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Classifying systemic differences between Software as a Service- and On-Premise-Enterprise Resource Planning

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Abstract

Purpose – The technological innovation of Software as a Service-Enterprise Resource Planning (SaaS-ERP) opens several relative advantages, which may be realized by choosing the proper operation mode. Thus a company looking for a new ERP system faces the question: When and under what conditions does it make sense to choose a SaaS-ERP system? The paper aims to discuss these issues.
Design/methodology/approach – The relative advantage criterion of the diffusion of innovation theory, derived as operation mode differences, determine the conditions under which SaaS- or On-Premise-ERP is preferable: a classification of all main systemic operation mode differences between SaaS and On-Premise for the more complex ERP systems is presented. The systemic differences were identified by analytic generalization using triangulation between a literature review and a multiple case study with four ERP producers.
Findings – The most significant decision factors between ERP operation modes are flexibility, customization, cost, and operation and maintenance. General strategies have been derived by bringing the theoretical reasons together with the operation mode difference criteria. Typical criteria for selecting SaaS-ERP are a lack of IT-capacity or capabilities, as well as high need for flexibility, due to business development, seasonality, growth, collaboration and/or expansion. On-Premise-ERPs should be selected if specific or strategic resources would be outsourced or when major customization is a need.
Research limitations/implications – Case research is limited in that it reveals only ERP producers' view and omits outlying cases.
Practical implications – The findings implicate that ERP selecting customers should consider and expand their criteria for ERP selection by operation mode criteria.
Originality/value – The classification of the most essential operation mode differences allows, for the first time, ERP selecting customers to design selection strategies. ERP selecting companies should strategically favor the operation mode that best suits their respective organizational characteristics so as to obtain the best possible support from the ERP operation modes.

Keywords ERP delivery mode, ERP operation mode, Operation mode difference, SaaS-ERP, Selection strategies, Systemic difference

Paper type Case study

1. Introduction

Many complex IT systems such as Enterprise Resource Planning (ERP) systems were, until recently, operated only as licensed products on local or hosted servers. The Software as a Service (SaaS) innovation, drawing on existing technology, now makes it possible for providers not only to offer a more complex system but also to deliver it over the internet. Each new operating mode allows additional application options; the

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question for research is, then, which of the two operating modes, SaaS or On-Premise, offers better long-term value in a particular ERP case. By making a first step in this direction, this contribution gives answers to the following research questions:

RQ1. What ERP operation mode differences exist between SaaS and On-Premise?

RQ2. What advantages can be gained by choosing the SaaS or the On-Premise ERP operation mode?

The aim of the research is to generate a list of general ERP operation mode differences and add up all comparative advantages between the ERP operation modes. In this respect, the paper contributes in two ways to the extant literature: first, no paper has ever compared ERP operation modes, until now. ERP operation modes must be considered separately from other applications, because ERP systems differ fundamentally from other applications in several ways: they are of extremely high-strategic relevance to the company, have high-implementation costs and a long implementation period, and must be adapted to the operational processes (Lechesa *et al.*, 2012; Loh and Koh, 2004). Second, as Table I indicates, there has been no classification of application-unspecific operation mode differences that is as extensive and complete as this contribution. This contribution

References are color coded: black = SaaS; red = SaaS-ERP; green = ASP; magenta = Cloud Computing; turquoise = outsourcing; blue = ERP; grey = other Conceptual code of operation mode differences:	Altaf and Schuff (2010)	Benlian and Hess (2010a)	Benlian and Hess (2010b)	Bezemer and Zaidman (2010)	Brass and Zimmermann (2010)	Buxmann *et al.* (2008)	Chen and Soliman (2002)	Choudhary (2007)	Dibbern *et al.* (2004)	Farah (2010)	Fuller and McLaren (2010)	Gill (2011)	Heart (2010)	Herbert (2007)	Höse *et al.* (2009)	Kakabadse and Kakabadse (2002)	Katzan Jr and Dowling (2010)	Kim *et al.* (2009)	Koh *et al.* (2009)	Lehmann *et al.* (2010)	Löwer and Picot (2002)	Marston *et al.* (2010)	Mathew and Nair (2010)	Matros *et al.* (2010)	Mietzner *et al.* (2009)	Olson and Wu (2011)	Repschläger *et al.* (2010)	Sääksjärvi *et al.* (2005)	Sharma and Gupta (2002)	Sonnow and Klement (2010a)	Sonnow and Klement (2010b)	Subashini and Kavitha (2010)	Umble *et al.* (2003)	Waters (2005)	Weiping (2009)	Wu *et al.* (2011)	Xin and Levina (2008)
Cluster 1: *ERP system cost*																																					
License cost			X		X	X																		X											X		
Liquidity			X						X		X											X												X	X	X	
Installation cost																								X											X		
Deployment/installation time								X		X	X	X			X							X		X		X			X								
Maintenance contract			X			X								X									X	X					X		X			X		X
Service contract						X																									X				X		
Subscription fee				X		X		X						X						X			X	X					X	X	X			X	X	X
Cluster 2: *ERP operation and maintenance*																																					
IT Professionals	X				X						X												X	X				X	X		X					X
Infrastructure and system mainten. cost				X	X		X	X		X		X			X	X						X		X		X		X								
Support						X																	X														
Updates		X			X		X						X									X										X			X	X
Release/update interval					X		X							X										X				X	X				X			
Backup			X			X									X														X							
Cluster 3: *Initiation and implementation*																																					
Multitenant capability			X	X	X					X					X		X					X	X		X		X	X						X		
Implementation time					X	X		X		X				X	X	X						X		X		X		X				X			X		
Preliminary project						X																											X				
Training																			X																		
Cluster 4: *Flexibility and changeability*																																					
Module upscaling																								X													X
Module downscaling																								X													X
User scaling		X	X	X			X	X			X					X							X		X			X		X	X	X		X		X	X
Ubiquity						X		X							X	X							X						X		X						
Cluster 5: *Customization and configurability*																																					
Customization	X	X	X				X	X			X	X		X	X	X					X											X					X
Configurability						X																															X
Cluster 6: *Security*																																					
Certificates	X												X											X													
Encryption																																	X				
Safety for highly sensitive data					X													X														X		X		
Cluster 7: *Characteristics and dependencies*																																					
Cost certainty and transparency									X							X								X			X	X		X	X			X		
OS independence							X																														
Dependence on provider					X	X								X	X								X				X			X	X					
Dependence on internet		X										X			X			X						X		X										
Total of systemic criteria mentioned	3	4	7	4	11	12	7	3	2	5	4	4	2	6	9	6	1	2	1	1	1	9	5	15	1	4	4	6	7	5	8	6	1	6	6	6	9

Table I.
Literature based coding results (are marked with an "X" if conceptual code has been found) – a reference ordered display

collects, arranges and completes the existing knowledge about application-unspecific operation mode differences and applies this knowledge specifically to ERP operation modes. This paper classifies systemic operation mode differences and states strategies for the selection of ERP operation modes, enabling the ERP implementing customer to select the appropriate ERP operation mode in light of the company's characteristics.

The findings implicate that ERP selecting customers should consider and expand their criteria for ERP selection by the results of this contribution. To make a favorable selection, ERP selecting companies should align the technical functions and operation mode of the ERP system to their company characteristics. In-house IT capability is an especially important factor in deciding between SaaS or On-Premise. The less IT knowledge a company has, the more likely that a SaaS ERP is the best choice. This postulate is limited by the company's requirements, especially in respect to the flexibility, changeability, security and customization needs. Therefore, during their ERP selection and evaluation process, IT managers should match the advantages of each ERP operation mode to their company characteristics and balance the requirements against the company's IT capabilities.

The paper is structured as follows: the extant literature on the ERP application type and the SaaS operation mode in general, as well as on SaaS-ERP in particular, is the starting point for research. Section 2 describes this related work and provides a literature review. The general literature results have been substantiated by case study research. The method used to gather evidence is briefly described in Section 3. Section 4, the findings, shows the advantages of the two operation modes, thereby illustrating in a simple way the systemic differences between SaaS- and On-Premise-ERP. The selection strategy section will derive strategic implications from these operation mode differences so as to support the ERP implementing customer with information about when to choose which of these two operation modes.

2. Related work

To identify and conceptualize the extant knowledge of the topic of ERP operation mode selection, the research field must be broken down (vom Brocke *et al.*, 2009, p. 9). The three key terms that narrow the present topic are selection, ERP and customer. Selection refers to the operation mode choice ex ante; the other terms limit the research field to one specific application type and to one point of view. According to Zorn and Campbell (2006, p. 175) working definitions of the key terms (see Appendix 1) and a terminological conceptualization have to be provided to specify the relevant subject area (Bhattacherjee, 2012).

2.1 Theoretical conceptualization of application outsourcing and selection

How applications are selected has been studied based on various principles and economic, social and strategic theories (cf. Dibbern *et al.*, 2004). Economic theories focus on the efficient coordination and management of enterprises and their stakeholders. The coordination is efficient if the final product or service is provided at the lowest cost. Transaction and production cost economics have typically been used to explain outsourcing and monitoring costs (cf. Jayatilaka *et al.*, 2003; Schwarz *et al.*, 2009).

The social science theories deal with the user's behavior as an explanatory factor in adopting innovations. The widely used diffusion of innovation theory is the only approach for explaining outsourcing decisions *ex post* (Dibbern *et al.*, 2004; Wang *et al.*, 2012, with further references). The main factors in innovation adoptions

are the relative advantage, compatibility, complexity, trialability and observability (Rogers, 2003). Relative advantage and compatibility were found to be positively correlated with adoption, whereas a negative correlation between complexity and rate of adoption has been confirmed by a variety of studies (cf. Tornatzky and Klein, 1982). No significant effects could be confirmed with the trialability and the observability criteria due to a lack of reliable metrics (cf. Moore and Benbasat, 1991; Tornatzky and Klein, 1982).

The most common strategic theories to explain outsourcing decisions are the resource-based view and the outsourcing theory in the narrow sense. With the resource-based view, optimal resource allocation is used as the predicting factor of outsourcing: the effective and efficient use of resources means using the resources and skills when they are valuable and rare, neither imitable nor substitutable (Barney, 1991). Otherwise no sustainable competitive advantage can be preserved and higher costs will be incurred by using internal resources (Grant, 1991). IT resources either should be operated as cost-effectively as possible, which may be achieved by outsourcing, or should provide a competitive advantage (Jayatilaka *et al.*, 2003). The outsourcing theory goes further than the resource-based view to include the outsourcing objects in the selection and implementation strategy (cf. Dibbern *et al.*, 2004). There are three stages in the outsourcing selection: the outsourcing strategy looks at why the company should outsource, the application stage explores what to outsource and the selection itself evaluates how to outsource and which application to select (Dibbern *et al.*, 2004, p. 14 et seq.).

Operation mode selection. There is little scientific evidence about how organizations should select ERP operation modes, because existing literature is sparse. Most of the literature pertains to selection processes for IT applications and their functionalities (e.g. Ayağ and Özdemir, 2007; Deep *et al.*, 2008; Umble *et al.*, 2003). An ERP operation mode outsourcing strategy and process therefore must be developed according to the research. The outsourcing strategy should provide a financial or strategic advantage; this comes from selecting the proper operation mode with respect to the specific company characteristics and requirements. The relative advantage criterion of the diffusion of innovation theory unveils possible systemic differences between the ERP operation modes. So, a classification of general systemic differences of ERP operation modes is the first step toward developing outsourcing strategies and processes.

Most of the operation mode literature relates to cloud computing (CC). CC, however, represents only a part of the operation mode selection. Neither On-Premise, nor hosting and Application Service Providing (ASP) for private clouds belong to the category of CC (Armbrust *et al.*, 2009). But private clouds are often used as contrasts to public, community or hybrid clouds, so searching the general CC literature may be informative for finding general differences between application-unspecific operation modes. With this in mind, the following combined search terms were applied in the literature review:

SaaS and ERP	ASP and ERP	ERP Selection
On-Demand and ERP	Decision Support and ERP	

2.2 Literature review

A literature review as described by vom Brocke *et al.* (2009) was conducted to gain insight into the current state of research and to obtain more background information about general operation mode differences between SaaS and On-Premise applications. This literature review enables a detailed exploration of existing general

application-unspecific operation mode differences, which may be applied to the more specialized domain of ERP operation modes. The applicability of the general differences found in the literature will be investigated by the following case study research. The case study analysis verified the applicability, with the inappropriate differences discarded and the general operation mode differences extended by further ERP-specific systemic differences. The literature review has also allowed the remaining research gap with respect to the more specific ERP operation mode differences to be identified (Gephart, 2004).

Data acquisition. The databases ACM Digital Library and AISel were searched for conference papers; contributions to journals and book chapters were searched for in the databases EBSCOhost (Business Source Premier), Elsevier ScienceDirect, EMERALD, ProQuest, Springerlink and WISO Praxis. In total, 86 publications were found by applying the search terms mentioned above to the eight selected databases. An additional 17 publications were identified with a backward search, so that a total of 103 publications were aggregated in the literature stock. The search period was limited by the keywords themselves, so no further time limit was applied[1].

Data analysis. The papers in the literature stock were first coded by their main contribution to the research field to highlight the origin and main background of the papers; this information, provided as color coding in Table I, eases understanding of the operation mode difference code. The papers have been assigned to the operation mode classes: On-Premise, CC (general), SaaS, SaaS-ERP, ASP, ASP-ERP, outsourcing, outsourcing-ERP, ERP (general). Only a few publications were assigned to the application-specific SaaS-ERP class: research into SaaS-ERP is definitely limited (Lechesa *et al.*, 2012). Therefore, the literature had to be analyzed by using the application-unspecific general operation mode differences. They have been coded using a starting list of open codes, which was expanded during the analysis (Strauss and Corbin, 1998). Categories of operation mode differences defined as relative advantages emerged out of the coding procedure when the same phenomena were matched. Constant comparison was used to refine and validate the categories (Bhattacherjee, 2012, p. 115). The final list was transferred into the rows of a contrasting meta-matrix, which compares On-Premise and SaaS in the columns (Miles and Huberman, 1994, pp. 177-186). The cell values ("operation mode difference" to "operation mode") contain the reference to the respective literature source. All of the entries have been highlighted in the source text to allow immediate retrieval of the information. The unstructured meta-matrix was searched for pattern codes in the sense of finding main pattern clusters of similar operation mode difference categories (Miles and Huberman, 1994). Then the operation mode differences that were found could be conceptually reordered. The extensive information contained in the meta-matrix was consulted in creating the semi-structured interview guide used in the subsequent case study research.

Literature analysis results. A total of 190 data entries were registered in the unstructured meta-matrix, out of which six main categories[2] emerged from the pattern clustering. Subsequent to the case study research (see next section), the more focussed ERP case study results were used to either confirm or reject these general operation mode differences found by studying the literature, enabling the 190 data entries of the meta-matrix to be condensed. All data entries not confirmed by the case results were deleted from the meta-matrix to allow the main difference factors to be focussed on. The final rearrangement of the remaining meta-matrix entries to a reference-ordered display,

as shown in Table I, crosses the papers of the literature review with the operation mode differences to show the source of the systemic differences factors. Further, Table I indicates that no paper has found all 30 of the systemic difference criteria; the maximum mentioned in one paper is 15. Moreover, the SaaS, SaaS-ERP and ASP papers are most concerned with these systemic difference criteria, mentioning approximately five to six criteria per paper on average; the CC papers mention nearly five criteria on average, whereas the outsourcing and ERP papers found fewer than two systemic difference criteria on average. This result shows, first, that the CC domain (including SaaS) is far more concerned with systemic differences, because they matter when comparing On-Premise products with CC offers, and second, that no publication has ever researched and classified all these general systemic difference criteria.

In all, 20 papers from the literature stock combine operation modes with the application ERP, but no publication deals with ERP operation mode selection. There is one publication that determines and compares the characteristics of SaaS, best-of-breed and On-Premise to identify to what extent the operation modes match the needs of small- and medium-sized enterprises (SMEs; Fuller and McLaren, 2010). Another publication compares the risks of On-Premise-ERP and ASP-ERP using a multiple criteria analysis (Olson and Wu, 2011). The Sontow and Kleinert (2010a, b) studies examine the criteria for adopting SaaS-ERPs by using quantitative opinion research. Further, some initial studies on strategic considerations when adopting SaaS deal with the opportunities and risks of the applications (Benlian and Hess, 2010b) or with the selection and acceptance criteria that are relevant to the adoption of SaaS (Kim *et al.*, 2009). The adoption criteria for some general SaaS offerings have already been investigated to some extent using economic and strategic theories (transaction and production cost theory, resource-based view, theory of planned behavior, property rights theory, institutional theory, IT governance theory; cf. Benlian and Hess, 2010b; Benlian and Hess, 2009; Buxmann *et al.*, 2008; Heart, 2010; Xin and Levina, 2008).

Hence, a first research gap is found in the general difference criteria incompleteness of ERP operation modes. A second research gap can be identified as the effects and implications of the operation mode difference for the ERP selecting company. Both gaps will be closed with the subsequent case study.

3. Method and sources of evidence

The application-unspecific operation mode differences, which have been identified through literature research, have to be validated and refined for the more specific domain of ERP. Because ERP systems are so complex, a deep understanding of the ERP system and its operation mode designs is required to develop general ERP operation mode selection criteria. According to Dubé and Paré (2003, with further references) case research is useful when a phenomenon is broad and complex, when a holistic, in-depth investigation is needed, and when a phenomenon cannot be studied outside the context in which it occurs. Therefore, a multiple case study, as Yin (2003) defines it, was conducted to verify and refine for the ERP domain the literature-based operation mode differences described in the previous section. Then, new and ERP-specific operation mode differences are explored in the case studies and added to the refined literature-based operation mode differences. The case study moreover offers more background information, permitting the researcher to find explanations for the systemic differences and to better understand their contexts. Figure 1 provides an overview of the applied research design.

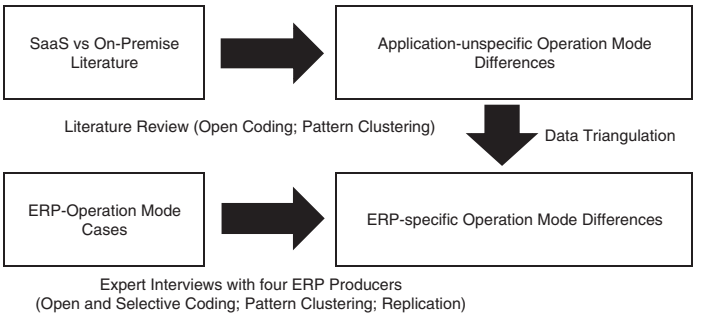

Figure 1.
Research design

3.1 Case data acquisition

Four ERP vendors (Abacus, myfactory, Microsoft and SAP) have been studied through semi-structured interviews with key information persons, each from different divisions, so that diverse views could be considered and balanced. Thus the expertise of each interviewee's division has been captured in detail. These four different cases have been chosen to control for the criteria of size, market power, number of modules, and product strategy (SaaS as a new product vs SaaS as identical to an existing On-Premise product). These four vendors complement each other and represent a typical sample of European ERP system vendors with multiple operation mode portfolios.

The interview guide, which provided the structure for the interview, was generated according to the six main literature review categories and by using the codes and patterns found in the literature review: information on the functionality, systems architecture, flexibility and changeability, business model and costs, data security, and the advantages and weaknesses of SaaS-ERP systems were collected with regard to each producer in order to identify all the differences between SaaS and On-Premise from all angles of view. Most of the questions were open-ended to allow deeper insights into the interviewee's opinions and background information, so that new or ERP-specific operation mode differences could be explored (Yin, 2003). The interview was only semi-structured in that the interviewer could follow-up on this new information as it came up. The information obtained was enriched through document analysis (web sites, information material, pricing lists, internal documents, etc.); the researcher's notes and real artifacts (ERP systems, test accounts, instructional videos) were used as additional sources of information (cf. Benbasat *et al.*, 1987, p. 374; Darke *et al.*, 1998, p. 278; Yin, 2003, pp. 85-97). Appendix 2 provides more information about the four vendors interviewed.

3.2 Case data analysis

All interviews were transcribed and a within-case analysis with selective coding was used in order to refine the literature review categories and systemic differences; open codes were applied to find new operation mode difference criteria (cf. Miles and Huberman, 1994; Strauss and Corbin, 1998; Yin, 2003). For each case, a separate contrasting matrix containing all the systemic difference criteria codes pertaining to it was drawn up: the second column crosses the transcript reference (denoted as ⟨interviewee's initials⟩ (⟨line number of transcript⟩)) with the ERP operation mode difference criteria found. The third and fourth columns cross the operation mode with the ERP difference criteria, giving operation mode-specific explanations and contextual information as cell values: this analysis provides evidence of why a certain criterion is a general ERP operation mode difference.

The interview data were further supplemented and validated by analyzing the other sources of information, mostly document analysis of official or internal written documents, using the same coding and data display as with the interviews. This supplementation reduces the response bias typical of interviews. After the within-case analysis, a between-case analysis looking for similarities in the four case studies was started to substantiate the evidence using a replication logic strategy, as well as data triangulation between the difference criteria from the literature and the between-case results (cf. Dubé and Paré, 2003, p. 615; Miles and Huberman, 1994; Yin, 2003). Because both the replication logic used and the data triangulation isolate the results from the data collection method, the procedural and especially measurement biases of the research are minimized. Condensing the four within-case contrasting matrices to one data set produced the greatest possible number of differences. Pure producer specifics were removed so that no attention would be paid to them. Further, by applying data triangulation and searching for replication, all data not supported by further case data or literature review difference criteria were removed from the between-case contrasting matrix. A final step was to use the same method of pattern clustering as used in the literature review to revise and sharpen the main classes (Miles and Huberman, 1994), which revealed the seven main categories as used in the next section. This whole procedure resulted in the final contrasting matrix, which is depicted in Appendix 3. The next section provides evidence and an explanation of the main systemic ERP operation mode differences.

4. Classification of the systemic differences: results and brief discussions

In the words of MB (technical staff of the sales division, SAP), the main differences between the characteristics of SaaS- and On-Premise-ERP can be expressed with a simple metaphor:

> One can go his own way, that would be like a taxi-ride, where the customer decides where he wants to be picked up and where he wants to exit. This will be a bit more expensive. Otherwise, he takes the city bus; there it is predefined in a way where he has to enter and leave the bus[3].

This metaphor shows precisely that the customer's latitude will clearly be restricted with a SaaS-ERP, because multiple customers share the same application. But it is this sharing of the ERP application that allows lower prices. The general differences between SaaS- and On-Premise-ERP have to be taken into consideration in selecting the proper ERP operation mode. Each difference is a source of a relative advantage, and if this matches the adopter's characteristics and requirements, it may provide strategic or financial benefits for the customer (Rogers, 2003, p. 216). Different viewpoints must be considered, including the business (e.g. cost aspects), the technical (e.g. maintenance) and the operation mode-based functional perspective (e.g. ability to customize) to give a holistic view of ERP-specific operation mode advantages. The following section gives an overview of the most significant systemic differentiation factors between SaaS- and On-Premise-ERP:

4.1 ERP system costs/total cost of ownership

Pricing. The main and most noticeable difference between SaaS and On-Premise-ERP is the unequal business model. A SaaS system is typically rented by paying a monthly subscription fee, which covers all services of providing and maintaining the ERP

system. In contrast, licenses must be purchased for On-Premise-ERP systems. The license does not cover the costs of installing, maintaining or updating the system. So the On-Premise customer has to provide the respective infrastructure (server, operating system (OS) and databases) and has to sign maintenance and service contracts:

> One of the biggest advantages is the price, simply because these costs can be shared with the other customers; the hardware, the maintenance […] But as well cost certainty with the monthly subscription: A SME that opened up recently, knows with my 3 users I have to pay, let's say 100 SFr. per month, which is definitively fixed. This amount I have to put aside. I do not have to spend thousands of francs from the beginning (CS, engineering and maintenance, myfactory).

Liquidity. Providing the ERP system as a service rather than a product replaces non-recurring with recurring costs and lowers initial costs. Hence, SaaS lowers the cost of entry and companies with high-capital costs may preserve their liquidity by spreading the service cost over the usage period (Shukla *et al.*, 2012; Xin and Levina, 2008):

> The type of payment is different: rent is off-balance, whereas licenses have to be capitalized (CP, manager product sales, SAP).

Cost differences. The most interesting factor in this section is clearly the calculation of the cost difference between the ERP operation modes. The comparative calculation method used must include all difference criteria that affect finances. The method of Link and Back (2013) uses a relative total cost evaluation of ERP operation mode differences to sum all relevant relative cost differences over the life cycle of an information system. The resulting cost difference shows which operation mode is cheaper and which savings can be expected. This method must take into account all difference criteria with financial aspects. With SaaS, there is only a variable (based on number of users, space, cpu-power, etc.) but transparent subscription fee paid on a monthly basis; with On-Premise, there is a one-time license fee to be paid, which has to be depreciated, as well as annual maintenance costs amounting to between 15 and 25 percent of the license fee, and a service fee (e.g. installation of updates; Fulford and Love, 2004, p. 451; Sammon *et al.*, 2009, p. 501). Besides these fees, internal maintenance and operating costs (hardware, server, OS, firewall, etc.) will be incurred, which have to be estimated and added to the license and maintenance costs before an accurate comparison between the On-Premise costs and the subscription fee of SaaS can be made.

4.2 Operation, hardware and software maintenance, updates

A SaaS-ERP system is by definition multitenant capable. This precondition of SaaS enables the providers to pool multiple customers on one instance, and thus to distribute the costs incurred in providing the system over an increasing number of customers (Koslowski and Strüker, 2011). This architectural improvement over an On-Premise system allows economies of scale to be realized by the providers when buying and maintaining hard- and middleware, as well as maintaining the SaaS-ERP itself (Armbrust *et al.*, 2009). With On-Premise-ERPs each individual instance has to be maintained and updated, requiring the respective IT know-how and staff, and incurring infrastructure and system maintenance costs in keeping the systems' hard- and software up to date:

> When you have no IT department, an important factor too is whether you have somebody internally, who enjoys and is also experienced in such tasks [hardware and maintenance] (DS, support, advice and course management, myfactory).

IT personnel. SaaS-ERP needs no IT professionals, thereby eliminating the need for internal IT departments. The SaaS-ERP customer does not have to take care of the infrastructure, maintenance or updates. Further, SaaS needs no installation; installation and its concomitant problems usually faced in On-Premise systems do not arise:

> All that's necessary are 2 pc's, an internet line and a printer (DL, CEO, myfactory).

The customer need not be concerned with running the system and can therefore concentrate on the company's core competencies. As DS (support, advice and course management, myfactory) pointedly puts it:

> Why do you [customer] want to take care of the stuff all around the ERP system? Your intention is to work with it!

Update interval and constraint. The provider must keep the SaaS-ERP system up to date, so the customer's SaaS-ERP system will run on the newest version and will use new technologies, features and functionalities sooner than On-Premise-ERP systems will:

> That [update interval] has changed: There are new updates out sooner now; the system will be updated several times a year, up to 8 or 10 times and with this procedure the newest version will always be available (MB, project manager, myfactory).

Since the SaaS-ERP system is installed at the provider's premises, updates can be installed incrementally (Herbert, 2007), so the latest technologies and functionalities will be immediately available. An incremental updating of an On-Premise system is too costly, because each instance has to be updated. Often, the fast and incremental updating is perceived as highly desirable, but when not, e.g., when third systems are customized to connect to the ERP system and will not run with the newest release, it is not possible to roll back or remain on older versions as it is with On-Premise-ERP systems.

Backup. A good backup standard and guidelines about how these backups have to be handled is essential in ERP systems. A trusted provider can achieve a higher backup standard than most internal IT departments can establish. With a SaaS-ERP good backup is default and a prerequisite, so it is part of the service. In an On-Premise-ERP, professional backup is obviously the responsibility of the customer. How reliable this is and what safety standards are applied is therefore defined by the customer. In a SaaS-ERP the customer loses the control over the data and the safety standards applied, because these are in the hands of the provider (Marston *et al.*, 2011, p. 181). But like a money bank handling deposits, a professional and reliable SaaS provider will always be better able to ensure a safer and more up-to-date backup system at lower cost than a company can establish on its own.

4.3 Initiation and implementation

Trialability. SaaS-ERP systems can be tested immediately in advance using a demo account, shortening the selection and evaluation process in comparison to an On-Premise-ERP (Boyle, 2002, p. 27):

> [The final decision with an On-Premise-ERP will often be made in a preliminary project.] In a SaaS-ERP this is not at all the case, no, there you decide according to a demo: I order a demo and then I start to test it (MB, project manager, myfactory).

Time. The SaaS-ERP system can generally be implemented faster since no hardware needs to be provided and no installation is necessary:

> [Enumeration of SaaS-ERP advantages]: I think, there is the speed of availability [for the customer] to establish the account, it will take 5 minutes and then you will have the access (CS, engineering and maintenance, myfactory).

Preconfiguration. By default, the standard SaaS system is preconfigured to be able to work immediately with the system, e.g., SAP Business ByDesign has implemented a whole business configurator for self-configuration purpose in its product:

> For the most part, this [the user-configurability] works exactly the same [as in an On-Premise-ERP], but more automatic functions are built into SaaS; hence, some things are already parameterized and preconfigured (MB, project manager, myfactory).

Preliminary project and migration. The preconfiguration does not mean that no preliminary project is necessary, because the pre-configured standard system rarely meets the needs of the customer. So the configuration settings often have to be changed to adapt the system to the business procedures. Especially, the more complex the SaaS configuration mechanisms are, and the more options are available, the more extensive the preliminary project will be (Höß *et al.*, 2008, p. 9). The effort to implement and configure the ERP system can be dramatically high, if many configuration options have to be aligned to the business procedures (Wortmann *et al.*, 2012). Approximately the same effort of data migration is needed to get the data into the new system, whether the system is On-Premise or SaaS.

Training. Training is required for any ERP system, but the amount and time of training needed depends on the training concept. In SaaS-ERP, self-training can for the first time easily be provided via web videos or web learning lessons; in the case of Business ByDesign, exclusively by these methods. The training sessions can be carried out whenever the instructions are needed, rather than the user having to wait until the next individual or group contact training lesson is scheduled. With On-Premise, the traditional individual and group contact training lessons still predominate, even though the new training methods could also be used for On-Premise-ERP.

4.4 Flexibility and changeability

SaaS provides significantly more flexibility than does On-Premise, enabling new business models:

> I am absolutely convinced that ByDesign with its on-demand-model has initiated the next generation ERP systems; therefore, plug-in business administration will become standard in our internet world and this will entail a very high increase in flexibility. Well, in fact, scalability without constraints (CP, manager product sales, SAP).

Resource variability. The increased flexibility with SaaS-ERPs is the result of a greater variability of resources. It becomes easier to add new functionalities by subscribing to the new modules. It is possible to start with the core functionalities and expand with new functionalities when required over time (Juell-Skielse and Enquist, 2012). Further, user quantities can be scaled up and down on a monthly billing basis (Armbrust *et al.*, 2009). The customer therefore has access to almost infinitely scalable resources and can adjust its requirements and the price to its economic situation.

Companies with a typically volatile business, e.g., seasonal or project-oriented, can therefore benefit most from SaaS-ERPs:

> For example: We have customers who have a strong Christmas season, so the shop is booming in Q4, but what about throughout the year? […] Or hotels in the Swiss mountains, they have a season that runs only from November to April. Approximately 50% of the hotel capacity of St. Moritz is only available in the winter season. In the summer they are closed. They always have to (re-)consider how far they have to run this business model […] We have exactly this issue [of volatile business], because these customers have project-dependent numbers of clients. They have some projects at their own customers' sites that last for half a year. Then our customers need 5 more ERP clients. They really need new clients then. And when the project is finished, then these clients will not be needed anymore (HW, CEO Dynamics, Microsoft).

The On-Premise customer requires peak-load capacity all the time, even if nearly all of this capacity remains unused most of the time:

> It is a further advantage for our customers and partners [of SaaS-ERP], that you can balance the peaks better. Today [for On-Premise-ERP], you need to buy complex and expensive infrastructure (hardware, databases, etc.) to balance your peaks for 2 × 2 months a year (PM, marketing manager, Microsoft).

Contractual binding. In SaaS, modules can be selected individually or, increasingly, only as a bundle: the customer must choose from diverse packages (e.g. normal user, light user, standard, advanced, ultimate package, etc.). These bundles generally force customers to rent modules they do not need; moreover this system restricts the choice in comparison to the On-Premise-ERP, where, typically, each module can be selected individually. But the reduction of choice may simplify the module selection, resulting in a lower selection effort. Furthermore, a change of package or the addition or removal of a module is done within a very short time frame with a few mouse clicks, whereas in an On-Premise system major module upgrades need installations, although minor module upgrades are simply unlocked using a license key. It is not possible to remove modules from On-Premise-ERPs; the maintenance contract cost can be reduced, but only if a given module will never be required later. However, the reduction of modules is not problem-free in SaaS either: since the historical data of the reduced module is no longer available, a prior migration to Excel or another database will be required.

Changes in a SaaS-ERP can be made on a monthly basis, whereas On-Premise contractual terms are usually longer, with a minimum duration of one year. In contrast, minimum numbers of user accounts are often not required in On-Premise systems, but are not uncommon in SaaS systems.

Ubiquity. The system architecture of SaaS requires a web access that is standardized and built on web technologies. This ubiquitous form of access allows location-independence and data access via several mobile devices by default. In On-Premise systems today, access from outside by internet or mobile devices can also be realized when web clients are available for the respective ERP system. Otherwise VPNs and client software have to be rolled out in addition to the standard On-Premise system:

> For example, companies that give their tax advisors access to their system, they say: "Close the books for the period". He gets one of these 10 user accesses and then he has access to the system from outside. He has nothing to install on his site. […] First of all, [with On-Premise] you need to ensure that your tax advisors can access your internal network. Then you need to

> install your front-end applications at his site. And this is something where a tax advisor says: Well, I cannot install front-ends for every customer, but if you have a web access with a certificate, then it is o.k (CP, manager product sales, SAP).

4.5 Configurability, customization and adaption

The adaption of software to the business processes is a common paradigm of ERP software, because the ERP system has to support the company's business processes (Palanisamy *et al.*, 2010, p. 621; Pozzebon and Pinsonneault, 2005). The resource-based view demands using the company's resources and skills optimally and strategically to support best their business processes. The standard ERP system must be customized, where needed. But customization should be limited to the minimum possible, because any adaption may be a source of error in future updates (Loh and Koh, 2004). ERP customization, then, has to be strategically important. Supporting processes that are strategically important should not be outsourced, if there is a risk that these skills or resources will become lost in future or may be taken over by competitors, e.g., by customizing the SaaS standard application. Because program adjustments made at the core of the instance affect all SaaS customers, the adaptability of SaaS-ERP is limited to the configuration options and interfaces that were thought of in advance:

> The problem is standardization. That means that the SaaS system is only as good as the requirements which can be covered by the standard; or in other words, how easy it is to parameterize at reasonable cost and how well suited the parameters are (DHT, channel manager, Microsoft).

> A disadvantage [of SaaS-ERP] is of course that we cannot fulfill all adjustments that may be required (MB, project manager, myfactory).

The partners of ERP producers may develop individualized sector-specific industry solutions, adapted at the core of the SaaS system. These sector-specific solutions are also difficult for the customer to adjust. There may be additional variability in an On-Premise-ERP, but core- and self-programming in On-Premise systems may incur very high costs and make the systems more difficult to maintain and update afterwards, but give customers the freedom to realize these changes:

> Of course, with On-Premise-ERP everything is possible, also with an All-in-One. With software programming everything is possible, but can I and will I pay for it? And is it affordable? And does this change still have a positive net benefit for me, if I invest a lot to get my very special solution? And then it is modified and therefore the principle of "never change a running system" should be applied, a principle which has to be rejected in a SaaS-ERP (CH, director Business ByDesign, SAP).

4.6 Security

With a SaaS system the customer must accept the loss of control over the data and application, and therefore will have no influence on the performance, nor on the data storage or backup system (Marston *et al.*, 2011, p. 181). But, a reliable and professional provider will always acquire much more expertise and know-how about the safe operation of ERP systems than a company with other core competencies ever can (Gill, 2011, pp. 46-47):

> There are definitely advantages with SAP [which is regarded as a trustworthy provider] as a very famous brand name (MB, technical staff of the sales division, SAP).

A trustworthy SaaS provider will need certificates to ensure professionalism and reliability:

> Business ByDesign has its own data storage. Business ByDesign runs in a high-security data center according to the SAS 70 standards. Moreover, SAP has the only data center that has a TÜV certificate [very high graded German technical supervisory association] for data centers. SAP achieved a PS 880 certification, certified by PwC and Ernst & Young, for our financial processes. Very few software solutions for medium-sized enterprises earn these certificates (CP, manager product sales, SAP).

Also, safety standards such as SSL-encryptions with corresponding certificates and high-tech data centers remedy the higher transmission and access risk (Höß *et al.*, 2009, p. 9). In contrast, these safety measures are not necessary in an On-Premise system, so neither trust-building measures, nor certificates or SSL-encryption are implemented in the standard. But, on the one side:

> There is virtually no company that is not connected to the internet. So, therefore, there is virtually no company that is not attackable over the internet (CH, director Business ByDesign, SAP).

However:

> 70% of data theft occurs in-house by employees (CP, manager product sales, SAP).

These risks have to be handled in-house by restrictive access rights. Provided that security standards similar to those of a data center are applied, then an On-Premise-ERP can achieve higher security if the system works autonomously, disconnected from the internet (with all the disadvantages of offline operation). However, the cost-benefit aspect of an autonomously operated ERP system can rarely be justified and achieved by SMEs.

4.7 Characteristics and dependencies of the operation modes

Cost certainty. One main advantage of SaaS-ERP is cost certainty and transparency because subscription costs are predictable. In an On-Premise-ERP, costs due to hardware malfunctions, installation problems, extra maintenance expenses, etc., are unpredictable and can occur anytime (Waters, 2005). These unpredictable costs may be partially outsourced by selecting an ASP-ERP system.

Performance and dependencies. SaaS-ERPs are generally OS independent, provided that multiple browsers are supported. The principle of accessing the software over a web interface can be an option for an On-Premise-ERP, but with a reduction in performance, as full clients are often faster than web clients. This reduced performance arises with SaaS as well, but with SaaS the web client is the only way to access the system. Furthermore, the SaaS system is dependent on the internet and its performance. Especially when a SaaS customer wants to use the ERP system as a content management system, the usually lower upload speed can be a real limitation. Moreover, a SaaS-ERP is highly dependent on the ERP provider. Should the provider discontinue the service, whether the discontinuation is planned or unplanned (e.g. due to bankruptcy), then all the customer can do is to change the system and export the data to a common format (e.g. Excel tables or SQL DB). On-Premise systems have the advantage that they can continue to operate even though the product has been discontinued. Thus, the timing of the system replacement can be postponed and planned effectively, in contrast to the SaaS-ERP. But:

> I suppose a company that has shifted its entire business onto an ERP system has per se a certain dependence. Whether this is Semiramis or a Microsoft Navision or whatever, there is

> always a high change hurdle to be overcome, when someone has implemented a system in the whole area (CP, manager product sales, SAP).

Service scope. SaaS-ERP systems are young, so the systems are often still under construction. For this reason, the scope of services and functionalities may be limited, and specialized industry-specific modules may not be available. In this case, if the functionality or service is indispensable for a company, then only an On-Premise-ERP can be selected, as the full scope of services is currently only available in this operation mode (Everdingen *et al.*, 2000, pp. 29-30; Keil and Tiwana, 2006, pp. 253-254).

Stability. With increasing standardization of ERP systems, their failure rate decreases:

> An advantage is the guarantee of its ability to run when you have implemented a pure standard. The ability to run is much higher, I think, than with an On-Premise, because a lot of changes are typically programmed (MB, project manager, myfactory).

SaaS-ERPs are de facto always on the standard, so a SaaS-ERP can be expected to have a lower probability of error than an On-Premise. Furthermore, a SaaS-ERP will face lower downtime, due to the fact that the SaaS-ERP system is located at the provider/ERP producer's site. The service personnel therefore have immediate access to the system, whereas in an On-Premise the service personnel must be contacted before they can begin to access and fix the problem.

5. Operation mode selection strategies

An ERP selecting customer has to select the proper ERP operation mode according to the general findings. The first step, the chartering phase (Markus and Tanis, 2000), involves evaluating the ERP candidates' coverage of the company's functional requirements to select the ERP system (Umble *et al.*, 2003). The highest compliance ensures functional alignment between the ERP system and the business processes. Hence, the ERP embedded structures have to comply with the organization's embedded structures to align the ERP system to the institutional context of the company (Soh and Sia, 2004). If the highest evaluated ERP system has operation mode alternatives, ERP selecting companies should, in a second step, strategically favor the operation mode best suited to the respective organizational characteristics. The following steps have to be considered when selecting ERP operation modes.

5.1 IT skills and IT resources

ERP selecting companies should check whether the IT department or IT professionals (if there are any) have the ability and capacity to take care of the ERP system. An On-Premise-ERP may be appropriate, e.g., when ERP customers say:

> We have an IT department of our own anyway, perhaps the servers are under-utilized, we do not need to buy something special, […] (CS, engineering and maintenance, myfactory).

In contrast, non-core competences imply higher complexity and require more investment into acquisition of the specific IT skills (Koslowski and Strüker, 2011). Selecting On-Premise-ERP would lead to higher costs of self-operation. It follows from the resource-based view that the main strategy in this case must be to outsource the operation, e.g., by taking a SaaS-ERP or by engaging a partner to host or maintain the system (Poppo and Zenger, 1998; Quinn and Hilmer, 1994; Watjatrakul, 2005). From the strategic point of view this strategy should also be adhered to when the loss of control over data and application is perceived as a significant security risk, because no

internal IT know-how is available to protect the data more professionally or in a more specific way than a provider would. According to the transaction cost theory, insourcing is recommended when a high specificity of the system is necessary to achieve a good functional fit (Watjatrakul, 2005). Therefore for a company with internal IT know-how, high need for procedural integration and the capacity to operate an ERP system, and especially when specific and strategic resources would be outsourced, On-Premise-ERP is clearly the more strategic choice (Nam *et al.*, 1996).

5.2 Agility and flexibility requirement

SaaS should be preferred when the business will not remain the same for the next several years, due to business development, seasonality, growth, expansion, etc:

> What we have just recognized as well, is that it [SaaS-ERP] is principally very much in demand in start-ups and joint ventures. That means in companies where it is clear that they will certainly grow in the next 2 to 3 years; principally, where the growth slope is already given due to their investment plan (CP, manager product sales, SAP).

High-market pressure and shorter funding cycles require revisions in the implementation strategy, especially for startups (Wagner, 2004), so the question of realigning the ERP system arises more often than was the case some years ago (Sprott, 2000). If flexibility and fast response are an important differentiation strategy for a company (Porter, 1998), the ERP system has to support these important business procedures functionally and technically with the respective operation modes. The more fixed an ERP system is, the more misaligned to the organization's embedded structure the system gets over time. SaaS-ERP systems can help especially to align the resource quantities (user, space, modules) to the economic situation and to the organization's needs, although this is limited to the standard structures and configurability.

5.3 Customization

Specialized modules and customization by programming may, according to the resource-based view, become a strategic resource through inimitability and better alignment of the business process (Barney, 1991; Watjatrakul, 2005; Xin and Levina, 2008). Strategic resources should be kept within the companies and continuously improved by internal skills, so On-Premise-ERPs are highly recommended in these cases. Hence:

> On-Premise should be chosen if I need a customized ERP-system which otherwise does not run as intended or when I need industry specific functions (DL, CEO, myfactory).

5.4 Performance

A further consideration in strategically evaluating the ERP operation modes is to look at the performance and the working requirements. The performance is considered a prerequisite, and therefore may be a strategic resource, when many, or especially continuous, interactions with the ERP system are involved in daily operations, e.g., many new orders each day, a short planning horizon with frequent replanning, or especially when high-data volume modules such as PPC and synchronized PDA-Terminals[4] are in use. In the case of SaaS-ERP, the more interactions with the ERP system are necessary each day, the better the internet connection performance must be. Today's internet lines are generally quite fast, but depending on the technology used in SaaS and the daily data traffic required, the internet line may nevertheless be too slow for a given customer. According the production cost economic

theory, the strategic operation mode for this customer must be On-Premise-ERP, because a slow internet line with a lot of waiting time for each user would mean a loss of efficiency from using the SaaS-ERP system. But when the web client performance is sufficient and especially when mobile access from outside the company is strongly required, e.g., for salespeople, maintenance technicians, etc., then SaaS is the strategically better solution.

5.5 Standardization vs specialization

The most strategic ERP operation mode, defined as delivering a unique type of value to the business (Porter, cited in Lee and Myers, 2004), can be achieved by assessing which criterion, specialization of the ERP system vs standardization with improved flexibility and agility, has to be weighted higher by the implementing customer. Customers with an ERP-differentiation strategy typically stress more the specialization and should rather select On-Premise-ERP systems. In contrast, customers with no IT skills and for which the ERP system is a simple standard working tool should rather outsource the technical ERP operation. SaaS-ERP providers are better placed to achieve overall cost leadership due to economics of scale. The lower production costs at the provider's site will lower the subscription fees for the SaaS-ERP subscribers. In this sense, the ERP operation should be outsourced if the production costs of an On-Premise-ERP will exceed the SaaS subscription fees.

5.6 Financial considerations

The company's own financial situation should be considered, besides checking which ERP operation mode is in sum higher in price, in the cases where there is no aim at differentiation with the ERP. ERP customers facing very high-capital costs, e.g., high-risk enterprises or startups, may reduce the capital amount required by choosing a SaaS- over an On-Premise-ERP system (Smith *et al.*, 1998). Further, ERP customers who want to outsource the risks and costs of operating the ERP system are better served by taking the SaaS-ERP solution.

6. Conclusion and limitations

This publication contributes to the extant literature by providing an unprecedented classification of the main ERP operation mode differences with their respective relative advantages. The contribution reveals that the SaaS-ERP systems are not superior in all respects to the On-Premise-ERP systems.

6.1 Implications on theory

Capital intensity. SaaS-ERPs reduce the frequency of transactions and lower the cost, in terms of capital search, contract negotiation and contract monitoring. According to the transaction cost theory, companies with low equity and low liquidity are better off with SaaS than with an On-Premise (cf. Section 4.1).

IT skills. The main argument of the resource-based view is the optimal allocation of resources. Specific IT skills unrelated to the main business may be complex; learning them requires investment (Koslowski and Strüker, 2011). If IT operation is a non-core competency and the company lacks the IT skills, then the ERP selecting customer is better served with a SaaS-ERP (cf. Section 4.2).

Agility and flexibility. Higher flexibility and more responsiveness may be the result of strategic resource combinations and may be an important differentiation advantage for the company. This flexibility or agility can be drawn from functional or operation mode

technical requirements. The latter requirements in the sense of greater recentness, configurability, changes in the number of users or modules, growth, seasonal variations and strong fluctuations in capacity can be better met by a SaaS-ERP system (cf. Sections 4.3-4.5).

Ubiquity and mobility. SaaS allows bundling of all information to one location. Bundling of information reduces the production cost, because data have neither to be added later nor to be synchronized with the ERP (cf. Section 4.4).

Customization. The optimal resource allocation requires using the company's abilities strategically to secure competitive advantages from them. In this respect, an ERP system should support the key business processes optimally, which may require adjustments to the ERP software. Hence, only and all strategically important adjustments should be made to the ERP software. Strategically important supporting processes, however, should not be outsourced, if there is a risk that these important competitive skills will be lost in the future or could be taken over by competitors (e.g. by adapting the SaaS-ERP standard; cf. Section 4.5).

Security. Security costs are unproductive but necessary expenses for companies without IT skills. A professional and reliable provider will always supply better and cheaper security systems than a company with other core competencies can, due to specialization and economies of scale (cf. Section 4.6).

Performance. Internet response times may distort efficiency of daily business, which directly affects production costs (cf. Section 4.7).

6.2 Practical implications

The typical ERP selection process has to be expanded so that the chartering phase includes the selection of the operation mode. The selection criteria should include all important operation mode differences that have been classified in this contribution, so that the ERP selecting company can deal with the relative advantages of each operation mode. In detail as the following.

Capital intensity. The lower capital intensity of a SaaS-ERP system reduces the need to raise capital in the financial market (cf. Section 4.1).

IT skills. SaaS-ERP reduces the need of IT skills (cf. Section 4.2).

Agility and flexibility. Companies can react faster to changes in business with SaaS, due to the shorter adjustment periods, usually monthly (cf. Sections 4.3-4.5).

Ubiquity and mobility. SaaS-ERP systems can be accessed ubiquitously, which allows integrated business processes within and outside of the company. Further, the higher mobility of SaaS-ERP systems supports collaboration and supply chain management better (cf. Section 4.4).

Customization. Customers should avoid outsourcing their important adjustments by choosing On-Premise ERP systems (cf. Section 4.5).

Security. If there are no special security requirements for the IT systems, ERP selecting customers should outsource by choosing SaaS. In contrast, companies with special security requirements as well as internal IT skills are better served by choosing On-Premise-ERP systems (cf. Section 4.6).

Performance. Delays due to long response times may impede the daily business and reduce the efficiency of daily work. If there is a risk of the internet response being too slow or if high-data traffic or frequent interactions slow the ERP system, then it is advisable to use an On-Premise-ERP system (cf. Section 4.7)

With each difference in ERP operation modes, there is a relative advantage to be gained by a selecting company if the company selects the ERP operation mode that corresponds to the company characteristics. The difference criteria, with the corresponding relative advantages, are the basis for developing the respective operation mode strategy. This includes the possibility of discussing the remaining disadvantages of the preferred ERP operation mode with the ERP partner, if applicable, with an aim to reducing them. Further, the classification highlights current and future gains of the respective operation modes.

Besides choosing the more advantageous of the operation modes in terms of technical differences, customers wish to implement the cheapest operation mode in the long run. This goal could be achieved by calculating the relative cost differences between the two operation modes for a specific case. Details of this calculation method are presented in Link and Back (2013).

6.3 Limitations

The research scope is limited with respect to the classification of typical ERP operation mode differences and their effects on the selection of ERP operation modes. Further, several conflicts in the selection strategies of each particular operation mode difference remain unresolved. For example, if the operation of the ERP system is non-strategic, but the specificity of the system means that it must be customized, the strategy with the first criterion should be outsourcing, but the second criterion opposes that. The problem in this situation has been addressed by Watjatrakul (2005), who recommended choosing the specificity over the non-strategic resource, because, in case of conflict, the transaction cost theory better explains an organization's sourcing decision than the resource-based view. However, few conflicts have been researched theoretically; which of the other criteria should be followed in case of conflict remains unclear. But there is a pragmatic approach to overcoming this limitation of this study: using the singular strategic selection factors for each operation mode difference and weighting them according to the ERP implementing customer's preferences.

This study has intentionally researched the two extremes, SaaS- vs On-Premise-ERP, in order to give evidence of the main systemic differences, although ASP- or intermediate forms between SaaS- and On-Premise-ERP may exist. In principle, the intermediate forms do not contradict the findings of this contribution, but each similarity to either SaaS or On-Premise will reduce some of the differences without generating new ones. For example, the operation and customization differences are reduced with an ASP-ERP, whereas cost disadvantages due to the independent instance remain.

Limitations may arise because the investigations were carried out at the ERP producers' premises, which are all located in Europe. There may be a sampling bias toward different cultures and nationalities. Another limitation is in the generalization of the results, which have been researched and evaluated by qualitative methods. The typical weaknesses and limitations of case study research and analytical generalization are applicable (cf. Yin, 2003, p. 85ff.). Beyond these limitations, deviant or discrepant cases, atypical settings, unique treatments or unusual events may be identified (Miles and Huberman, 1994). These cases are outliers or extreme cases of theory and have not been examined in this contribution. Possible deviations may be caused, e.g., by industry differences, by evolution and development of the ERP

products and their operation modes, by national laws, etc. Further, ERP customers usually have different requirements and characteristics and therefore have different viewpoints on the ERP system. The strategy of operation mode selection will obviously be influenced by the ERP customer's characteristics and requirements. This connection between the operation mode selection strategy and the characteristics was explored in Link (2013).

Notes

1. More information about the literature review, its search rules or the individual hits of the search terms with respect to the databases is available on request.
2. The seventh cluster as depicted in Table I emerged from case study analysis.
3. All interview quotations mentioned here have been translated from the original German.
4. Production Data Acquisition (PDA) is a software with a user-friendly surface for the end-user's data acquisition, which is directly interconnected to the PPC system. Typical data which are reported are: working hours, production data, production quantities, progression through working steps, machine and process data, etc.

References

Altaf, F. and Schuff, D. (2010), "Taking a flexible approach to ASPs", *Communications of the ACM*, Vol. 53 No. 2, pp. 139-143.

Armbrust, M., Fox, A., Griffith, R., Joseph, A.D., Katz, R.H., Konwinski, A., Lee, G., Patterson, D.A., Rabkin, A., Stoica, I. and Zaharia, M. (2009), "Above the clouds: a Berkeley view of cloud computing", Technical Report No. UCB/EECS-2009-28, University of California (UC), Berkeley Reliable Adaptive Distributed Systems Laboratory, Berkeley, CA.

Ayağ, Z. and Özdemir, R.G. (2007), "An intelligent approach to ERP software selection through fuzzy ANP", *International Journal of Production Research*, Vol. 45 No. 10, pp. 2169-2194.

Barney, J. (1991), "Firm resources and sustained competitive advantage", *Journal of Management*, Vol. 17 No. 1, pp. 99-120.

Benbasat, I., Goldstein, D.K. and Mead, M. (1987), "The case research strategy in studies of information systems", *MIS Quaterly*, Vol. 11 No. 3, pp. 369-386.

Benlian, A. and Hess, T. (2010a), "The risks of sourcing Software as a Service – an empirical analysis of adopters and non-adopters", *Proceedings of European Conference on Information Systems, paper 142, Pretoria, June 7-9*.

Benlian, A. and Hess, T. (2010b), "Chancen und Risiken des Einsatzes von SaaS – Die Sicht der Anwender", in Benlian, A., Hess, T. and Buxmann, P. (Eds), *Software-as-a-Service*, Gabler, Wiesbaden, pp. 173-178.

Benlian, A. and Hess, T. (2009), "Drivers of SaaS-adoption – an empirical study of different application types", *Business Information Systems Engineering*, Vol. 1 No. 5, pp. 357-369.

Bezemer, C. and Zaidmann, A. (2010), "Multi-tenant SaaS applications: maintenance dream or nightmare?", *Joint proceedings of ERCIM EVOL and IWPSE, ACM, Antwerp, September 20-21*, pp. 88-92.

Bhattacherjee, A. (2012), *Social Science Research: Principles, Methods and Practices*, (Vol. 3), USF Tampa Bay Open Access Textbooks Collection, Tampa.

Botta-Genoulaz, V. and Millet, P.-A. (2006), "An investigation into the use of ERP systems in the service sector", *International Journal of Production Economics*, Vol. 99 Nos 1-2, pp. 202-221.

Boyle, R.D. (2002), "Doing business with an application service provider", *Strategic Finance*, Vol. 83 No. 9, pp. 24-28.

Braß, D. and Zimmermann, R. (2010), "Software as a Service – am Beispiel einer business-intelligence-Lösung in der Logistik", *HMD*, Vol. 47 No. 5, pp. 42-51.

Buxmann, P., Hess, T. and Lehmann, S. (2008), "Software as a service", *Business & Information Systems Engineering*, Vol. 50 No. 6, pp. 500-503.

Chen, L. and Soliman, K.S. (2002), "Managing IT outsourcing: a value-driven approach to outsourcing using application service providers", *Logistics Information Management*, Vol. 15 No. 3, pp. 180-191.

Choudhary, V. (2007), "Comparison of software quality under perpetual licensing and software as a service", *Journal of Management Information Systems*, Vol. 24 No. 2, pp. 141-165.

Darke, P., Shanks, G. and Broadbent, M. (1998), "Successfully completing case study research: combining rigour, relevance and pragmatism", *Information Systems Journal*, Vol. 8 No. 4, pp. 273-289.

Deep, A., Guttridge, P., Dani, S. and Burns, N. (2008), "Investigating factors affecting ERP selection in made-to-order SME sector", *Journal of Manufacturing Technology Management*, Vol. 19 No. 4, pp. 430-446.

Dibbern, J., Goles, T., Hirschheim, R. and Jayatilaka, B. (2004), "Information systems outsourcing: a survey and analysis of the literature", *Data Base for Advances in Information Systems*, Vol. 35 No. 4, pp. 6-102.

Dubé, L. and Paré, G. (2003), "Rigor in information systems positivist case research: current practices, trends and recommendations", *MIS Quaterly*, Vol. 27 No. 4, pp. 597-635.

Everdingen, Y.V., Hillegersberg, J.V. and Waarts, E. (2000), "Enterprise resource planning: ERP adoption by European midsize companies", *Communications of the ACM*, Vol. 43 No. 4, pp. 27-31.

Farah, S. (2010), "Cloud computing or software as a service – which makes the most sense for HR?", *Employment Relations Today*, Vol. 36 No. 4, pp. 31-37.

Fulford, R. and Love, P.E. (2004), "Propagation of an alternative enterprise service application adoption model", *Industrial Management & Data Systems*, Vol. 104 No. 6, pp. 450-456.

Fuller, S. and McLaren, T. (2010), "Analyzing enterprise systems delivery modes for small and medium enterprises", *Proceedings of Americas Conference on Information Systems, paper 380, Lima, August 12-15*.

Gephart, R.P. (2004), "Qualitative research and the Academy of Management Journal", *Academy of Management Journal*, Vol. 47 No. 4, pp. 454-462.

Gill, R. (2011), "Why cloud computing matters to finance", *Strategic Finance*, Vol. 92 No. 7, pp. 43-47.

Grant, R.M. (1991), "The resource-based theory of competitive advantage: implications for strategy formulation", *California Management Review*, Vol. 33 No. 3, pp. 114-135.

Heart, T. (2010), "Who is out there? Exploring the effects of trust and perceived risk on saas adoption intentions", *Data Base for Advances in Information Systems*, Vol. 41 No. 3, pp. 49-68.

Herbert, L. (2007), "When Software-as-a-Service makes sense", *Supply and Demand Chain Executive*, Vol. 1, available at: www.sdcexec.com/

Höß, O., Weisbecker, A. and Spath, D. (2008), "Software as a Service – Potenziale, Risiken und trends", *Information Management & Consulting*, Vol. 23 No. 4, pp. 6-11.

Jayatilaka, B., Schwarz, A. and Hirschheim, R. (2003), "Determinants of ASP choice: an integrated perspective", *European Journal of Information Systems*, Vol. 12 No. 3, pp. 210-224.

Juell-Skielse, G. and Enquist, H. (2012), "Implications of ERP as service", in Møller, C. and Chaudhry, S. (Eds), *Re-Conceptualizing Enterprise Information Systems*, Springer, Heidelberg, pp. 129-151.

Kakabadse, A. and Kakabadse, N. (2002), "Application service providers (ASPs): new impetus for transformational change", *Knowledge and Process Management*, Vol. 9 No. 4, pp. 205-218.

Katzan, H. Jr and Dowling, W.A. (2010), "Software-as-a-Service economics", *The Review of Business Information Systems*, Vol. 14 No. 1, pp. 27-37.

Keil, M. and Tiwana, A. (2006), "Relative importance of evaluation criteria for enterprise systems: a conjoint study", *Information Systems Journal*, Vol. 16 No. 3, pp. 237-262.

Kim, W., Kim, S.D., Lee, E. and Lee, S. (2009), "Adoption issues for cloud computing", *Proceedings of International Conference on Advances in Mobile Computing and Multimedia, ACM, Kuala Lumpur, December 14-16*, pp. 3-6.

Koh, S.C., Gunasekaran, A. and Cooper, J.R. (2009), "The demand for training and consultancy investment in SME-specific ERP systems implementation and operation", *International Journal of Production Economics*, Vol. 122 No. 1, pp. 241-254.

Koslowski, T. and Strüker, J. (2011), "ERP-on-demand-plattform: Komplementäreffekte am Beispiel eines Nachhaltigkeits-Benchmarking-Dienstes", *Wirtschaftsinformatik*, Vol. 53 No. 6, pp. 347-356.

Lechesa, M., Seymour, L. and Schuler, J. (2012), "ERP Software as Service (SaaS): factors affecting adoption in South Africa", in Møller, C. and Chaudhry, S. (Eds), *Re-Conceptualizing Enterprise Information Systems*, Springer, Heidelberg, pp. 152-167.

Lee, J.C. and Myers, M.D. (2004), "Dominant actors, political agendas and strategic shifts over time: a critical ethnography of an enterprise systems implementation", *Journal of Strategic Information Systems*, Vol. 13 No. 4, pp. 355-374.

Lehmann, S., Draisbach, T., Koll, C., Buxmann, P. and Diefenbach, H. (2010), "SaaS-Preisgestaltung: Bestehende Preismodelle im Überblick", in Benlian, A., Hess, T. and Buxmann, P. (Eds), *Software-As-A-Service*, Gabler, Wiesbaden, pp. 155-169.

Link, B. (2013), "Considering the company's characteristics in choosing between SaaS vs On-Premise-ERP's", *Wirtschaftsinformatik Proceedings, Leipzig, 27 February - 1 March, Gabler, Wiesbaden*, pp. 155-169.

Link, B. and Back, A. (2013), "Systemic differences between SaaS- and On-Premise-ERP: an overview of a qualitative option calculation scheme", *AIS Transactions on Enterprise Systems*, Vol. 4 No. 1, pp. 11-23.

Loh, T.C. and Koh, S.C. (2004), "Critical elements for a successful enterprise resource planning implementation in small- and medium-sized enterprises", *International Journal of Production Research*, Vol. 42 No. 17, pp. 3433-3455.

Löwer, U.M. and Picot, A. (2002), "Web services – technologie-hype oder strategie-faktor?", *Information Management und Consulting*, Vol. 17 No. 3, pp. 20-25.

Markus, L.M. and Tanis, C. (2000), "The enterprise system experience – from adoption to success", in Zmund, R.W. (Ed.), *Framing the Domains of IT Management: Projecting the Future … Through the Past*, Pinnaflex Educational Resources Inc., Cincinnati, OH, pp. 173-207.

Marston, S., Li, Z., Bandyopadhyay, S., Zhang, J. and Ghalsasi, A. (2011), "Cloud computing – the business perspective", *Decision Support Systems*, Vol. 51 No. 1, pp. 176-189.

Mathew, M. and Nair, S. (2010), "Pricing SaaS models: perceptions of business service providers and clients", *Journal of Services Research*, Vol. 10 No. 1, pp. 51-69.

Matros, R., Rietze, C. and Eymann, T. (2010), "SaaS und Unternehmenserfolg: Erfolgskategorien für die Praxis", in Benlian, A., Hess, T. and Buxmann, P. (Eds), *Software-As-A-Service*, Gabler, Wiesbaden, pp. 239-254.

Mietzner, R., Metzger, A., Leymann, F. and Pohl, K. (2009), "Variability modeling to support customization and deployment of multi-tenant-aware software as a service applications", *ICSE Workshop on Principles of Engineering Service Oriented Systems, IEEE Computer Society, Vancouver, BC, May 18-19*, pp. 18-25.

Miles, M.B. and Huberman, M.A. (1994), *Qualitative Data Analysis – An Expanded Sourcebook*, 2nd ed., Sage Publications, Thousand Oaks, CA.

Moore, G.C. and Benbasat, I. (1991), "Development of an instrument to measure the perceptions of adopting an information technology innovation", *Information Systems Research*, Vol. 2 No. 3, pp. 192-222.

Nam, K., Rajagopalan, S., Rao, H.R. and Chaudhury, A. (1996), "A two-level investigation of information systems", *Communications of the ACM*, Vol. 39 No. 7, pp. 36-44.

Olson, D.L. and Wu, D.D. (2011), "Multiple criteria analysis for evaluation of information system risk", *Asia-Pacific Journal of Operational Research*, Vol. 28 No. 1, pp. 25-39.

Palanisamy, R., Verville, J., Bernadas, C. and Taskin, N. (2010), "An empirical study on the influences on the acquisition of enterprise software decisions: a practitioner's perspective", *Journal of Enterprise Information Management*, Vol. 23 No. 5, pp. 610-639.

Perera, H.S. and Costa, W.K. (2008), "Analytic hierarchy process for selection of ERP software for manufacturing companies", *The Journal of Business Perspective*, Vol. 12 No. 4, pp. 1-11.

Poppo, L. and Zenger, T. (1998), "Testing alternative theories of the firm: transaction cost, knowledge-based and measurement explanations for make-or-buy decisions in information services", *Strategic Management Journal*, Vol. 19 No. 9, pp. 853-877.

Porter, M.E. (1998), *Competitive Strategy: Techniques for Analyzing Industries and Competitors*, The Free Press, New York, NY.

Pozzebon, M. and Pinsonneault, A. (2005), "Global-local negotiations for implementing configurable packages: the power of initial organizational decisions", *Journal of Strategic Information Systems*, Vol. 14 No. 2, pp. 121-145.

Quinn, J.B. and Hilmer, F.G. (1994), "Strategic outsourcing", *Sloan Management Review*, Vol. 35 No. 4, pp. 43-55.

Repschläger, J., Pannicke, D. and Zarnekow, R. (2010), "Cloud computing: definitionen, Geschäftsmodelle und Entwicklungspotenziale", *HMD*, Vol. 47 No. 5, pp. 6-15.

Rogers, E.M. (2003), *Diffusion of Innovations*, 5th ed., The Free Press, New York, NY.

Sääksjärvi, M., Lassila, A. and Nordström, H. (2005), "Evaluating the software as a service business model: from CPU time-sharing to online innovation sharing", *Proceedings of IADIS International Conference on E-Society, Qawra*, pp. 177-186.

Sammon, D., Adam, F. and Carlsson, S. (2009), "CSF relationships in ERP project implementations: a collective case study", *Proceedings of Americas Conference on Information Systems, paper 744, San Francisco, August 6-9*.

Schubert, P. and Adisa, F. (2011), "Cloud computing for standard ERP systems: reference framework and research agenda", Working Paper No. 16, Institut für Wirtschafts- und Verwaltungsinformatik, University of Koblenz-Landau, Koblenz.

Schwarz, A., Jayatilaka, B., Hirschheim, R. and Goles, T. (2009), "A conjoint approach to understanding IT application service outsourcing", *Journal of the Association for Information Systems*, Vol. 10 No. 10, pp. 748-781.

Sharma, S.K. and Gupta, J.N. (2002), "Application service providers: issues and challenges", *Logistics Information Management*, Vol. 15 No. 3, pp. 160-169.

Shehab, E.M., Sharp, M.W., Supramaniam, L. and Spedding, T. (2004), "Enterprise resource planning: an integrative review", *Business Process Management Journal*, Vol. 10 No. 4, pp. 359-386.

Shukla, S., Agarwal, S. and Shukla, A. (2012), "Trends in cloud-ERP for SMB's: a review", *International Journal of New Innovations in Engineering and Technology*, Vol. 1 No. 1, pp. 7-11.

Smith, M., Mitra, S. and Narasimhan, S. (1998), "Information systems outsourcing: a study of pre-event firm characteristics", *Journal of Management Information Systems*, Vol. 15 No. 2, pp. 60-93.

Soh, C. and Sia, S. (2004), "An institutional perspective on sources of ERP package–organisation misalignments", *Journal of Strategic Information Systems*, Vol. 13 No. 4, pp. 375-397.

Sontow, K. and Kleinert, A. (2010a), "ERP-as-a-Service zwischen Euphorie und Skepsis", *Industrial Engineering*, Vol. 63 No. 3, pp. 10-18.

Sontow, K. and Kleinert, A. (2010b), "Software as a Service – Die schlanke Zukunft für ERP-Lösungen? Ergebnisse eine Anwenderbefragung", *ERP Management*, Vol. 6 No. 4, pp. 24-27.

Sprott, D. (2000), "Enterprise resource planning: componentizing the enterprise application packages", *Communications of the ACM*, Vol. 43 No. 4, pp. 63-69.

Strauss, A. and Corbin, J. M. (1998), *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*, 2nd ed., Sage Publications, Thousand Oaks, CA.

Subashini, S. and Kavitha, V. (2010), "A survey on security issues in service delivery models of cloud computing", *Journal of Network and Computer Applications*, Vol. 34 No. 1, pp. 1-11.

Tornatzky, L.G. and Klein, K.J. (1982), "Innovation characteristics and innovation adoption-implementation: a meta-analysis of findings", *IEEE Transactions on Engineering Management*, Vol. 29 No. 1, pp. 28-43.

Umble, E.J., Haft, R.R. and Umble, M.M. (2003), "Enterprise resource planning: implementation procedures and critical success factors", *European Journal of Operational Research*, Vol. 146 No. 2, pp. 241-257.

vom Brocke, J., Simons, A., Niehaves, B., Riemer, K., Plattfaut, R. and Cleven, A. (2009), "Reconstructing the giant: on the importance of rigour in documenting the literature search process", *Proceedings of European Conference on Information Systems, Verona*, pp. 2206-2217.

Wagner, C. (2004), "Enterprise strategy management systems: current and next generation", *Journal of Strategic Information Systems*, Vol. 13 No. 2, pp. 105-128.

Wang, Y.-S., Wu, S.-C., Lin, H.-H., Wang, Y.-M. and He, T.-R. (2012), "Determinants of user adoption of web ATM: an integrated model of TCT and IDT", *The Service Industries Journal*, Vol. 32 No. 9, pp. 1505-1525.

Waters, B. (2005), "Software as a Service: a look at the customer benefit", *Journal of Digital Asset Management*, Vol. 1 No. 1, pp. 32-39.

Watjatrakul, B. (2005), "Determinants of IS sourcing decisions: a comparative study of transaction cost theory versus the resource-based view", *Journal of Strategic Information Systems*, Vol. 14 No. 4, pp. 389-415.

Weiping, L. (2009), "An analysis of new features for workflow system in the SaaS software", *Proceedings of International Conference on Information Systems, ACM, Milan, May 6-10*, pp. 110-114.

Wortmann, J.C., Don, H., Hasselman, J. and Wilbrink, A. (2012), "Enterprise information systems as a service: re-engineering enterprise software as product-service system", in Frick, J. and Laugen, B.T. (Eds.), *Advances in Production Management Systems – Value Networks: Innovation, Technologies and Management*, Vol. 384, Springer, Berlin and Heidelberg, pp. 496-505.

Wu, W., Lan, L.W. and Le, Y. (2011), "Exploring decisive factors affecting an organization's SaaS adoption: a case study", *International Journal of Information Management*, Vol. 31 No. 6, pp. 556-563.

Xin, M. and Levina, N. (2008), "Software-as-a Service model: elaborating client-side adoption factors", *Proceedings of International Conference of Information Systems*, *Paris*, paper 86, December 14-17.

Yin, R.K. (2003), *Case Study Research. Design and Methods*, Sage Publications, Thousand Oaks, CA.

Zorn, T. and Campbell, N. (2006), "Improving the writing of literature reviews through a literature integration exercise", *Business Communication Quarterly*, Vol. 69 No. 2, pp. 172-183.

Appendix 1. Definitions

Applications

ERP

The application type ERP is a set of functional modules that support the core activities of a company (Perera and Costa, 2008, p. 1). These modules include all essential information about the stakeholders (suppliers, customers, employees and so on), processes and resources of a company and most importantly encompass all needed modules, including finance and accounting, marketing, logistics, sales, purchasing, PPC, HRM and warehouse management (Shehab *et al.*, 2004, pp. 362-365). There is no specific functional range for all ERPs; that depends primarily on the requirements of the implementing company (Botta-Genoulaz and Millet, 2006).

Operation/delivery modes of applications

On-Premise and hosting

The term On-Premise software refers to the traditional mode of software operation, characterized by the purchase of a license, as well as by the need to install a local instance of the software and for the customer to maintain it (Xin and Levina, 2008, pp. 4-5). The hosted application is an On-Premise installation in a private cloud, which can be operated internally or outsourced to a third party (Schubert and Adisa, 2011). Most existing ERP systems are currently only offered as an On-Premise. Each customer therefore has its own customizable ERP system.

ASP

ASP is an intermediate form of operation, in which the software, hardware, support and hosting is offered by a provider and rented as a service by a customer (Jayatilaka *et al.*, 2003). In contrast to an outsourced hosted On-Premise application, in which the software must be purchased and installed by the application customer, the application service provider also rents the application to the customer. In this respect, the ASP operation mode is not different from a SaaS offering. The differences are in the details, because the ASP does not have multi-tenant capability and runs on a private cloud: each application is offered as its own customizable instance, and each instance has to be maintained individually (Benlian and Hess, 2010a). As with an On-Premise application the ERP provider acquires the necessary licenses and maintenance contracts in order to keep the software up to date (Choudhary, 2007). Economies of scale can only be gained with the technical infrastructure, not with the application operation and maintenance.

SaaS

SaaS is a form of IT outsourcing in which the operation, as well as the hardware and software maintenance, are undertaken by the provider. The customer rents the application as a service over a specific period (usually monthly), that typically includes the use of the software and hardware, as well as the software maintenance and updates (Braß and Zimmermann, 2010; Höß *et al.*, 2008). The software is accessed without a local installation, through a web interface on the provider's servers (Höß *et al.*, 2008; Schubert and Adisa, 2011). In contrast to ASP, SaaS allows for pooling multiple customers on one application and database (multi-tenancy) and is consequently built on internet technology (Bezemer and Zaidmann, 2010; Höß *et al.*, 2008).

Appendix 2

ERP producer	Description of the criteria for selection	Number of interviews/interviewees' position
Abacus	Medium sized; dominant in Switzerland. Launched first SaaS version in March 2010	2[b] interviews (without recordings, notes were taken instead): development; customer relationship
myfactory (Switzerland)	Small; has provided the ASP mode of operation in Germany since 2002; has offered the SaaS mode of operation since November 2006; the first SaaS-ERP mover in the EU	4 interviews (4 recordings) CEO; project manager; support, advice and course management (individual training), engineering and maintenance
Microsoft Dynamics (Switzerland)	Medium sized; currently, partner hosted solutions are available, but no own SaaS-ERP offering. One is being planned as a part of the Microsoft Azure cloud strategy. A first full SaaS-based approach can be seen with the ERP trial account: tryERP (www.tryerp.ch)	5 interviews (with 6 persons; 5 recordings) CEO Dynamics Switzerland; marketing manager; product manager; technical specialist; large deal specialist; channel manager
SAP (Business ByDesign – Germany)	Very large, dominant position; on the market since 2007 with Business ByDesign; solution highly customizable; benchmark for other producers	4 interviews (4 recordings) Former head of Business ByDesign; director Business ByDesign; technical staff of the sales division; manager product sales

Notes: [a]More and more detailed information about the ERP vendors will be provided on request; [b]The ERP producer did not approve more or more intensive interviews

Table AI.
Data origin of the multiple case study[a]

Appendix 3

SaaS-ERP	On-Premise-ERP (OP-ERP)
Total cost of ownership/ERP system costs	
Pricing	
Monthly service fee to rent ERP system	License costs
No additional service contracts will be required	Annual ERP maintenance fee to obtain updates
Preserves liquidity	Service contracts may be required to get installations and general support services
	Liquidity is needed for license purchase
Installation Cost (ERP)	
Already installed on the provider's servers	Preliminary installation costs to set up the hardware and software
No preliminary installation cost	
Registration fees for the activation of the account may be charged, but usually are not	ERP installation onto customer's own servers prior to the first use
Infrastructure and operating system maintenance cost	
No infrastructure and system maintenance cost	Infrastructure must be provided first
	The costs of the infrastructure acquisition and operation must be paid by the customer
Operation, hardware and software maintenance, updates	
IT professionals	
No IT professionals needed	IT professionals required for hardware deployment and software installations
Installation difficulties	
No installation difficulties can arise since only an account has to be created	Installation difficulties and delays may arise with the hardware provisioning (e.g. Windows server settings), the hosting of the system and the installation of the ERP system itself
Updates	
Included in subscription fee	Included in maintenance contract
All of the releases have to be adopted, since there is only one instance which can be updated	Extra expense for updating the hardware and operating systems
	Service contract to outsource the update effort
	Not forced to adopt all releases
Release/update interval	
Slightly shorter update interval	Fixed update interval (e.g. 2 times a year)
Only one single standardized system needs to be maintained	The closer the OP system is to the standard, the faster the system can be updated
	Multiple instances must be maintained
Backup	
Reliable and professional data backup is a basic prerequisite	Customer is responsible for the security and data backups
Loss of control over data and backup	Customer bears the costs himself
Initiation and implementation	
Implementation time	
Significantly shorter time for implementation	No quick implementation
No hardware needs to be provided/no installations have to be done	Hardware must be provided and installations have to be done
All that is required is the creation of an account	System is usually not pre-configured for quick use

Table AII.
Framework of ERP operation mode differences

(*continued*)

Preliminary project	
The more complex the SaaS system is and the more options are available, the more intensive the preliminary project will be	Preliminary projects are essential to adjust the configuration settings to the customer's needs
It would be almost impossible to find the proper configuration settings without a preliminary project	The duration and costs may be higher than with SaaS-ERP
Data migration costs are identical to OP-ERP	Data migration costs are identical to SaaS-ERP
Training	
Web videos or web learning can be centrally integrated into the system	Traditional individual and group training is still predominant
Equal or lower costs of training, depending on the training concept and the software	The integration of web videos and web learning needs the use of permanent hyperlinks, since multiple instances exist
	In principle, training concepts similar to those used in a SaaS-ERP would be quite feasible
Flexibility, changeability	
Upscaling of modules	
Additional modules can be chosen within a very short time frame if needed	Adding modules may result in major changes: e.g., if another ERP-package has to be installed to get the additional module, then the old package has to be uninstalled and the new one re-installed
Downscaling of modules	
Reduction of the service possible→non-required modules can be deselected at any time	No license return and cash back with a software buy
Reduction causes the problem that the historical data of the reduced module is no longer available, so that a prior data migration to Excel or another database is necessary	Only the maintenance (contract) costs can be reduced
	By reducing the maintenance fee, customer risks paying an extra fee if an updated version of the module should be reactivated in future
	No data migration for reduced modules needed
Selection of modules	
Bundling modules into subscription offers may reduce flexibility→not all modules can be rented individually	Typically only required modules will be purchased→each module can be selected individually
Variation of user's width of functionality for the purpose of price classifications (normal user vs light user)	
User scalability	
The required number of user accesses can be adapted to the existing needs on a monthly basis	No compensation for seasonal fluctuations
Compensation for seasonal fluctuations (e.g. Christmas trade, annual financial statements, inventory taking, …)	Peak-load capacity has to be provided, even if this capacity will be unused most of the time→idle time
	If the capacity limits have been reached then the expansion costs will be step-fixed
Contractual binding	
Change may be strongly constrained by minimum quantities or long notice periods	Typically long-term-oriented contractual terms (1-3 years)→changes can only take effect much later
Changes can typically be made on a monthly basis	Premature module increases can be negotiated
	Premature reduction is rarely possible

(*continued*)

Table AII.

Ubiquity	
Location independent: accessible from anywhere, even mobile at no additional cost Data access via mobile devices	Running the system independent of the location possible if the customer hosts the system The customer will bear the hosting costs Mobile access can be enabled if a license is purchased for this respective module or for a terminal server software
Customization, configurability and adaption	
Customization	
Customizability limited through predefined configuration options Individualization by sector-specific industry solution feasible: ERP-partner can host individualized sector-specific industry solutions Customization using standardized interfaces and web services is possible at any time Neither core-programming nor self-programming is possible	Unlimited user-adaptable solution, because no third party is affected by the adaption Allows core- and self-programming Core- and self-programming incur very high costs
Configurability	
Mostly configurable and preconfigured System can be used immediately	Can usually be configured (precondition of standard ERP packages) Degree of self-configuration is rather low
Security	
Certificates	
Measure of trust-building to ensure professionalism and reliability	Not needed
Encryption	
SSL encryption with the corresponding certificates used by default Access and transmission risk higher because data leave the company	SSL encryption can be applied too, but it is up to the customer to obtain the necessary certificates No data transmission outside the company necessary
Characteristics and dependencies	
Cost certainty and transparency	
Costs can be estimated, because each month the use of service can be verified Predictable costs based on usage price lists	Complete cost certainty not possible, because hard- and software failures can arise any time; maintenance costs can be roughly estimated in advance Difficult to delineate costs incurred by the ERP system vs other IT
OS independence	
OS independence is provided through web access and is limited by the number of supported browsers	OS independence through web interface is possible for hosted OP systems as for SaaS-ERP
Service scope	
Limited due to the implementation of standard modules: specialized modules are often not available	Full scope is available from most of the ERP producers
Content management	
No need of own servers for a simple content management system Upload speed often limited by internet provider	Performance is dependent on the customer's own infrastructure

Table AII. (*continued*)

Dependence on the provider	
ERP provider's discontinuation of the SaaS system always requires the customer to replace the system	System replacement not immediately necessary; system can proceed on its own, without ERP producer's support
Data export into general format (Excel, SQL, …) required before the system is discontinued	System exchange can be planned and the data can be migrated directly into the new system
Dependence on internet	
Highly dependent on the internet and its performance	Not dependent on the internet locally
Internet connection availability can be improved by establishing a second line (e.g. mobile)	Dependent when other locations need access to the main location
Stability and failure rate	
Reduced failure rate due to the standardization	The more standardized the system is, the less prone to errors the system will be, the lower the error probability
Less downtime, because system is located at the provider/ERP maker and therefore more accessible to the IT service personnel	More downtime on average, because the support message must be carried over to the required service personnel; the service personnel can only then access the system and fix the problem

Table AII.

About the authors

Björn Link, MA HSG, received his Masters Degree in Law and Economics from the University of St Gallen (HSG). In 2009 he started as an external PhD student with the doctoral thesis about operation modes of ERP systems to enable ERP customers to select the proper ERP operation mode in respect to their characteristics. Professionally, MA Björn Link gained experiences in business process management reengineering in SME's of the micro circuit industry and has already practically evaluated, selected and implemented On-Premise ERP systems. Björn Link is the corresponding author and can be contacted at: bjoern.link@student.unisg.ch

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