management support and the moderating effects of voluntariness are also not significant. Thus, we find no support in H4c, HM1, HM2, and HM3. The non-significant Wald χ^2 statistics for the control variables support the controls C1 to C6, signifying that the post-adoption decision does not exhibit the same influence factors as adoption on the company-level.

The R^2 to test the goodness-of-fit does not exist in logistic regressions. The Hosmer-Lemeshow test analyzes the differences between the fitted values and the actual values [58]. The non-significant p-values indicate no significant difference between the model and a perfect model [53]. Nagelkerke's R^2 provides a statistical measure for the model's ability to explain the data [53], exhibiting low explanatory power. However, the practical relevance of logistic models depends on the model's ability to correctly classify observations [53]. We, therefore, assess the practical significance of the model results using a classification matrix. The common standards of comparisons of the classification accuracy when group sizes are unequal are the proportionate chance criterium and the very conservative maximum chance criterium [53].

Despite the low Nagelkerke's R^2, indicating low explanatory power, the model has practical relevance to classify observations correctly, displayed in Table 4. The classification accuracy exceeds the conservative maximum chance criterium, which classifies all observations as post-adopters, and therefore exhibits an accuracy of 85.1% (143 out of 168). The proportionate chance criterium is 74.7%, assuming unequal group sizes with the proportions of the sample distribution of PaaS post-adoption. A statistical test for the discriminatory power of the model is Press' Q, testing whether the model significantly outperforms the chance model [53], which is significant at the p=0.001 level of significance. The model correctly classifies all post-adopters but identifies only one non-post-adopter. This outcome, the overall low Nagelkerke's R^2, and the significant influence of perceived risks may be caused by an underlying structure creating noise. I.e., the model's parameters are different for subsamples constructed by the form of post-adoptive use which we explore in the subsequent section.

Table 3. Logistic regression results of hypotheses on PaaS post-adoption

Coefficients					
Independent variables	**β**	**Std. Err.**	**Wald χ²**	**Pr > χ²**	**Hypothesis/control**
Perceived benefits	0.183	0.218	0.70	0.4034	H1a: Not supported
Perceived risks	-0.585*	0.248	5.58	0.0182	H1b: Supported
Top management support	0.068	0.228	0.09	0.7673	H4c: Not supported
Mod. perceived benefits	-0.010	0.219	0.00	0.9619	HM1: Not supported
Mod. perceived risks	-0.060	0.235	0.07	0.7981	HM2: Not supported
Mod. top mgmt. supp.	-0.071	0.222	0.10	0.7513	HM3: Not supported
Security and privacy	0.032	0.236	0.02	0.8912	C1: Supported
Cost savings	0.058	0.250	0.05	0.8155	C2: Supported
IT organization size	-0.229	0.162	2.00	0.1578	C3: Supported
IT organization structure	-0.375	0.222	2.84	0.0917	C4: Supported
Year	-0.482	0.315	2.34	0.1259	C5: Supported
Constant	4.191***	1.154	13.2	0.0003	
Goodness-of-fit measures					
-2LL	-63.02	Nagelkerke R²	0.15		
Hosmer-Lemeshow	174.1**	Press Q	85.7***		

Table 4. Classification matrix (full sample)

		Predicted		
		Post-adopters	**Non-post-adopters**	**Accuracy**
Observed	**Post-adopters**	143	24	100%
	Non-post-adopters	0	1	4%
Overall percentage				86%

5.4 Step 4: sub-sample analysis by forms of post-adoptive use

We run the sample model of step 3 separately for the subsamples of the form of post-adoptive use (1) Migration of existing system, (2) Enhancement of existing system, and (3) New IS development.

Table 5 exhibits the results of the sub-sample assessment. Assessing the goodness-of-fit for the post-adoptive use specific models yield increases of Nagelkerke's R^2 for all subsamples (0.283, 0.502, 0.294). Hosmer-Lemeshow tests still indicate no significant difference in the model compared to the perfect model for sub-samples (2) and (3), but not for subsample (1). The classification accuracy (reported in

Table 6) improves to 89%, identifying further eight non-post-adopters correctly, at the expense of misclassifying two post-adopters, leading to an increase in Q Press' test statistic compared to the full sample assessment. We, therefore, conclude that the post-adoptive-use-specific models fit the data better than the full sample assessment.

Analyzing subsamples comes at the expense of reduced statistical power. A reduced statistical power means that non-significant results for the coefficients not necessarily imply that the effect is not significant in the population. We find differences in the coefficient values worth noting, despite that they are mostly non-significant. Perceived benefits exhibit a large, positive, but insignificant coefficient for subsample (1), but is close to zero for subsamples (2) and (3). The perceived risk coefficient is negative for all subsamples, but much smaller for subsample (2) and significantly different from zero, despite the small sample size. The size of the IT organization exhibits a significant, negative influence on PaaS post-adoption in subsample (1). For all other variables than security and privacy, the results show changes in arithmetic signs or large differences in coefficient size across subsamples.

Table 5. Logistic regression results of subsamples constructed by the form of post-adoptive use

Independent variables	**(1) β**	**(2) β**	**(3) β**
Perceived benefits	0.750	-0.111	0.043
Perceived risks	-0.325	-1.969*	-0.772
Top management support	0.163	0.173	-0.095
Mod. perceived benefits	0.073	0.066	-0.288
Mod. perceived risks	0.215	-1.646	0.356
Mod. top mgmt. supp.	-0.496	-0.905	0.481
Security and privacy	-0.174	-0.289	-0.240
Cost savings	-0.328	0.245	0.194
IT organization size	-0.755*	-0.215	0.058
IT organization structure	-0.253	-0.806	-0.521
Year	0.065	-0.273	-1.667
Constant	5.682*	6.750*	4.320
Goodness-of-fit measures			
-2LL	-18.82	-11.56	-21.30
Hosmer-Lemeshow	73.62	33.59**	55.41**
Nagelkerke R^2	0.283	0.502	0.294
Press Q	103.7142857***		

(1) Migration of existing system; (2) enhancement of existing system; (3) new IS development
* Coefficient's Wald test significant at 0.05 level of significance
**Test is non-significant at the 0.05 level of significance (p=0.3427/0.7406)
*** Test is significant at the 0.001 level of significance

Table 6. Classification matrix (sub-samples)

		Predicted		
		Post-adopters	**Non-post-adopters**	**Accuracy**
Observed	**Post-adopters**	141	16	99%
	Non-post-adopters	2	9	36%
Overall percentage				89%

6. Discussion and limitations

Contrary to research on CC adoption [51], cost savings, top management support, and security and privacy risks, do not influence the PaaS post-adoption decision. Stieninger et al. [59] also found that relative advantage (a construct similar to perceived benefits) and security and trust do not influence actual usage but have a weak influence on the attitude towards CC. Al-Sharafi et al. [46] identified cost savings, top management support, and relative advantage being the most influential factors for continuant use of CC. The only other study in the field of PaaS post-adoption to compare our results investigated the cases of an integrating and an application PaaS retrospectively [11]. The study found as well that cost savings did not motivate post-adoption. While the study identified technological characteristics as flexibility, time-to-market, enabling innovation, and reducing IT complexity as motivations, we showed that these perceived benefits do not differentiate between post-adopters and non-post-adopters. Considering that our dataset involved mainly non-post-adopters that decided for other CC delivery models, we conclude that these perceived benefits apply across delivery models, as shown previously in a multiple case study [60].

Assessing a model's goodness-of-fit requires comparison to similar studies in the same field [52], for which we compare our results to logistic regressions on CC adoption. Lynn et al. [33] report a Nagelkerke R^2 of 0.34 and classification accuracy of 74.4%. Loukis et al. [61] report a Nagelkerke R^2 of 0.18, and Senyo et al. [40] a Nagelkerke R^2 of 0.13. Hence, we conclude that our full sample results yielded comparable results with a Nagelkerke R^2 of 0.15 and classification accuracy of 86%. The subsample results exceed these comparison studies with Nagelkerke R^2 values of 0.28, 0.50, and 0.29, and classification accuracy of 89%.

By design, the results obtained in this paper consider large-scale companies only. The data collection focus on Germany makes the results applicable to developed countries but did not allow for comparisons across countries, which could be subject to legal differences regarding the usage of PaaS. Statistically, we acknowledge that the results are limited by the internal consistency reliability of competitive pressure, vendor trust, trading partner pressure, and perceived risk if one applies Cronbach's Alpha as the standard of comparison, but not if the composite reliability is applied. The analysis of post-adoptive use subsamples reduces the statistical power of the analysis given the small subsample size. Hence, we did not reliably identify all effects in the real population but can provide indications which factors are more important for the specific form of post-adoptive use.

7. Conclusion

Regarding the influence factors of PaaS post-adoption (RQ1), we find that the factors most frequently discussed in the context of company-level CC adoption (cost savings, security and privacy, and top management support) do not influence the post-adoption decision on IS-level. However, we find that the decision-maker's perceived risks negatively influence PaaS post-adoption. In summary, decision-makers on IS-level aim to avoid mistakes (i.e., decide risk-averse), rather than considering the security and privacy implications of an adopted technology in detail, the benefits such as cost savings, or top management's support. As antecedents, trialability and the trust in the vendor significantly lower the perceived risks. Practitioners aiming to foster PaaS post-adoption in their company should establish trial possibilities for the decision-makers as training, demos, and the distribution of trial versions. Moreover, practitioners aiming to promote PaaS post-adoption should regard the vendor relationship to enhance trust. This includes selecting a trustworthy vendor in the first place, but also establishing a trustful relationship after that.

RQ2 suggests that the decision-making process upon PaaS post-adoption could be pre-empted by the macro decision to adopt PaaS on the company-level. The conducted analysis revealed non-significant coefficients for the top management support, and the moderating effects of voluntariness on top management support, perceived benefits, and perceived risks. Our interpretation of these results is that decision-makers decide on PaaS post-adoption based on their perceived risks and do not "have" to decide on it based on the adoption decision on the company-level. Hence, the post-adoption of PaaS is a company-wide endeavor that requires support from the decision-makers on IS-level.

Investigating the dependency of the form of post-adoptive use (RQ3), we find that the subsample analysis better fits the data. This lets us conclude that the coefficients of the variables in the model differ in the form of post-adoptive use. We see that perceived risks have the strongest (negative) impact on PaaS post-adoption for enhancements of existing IS, and the IT organization's size negatively affects migrations of existing ISs. The practical implication of the above finding is that the decision on IS enhancements is, to the largest extent, driven by the decision-maker's perception of risks. The latter finding signifies that larger IT organizations tend to develop functionalities themselves on IaaS, rather than sourcing functionalities via PaaS.

While the conducted analysis yielded an overall practical significance in classifying post-adopters and non-post-adopters, we explored that models' coefficients varied across the form of post-adoptive use. This observation prompts us to call for further research on PaaS-post-adoption that investigates the differences across forms of post-adoptive use in more depth. Especially, the question of what influences post-adoption decisions that regard new IS development requires further exploration.

References

[1] F. Wulf, M. Westner, M. Schön, S. Strahringer, and C. Loebbecke, "Preparing for a Digital Future: Cloud Strategy at Continental AG," in P*roceedings of the 40th International Conference on Information Systems (ICIS)*, 2019.

[2] A. Pols and M. Vogel, "Cloud-Monitor 2019," *Bitkom*, 2019. [Online] Available: https://www.bitkom.org/sites/default/files/2019-06/bitkom_kpmg_pk_charts_cloud_monitor_18_06_2019.pdf

[3] K. Costello and M. Rimol (2019, Nov 13), *Gartner Forecasts Worldwide Public Cloud Revenue to Grow 17% in 2020* [Online]. Available: https://www.gartner.com/en/newsroom/press-releases/2019-11-13-gartner-forecasts-worldwide-public-cloud-revenue-to-grow-17-percent-in-2020

[4] K. Zhu, S. Dong, S. X. Xu, and K. L. Kraemer, "Innovation diffusion in global contexts: determinants of post-adoption digital transformation of European companies," *European Journal of Information Systems*, vol. 15, no. 6, pp. 601–616, 2006.

[5] F. Bagayogo, L. Lapointe, and G. Bassellier, "Enhanced Use of IT: A new perspective on post-adoption," *Journal of the Association for Information Systems*, vol. 15, no. 7, pp. 361–387, 2014.

[6] F. Bélanger, M. Cefaratti, T. Carte, and S. Markham, "Multilevel Research in Information Systems: Concepts, Strategies, Problems, and Pitfalls," *Journal of the Association for Information Systems*, vol. 15, no. 9, pp. 614–650, 2014.

[7] K. Klein and S. W. J. Kozlowski, "From Micro to Meso: Critical Steps in Conceptualizing and Conducting Multilevel Research," *Organizational Research Methods*, vol. 3, no. 3, pp. 211–236, 2000.

[8] K. J. Klein, F. Dansereau, and R. Hall, "Levels Issues in Theory Development, Data Collection, and Analysis," *Academy of Management Review*, vol. 19, no. 2, pp. 195–229, 1994.

[9] F. Morgeson and D. Hofman, "The structure and function of collective constructs: Implications for multilevel research and theory development," *Academy of Management Review*, vol. 24, no. 2, pp. 249–265, 1999.

[10] F. Wulf, "Platform-As-A-Service Post-Adoption by Large-Scale Organizations: A Research Model Design," in *ECIS 2020 Research-in-Progress Papers*, 2020.

[11] T. Boillat and C. Legner, "Why Do Companies Migrate Towards Cloud Enterprise Systems? A Post-Implementation Perspective," in *2014 IEEE 16th Conference on Business Informatics*, Geneva, Switzerland, 2014, pp. 102–109.

[12] Q. Zhang, L. Cheng, and R. Boutaba, "Cloud Computing: State-of-the-Art and Research Challenges," *Journal of Internet Services and Applications*, vol. 1, no. 1, pp. 7–18, 2010.

[13] A. Rashid and A. Chaturvedi, "Cloud Computing Characteristics and Services A Brief Review," *International Journal of Computer Sciences and Engineering*, vol. 7, no. 2, pp. 421–426, 2019.

[14] F. D. Davis, "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly*, vol. 13, no. 3, pp. 319–340, 1989.

[15] N. Haile and J. Altmann, "Risk-Benefit-Mediated Impact of Determinants on the Adoption of Cloud Federation," in *Pacific Asia Conference on Information Systems*, Singapore, Singapore, 2015.

[16] D. Kumar, H. V. Samalia, and P. Verma, "Factors Influencing Cloud Computing Adoption by Small and Medium-Sized Enterprises (SMEs) In India," *Pacific Asia Journal of the Association for Information Systems*, vol. 9, no. 3, pp. 25–48, 2017.
[17] M. Velázquez and S. M. Ho, "Do You Trust the Cloud? Modeling Cloud Technology Adoption in Organizations," in *Americas Conference on Information Systems*, Puerto Rico, 2015.
[18] S. Alharbi, "An Empirical Investigation on the Impact of Trust Mediated Determinants and Moderating Factors on the Adoption of Cloud Computing," *International Journal of Information Technology and Computer Science*, vol. 9, no. 11, pp. 12–22, 2017.
[19] N. Khanal, G. Parsons, T. Mantz, and R. Mendelson, "Critical Factors Influencing the Adoption of Cloud Computing," *European Journal of Business Research*, vol. 16, no. 1, pp. 73–96, 2016.
[20] X. Cheng, "Cloud Computing and Decision-Making: Determinants, Modelling and Impacts," PhD. dissertation, Université Paris-Saclay, Paris, France, 2017.
[21] C.-L. Hsu and J. C.-C. Lin, "Factors Affecting the Adoption of Cloud Services in Enterprises," *Information Systems and e-Business Management*, vol. 14, no. 4, pp. 791–822, 2016.
[22] S. Karunagaran, S. Mathew, and F. Lehner, "Differential Adoption of Cloud Technology: A Multiple Case Study of Large Firms and SMEs," in *International Conference on Information Systems*, Dublin, Ireland, 2016.
[23] L. G. Tornatzky and M. Fleischer, *The Processes of Technological Innovation*. Lexington, MA: Lexington Books, 1990.
[24] T. Oliveira, M. Thomas, and M. Espadanal, "Assessing the determinants of cloud computing adoption: An analysis of the manufacturing and services sectors," *Information & Management*, vol. 51, no. 5, pp. 497–510, 2014.
[25] W. J. Orlikowski and D. C. Gash, "Technological frames: making sense of information technology in organizations," *ACM Transactions on Information Systems*, vol. 12, no. 2, pp. 174–207, 1994.
[26] D. A. Goia, "Symbols, scripts, and sensemaking: Creating meaning in the organizational experience.," *The thinking organization*, vol. 49, pp. 49–74, 1986.
[27] W. Bijker, *Of bicycles, bakelites and bulbs: Toward a theory of sociotechnical change*. Cambridge, MA; London, UK: MIT Press, 1995.
[28] E. Davidson, "A Technological Frames Perspective on Information Technology and Organizational Change," *The Journal of Applied Behavioral Science*, vol. 42, no. 1, pp. 23–39, 2006.
[29] T. McGovern and C. Hicks, "How political processes shaped the IT adopted by a small make-to-order company: a case study in the insulated wire and cable industry," *Information & Management*, vol. 42, no. 1, pp. 243–257, 2004.
[30] N. Shaw, L.-P. Eng, and J. Ang, "Understanding End-User Computing Through Technological Frames," in *International Conference on Information Systems*, 1997, pp. 453–459.
[31] K. J. Klein, H. Tosi, and A. A. Cannella Jr, "Multilevel Theory Building: Benefits, Barriers, and new Developments," *Academy of Management Review*, vol. 24, no. 2, pp. 243–248, 1999.
[32] R. Agarwal and H. Lucas, "The Information Systems Identity Crisis: Focusing on High-Visibility and High-Impact Research," *MIS Quarterly*, vol. 29, no. 3, pp. 381–398, 2005.
[33] R. P. DeShon, S. W. J. Kozlowski, A. M. Schmidt, K. R. Milner, and D. Wiechmann, "A Multiple-Goal, Multilevel Model of Feedback Effects on the Regulation of Individual and Team Performance.," *Journal of Applied Psychology*, vol. 89, no. 6, pp. 1035–1056, 2004.
[34] T. Lynn, J. P. Morrison, X. Liang, G. Fox, A. Gourinovitch, and P. Rosati, "Understanding the Determinants of Cloud Computing Adoption for High Performance Computing," in *Hawaii International Conference on System Sciences*, 2018, pp. 3894–3903.
[35] P. Priyadarshinee, R. D. Raut, M. K. Jha, and B. B. Gardas, "Understanding and Predicting the Determinants of Cloud Computing Adoption: A Two Staged Hybrid SEM - Neural Networks Approach," *Computers in Human Behavior*, vol. 76, pp. 341–362, 2017.
[36] S.-L. Chen, J.-H. Chen, and S. C. Chang, "Understanding the Antecedents of Individuals Intention of Using Cloud Services," *Journal of Economics and Management*, vol. 13, no. 2, pp. 139–166, 2017.

[37] V. Ratten, "Factors Influencing Consumer Purchase Intention of Cloud Computing in the United States and Turkey: The Role of Performance Expectancy, Ethical Awareness and Consumer Innovation," *EuroMed Journal of Business*, vol. 10, no. 1, pp. 80–97, 2015.
[38] E. Donovan, I. R. Guzman, M. Adya, and W. Wang, "A Cloud Update of the Delone and McLean Model of Information Systems Success," *Journal of Information Technology Management*, vol. 29, no. 3, pp. 23–34, 2018.
[39] M. Holloway, M. Dickhaus, R. Hans, B. Emondts, A. Rizk, and R. Steinmetz, "Cloud Adoption in the Spotlight - Empirical Insights from German IT Experts," in *Americas Conference on Information Systems*, Boston, MA, USA, 2017.
[40] A. Kopper *et al.*, "Shadow IT and Business-Managed IT: A Conceptual Framework and Empirical Illustration," *International Journal of IT/Business Alignment and Governance*, vol. 9, no. 2, pp. 53–71, 2018.
[41] P. K. Senyo, J. Effah, and E. Addae, "Preliminary Insight into Cloud Computing Adoption in a Developing Country," *Journal of Enterprise Information Management*, vol. 29, no. 4, pp. 505–524,. 2016.
[42] Z. S. Hachicha and K. Mezghani, "Understanding Intentions to Switch Toward Cloud Computing at Firms' Level: A Multiple Case Study in Tunisia," *Journal of Global Information Management*, vol. 26, no. 1, pp. 136–165, 2018.
[43] M. Alavi and D. E. Leidner, "Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues," *MIS Quarterly*, vol. 25, no. 1, pp. 107–136, 2001.
[44] E. O. Güner and E. Sneiders, "Cloud Computing Adoption Factors in Turkish Large Scale Enterprises," in *Pacific Asia Conference on Information System*s, Chengdu, China, 2014.
[45] H. Gangwar, H. Date, and R. Ramaswamy, "Understanding determinants of cloud computing adoption using an integrated TAM-TOE model," *Journal of Enterprise Information Management*, vol. 28, no. 1, pp. 107–130, 2015.
[46] M. A. Al-Sharafi, R. A. Arshah, and E. A. Abu-Shanab, "Factors Affecting the Continuous Use of Cloud Computing Services from Expert's Perspective," in *TENCON 2017 - 2017 IEEE Region 10 Conference*, Penang, Malaysia, 2017, pp. 986–991.
[47] J. K. Adjei, "Explaining the Role of Trust in Cloud Computing Services," *info*, vol. 17, no. 1, pp. 54–67, 2015.
[48] A. Dimoka, "What Does the Brain Tell Us About Trust and Distrust? Evidence from a Functional Neuroimaging Study," *MIS Quarterly*, vol. 34, no. 2, pp. 373–396, 2010.
[49] A. Gutierrez and R. Lumsden, "Key Management Determinants For Cloud Computing Adoption," in *UK Academy for Information Systems Conference*, Oxford, United Kingdom, 2014.
[50] R. F. Speklé and S. K. Widener, "Challenging Issues in Survey Research: Discussion and Suggestions," *Journal of Management Accounting Research*, vol. 30, no. 2, pp. 3–21, 2018.
[51] S. Schneider and A. Sunyaev, "Determinant Factors of Cloud-Sourcing Decisions: Reflecting on the IT Outsourcing Literature in the Era of Cloud Computing," *Journal of Information Technology*, vol. 31, no. 1, pp. 1–31, 2016.
[52] J. F. Hair, G. T. M. Hult, C. Ringle, and M. Sarstedt, *A primer on partial least squares structural equation modeling (PLS-SEM)*. Sage, 2016.
[53] J. F. Jr. Hair, W. C. Black, B. J. Babin, and R. E. Anderson, *Multivariate Data Analysis*, 7th ed. Prentice hall, NY, USA: Upper Saddle River, 2009.
[54] G. Premkumar, "A Meta-Analysis of Research on Information Technology Implementation in Small Business," *Journal of Organizational Computing and Electronic Commerce*, vol. 13, no. 2, pp. 91–121, 2003.
[55] D. Bodoff and S. Y. Ho, "Partial Least Squares Structural Equation Modeling Approach for Analyzing a Model with a Binary Indicator as an Endogenous Variable," *Communications of the Association for Information Systems*, vol. 38, pp. 400–419, 2016.
[56] C. M. Ringle, S. Wende, and J.-M. Becker (2015), *SmartPLS 3*. [Online]. Available: http://www.smartpls.com
[57] J. Henseler, C. M. Ringle, and M. Sarstedt, "A new criterion for assessing discriminant validity in variance-based structural equation modeling," *Journal of the Academy of Marketing Science*, vol. 43, no. 1, pp. 115–135, 2015.
[58] D. W. Jr. Hosmer, S. Lemeshow, and R. X. Sturdivant, "Applied Logistic Regression." John Wiley & Sons, 2013.
[59] M. Stieninger, D. Nedbal, W. Wetzlinger, G. Wagner, and M. A. Erskine, "Factors influencing the organizational adoption of cloud computing: a survey among cloud workers," *International Journal of Information Systems and Project Management*, vol. 6, no. 1, pp. 5–23, 2018.

[60] F. Wulf, T. Lindner, M. Westner, and S. Strahringer, “IaaS, PaaS, or SaaS? The Why of Cloud Computing Delivery Model Selection – Vignettes on the Post-Adoption of Cloud Computing,” in *Hawaii International Conference on System Sciences*, 2021.
[61] E. Loukis, S. Arvanitis, and N. Kyriakou, “An Empirical Investigation of the Effects of Firm Characteristics on the Propensity to Adopt Cloud Computing,” *Information Systems and e-Business Management*, vol. 15, no. 4, pp. 963–988, 2017.
[62] G. C. Moore and I. Benbasat, “Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation,” *Information Systems Research*, vol. 2, no. 3, pp. 192–222, 1991.
[63] J. S. Holste and D. Fields, “Trust and Tacit Knowledge Sharing and Use,” *Journal of Knowledge Management*, vol. 14, no. 1, pp. 128–140, 2010.
[64] C.-P. Lin, “To Share or Not to Share: Modeling Tacit Knowledge Sharing, Its Mediators and Antecedents,” *Journal of Business Ethics*, vol. 70, no. 4, pp. 411–428, 2007.
[65] Z. Wang and N. Wang, “Knowledge Sharing, Innovation and Firm Performance,” *Expert Systems with Applications*, vol. 39, no. 10, pp. 8899–8908, 2012.
[66] Z. Wang, N. Wang, and H. Liang, “Knowledge Sharing, Intellectual Capital and Firm Performance,” *Management Decision*, vol. 52, no. 2, pp. 230–258, 2014.
[67] S. S. Alam, Md. Y. Ali, and Mohd. F. Mohd. Jani, “An Empirical Study of Factors Affecting Electronic Commerce Adoption Among Smes in Malaysia,” *Journal of Business Economics and Management*, vol. 12, no. 2, pp. 375–399, 2011.
[68] P. Chwelos, I. Benbasat, and A. S. Dexter, “Research Report: Empirical Test of an EDI Adoption Model,” *Information Systems Research*, vol. 12, no. 3, pp. 304–321, 2001.
[69] Y. Zhu, Y. Li, W. Wang, and J. Chen, “What Leads to Post-Implementation Success of ERP? An Empirical Study of the Chinese Retail Industry,” *International Journal of Information Management*, vol. 30, no. 3, pp. 265–276, 2010.
[70] S. Chakrabarty, D. Whitten, and K. Green, “Understanding Service Quality and Relationship Quality in is Outsourcing: Client Orientation & Promotion, Project Management Effectiveness, and the Task-Technology-Structure Fit,” *Journal of Computer Information Systems*, vol. 48, no. 2, pp. 1–15, 2016.
[71] A. Gutierrez, E. Boukrami, and R. Lumsden, “Technological, Organisational and Environmental Factors influencing Managers’ Decision to Adopt Cloud Computing in the UK,” *Journal of Enterprise Information Management*, vol. 28, no. 6, pp. 788–807, 2015.
[72] P.-F. Hsu, S. Ray, and Y.-Y. Li-Hsieh, “Examining Cloud Computing Adoption Intention, Pricing Mechanism, and Deployment Model,” *International Journal of Information Management*, vol. 34, no. 4, pp. 474–488, 2014.
[73] C. Low, Y. Chen, and M. Wu, “Understanding the Determinants of Cloud Adoption,” *Industrial Management & Data Systems*, vol. 111, no. 7, pp. 1006–1023, 2011.
[74] T. Oliveira and M. F. Martins, “Literature Review of Information Technology Adoption Models at Firm Level,” *The Electronic Journal Information Systems Evaluation*, vol. 14, no. 1, pp. 110–121, 2011.
[75] P. Ifinedo, “An Empirical Analysis of Factors Influencing Internet/E-business Technologies Adoption by SMEs in Canada,” *International Journal of Information Technology & Decision Making*, vol. 10, no. 4, pp. 731–766, 2011.
[76] T. Oliveira and M. F. Martins, “Understanding E-business Adoption Across Industries in European Countries,” *Industrial Management & Data Systems*, vol. 110, no. 9, pp. 1337–1354, 2010.
[77] T. Oliveira and M. F. Martins, “Firms Patterns of E-business Adoption: Evidence for the European Union-27,” *Electronic Journal of Information Systems Evaluation*, vol. 13, no. 1, pp. 47–56, 2010.
[78] M. Ghobakhloo, D. Arias-Aranda, and J. Benitez-Amado, “Adoption of e-commerce applications in SMEs,” *Industrial Management & Data Systems*, vol. 111, no. 8, pp. 1238–1269, 2011.
[79] A. Benlian and T. Hess, “Opportunities and Risks of Software-as-a-Service: Findings from a Survey of IT Executives,” *Decision Support Systems*, vol. 52, no. 1, pp. 232–246, 2011.
[80] M. S. Featherman and P. A. Pavlou, “Predicting E-services Adoption: A Perceived Risk Facets Perspective,” *International Journal of Human-Computer Studies*, vol. 59, no. 4, pp. 451–474, 2003.

Appendix A. Measurement instruments

Table A1. Measurement instruments

	Index	Indicator	Scale/ options	Origin
Trialability	TRIA1	I had a great deal of opportunity to try various PaaS services.	5pt Likert	[21], [62]
	TRIA2	Before deciding whether to use PaaS, I was able to properly try it out.		
	TRIA3	I was permitted to use PaaS on a trial basis long enough to see what it could do.		
Tacit knowledge sharing	TKLS1	Employees in my company frequently shared knowledge based on their experience.	7pt Likert	[63]–[66]
	TKLS2	Employees in my company frequently collected knowledge from others based on their experience.		
	TKLS3	Employees in my company frequently shared knowledge of know-where or know-whom with others.		
	TKLS4	Employees in my company frequently collected knowledge of know-where or know-whom with others.		
	TKLS5	Employees in my company frequently shared knowledge based on their expertise.		
	TKLS6	Employees in my company frequently collected knowledge from others based on their expertise.		
	TKLS7	Employees in my company shared lessons learned from past failures when they felt that it was necessary.		
Top management support	TMGS1	The company’s top management supported the implementation of PaaS.	5pt Likert	[24], [67]–[69]
	TMGS2	The company’s top management provided strong leadership and engaged in the process when it comes to information systems.		
	TMGS3	The company’s top management was willing to take risks (financial and organizational) involved in the adoption of PaaS.		
Voluntariness	VLTN1	My superiors expected me to decide to use PaaS.	7pt Likert	[62]
	VLTN2	My decision whether to use PaaS was voluntary.		
	VLTN3	My boss did not require me to decide in favor for PaaS.		
	VLTN4	Although it might be helpful, deciding to use PaaS was certainly not mandatory.		
Vendor trust	VNDT1	In our relationship, the PaaS service provider made decisions beneficial to us.	7pt Likert	[70]
	VNDT2	In our relationship, the PaaS service provider was willing to provide assistance to us.		
	VNDT3	In our relationship the PaaS service provider was honest.		
Trading partner pressure	TPPR1	Adoption of PaaS required support from our business partners.	5pt Likert	TPPR1,3,4: [71]–[74] TPPR2: own
	TPPR2	Adoption of PaaS was demanded by our business partners.		
	TPPR3	Adoption of PaaS was influenced by the marketing activities of our business partners.		

	Index	Indicator	Scale/ options	Origin
	TPPR4	Adoption of PaaS was influenced by our business partners' level of support.		
Competitive pressure	CMPR1	Top management thought that PaaS has an influence on competition in their industry.	7pt Likert	[24], [75]–[77]
	CMPR2	Our company was under pressure from competitors to adopt PaaS.		
	CMPR3	Some of our competitors already started using PaaS.		
Perceived benefits	PBEN1	PaaS allows to manage operations in an efficient way.	5pt Likert	[24], [62], [75], [78]
	PBEN2	The use of PaaS improves the quality of operations.		
	PBEN3	Using PaaS allows to perform specific tasks more quickly.		
	PBEN4	The use of PaaS offers new opportunities.		
	PBEN5	Using PaaS allows to increase business productivity.		
Perceived risks	PCRK1	Adopting PaaS is associated with a high level of risk.	5pt Likert	[79], [80]
	PCRK2	There is a high level of risk that the expected benefits of adopting PaaS will not come true.		
	PCRK3	Overall, I consider the adoption of PaaS to be risky.		
PaaS post-adoption	PPAD	Did the company decide in favor of PaaS in this decision?	Yes=1, No=0	Own
Security and privacy	SCNP1	The security systems built into PaaS are strong enough to secure our data.	5pt Likert	[16], [24]
	SCNP2	The confidentiality of business data is guaranteed when using PaaS.		
	SCNP3	I am confident that the PaaS provider will not use my company’s data for their own commercial benefits.		
Cost savings	COST	Using PaaS reduces costs (e.g., customer service, procurement, human resources, IT training, investment and administration management).	5pt Likert	[21], [62]
IT organization size	SIZE	How many employees work in IT-roles in your company?	6pt scale (below 500 to above 10,000)	Own
IT organiz-ation structure	STRT	How would you describe the structure of the IT-organization in your company?	5pt Likert	Own
Form of post-adoptive use		What was the context of the decision on whether to use PaaS?	Migration, Enhance-ment, New develop-ment	Own

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