

“That Sweet Spot, Where Technology Is Just Mature Enough to Be Stable”: A Case Study on the Right Timing for Cloud ERP and Blockchain Adoption

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Abstract: The adoption of disruptive technologies like Cloud ERP and Blockchain has been a topic of ongoing research. Oriented on the TOE framework and informed by recent literature on the adoption of these technologies, we conducted a qualitative analysis within an international company on the threshold of integrating Cloud ERP and on the point of discussing the potential of Blockchain. Interviews revealed most of the TOE factors as equally important for both technologies, thus underlining the importance of the TOE framework and the explanatory power to describe the contextual factors for technology adoption. At the same time they gave evidence for a deficiency in the explanatory power of this model: The right timing for technology adoption must be explained by more dynamic aspects. The interviews pointed to the maturity of the technology and the market demand as paramount for the timing decision. This paper contributes to the body of knowledge by expanding research on the timing decision of technology adoption and recommends to improve the explanatory power of the TOE framework by taking the maturity level of the technology into account. As the evidence given by a single use case is too small, further research is required to confirm the results.


1 INTRODUCTION

In the last decades companies were confronted with several new and rapidly evolving technologies, each of them promising iterative or disruptive changes to the benefit of the companies. Among those technologies Cloud ERP and Blockchain are striking out. ERP systems are integrated applications to manage internal and external resources of a company, by facilitating the information flow between all business areas (Raihana 2012). Expanding the Cloud computing service model “Software-as-a-Service“ (SaaS) on ERP, leads to Cloud ERP. Flexibility, cost efficiency, scalability, adaptability, availability and configurable data are the most important benefits of Cloud ERP (AlBar & Hoque 2019). Blockchain can be understood as a digital ledger, allowing fast transactions within a decentralized peer to peer network and brokering trust between anonymous peers, promising outstanding advantages like anonymity, immutability and transparency (Clohessy et al. 2019). Most characteristics remain unchanged

arguments for each of these technologies ever since their term was coined.

Beyond the hype around both technologies, business cases are concealed, each of them promising benefits and disruptive change as well as risks and challenges to be mastered. Both technologies evoked a large number of publications oriented on the process of technology adoption, it’s benefits and pitfalls. Many explanatory approaches on technology adoption rely on the Technology –Organization-Environment (TOE) framework (Tornatzky & Fleischer 1990). Because of this, we took a deeper look into recent literature on this framework for both technologies.

Comparing the contextual factors for the adoption of Cloud ERP and Blockchain showed striking similarities. Due to the generality of the model, this doesn’t come as a surprise, but gives evidence for a deficiency in the explanatory power of this model. The TOE framework is limited to characterizing “fertile soil” for technology adoption, but the right

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timing must be explained by more dynamic aspects related to the perception of the value of a technology.

Even though the process of technology adoption within an organization has been a topic of ongoing interest, setting the right time is still an unexplored part of the decision. A mis-timed adoption decision or a lack of market demand can be fatal for the success of a technology adoption (Schlichte et al. 2019). Because of this, the focus of our interest is on the timing decision for Cloud ERP adoption in demarcation to Blockchain adoption. “Why now?” is the research question to be answered. To explore the timing decision, we’ve chosen those two technologies for a comparative assessment of their potential within an organization: Cloud ERP and Blockchain. We report on a case study to explore and describe the phenomenon of the adoption of both technologies within an international organization on the threshold of integrating Cloud ERP and on the point of discussing the potential of Blockchain.

The contextual factors for Cloud ERP and Blockchain were perceived as equally important factors for both technologies, which confirmed our assumptions. While Cloud ERP already reached a certain degree of maturity, Blockchain is still in its infancy. Interviews revealed little resistance against heading into Blockchain, unless the maturity of the technology has increased and market demands become more pressing, thus underlining the relevance of the maturity level and the market demand for the timing decision. As both evolve over time, timing is important: If technologies do not mature according to market demands, their market might “dry up” (McGeogh & Donnellan 2013).

2 RELATED LITERATURE

2.1 Technology Adoption

The unit of our interest is on organizations. User oriented approaches on technology acceptance like the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT) or UTAUT2 (Davis 1989; Davis et al. 1989; Venkatesh & Davis 2000; Venkatesh et al. 2003; Venkatesh et al. 2012) are therefore unsuitable for our analysis.

Building upon the diffusion of innovation theory (DOI), the TOE framework has become well accepted in explaining aspects of technology adoption in organizations. Within the TOE framework various factors influencing the process of technology adoption have been bundled into three contexts:

technological, organizational, and environmental (Tornatzky und Fleischer 1990; Oliveira und Martins 2011). The contextual factors of the TOE framework offer a steady and stable overview of contextual factors underlying the decisions to adopt technologies in organizations. Relative advantages, complexity and compatibility are covered by the technological context. Relevant internal and external technologies are taken into account (Borgman et al. 2014). Scope, size, and managerial structure are addressed in the organizational context (Oliveira und Martins 2011). The demand of the market is an important environmental contextual factor (Côte-Real et al. 2017) as well as legal issues. As the factors within the framework are highly adjustable to the context of research, the framework itself remains stable, without restricting the freedom to vary the factors within (Baker 2012).

Even though the process of technology adoption within an organization has been a topic of ongoing interest, setting the right time is still an unexplored part of the decision. A mis-timed adoption decision or a lack of market demand can be fatal for the success of a technology adoption (Schlichte et al. 2019). When the time and the technology are ripe to be adopted by an organization, is at the core of our interest. To get a hold on the contextual factors relevant for adoption of these two technologies, we reviewed recent literature on the adoption of Cloud ERP and Blockchain.

2.2 Cloud ERP Adoption

In the last decades companies refrained from developing enterprise resource planning (ERP) systems in-house, and purchased them from software vendors instead (Hong & Kim 2002), using cloud computing in the form of the “software as a service” (SaaS) model. Cloud computing can thereby be defined as a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources. Using the model SaaS, the ERP is running on the cloud infrastructure of the provider and is managed and controlled by the software vendor (Mell & Grance 2011).

Even though Cloud ERP benefits from the promises kept by cloud computing, Enterprise resource planning systems (ERP) as the backbone and most crucial information systems of organizations, are a different matter. To get a hold on the contextual factors relevant for Cloud ERP adoption, we had a deeper look into recent literature (table 1). Reliability and privacy are among the most crucial requirements

Cloud ERP needs to fulfil. Related to Cloud computing, (McGeogh & Donnellan 2013) pointed out, that “one major incident of losing confidential information on the cloud” would be sufficient for the adoption rates to slow down. They also pointed out legal issues to be taken into account (e.g. European privacy laws).

Table 1: Some recent studies on Cloud ERP adoption (ordered by year and name).

Reference	Theory	Research Method
(Qian et al. 2016)	TOE	Survey (102 Small and Medium sized enterprises (SMEs) in Malaysia)
(AlBar & Hoque 2019)	TOE, DOI	Questionnaire survey, 136 managers in Saudi Arabia
(Bhadra et al. 2019)	-	Stratified survey, 148 responses
(Ongowarsito et al. 2019)	UTAUT2	Online questionnaire survey, 30 participants representing users from 30 big companies in Indonesia
(Tongsuksai et al. 2019)	TOE, UTAUT	Interviews with ERP vendors (1. Stage), practitioners and managers (2. Stage), questionnaire survey with employees, SMEs
(Usman et al. 2019)	TOE	Manufacturing SMEs in Nigeria

Within the aforementioned literature, the value of Cloud ERP adoption was discussed with a main focus on the organizational or the environmental context. The contextual factors for Cloud ERP adoption in SMEs was a topic of recent research (e.g. (Qian et al. 2016; Tongsuksai et al. 2019; Usman et al. 2019) as well as Cloud ERP adoption in developing versus developed countries (e.g. (AlBar & Hoque 2019; Usman et al. 2019).

Neither the size nor the country is the main focus of this paper, but the literature offered valuable information and provided a list of contextual factors relevant for Cloud ERP adoption, that we could expand on. With this case study we expect to confirm the TOE factors discussed in (AlBar & Hoque 2019) and (Ongowarsito et al. 2019 - 2019) and to gain insights upon the timing decision for technology adoption.

2.3 Blockchain Adoption

Blockchain can be understood as a combination of already known technologies, including cryptographic components such as hashing, private and public key infrastructures, consensus processes, and elements of decentralized systems (Schütte et al. 2017). The outstanding advantages of this technology are anonymity, immutability and transparency (Clohessy et al. 2019). Blockchain obtained its attention in tow of the increasing attention regarding cryptocurrencies like Bitcoin and has the potential to become the next disruptive innovation, changing many areas of society far beyond the field of digital currencies (Schlatt et al. 2016). In addition to the most well-known area of finance, these areas include e.g. the Internet of Things (IoT), Smart Contracts, Supply Chain Management, Privacy and Security, and Data Management (Meinel et al. 2018). To compare the contextual factors for Blockchain adoption with those relevant for Cloud ERP, we explored recent literature on that as well (table 2). Comparing the contextual factors revealed striking similarities with regard to the organizational and environmental factors. Main differences could be found within the technological context. Those factors took up on the specifics Blockchain has to offer, e.g. smart contract coding or permissions (public vs private) (Clohessy et al. 2019).

Table 2: Some recent studies on Blockchain adoption (ordered by year and name).

Reference	Theory	Research Method
(Albrecht et al. 2018)	TOE, DOI	Use cases
(Chen et al. 2016)	-	Literature review
(Clohessy et al. 2019)	TOE	Literature review
(Kühn et al. 2019)	TOE	Three stage Delphi study
(Queiroz & Fosso Wamba 2019)	TAM, UTAUT	Survey
(Schuetz & Venkatesh 2019)	-	Literature review
(Koster & Borgman 2020)	TOE	Case study

Due to the infancy of Blockchain technology, research methods relying on empirical evidence are scarce. The results are too general so far, leaving the essence of the timing decision unrevealed. In the literature review conducted by (Clohessy et al. 2019) “maturity” has been used as a contextual factor in five out of 16 references. Assessing the maturity level is a topic of ongoing research, thus underlining the importance of this factor. Based on the capability

maturity model (CMM), (Wang et al. 2016) introduced a Blockchain Maturity Model. (Richter et al. 2018) followed a similar approach in their Blockchain maturity model for local electricity markets. Both references claim the maturity level as insufficient for blockchain adoption, but maturity of technologies is evolving over time. Exploring the impact of this factor on the timing decision to adopt blockchain technology is worth further exploration.

3 RESEARCH METHOD

To explore the phenomenon in its context, we selected an instrumental case (Baxter & Jack 2008) to facilitate our understanding of the Cloud ERP adoption and the readiness for further technological change by Blockchain. With this case study we expect to confirm the TOE factors discussed in AlBar & Hoque (2019) and Ongowarsito et al. (2019) and expect to get a clearer view on the timing decision for technology adoption (“Why now?”). To get a hold on this, we selected an international organization, that offers mobile living solutions for food & beverage, climate, power & control, safety & security as well as for hygiene & sanitation. This organization has already decided on Cloud ERP adoption and is in the midst of integrating the technology, while in the same time discussing the potential of blockchain.

As the target group of this interview are managers, we expect them to withstand being influenced by guided interviews, therefore we drew up a guideline for the semi-structured interviews informed by the aforementioned literature covering the technological, organizational and environmental context of the framework. The interpretation followed the context of the TOE framework (deductive categorization). The most frequently mentioned contextual factors extracted from the literature overview were used as a starting point. Following Wengraf’s pyramid model (Wengraf 2001), the interview questions were built upon theoretical questions, the language adjusted to the target group. Each complex started with open-ended questions (Level 1), to allow the interviewees to contribute detailed information, if desired. Following up on this, the questions became more concrete (Level 2) and guided the interviewees towards the contextual factors, if necessary (Level 3). Contextual factors remaining unmentioned during the three levels of each interview were removed, new factors mentioned in the interview were added (inductive categorization). This was conducted for Cloud ERP (1st part) and repeated for Blockchain (2nd part).

Within the organizational context communication, stakeholder alignment and change management were addressed as well as top management support, organizational readiness and technology- and business model readiness. Perceived benefits, complexity and compatibility, data security, maturity and software architecture were thematized in the technological context. The environmental context covered market dynamics, industry pressure, customer relationships, business partners, regulatory environment and government support. Each interview contained two parts: the first part was related to the Cloud ERP adoption, the second part to a potential Blockchain adoption. Each interview started with a short video to explain the purpose of the interviews and to give a short introduction into Blockchain. Twelve managers and decision makers of the organization were interviewed as experts within the adoption process. Two expert interviews were conducted to assess feasibility, differentiate the statements made in the interviews and validate the conclusions drawn from an outside perspective. Due to the technological and strategic orientation of the organization and the introduction of Cloud ERP, an expert with experience in both Cloud ERP and Blockchain was interviewed. Two researchers examined the interviews of these managers independently, to explore the significance expressed within their statements.

4 FINDINGS

As the interviews consisted of two parts, the interpretation of the results had been split into Cloud ERP adoption and Blockchain adoption. Mentions of each of the contextual factor and the technology are given in table 3. Organizational readiness includes training, practice, go-live support, organizational maturity and relevance of organizational change. Perceived benefits cover the advantages of the technology to be introduced. Change acceptance includes aspects like cultural change and willingness/resistance to change. Aspects related to the corporate strategy, vision and orientation towards the future are summarized under the term business model readiness. The interviews uncovered factors not mentioned in the literature: change acceptance, implementation partner support, old-fashioned systems, cost, focus on core competency, customers, communication and alignment, trust, risk mitigation, data validation and integrity, mergers&acquisitions, public company, 24/7 support, system readiness and Segregation of Duties (SoD). On the other hand,

several factors found in the literature had not been mentioned within the interviews: participation incentives, critical user mass, relative advantages, disintermediation, smart contract, permissions (public vs private).

Table 3: Perceived importance of contextual factors for Cloud ERP and Blockchain adoption within the organization (T – technological context, O – organizational context, E – environmental context).

Contextual factor	Context	Mentions	
		Cloud ERP	Block-chain
Organizational readiness	O	10	9
Perceived benefits	T	11	7
Change acceptance	O	9	7
Business model readiness	O	7	6
Complexity	T	9	4
Implementation partner support	E	9	4
Technology knowledge	O	9	4
Old-fashioned systems	T	11	0
Cost	O	6	4
Top Management support	O	12	3
Technology readiness	O	4	5
Focus on core competency	O	8	0
Market dynamics	E	5	3
Customer	E	6	1
Business use cases	E	2	5

The results confirmed the importance of the contextual factors given in literature reviewed before and revealed that the contextual factors in both the first and second part of the interview were close to each other. The concordance between those factors for both technologies confirmed the stability of the TOE framework, but the number of mentions left the question at hand unanswered. Therefore further analysis of the statements given is necessary to explore their significance. As each complex started with open-ended questions, some interviewees followed this invitation to add more detailed information. This information provided valuable insights beyond the number of mentions listed above. One interviewee made a remarkable reference to the vision of the organization and revealed a self-confidence, founded on the perception of the organizational strength.

„We have a very clear vision decided by the board to digitize the way we operate and become a 21st century player, just strengthening our position as well as developing the whole industry” (Interview 12).

This statement reveals the importance of a digitalization strategy for this organization, which was confirmed by the importance of factors like top management support, change acceptance and organizational readiness. Another interviewee pointed out:

“I think having a culture that is hungry for change has to come from the top and it has to run all the way through the company down to basically whoever is picking and packing the orders and you have to be interested in technology and interested in how the technology can help you” (Interview 6).

This statement gives evidence for a successful translation of strategies into actions, for a culture unafraid of changes. Self-confident and ready to master the challenges at hand, the integration of Cloud ERP is perceived as just another step towards the realization of the vision mentioned above. The necessity of the step remains unquestioned, it is just considered a matter of the appropriate timing:

„By choosing a cloud-based ERP, we can actually have technology that is future proof, with the downside that it's still new. You wanna find that sweet spot, where technology is just mature enough to be stable [...]” (Interview 6).

This interview reveals the importance of the maturity of technology, in particular the factors of stability, innovativeness and future security. The interview reveals as well, that this organization is indeed fertile ground for successful implementation. The culture of change was easily transferred onto Blockchain:

“Absolutely [...] we need to keep on changing with the thing, because what we do today is not good enough tomorrow right” (Interview 11).

The decision of adopting a technology well matured is different than deciding on the adoption of a technology still in its infancy (like Blockchain). An interview with an external software provider revealed a way of reducing barriers:

“Our position is: not to build our own Blockchain, but to provide existing Blockchains as a service, to use it with no-code, low-code tools and to connect it to existing systems or to new systems to be built” (Interview 14).

Removing the barriers to deploy a technology and focussing on the business case instead, already worked for Cloud ERP adoption in this organization and might work for Blockchain adoption as well. Even though the perceived necessity of further change remains unquestioned, enthusiasm related to Blockchain was lower than related to Cloud ERP. Another interviewee elaborated on that by pointing

out to focus on the problem, that should be solved by the technology and not on the technology itself:

„People, companies, and users are not looking for technologies, they are looking for solutions“ (Interview 4).

With this, the interviewee voiced some doubts on Blockchain being the appropriate “means” to solve the problem. Without an appropriate business model, the right time for the organization to adopt Blockchain technology hasn’t come yet. Another interviewee confirmed:

“I don’t know if the need is developed enough [...] a lot of this will occur as we challenge the existing systems with new business models, like service, that require new solutions that don’t exist today” (Interview 7).

With this it became evident, that an adoption of Blockchain would be mis-timed for this organization as the need for Blockchain adoption is not yet developed enough at this point in time. A factor for the right timing in that sense can be explained by a demand from the customer side and a business case that satisfies that demand:

“You have to be where the customers are. If the customers demand Blockchain, it’s a no-brainer to implement, but right now I don’t think the demand is large enough.” (Interview 6).

The necessity of business case work or establishing a proof-of-concept was confirmed as relevant in five of the interviews. For timing the adoption decision, this aspect is worth further exploration.

5 CONCLUSIONS

The main focus of this paper was on revealing the essence of technology adoption from an inside perspective, diving into an international corporation oriented on mobile living products and services, standing on the edge of Cloud ERP adoption. As the TOE framework offers a stable overview of contextual factors underlying the decisions to adopt technologies in organizations, we examined the TOE factors for the adoption of both technologies in recent literature and found striking similarities. A switch of the technology discussed within these interviews (from Cloud ERP to Blockchain) left most contextual factors within the organizational and environmental context unvaried, thus giving evidence for the stability of the framework. On the other hand, the findings indicate an explanatory weakness regarding the timing decision. The interviews pointed toward

the maturity of the technology and the market demand as paramount for this.

Interviews within the organization revealed a readiness to change deeply rooted in the organizational culture. The decision on “why now” in case of Cloud ERP adoption has been based on the need for a more integrated operational model as well as on improving the customer experience, internal efficiency and quality. Acting proactively on new market and customer requirements is another important factor in deciding when to introduce a new technology. The integration of Cloud ERP was considered a necessary step, beneficial for the processes, the customers and thus for the company.

As the maturity is one of the dynamic factors of importance evolving over time, we put special attention on the perception of the maturity. Maturity of the technology is not part of the most frequently mentioned influencing factors in table 3, however, it has a significant influence on the timing decision of technology adoption. While Cloud ERP already reached a certain degree of maturity, Blockchain is still in its infancy. The statements of the interviewees revealed little resistance against heading into Blockchain, once the maturity of the technology has increased and market demands become more pressing. While the market demand is a factor covered by the environmental context, the maturity is not yet established within the TOE framework. We suggest improving the explanatory power, of the TOE framework by taking the maturity level of a technology into account as a contextual factor. We contribute to the body of knowledge by expanding research in the timing decision of technology adoption and recommend further research to better understand the approximation of market demands and maturing technology. The argument is supported by an ongoing discussion on maturity assessments in recent research. Relying on a single case study limits a generalization of the findings and further validation is necessary to expand on this. The disruptive character of Blockchain puts another limitation to the paper, since the degree of disruption invoked by this technology is hard to predict. The case study confirmed, that cultural change is one of the main challenges. The effects on how often or regularly a company is exposed to cultural changes on the adoption would be worth further exploration. In some cases not the idea in general, but the wrong timing can trigger a failure (Schlichte et al. 2019). As the interviews revealed, working on the business case and conducting a proof-of-concept can mitigate the risk of a mis-timed adoption, and assist the organization by

finding the sweet spot, where a technology is just mature enough to be stable.

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