Considering the Company's Characteristics in Choosing between SaaS vs. On-Premise-ERPs

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Abstract. Today, companies selecting an ERP must decide between SaaS- and On-Premise-ERP. This special topic of deciding between ERP operation modes has not been addressed since the first SaaS-ERP system was introduced. To provide guidance in the selection of ERP operation modes, systemic differences between SaaS and On-Premise have been researched and considered together with the company's characteristics. For this purpose a short list of all main systemic operation mode differences is presented. These differences are the starting point for matching the company characteristics with the respective operation mode. 7 single case studies of ERP customers have been conducted and analyzed for the purpose of developing these claims of superior fit and offering first evidence of their validity. The case study results, as well as the developed claims, show the ERP selecting reader which characteristics fit best with which operation mode, enabling him to take all main criteria into consideration.

Keywords: ERP operation modes, SaaS-ERP, company characteristics, systemic difference, decision support

1 Introduction

Relatively complex IT systems such as ERPs[1] could until recently only be operated as licensed products on local servers. The SaaS[2] innovation, drawing on existing technology, made it possible for the first time for providers not only to offer a more complex system but also to deliver it over the Internet. However, the high complexity of an ERP system and the requirement that it be in line with all the customer's internal procedures makes the selection of the operation mode in ERP systems a special case [7]. This selection is not as easy as for clearly defined applications, such as word processors. Each new operating model allows additional application options; the question for research is then which of the two operating modes, SaaS or On-Premise (abbr.: OP), offers better long-term value in a particular ERP case. It is then left to each

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[1] Enterprise Resource Planning is a set of functional modules that support the core activities of a company. More concrete definitions are available, e.g., in: [18] or [24].

[2] Software as a Service. This contribution follows the definitions of: [16]; further: [3], [10], [21], [32].

company to select those solutions that offer the lowest cost with the best possible support for their operational procedures.

For that purpose it is necessary to identify all the main criteria that can influence the ERP operation mode selection. Two crucial factors determine whether a SaaS- or an OP-ERP should be selected: the systemic differences between the ERP operation modes and the characteristics of the selecting company. The first factor has been previously investigated by the author and the results will be briefly summarized in the next section. This contribution hence deals with the second factor: the different customer characteristics as they relate to the systemic differences of ERP operation modes. The intent is to extract general characteristics that perform best with one of the two ERP operation modes. This paper lays the foundation in a qualitative way by using case study research to investigate different company characteristics and align them to the respective systemic operation mode differences. After a brief description of the research method in the 3rd section, all these characteristics will be identified and matched to the respective systemic differences in the 4th section. This paper closes with a short discussion in the 5th section and the conclusions in the 6th section.

2 Previous Research and Results

A "rigorous literature review" as described by vom Brocke et al. had been conducted to gain insight into what already exists [30]. This literature review enabled a detailed exploration of all existing general operation mode differences between cloud computing and OP, which may be applied to the more specific domain of ERP operation modes and further to identify the remaining research gap with respect to the more specific ERP operation mode differences [9]. The data from the literature were analyzed using both open coding and operation mode-contrasting meta-matrices. The matrix thus obtained, when analyzed using pattern coding, revealed 6 main pattern clusters and many systemic differences [17], [28]. The applicability of the general differences found in the literature had been investigated by case study research at ERP producers' premises. This investigation enabled the applicability to be verified, with the inappropriate differences discarded and the general operation mode differences extended by further ERP special systemic differences. These case studies moreover provided more background information, allowing explanations to be found for the systemic differences or a better understanding of their contexts. In total, 15 interviews with 4 different ERP producers had been conducted and transcribed. The data collection was supplemented by document analysis (Web sites, informational material, pricing lists, internal documents, etc.), researcher's notes and real artifacts (ERP systems, test accounts, instructional videos) [2], [6], [34]. These case data were analyzed using selective and open coding and were structured in a contrasting meta-matrix where operation-mode specific explanations and contextual information had been assigned to the respective systemic difference criteria [17], [28]. The meta-matrices for each case had been condensed to an aggregate contrasting meta-matrix; the most important systemic differences are depicted in Table 1 using a replication-logic [34].

Table 1. Classification of Differences between SaaS- and OP-ERP

SaaS-ERP	On-Premise-ERP
Total Cost of Ownership / ERP System Costs	
Liquidity saved (+)	License costs (-)
Registration is sufficient to access system (+)	**Installation:** time and money needed to install
Maintenance, updates, releases included in service (+)	ERP system (-)
No special **service contract** needed (+)	Installation difficulties may arise (-)
Subscription costs: service fee to rent ERP system,	**Maintenance** contract required (-)
may or may not be monthly usage-dependent (-)	**Service contracts** are often required (-)
Operation, Hardware and Software Maintenance, Updates	
Neither IT professionals nor IT know-how needed (+)	Not forced to adopt all **releases / updates** (+)
No special hardware or infrastructure needed (+)	IT professionals or ERP-partner needed to deploy
Incremental **release / update interval** and immedi-	ERP system (-)
ately available (+)	**IT infrastructure** must be acquired first, incurring
Multitenant capability allows bundling of multiple	acquisition costs (-)
customers to achieve **economies of scale** (+)	**Updates / releases** are bundled; some innovations
All **releases / updates** have to be adopted (-)	will only be available in the new version (-)
Loss of control over ERP system, backups and data (-)	**Backup** is the customer's responsibility (-)
Initiation and Implementation	
Shorter **implementation time**, because no hardware or	No pre-configuration (-)
software needs to be acquired (+)	Traditional individual and group classroom learn-
Pre-configuration allows immediate operation (+)	ing predominates (-)
Training concepts (**Web- or E-Learning**) result in	
lower cost and in less time (+)	
Long **migration projects** may partially offset the	
shorter implementation time (-)	
Flexibility, Changeability	
Flexibility in module scaling (+):	Modules can often be selected individually (+)
service extension by adding modules or	No minimum number of users (+)
service reduction by deselecting modules	Typically inflexible to change (-)
Number of users can be changed each month → "pay	**module extension** generally incurs high imple-
as you go" principle (+):	mentation cost (installation, migration, etc.)
compensation for **seasonal fluctuations** (+)	**module reduction** not possible, only reduction of
Short **change periods**: most monthly (+)	maintenance contract
Bundling of modules (-)	**Peak-load capacity** has to be provided (-)
Location independence of system access / access via	Capacity expansion requires investment (-)
mobile devices (+)	Long **contractual terms**: most 1 to 3 years (-)
Minimum number of users (-)	
Data history of reduced modules must be migrated (-)	
Customization, Configurability and Adaption	
Strongly configurable (+)	Unlimited user-adaptability (+)
Pre-configured (+)	**Programming** and **major adaption** incur high costs (
Limited customizability (-)	)
	Few options for self-configuration (-)
Security	
Certificates ensure professionalism and reliability (+)	**Highly sensitive data** can be better protected (+)
SSL-encryption (+)	**Backup and professional maintenance** is the
Loss of control over data and application (-)	responsibility of the customer. Therefore safety
Higher access and transmission risk (-)	gaps may arise, when not well done (-)
Further Characteristics	
Cost certainty and transparency (+)	Full scope of services and modules available (+)
OS independence (+)	**Full-clients** are faster than Web-clients (+)
No specialized modules available (-)	No immediate system replacement in case of
ERP customer has no influence on the **performance**(-)	**discontinuation** needed (+)
Depends on the internet speed; lower upload-speed (-)	**Cost accrual** difficult: ERP system vs. other IT (-)
Discontinuation of ERP system requires replacing it(-)	Hard- and software failure is at customer's risk (-)

Legend: (+) Advantages   (-) Disadvantages / Expenditures

3 Method

The previous section shows a classification of systemic criteria that does not consider the customers' perspectives, situations and characteristics. This contribution fills this gap by conducting 7 single case studies with multiple sources of evidence [34]. The company is used as the unit of analysis; its characteristics, considered to be the main factor in ERP operation mode selection, are analyzed to identify ERP customers' general selection strategies [34]. For each single case, semi-structured interviews were conducted with the key information persons; an interview guide, developed using the information described in the classification section, had been made available in advance. All interviews were transcribed and analyzed. The information obtained was enriched through document analysis (Web sites and internal documents) and the researcher's notes [2], [6], [34].

The case companies were chosen by looking for variety in operation modes, sectors, sizes and characteristics. The choice was also limited in time. The ERP system had to have been introduced a maximum of 3 years previously, to avoid losing useful information and to ensure that the selecting company did have a choice between a SaaS and an OP. In addition, the intention was to take into consideration only those companies that had actively chosen between the two ERP operation modes, but unfortunately this criterion remained in use only for all SaaS-ERP implementing companies. No OP Company could be found, which had evaluated a SaaS system in detail. All of them rejected the SaaS in the pre-evaluation phase, for diverse reasons (case 1: company characteristics; case 4: personal preference; case 6: functional reason, no offer found; case 7: functional reason and personal preference). Lastly, multiple ERP solutions were examined to avoid a bias towards a certain ERP product. The cases are briefly described in the annex.

The case data were analyzed using selective coding with the systemic difference criteria as coding parameters [28]. The data were structured in a case ordered meta-matrix (as described by Miles & Huberman [17]) which crosses the case with a characteristic criterion, as can be seen in the annex. This matrix allowed replication to be identified and enabled the hypotheses to be constructed in relation to the respective contexts, discussed in the next section [34]. The reliability of the hypothesis, graded according to the replication found in the data, is shown after each hypothesis: "Strong evidence" means that the hypothesis statement and interrelation were found in most of the cases; "weak evidence" shows that the hypothesis statement was found in one of the cases without contradiction by other cases; "evidence not consistent" indicates that there were cases that supported and cases that contradicted the hypothesis. The hypothesis was rejected (not supported) when only contradicting cases to the hypothesis statement were found.

4 Case Company Characteristics: Case Study Results

A company usually selects an ERP system according to functional criteria [11]. For this purpose, most of the implementing companies formulate requirements and evalu-

ate according to these, to get a list of the most appropriate ERP systems (cf. [29]). The requirements themselves are derived from the company's needs. But the needs are nothing other than a characterization of the company. In effect, the company's characteristics are the main determinants of the company's needs, which are in turn used to formulate the requirements. This principle should hold when comparing different ERP operation modes as well, because the operation mode differences can generate advantages when the company's requirements are best met. Therefore a company characteristic should be directly assignable to an operation mode difference criterion. Hence, it is presumed in this contribution, that the company characteristics have a direct relationship to the operation mode selection. To collect evidence for this hypothesis, each characteristic of the case companies should be isolated and compared with the operation mode differences. Hence, for this purpose all determined characteristics of the case companies that favor a particular operation mode advantage will be discussed and classified in the categories used in section 2.

4.1   Total Cost of Ownership / ERP System Costs

Financial Power. One of the main critical characteristics is the financial power of a company, especially when an OP-ERP is to be implemented. Purchasing a license creates a high financial burden on the company. Company 6 indicated that the system was a very high burden on its finances and could only be realized by long-term planning and putting aside money for the ERP system. This was necessary to meet the high purchase price without having to fund the system with external loans. For company 7 the price represented a high financial burden too, and the company was not able to fund the ERP system. The company instead leased the ERP from the ERP-partner. In case 4, a short-term bank loan was taken out to finance the ERP system, creating a high financial burden for a short time frame. Only company 1 indicated that the ERP system was not a high financial burden. One reason may be the lower prices of the myfactory software in comparison to its competitors. But even if this is the reason in case 1, the affordability of an OP-ERP system is directly dependent on the financial situation of the company. So when not enough capital is available to buy the system, loans are needed or the system must be leased.

Claim 1:   SaaS-ERP is the better choice, when the system is a high financial burden due to high interest rates.   [we][3]

Investment Advantage. Another option would be to choose SaaS, for which no licenses have to be bought. This investment advantage was utilized by company 5 specifically to avoid using all its starting capital for the ERP system. According to company 5's predictions, SaaS will cost more in the long run. The same statement was given by company 3, but not by company 2. It seems to depend on the specific case situation and option calculation between the two operation modes, whether SaaS or OP costs more in the long run. One further criterion in this respect is the size of the company, because the size is most often directly related to the number of users to be

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[3] se = strong evidence, we = weak evidence, ne = no evidence; enc = evidence not consistent; ns = not supported

paid for. Company 3 has 10 full users and 25 light users, far more than the 3 users of companies 2 and 5. This may explain why SaaS may be more expensive than OP in the long run for company 3, but cannot explain the different projections of the comparable companies 2 and 5.

Claim 2: SaaS-ERP is better suited to preserving liquidity. [se]

Claim 3: SaaS-ERP is less expensive for small companies even in the long run. [enc]

4.2 Operation, Hardware and Software Maintenance, Updates

Maintenance. Some companies have IT personnel or at least know-how to operate and maintain the ERP system. The others, especially the small companies, have no IT know-how (companies 2, 3, 4, 5), and must purchase these services from an IT-partner if using an OP [4]. This holds even for companies with IT know-how: companies 4, 6 and 7 engage ERP-partners to maintain their OP-ERP systems. But in cases 6 and 7, the hardware maintenance is done by their own personnel, whereas in case 4 the hardware maintenance is also transferred to the ERP-partner. Only company 1 does all its own maintenance.

Claim 4: SaaS-ERP should be selected when the company is not in a position to maintain the ERP system on its own. [enc]

Claim 5: SaaS-ERP should be selected when the company is not in a position to maintain the hardware on its own. [se]

IT Know-how. Engaging an ERP-partner to maintain the ERP system is not required when using a SaaS-ERP, because the provider handles all the operation and maintenance [15]. Hence SaaS is simply the better choice, when no IT know-how is available and the service has to be purchased anyway [22], [33]. In contrast, an OP would be better when IT personnel are on site or the specific IT know-how creates a competitive advantage, which would be outsourced with a SaaS (cf. knowledge-based view: [23]). Exactly this would have been the case with company 1 if it had opted for a SaaS. As an IT security specialist, company 1 chose an OP system, even though it has only 6 employees, which would be a typical size for a SaaS. Companies 2 and 5 are small sized and are pure software users. They have neither the IT know-how nor the human resources to operate an ERP system. In contrast, companies 6 and 7 have (part-time) IT officers and have the essential know-how to operate the ERP system as an OP. Company 3 has some IT know-how and outsources the IT when it can be operated with more reliability or at a lower price. This case is therefore not clear-cut, but does not contradict the assumptions stated here. Company 4 is a contradicting case, where an OP-ERP is operated with no particular IT know-how. Company 4's need for customization was paramount; it will likely create a part-time IT job in the future.

Claim 6: OP-ERP should be selected when a competitive advantage would be outsourced by taking a SaaS-ERP. [se]

Claim 7: SaaS-ERP is the better choice, when no IT personnel or no IT know-how is available. [we]

Backup. A professional backup is an important advantage of SaaS, as was mentioned by company 5. All companies using a SaaS-ERP are assured of professional and se-

cure backups of all the ERP data. Company 7 does its own backup, but this backup is maintained by the ERP-partner to achieve a high data reliability and security. This high security standard is not achieved by company 4. In companies 1 and 4 the back-up media have to be changed manually and stored secure from fire and water. Thus, when a high data security standard is essential for a company, then a SaaS-ERP will be better suited in this respect, or at least a hybrid SaaS data backup of an OP-ERP, automated and at a second location.

Claim 8: SaaS-ERP should be selected when no professional and automated backup is available in-house. *[se]*

Update Constraint. In a SaaS-ERP all updates are immediately available and installed by the provider; in an OP-ERP the updating has to be done by the customer. The OP customer can therefore choose whether or not to adopt the respective update. In contrast, the SaaS customer has no choice in this respect [3], [5], [33]. Company 5 is therefore worried about needing to retrain the employees often because of changing masks or screen designs, whereas companies 2 and 3 are relaxed about this constraint.

Claim 9: Updates in SaaS-ERPs are immediately available for no additional expense beyond the subscription costs; SaaS is therefore better suited when this is a need. *[we]*

Claim 10: SaaS-ERP customers have to accept all the updates and therefore worry about having to retrain the employees more often. *[we]*

4.3 Initiation and Implementation

Demo Account and Pilot Phase. In all of the cases, demo accounts were available for the companies to test the ERP systems, so no difference between SaaS and OP was found in this respect. Only company 6 found the demo account very useful for making the decision, and companies 2 and 4 tested the demo account, whereas companies 1, 3 and 7 did not use it at all. No information about a demo account or pilot phase was received from company 5. Companies 1 and 3 instead conducted a more intensive pilot phase to pre-implement and configure the system. No pilot phase at all was conducted in cases 2 and 7. Companies 4 and 6 preferred a forerun on the definitive ERP system to pre-implement and configure the system. Hence, in most of the cases at least one of the two options, demo account and pilot phase, was used to get more information on the system, irrespective of the ERP operation mode.

Claim 11: SaaS-ERP needs no pilot phase, because the ERP can easily be tested using a demo. *[enc]*

Claim 12: OP-ERP needs a pilot phase to pre-implement and configure the system. *[enc]*

Installation, Configuration and Immediate Use. Each OP system has to be installed by the ERP-partner on the customer's server, which therefore must have the appropriate hardware and operating systems. This is not necessary in a SaaS, but the advantage will never be really significant. Further, the standard system rarely meets the needs of the customer, and therefore has to be configured prior to the first use. By default, the standard SaaS system is preconfigured to be able to work immediately

with the system [8], [10], [15]. But none of the case companies could start to work with the system right away. Each company required some configuration first: companies 1, 3 and 6 configured part of their systems on their own, whereas companies 2, 4, 5 and 7 left the configuration for their ERP-partners. This correlates strongly with the company's having IT capabilities, with the exception of company 7. In cases 4 and 7 some adaptations were carried out prior to going live. Hence, the time required between implementation and going live is strongly dependent on the simplicity and characteristics of the ERP implementing company, but not on the selected ERP operation mode.

Claim 13: SaaS-ERP is the better choice when immediate use is essential.   *[ns]*

Training. A new self-training concept is available for SaaS systems, using Web- or E-learning content, instead of the traditional individual and group learning in classrooms. In all the OP cases, classroom learning was the predominant style, even though in cases 6 and 7 Web-learning lessons were available. Company 2 used classroom learning as well as unguided self-training to become informed about their ERP system. In case 3, the E-learning content, as well as unguided self-training, was used. No learning was necessary in company 5, because of previous experience. So it remains somewhat unclear, whether the training concept is typical to SaaS, because only company 3 waived the traditional classroom learning. But company 2 was able to save time and money by using self-training.

Claim 14: SaaS-ERP is better suited to having employees trained by Web- or E-learning content, without the wait for classroom learning sessions.   *[we]*

4.4 Flexibility, Changeability

Functional Change. The architecture of SaaS allows more flexibility or functional change, because its configuration enables or disables all the functions, settings or customer processes that the ERP system should include. So no further installations or integrations have to be conducted to implement a new module, as they do in an OP system. Hence, all contained modules in a SaaS-ERP can be introduced immediately with a few mouse clicks, whereas additional requirements would generate a level of effort comparable to what is required in an OP-ERP. Furthermore, SaaS systems are always in the latest version; ERP system replacement will never arise in a SaaS [5]. These compatibility problems may arise at any time in OP systems, as was the case in company 4. After 5 years, the existing ERP system was already outdated and no longer supported, and so had to be replaced with a newly revised system, incurring very high costs. Changes are planned in companies 1, 4 and 6, which are all working on OP systems. But none of the SaaS-ERP customers have planned any change in the future, even though it would be simpler than in an OP. It may be exactly because of this simplicity that all SaaS-ERP customers have just implemented systems that meet all their needs, whereas OP customers need money and resources to realize their projects.

Claim 15: Functional changes are simpler and faster with a SaaS-ERP, as long as they can be made by configuration.   *[we]*

Claim 16: SaaS-ERP is always on the latest version, whereas OP-ERP will be outdated after a while and need to be reinstalled on a new platform.   *[se]*

Scalability, Seasonality and Growth. Scalability is a special feature of SaaS, allowing more or fewer user accounts to be rented according to the company's economic situation [8], [14], [33]. None of the companies have utilized this advantage, but for company 2 a temporary user expansion at the beginning would have been useful. Unfortunately they did not know that a temporary user expansion could be negotiated with their providers. Furthermore, none of the investigated companies have a strong seasonality, which would be the typical case for a temporary user expansion or reduction in SaaS. Besides this temporal volatility of users through seasonality there can be a long-term expansion of users due to corporate growth. Company 5 avoided integrating an OP-ERP because the system would have had to be sized for the next 5 to 10 years. With a SaaS, the company could begin with a small number of user accounts and increase the number economically as the company grows. Most of the companies (2, 3, 4, 5, and 6) predict at least a small expansion in staff, so the potential to expand or adapt the size of the system to the business's needs is a common requirement.

Claim 17: The number of users can be adapted to the economic situation in a SaaS-ERP.   *[we]*

Claim 18: SaaS-ERP is better suited when the company faces a strong seasonality. *[ne]*

Claim 19: SaaS-ERP is better suited when the ERP system should grow with the company.   *[we]*

Peak-Loads and Performance. In an OP-ERP, peak-load capacity has to be provided for the system to perform well, even when the peak-loads are short lasting or occur infrequently. This leads, then, to a high idle time if the excess capacity is provided, or otherwise to a low performance when the system capacity reaches its limit. The outsourcing of this problem by adopting a SaaS-ERP has the advantage that short but high peak-loads can be balanced by the provider, because customers' peaks often arise at different times [14]. The excess capacity needed will therefore be smaller in a data center than in-house. But, on the other hand, the SaaS-ERP customer loses the control over the provided performance, which is moreover directly dependent on the internet speed [14]. Companies 3 and 5 are satisfied with the provided speed, but for company 2 the provided speed is only just enough. Neither high uploads nor high peak-loads could be determined in the investigated cases, so no evidence for these claims can be investigated.

Claim 20: SaaS-ERP is better suited when high peak-loads emerge.   *[ne]*

Claim 21: OP-ERP is better suited when high uploads to the ERP system are required.   *[ne]*

Claim 22: SaaS-ERP customers relinquish control over the provided performance, so may suffer a low performance.   *[we]*

Projects and Collaboration. SaaS is better suited for business projects or collaboration from different locations, bcause it does not require clients to be installed on local computers and allows accounts to be opened up or closed down easily according to the project status. So companies with a project orientation have the flexibility to invite external companies or individuals to collaborate directly on the ERP system, e.g. the

invited company can place an order or can call up the current project status. The potential for collaboration between several companies was exactly the reason why company 3 selected the SAP Business ByDesign. In this case, 3 companies at 2 different locations collaborate on the same SaaS-ERP platform without having to roll out several clients on local computers.

Claim 23: SaaS is better suited for business projects or collaboration from different locations. *[se]*

Location Independence and Mobile Access. The location independence of SaaS makes it easily possible to integrate the local offices or locations into one system. This was, as mentioned above, only necessary at company 3, where foreign companies collaborated with each other. None of the other companies has a second location, but all require location independence in the sense of accessing the system from outside of the company, e.g. at home or at the customer's premises. This is typically a requirement for company representatives or field-services, where the access to the ERP system is needed at the customer's site. This is the case at company 2, which also has mobile access to the SaaS system, but also at the companies 4 and 6, where the access is not given by the ERP system per se. At company 4, a client has to be rolled out on each laptop, and there are no solutions for mobile devices. Company 6 solved this problem with a terminal server for laptops and mobile devices. The latter solution was also employed by company 7, which needed the access for field-services. The remaining 3 companies have no travelling representatives, so mobile access is not important for them.

Claim 24: SaaS-ERP is better suited to integrating several locations into one system. *[se]*

Claim 25: By default, SaaS-ERP is better suited to accessing the system from outside the company. *[se]*

Claim 26: SaaS-ERP is better suited to accessing the system from anywhere, with mobile devices. *[se]*

Dependence on the Provider or Internet. The SaaS-ERP systems depend on the supply, service quality and stability of the SaaS provider, as well as on the service quality of the internet [4], [10], [14], [25]. Both factors are required for a high-performance SaaS system. The OP system, in contrast, depends only on the company's own infrastructure. If the SaaS-ERP system support is discontinued, the system must be replaced immediately. Company 2 indicated that discontinuation would mean losing the whole implementation effort and all adaptations. Companies 3 and 5 have also recognized the extent of their dependence, but the latter could easily change systems because of the simplicity of the business. In contrast, company 1 indicated that they could proceed with the outdated ERP system, without any support and company 7 pointed out that the employees could perhaps solve the problems or the company would look for another ERP-partner.

Even a short outage would be critical for companies 2, 4 and 6. In case 2, with no in-house IT know-how, it is clear that a SaaS provider would be faster at fixing a problem. Company 4 indicated that SaaS would never work for the company because it requires giving up control over the system, and in the event of a system outage, the

ERP-partner would be notified immediately. But the interviewee was not able to estimate whether this would be faster than with a SaaS system. Company 6 cannot estimate which operation mode is faster in fixing problems either.

Furthermore, the OP system is not dependent on the internet, whereas the SaaS does not work without access to the data center. But all the SaaS customers noted that access via mobile internet would be an alternative way to overcome the temporary outage.

Claim 27: SaaS-ERP is better suited when the risk and cost of a system change is low.

[we]

Claim 28: The SaaS-ERP provider is faster at fixing a problem when no internal know-how is available.   *[we]*

4.5   Customization and Adaption

One of the main disadvantages of SaaS-ERP systems are their restricted customization capabilities [10], [26]. SaaS customers are not free to change whatever they want. And often, the provider will add the desired customization to the standard package, as was the case with company 2. Thus company 2 paid for something that future customers will use for free. No customization was necessary for companies 3 and 5. One of the main criteria for companies 4, 6 (CRM seminar system) and 7 to adopt an OP-ERP was the freedom to adapt the system at their own discretion.

Claim 29: OP-ERP is better suited when major adaptations have to be carried out. [se]

4.6   Security

System Security. One of the main problems with SaaS is that it is perceived as insecure, because the customer loses control over the data, the security system applied, and the maintenance of the system [14]. Even companies 3 and 5, which chose SaaS, have these concerns. Company 2 mentioned trusting only Swiss data centers with good reputations, whereas company 1, an IT security expert, does not trust any SaaS data center. In contrast, the remaining companies operating an OP-ERP are not at all concerned about security: Company 4 has no business secrets on the ERP system and company 7 carries the security over to the ERP-partner. This dichotomy cannot really be explained, especially because companies 1, 3, 4 and 7 would prefer local data storage, in order to avoid being dependent on the provider and the provider's security standards. Only companies 2 and 6 are open to giving away the data into a data center.

Claim 30: OP-ERP is better suited when the loss of control over data, security system, maintenance or performance poses an evident security risk.   *[enc]*

Data Encryption and Certificates. Security certificates and data encryption are the best way to show the security professionalism of the provider. In cases 2 and 5 no know-how is on hand to reach this security stage, so they seem to be better advised by trusting a provider with the corresponding certificates. In contrast, company 1 has exactly this know-how and can therefore secure its own system. What is interesting in case 3 is the importance placed on the SSL-encryption relative to that on the provid-

er's certification, even though company 3 uses SaaS. Of the other OP users, company 7 considers encryption important, while companies 4 and 6 do not.

Claim 31: SaaS-ERP with corresponding certificates and data encryption is better suited when no internal know-how is available.   *[se]*

5   Implications and Recommendations: A Brief Discussion

The analysis and results of the case studies generated 31 claims relating company characteristics to systemic operation mode differences. These claims suggest, for each criterion, which operation mode is preferable given the company characteristics. The significance and implications of these claims will be briefly discussed by embedding the results in basic theoretical concepts:

The main systemic advantages of SaaS-ERP are the provisioning of the system, the greater flexibility and the savings in capital. Therefore the following general selection strategies can be stated:

ERP selecting customers without an IT-department or which have neither IT know-how nor the capacity to maintain and secure the ERP system in-house are, according to claims 4, 5, 7, 8, 28 and 31, clearly strategically better served with a SaaS-ERP system. This postulation correlates with the resource-based view principle of outsourcing non-core competencies (cf. [19-20], [23]).

Customers needing flexibility, scaling or ubiquity, now or in the future, due to growth, expansion, change or seasonality can meet this need only with the SaaS operation mode. The postulations in claims 17, 18, 19 and 20 rely strongly on considerations of production cost economics, where optimal resource management entails paying for neither too many nor too few modules and user accounts [33]. Claims 15, 23, 24, 25, and 26 can be underpinned by transaction cost theory; using the internet for information transfer enables all desired software functions to be integrated into the ERP system, which eliminates dispersed data entries and data synchronization expenditures, and allows internal processes to be optimized [23].

Companies that are less financially strong or want to save money or invest it in different strategic projects, as indicated by claims 1, 2 and 3, are better served by considering the SaaS operation mode. The investment in more strategic assets and therefore the outsourcing of minor strategic resources will lead to higher asset specificity, as postulated by the resource-based view ([33], with further references).

The above-mentioned characteristics that a SaaS-ERP preferring customer should have are typically, but not exclusively, observed in SMEs, especially in the trade and services sector, where locations are dispersed or company representatives or field-servicers need mobility. Startup companies also tend to require agility and flexibility, since their growth and business development mean the ERP system requirements will change over time.

According to claims 29 and 30, one of the main systemic advantages of OP-ERP systems is the possibility of adapting the system beyond the standard, enabling it to be specialized to the business's needs [31]. When the ERP is so essential that its specialization creates a competitive advantage (claim 6), or when the system's constant

availability or high performance is indispensable, then a customer will be better served by choosing an OP-ERP system. By outsourcing, such a customer would risk losing his strategic resources if what is a competitive advantage becomes broadly available with expansion of the SaaS standard to include the specific know-how, or else if the ERP provider is not able or willing to expand his SaaS standard, so that the core competencies cannot be used at all [33]. Both implications are based on the resource-based view, where in the first case the rareness and imitability is violated through disclosure, and in the second no value can be gained from the competitive advantage [1], [31]. The knowledge-based view provides a similar argument (c.f. [23]).

Typical customers of an OP-ERP system should have quite stable businesses without much need for flexibility. Unlike with most service or trade-driven businesses, their competitive advantage comes from the uniqueness of their service or product. So, the ERP system likely must be adapted during implementation to support their business processes best, but not subsequently changed. These characteristics, which typically fit best with OP-ERP systems, are most often found in the specialized service sector and manufacturing industries, especially when adapted PPC[4] systems are required.

6   Conclusion and Outlook

Systemic differences exist between SaaS- and OP-ERP, and as such one will be preferable to a customer selecting an ERP: the operation mode which is aligned to the internal business processes and requirements. As with functional requirements, where the functions are selected and implemented in line with the daily business, ERP operation modes must be aligned with internal requirements and strategies and by this means deliver a unique type of value to the business (Porter, cited in [12]). On the one side, systemic differences indicate where an operation mode can be more advantageous; on the other side, the company characteristics and needs require the proper ERP functions and operation mode characteristics to be selected. Exactly these company characteristics and their interconnection to the respective systemic difference criteria were the focus of this contribution, in order to specify general types of customers as having a better fit to SaaS- or OP-ERP.

In general, SaaS-ERP customers should need flexibility, scaling or ubiquity, whereas OP-ERP customers should need high performance or system specialization. This rough segmentation of typical ERP customers with respect to the ERP operation modes shows general strategies about when to use which ERP operation mode. These guidelines help a selecting customer to choose the proper operation mode after limiting all possible ERP offers by functional requirements. The challenge in this respect arises from the fact that the selecting company will have a combination of different characteristics, which will most often lead to conflicts in selection when considering

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[4] Production Planning and Control: PPC systems manage the production activities of manufacturing companies. PPC systems typically include materials and capacity planning and scheduling. More concrete definitions are available, e.g., in: [13] or [27].

all the individual systemic difference criteria. The large number of difference criteria makes it impossible to give advice for each possible case. Hence, the selecting customer will soon observe that the ideal picture does not always fit his case and that he must always overcome some conflict in selection criteria by evaluating which criteria bring more benefits to that particular business. More precise statements of how to choose between operation modes in cases of conflict between the selection criteria will come from the hypothesis tests combined with analysis of the respective weighting factors. The hypothesis tests could further serve to verify the inconsistent evidence that was identified for some of the claims stated here. The hypothesis tests, as well as the respective survey, are currently pending, but will be published soon in a follow-up contribution.

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Annex: Case Study Descriptions and Interview Results - an Overview

Case 1: The first case illustrates how despite a company's very small size, other company characteristics may determine the operation mode. It seemed nearly self-evident that, irrespective of the company's size, an IT security specialist would never prefer a SaaS-ERP, because he has the know-how to implement and maintain the ERP system.

Case 2: The second case has all the characteristics of a typical SaaS-customer: The company is extremely small and therefore gains cost advantages in choosing a SaaS-ERP system. Furthermore, no internal IT know-how is available. Last but not least, the trade with mobile devices is highly competitive: the company needs the flexibility to adapt to all new situations, even in respect to the ERP system.

Case 3: The unique aspect of the third case is its collaboration requirement. This company runs an ERP system to which 2 additional companies need to have access. The integration of 3 different companies in 1 ERP system is unusual and a really strong case for a SaaS system, even though several further characteristics could be found that favor an OP system instead. The choice to use SaaS would not have been as clear without this collaboration aspect.

Case 4: The fourth case is a typical case, where two competing requirements, flexibility and specificity, have an impact on the operation mode selection. On the one hand, flexibility is needed in the highly competitive tire sector, to react to each new situation. Tires are, on the other hand, exchangeable and standardized generic goods, which can be bought around the world. This company requires a highly specific ERP system, which is adapted to the customer's business processes. Furthermore, this company is sensitive to ERP- or internet outages.

Case 5: The fifth case is characterized by very simple conditions, with a typical financial situation when the company was founded. The high up-front prices of ERP systems are often problematic for emerging companies, which may react by not implementing any ERP system. Therefore this is a typical case, where a SaaS can remedy the negative effect of the high initial costs. Furthermore an external accountant is employed, who needs access as well.

Case 6: The important criterion in the sixth case is location independence, which is inherent only to a SaaS-ERP. But this company uses an OP system, which required additional software to be installed. The case shows that a simple terminal server application has been used to overcome this problem. The reasons for not choosing a SaaS were that no comparable SaaS-ERP with the same functional range could be found and the company's need for a special seminar system, which was specifically programmed for it.

Case 7: The last case was explicitly chosen because of the large number of employees, to compare the difference between small and midrange companies and exclude any possible impact size may have on the ERP operation mode selection. The company is production-oriented and needs a highly adjusted PPC module, which, like most specialized modules is only available as an OP from most ERP-partners. As expected, SaaS was not considered, because the main focus was on the functional capabilities of the PPC module, irrespective of any operation modes.

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
ERP system	myfactory BusinessWorld	myfactory Global.ON!	SAP Business byDesign	Microsoft NAV	ABACUS SaaS ABAWEB	SAP Business One	SAP Business One
operation mode	On-Premise	SaaS	SaaS	On-Premise	SaaS	On-Premise	On-Premise
case type	comparative case (to case 2)	typical case	unique case	typical case	typical case	typical case	comparative case (comp. size)
specials	IT security specialist; size	size, commercial sector, needs flexibility	collaboration between 3 companies / organizations	specificity of the software, customization	liquidity protection, accounting is handled externally	location independence needed by the representatives	midrange size, production sector
sector / segment	service sector: IT security	commerce and service sector: mobile devices and tablets	service sector: development and training	commerce: import and export of tires	service sector: hair salon	commerce: import, export of hair products, general representative Switzerland	production: customer-specific tool milling machines
company size / no. of locations / users	6 employees / 1 location 6 users	3 employees / 1 location 3 users	– / 2 locations users:10 full, 25 light	20 employees / 1 location 18 users	– / 1 location 3 users	36 employees / 1 location users: 16 local, 15 mobile	> 100 employees / 1 location 47 users
modules	fin. accounting, CRM, MIS, HR, inventory management	fin. accounting, CRM, MIS, B2B, Webshop	fin. accounting, CRM, HR, PM	fin. accounting, CRM, inventory management, purchasing, sales, Webshop	fin. accounting	fin. & cost accounting, CRM & seminar system, inventory management, purchasing, sales, HR	fin. & cost accounting, CRM, inventory management, purchasing, sales, HR, marketing, maintenance & service module, PPC
Characteristics (excerpt*)							
cost & financing	no debt financing	SaaS is always less expensive than OP	SaaS: more expensive in the long run. Break-Even quickly reached. OP would need no debt financing.	very high costs; short-term debt financing	Investment advantage. Lower turnover at the beginning. OP less expensive in the long run.	long-term funding by planning	high costs; leasing of ERP system
cost certainty	quite important, difficult to allocate the internal cost to the ERP	Uncertain whether more cost certainty is given. Costs difficult to estimate.	some relevance there	New server purchased recently. High variability (15% to 20%) each year. → no certainty.	-	important, especially external costs; difficult to allocate internal cost to ERP	very important, maintenance costs and additional expense can be estimated
IT department / IT know-how	IT know-how	no, and no personnel for this purpose	IT know-how partially in-house, but part of IT outsourced	no, partner is concerned with maintenance	no	IT know-how, 1 IT officer	IT know-how, part-time IT-officer (30%-50%)
hardware, maintenance	on their own	by ERP provider	by ERP provider, but not an important criterion	Webshop is hosted. Maintenance contract with partner fixed for 5 years.	by ERP provider	on their own; maintenance by ERP-partner. Proximity to partner important.	infrastructure on their own or jointly; maintenance by ERP-partner
configuration / immediate use	jointly / no, config. first	partner / no, config. first	jointly / no, config. first & adaptations for 2 months	partner / no, config. & adaptations for 2 months	partner / immed. available, but set up by partner	jointly / no, config. first	partner / no; installation, config. and adaptation first
training	classroom learning	classroom learning, tutorials, self-training	E-learning, self-training	classroom learning with all employees	not necessary, because of previous knowledge	classroom learning; HR: Web-learning	classroom learning, but sporadic Web-learning
functional change	next module planned: portals	not needed yet	not needed yet	New ERP-installation after 5 years (outdated). 1-2 add. modules per year	not needed yet	next module planned: mobile access	not needed yet, but extensions with next release
location independence / collaboration	access: required / -	access: required and OP would incur extra costs / no	access: rather important, but optional for OP / collaboration between 3 companies	access: more and more important; installation of clients / no	access: not required, but conceivable in the future / no	access: not required qua ERP, growing need; terminal server / no	access: growing need; implementation of VPN solution / no
mobile access	not important	very important	not important	not important	not important	via terminal server	growing; via VPN
dependence on the provider	relatively high, but continuation without support possible	relatively high: fear of account locking when deficit in payment; cessation would incur loss of the individualizations	very high; dependence is not welcome	loss of control was an important factor against SaaS	relatively high, but change is an option, because of the company's simplicity	OP: dependence on the operation system requirements	relatively high; but one can try to fix the problem by oneself; otherwise there are of course further partners
customization and adaption	requirements realizable in SaaS; unclear whether upcoming changes would be possible in SaaS	interfaces to the Webshop; filter functionalities; everything has been included into the standard	not necessary; standard	interfaces, synchronization to the Webshop; multicurrency & multilingual capability. Free in all adaptation options	not necessary; standard	new seminar system was programmed	interfaces (time registration, CAD). Free in all the adaptation options.
system security	SaaS is less secure	Safety gaps depend on data location & provider's reputation. Difficult to reach the security standard on their own	loss of control over security and maintenance; provider's reputation important	security is less important, because no secrets are stored in the ERP	loss of control over data	Security like in a data center is not necessary. Security is own responsibility.	The partner is responsible for the security.

* The entire table could not be provided here due to space limitations. More information is available online: https://docs.google.com/folder/d/0B5CeS4BpEQBDbFhMRnNoM19LRWc/edit?usp=sharing&invite=CI3Km-AJ