

# Software-as-a-Service in Small and Medium Enterprises: An Empirical Attitude Assessment

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**Abstract.** Cloud service providers praise Software-as-a-Service (SaaS) as very attractive for small and medium enterprises (SMEs). However, little research has been done on the SMEs' perspectives on this matter. This paper presents the results of a survey conducted among German enterprises that tries to clarify their views of SaaS. Starting with the actual IT situation, we show the prerequisites as well as the reasons in favor of and against the use of SaaS. We then show that the views of SMEs differ in some significant respects from that of CSPs, and we deduce hypotheses that can help towards a better design and delivery of cloud software and services.

**Keywords:** Software-as-a-Service, SaaS, Cloud Computing, Small and Medium Enterprises, SME.

## 1 Introduction

Cloud service providers claim that cloud computing and particularly Software-as-a-Service are attractive models for small and medium enterprises (SMEs) that try to cut costs and at the same time increase the flexibility of their IT environment [18,25]. This paper presents the results of a survey whose goal was to clarify the view of the enterprises on this matter. We present agreements and differences of their views with those of the providers and present resulting conclusions.

Cloud computing is a new computing paradigm under which a cloud service provider (CSP) provides IT resources flexibly and on-demand as a service over a network, usually the Internet [18,19]. IT resources can be CPU time, network bandwidth, storage space, and also application instances [28]. All aspects of deployment, operation, and maintenance lie with the CSP, including, e.g., software updates and backups [2]. Depending on the type of resource provided, cloud services are typically categorized into one of three deployment models [18,19]: (1) *Infrastructure-as-a-Service* (IaaS), where the CSP provides virtualized hardware resources that can be used in place of physical infrastructure; (2) *Platform-as-a-Service* (PaaS), where the CSP sells

access to a software platform which allows building and executing custom logic in a cloud environment; (3) *Software-as-a-Service* (SaaS), where the CSP offers a software to the end user that can be accessed using a web browser.

According to expert [5,8,21] and also public opinion, one group of enterprises that ought to profit particularly well from SaaS products is the group of small and medium enterprises (SMEs). However, these are mainly theoretical deliberations as there has been little research on the SMEs' view on this matter. In order to address this issue, we have conducted an exploratory online survey among 55 German enterprises asking for their views on SaaS.

In light of this survey, our contributions are the following. We investigate the actual current IT situation in SMEs in Germany with respect to SaaS. We further show the prerequisites that SMEs expect from cloud software. Analogously, we present the relevant reasons in favor of and against the use of SaaS in the SME. Finally, we discuss the results showing that the SMEs' views on cloud software differs in some significant respects from that of the CSPs and deducing hypotheses that have relevant implications for the engineering of an optimal IT architecture.

The remainder of this paper is organized as follows. Section 2 sheds light on the special situation of SMEs in the German economy and provides a brief overview of the benefits of cloud computing. We then explain our research methodology in Section 3. Consequently, in Section 4 we present selected empirical results from the survey. The results are discussed in Section 5 where we formulate our hypotheses for further research. A conclusion in Section 6 wraps this paper up.

## 2 Basic Concepts and Related Work

### 2.1 Small and Medium Enterprises in Germany

SMEs play a very important role in Germany, both socially and economically. Providing 99.7 % of the about 3.2 million German companies that are subject to turnover tax (VAT), they generate about 37 % of the total revenue [12]. SMEs typically have very strong regional ties, forming a more robust financial foundation than large enterprises for the local communities in question [14]. Apart from that, SMEs contribute significantly to the social security system [12]. In essence, SMEs play a crucial role for the stability of the German economy through their large number, their independence, and their heterogeneity [14].

There are several definitions of what an SME is, with only slight variations [3]. For this study, we have chosen the SME definition by the European Union [11], which should facilitate comparisons with other studies in European countries. The classification provides three size classes – micro, small and medium – based on two criteria: (1) an upper bound on the number of employees as well as (2) an upper bound on the annual turnover or the total assets.

SMEs are in a situation that is considerably different from that of large companies, due to several characteristics. Important traits in this context are the lack of an IT strategy, limited financial resources, limited information skills, and often the presence of a solitary decision maker, i. e., the owner [4,6,7].

## 2.2 Software-as-a-Service for SMEs

The benefits of cloud computing for SMEs are quite similar to those for any other type of company [2,29]. However, they are more pronounced for SMEs in some respects because of their characteristic features. The principal argument for cloud computing is usually that it cuts cost in the enterprise, mainly because investments into hardware and maintenance can be reduced [1,2,23,29]. This also lowers the amount of money bound in capital expenditure, which is effectively converted into smaller periodic payments to the CSP, a model usually referred to as pay-per-use [28] or pay-as-you-go [2]. As a side-effect, the pay-per-use notion allows SMEs access to software that would otherwise be too expensive to purchase. Typically, SMEs are expected to have only semi-professional IT operations, which is why they can benefit significantly from the high standards in professionally operated data centers [10,18,22]. In addition, providing the typical cloud characteristics, such as elasticity and short-term contracts [19], cloud software can bring more flexibility for the SMEs [1].

Software-as-a-Service is essentially the successor of the older application service provider (ASP) concept [1]. A broad investigation of this was performed in [13] for SMEs in the midwest region of the USA, resulting in a model for SME ASP adoption. The proposed model was later refined stating that flexibility was a more important aspect to the adoption of SaaS in SMEs than topics like security, cost and capability [1]. In contrast, our results showed that security was the number one concern for SMEs from our sample. This divergence notwithstanding, our findings agree with the evidence from [1] that SMEs expect their CSPs to offer highly customizable software.

## 3 Research Methodology and Sample

The primary aim of this exploratory descriptive study was to elicit possible use cases for and problems with SaaS in SMEs. For that, we conducted an online survey using SurveyGizmo<sup>1</sup> during a 2-months period from August to September 2010.

The survey covered a variety of topics. First, the background of both the company and the respondent was clarified and the current situation of the IT in the SME was established. Then, the respondent was asked about prerequisites of using SaaS as well as reasons in favor of and against it. For each prerequisite, the respondent had to specify the relevance of the item on a rating scale ranging from 0 (“irrelevant”) to 5 (“indispensable”). Consequently, we asked to assess the relevance of the reasons in favor of or against SaaS using a similar scale that ranged from 0 (“irrelevant”) to 5 (“most important”). Thus, both scales were at least interval scaled, which justified the computation of sample means for the ratings. For each category, the list of items was based on a broad literature review and later enriched by further aspects found in influential online sources

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<sup>1</sup> <http://www.surveygizmo.com>

**Table 1.** Contingency table of the complete sample by origin and enterprise size

Size Class	S1	S2	S3	Frequency	
				abs.	rel.
Micro	4	1	2	7	12.7
Small	11	1	0	12	21.8
Medium	18	3	1	22	40.0
Large	8	3	3	14	25.5
<b>Freq. abs.</b>	41	8	6	55	100.0
<b>Freq. rel.</b>	74.5	14.5	10.9	100	

(expert blogs, online reports) as well as preliminary expert interviews conducted by our researches. The lists were consequently reduced by fusing similar items.

The survey was open to invited participants only. We sent out invitations to the following three groups of enterprises. **(S1)** Having had access to the mailing list of the regional chamber of industry and commerce (IHK Nord Westfalen), we randomly selected a total of 1,250 SMEs from all industries, 20 % of which are located in the Emscher-Lippe region while the remaining 80 % are located in the Münsterland region. In order to receive more meaningful results, we ensured a reasonable amount of larger SMEs in the pool by restricting the size of the SME classes to 100 micro, 400 small and 750 medium enterprises. **(S2)** The Federal Association for IT, Telecommunications and New Media (BITKOM) included the invitation to the survey in their monthly e-mail newsletter to more than 1,300 recipients. **(S3)** Additional 30 SMEs were contacted directly because of existing contacts, e.g., from prior research projects. The selection was independent of size, industry and regional parameters.

In each case, the recipients were informed that the questionnaire required substantial knowledge about the IT landscape and the business side of the enterprise and were asked to forward the invitation to a suitable person. In order to ensure a common understanding of the term Software-as-a-Service, the survey included a concise definition.

In total, 55 enterprises completed the survey, the majority of which (~75 %) was from group S1. The categorization into size classes was performed exclusively along the dimensions “number of employees” and “annual turnover” using the limits set by the European Union because the data about the total assets was not available. Due to missing data, six enterprises were categorized based on the numbers of employees only and one enterprise was categorized based on revenue only. The filtering of the recipients and the unambiguous introduction of the survey notwithstanding, a total of 14 large enterprises answered the survey. These were analyzed separately from the SMEs as a comparison group. Table 1 shows the structure of the complete sample by origin and enterprise size. As can be seen, there is an emphasis on S1, resulting in a regional focus on the Münsterland and Emscher-Lippe regions.

The results were analyzed using methods from descriptive statistics, primarily uni- and multivariate frequency distributions. More complex analyses were not

deemed feasible due to the small size of the sample. Most of the preparatory work and some of the analyses were performed as part of a bachelor thesis [24].

## 4 Empirical Results

As they constitute the main part of the survey, the analysis of the prerequisites, the advantages and disadvantages of SaaS will be presented in separate subsections. In our description, we will focus on the most interesting findings.

### 4.1 Actual IT Situation in the Investigated SMEs

As a first step in the analysis, the general IT landscape in the SMEs was investigated. This included a look at the IT infrastructure, the professional background of the IT staff as well as more aspects related to IT operations. Consequently, we inquired about the current software usage. Turning to SaaS, we then analyzed how cloud software was already deployed in the enterprises and whether there were any general reservations against SaaS. Some notable results are highlighted in the following paragraphs.

With regard to the IT infrastructure, staff and operations, the particular situation of SMEs vs. large enterprises became directly apparent: While 92.9 % of the large enterprises operated their own data center(s), only 41.5 % of the SMEs did. Most of the personnel involved with the IT in SMEs was expert staff. This was especially true for the IT services industry where almost nine out of ten (88.9 %) employees were experts while other industries had a lower ratio of specialists with only 65 % of the staff.

Another interesting finding was that the majority (68.3 %) of the SMEs mainly use standard software. Of these, 28.5 % (19.5 % of the sample) had not even customized the software. On the contrary, only 12.2 % used custom-made software. These facts are good news for SaaS providers since their products are typically customizable standard software by their nature.

SaaS was not yet used widely among the SMEs in the sample. Only about 27 % of the enterprises used SaaS, only 17 % thereof on a regular basis. Almost half of the SMEs (48.8 %) had no plans of introducing SaaS at all. However, when layered by different industries, it becomes apparent that SaaS was used almost exclusively in IT services enterprises, where almost one out of three (31.6 %) enterprises used SaaS on a regular basis already, an additional 15.8 % at least occasionally. Another group of 31.6 % was investigating the deployment of SaaS within the enterprise. Considering “other” industries, it was the other way around: 72.7 % had no plans of deploying SaaS and less than 10 % used SaaS at all, let alone regularly. Of those SMEs that had concrete plans of introducing SaaS, more than half were targeting a deployment within the next twelve months. The remainder was planning a medium-term deployment in twelve to 24 months. However, often the opinion of a solitary decision maker is the decisive factor for/against cloud services: In many SMEs (39 %) there was general reluctance against the use of SaaS. These reservations appeared to be independent of

**Table 2.** Prerequisites for using SaaS in the SME with mean rating  $\bar{x}$ , number of valid responses  $N$  and the standard error of the mean  $SE_{\bar{x}}$ , sorted by descending relevance

Rank	Prerequisites for using SaaS	$\bar{x}$	$N$	$SE_{\bar{x}}$
1	Confidentiality of data with respect to 3rd parties	4.95	40	.03
2	Permanent availability of the software	4.63	40	.11
3	Confidentiality of data with respect to CSP	4.50	40	.16
4	CSP has clearly defined backup strategy	4.40	40	.15
5	Performance of the software (no latency during use)	4.38	40	.13
6	Stable prices for service usage	4.10	40	.14
7	Usability resembles traditional desktop applications	4.03	40	.19
8	Possibility of complete data export (e.g., database dump)	3.97	39	.18
9	Guaranteed geographical limits for cloud service	3.51	37	.28
10	Possible integration into existing non-SaaS software	3.42	38	.23
11	Possibility of changing the CSP	3.37	38	.23
12	Custom SLAs	3.28	39	.18
13	CSP is located in Germany	2.97	37	.23
14	Possible integration into other SaaS software	2.88	40	.21
15	Possibility of local installation of the SaaS software	2.87	39	.23
16	CSP is located in the EU	2.62	34	.25
17	CSP has the Safe Harbor seal	2.41	27	.26
18	CSP has the PrivacyMark seal	2.36	25	.29
19	CSP is certified according to ISO/IEC 27001	2.26	31	.27
20	CSP is certified according to SAS 70	1.80	30	.26

both size and industry and mainly concerned the security risks of outsourcing enterprise data (stated by 86.7 %).

## 4.2 Perceived Prerequisites for SaaS

The respondents were asked to assign an importance rating to a list of 20 prerequisites. The list included various items from topics such as security, software usage and compliance in random order. Table 2 shows the detailed results for the prerequisites sorted by relevance. The following paragraphs explain the most relevant results.

Given the concerns about security mentioned in Section 4.1, it is not surprising that 95 % of the respondents rated the confidentiality of enterprise data towards third parties as indispensable. Furthermore, the SMEs from the sample showed a pronounced need for confidentiality towards the CSP as well. More than three out of four (77.5 %) SMEs regarded this as an indispensable precondition. Similarly important was that the provider had a clearly defined backup strategy, playing an important role (ratings 4–5) in the decision for 85 %.

Among the aspects concerning software usage, the most important prerequisite was the permanent availability of the SaaS solution. With 72.5 % of the respondents classifying it as indispensable and a total of 92.5 % in the rating categories 4–5, this aspect even received the second highest rating of all

prerequisites. At the same time, the performance of the application was rated only slightly less important.

By choosing a CSP that offers flexible data export, companies can reduce the risk of a vendor lock-in. Supporting expert claims that data lock-in is a great concern among cloud users [2], 41 % of the SMEs found flexible data export options indispensable. Interestingly, one important part of the concern seemed to be the possible loss of control over their own data. While 89.7 % of the respondents found the data export an important prerequisite for an SaaS solution (ratings 3–5), only 70.8 % thought so of the possibility to change the CSP. The wish for flexible data export might also be related to the SMEs' need to integrate the SaaS with other (non-cloud) software already used. In comparison, the integration with other SaaS was not a great concern.

Concerning compliance, many SMEs asked to be able to determine geographic boundaries for their data. Similarly to the concept of “regions” that the Amazon Web Services offer, the enterprises wanted to constrain their data geographically to certain countries, e. g., the EU. On the contrary, about one out of four (27 %) enterprises regarded this aspect as rather irrelevant (ratings 0–2). It was unclear which reasons had led to the diverging ratings. Interestingly, it was of much less importance whether the CSP was actually based in Germany or the EU. While German providers seemed to benefit from a slightly better image, both aspects received ratings across the whole scale with modes at 2 (EU) and 3 (Germany).

Tailor-made service level agreements (SLAs) seemed to be rather important (median  $\tilde{x} = 4$ ), although not vital for SMEs. Based on the sample, it seemed that the size of the enterprise has an influence on this. Smaller enterprises tended to rate this aspect as less important than larger enterprises. Even though custom SLAs appeared to be an important factor in the decision, there were very few companies (~10 %) that rated this aspect “indispensable.”

### 4.3 Perceived Reasons for Using SaaS

As with the prerequisites, the respondents were asked to rate a randomly ordered list of 15 reasons for using SaaS by relevance. Table 3 shows the results, the most relevant of which are discussed in this subsection.

Supporting the results from Section 4.2, the most highly rated advantage concerned the (expected) high level of security in professionally operated data centers. Quite intuitively, a CSP that specializes in providing secure cloud software can provide higher levels of security than a data center operated by the SME could [18]. Since security concerns were very important to the SMEs, it was not surprising that one third (33.3 %) of the enterprises regarded this aspect as very important (rating 4), 48.7 % even assigned the highest importance rating. Only 7.8 % of the respondents considered this an aspect of low importance (ratings 0–2).

With SaaS, the access to the software is performed using a standard web browser running on any platform and hardware. This easy access to the software, which also facilitates easy mobile access, was the second most important reason for using SaaS. Almost three out of four SMEs (74.4 %) deemed this aspect very

**Table 3.** Top reasons for using SaaS in the SME with mean rating  $\bar{x}$ , number of valid responses  $N$  and the standard error of the mean  $SE_{\bar{x}}$ , sorted by descending relevance

Rank	Reason for using SaaS	$\bar{x}$	$N$	$SE_{\bar{x}}$
1	High level of security from professional data center operation	4.15	39	.19
2	Easy access to software through web browser	3.95	39	.18
3	CSP handles all tasks related to data/storage, incl. backups	3.92	38	.18
4	No additional hardware investments for own infrastructure	3.84	38	.17
5	Better scalability and performance of the software	3.81	37	.13
6	Software safe from problems with own IT infrastructure	3.69	39	.19
7	No license or software issues when replacing hardware	3.47	38	.22
8	Zero maintenance: software updates etc. handled by CSP	3.42	38	.22
9	SaaS is ready for use more quickly than traditional software	3.03	38	.23
10	Usability of software is like that of well-known web sites	2.97	38	.24
11	Pay-per-use instead of traditional pricing models	2.92	38	.21
12	Easier possibility of changing the CSP later on	2.87	39	.21
13	Risk-free testing of new software without installation	2.87	39	.24
14	Access to software from mobile devices	2.79	38	.25
15	Short-term deployment for a specific time only (e. g., project)	2.56	36	.31

important (ratings 4–5). 70 % of these SMEs rated the importance as rather high (ratings 3–5), half of which even assigned ratings 4–5.

One commonly cited advantage of SaaS is the significantly reduced overhead of deploying and operating software and hardware [27]. The responses in the sample confirmed that the SMEs saw this as an important advantage, too. Most prominently, the outsourced data management, i. e., high-performance storage, redundant copies, secure backups, etc., was seen as a strong point of SaaS. It was closely followed by the elasticity, e. g., with regard to the number of users accessing the software. The SMEs also acknowledged that a professional CSP could offer a more reliable infrastructure. These three factors were regarded as quite important (ratings 4–5) by more than two thirds of the respondents. In addition, less than 16 % of the SMEs considered these aspects rather not important (ratings 0–2), in case of the data management, this portion was even below 8 %. Along the same lines, the SMEs appreciated the fact that they did not have to perform any maintenance of the software or hardware and did not have to tackle licensing problems when the hardware or software environment changed. Both aspects were rated as quite important (ratings 4–5) in 57.9 % and 63.2 % of the responses, respectively. Surprisingly, the licensing issues were considered slightly more important than software updates and upgrades, a fact that might indicate quite serious troubles with the software licenses in the SMEs.

Among the economic aspects of SaaS, the most prominent advantage was seen in the fact that many hardware investments for the IT infrastructure were no longer required because the infrastructure was provided by the CSP. 73.6 % of the SMEs found this aspect very important (ratings 4–5). The new pricing model based on the pay-per-use notion and periodic payments seemed to be not



**Table 4.** Top reasons for not using SaaS in the SME with mean rating  $\bar{x}$ , number of valid responses  $N$  and the standard error of the mean  $SE_{\bar{x}}$ , sorted by descending relevance

Rank	Reason for not using SaaS	$\bar{x}$	$N$	$SE_{\bar{x}}$
1	SaaS does not work well with other software	3.63	38	.20
2	Loss of control over access to data	3.59	39	.23
3	Data Migration from existing application too tedious	3.56	39	.23
4	High latency when using software (page loads)	3.44	39	.25
5	Less control over backups of data	3.41	39	.22
6	SaaS software lacks some desired features	2.97	35	.25
7	Permanent broadband Internet connection required	2.92	38	.29
8	Usability of web application worse than desktop application	2.63	38	.26
9	Lack of acceptance among employees	2.58	38	.25
10	Pay-per-use is not attractive	2.49	35	.25
11	Technical implementation too much effort	2.15	39	.23
12	Restrictions from existing contracts	2.14	37	.21
13	Benefits of SaaS are not seen	2.03	37	.26
14	Previous CAPEX has to be amortized first	1.97	38	.23

as attractive to the SMEs as it is often presented [17,20]. Only 28.9% deemed this an important aspect (ratings 4–5).

4.4 Perceived Reasons Against Using SaaS

As the next part, the survey contained a randomly ordered list of 14 reasons for not using SaaS. Again the respondents were asked to assign the relevance for their decisions to each item. Table 4 shows the detailed results sorted by relevance. The remainder of this subsection explains the most relevant results.

From the point of view of the respondents, the most important reason for not using SaaS was that the cloud software did not work well together with other software in the enterprise. 84.2% of the SMEs rated this aspect as important (ratings 3–5), the majority of which (60.5%) even rated this as quite relevant (ratings 4–5). This aspect is emphasized by the SMEs stating that their number three reason for not moving into the cloud was the fact that the one-time data migration from an existing application into the cloud was too tedious. While more SMEs rated this aspect as not very relevant (ratings 0–2) than the previous item (25.6% vs. 15.8%), there were also more respondents who rated this aspect as most important (38.5% vs. 26.3%). All in all, the relevance of this aspect was not significantly lower than the first, showing the problems that the SMEs still see with the data migration into the cloud.

The second most relevant reason for not using SaaS was the perceived loss of control over the access to the enterprise data. Interestingly, 61.6% of the SMEs deemed this aspect highly relevant (ratings 4–5), while 30.8% of the respondents only assigned ratings 1–2. It is likely that the respondents who did not see this as very relevant trusted in the prerequisite of data confidentiality (cf. Section 4.2)

and thus in the CSP’s ability to protect the enterprise data from unauthorized access. The related aspect of giving up control over the backup of the enterprise data and thus possible data loss, was judged a little less relevant with a mean rating of 3.41. Still, 53.8 % found this a very relevant reason, making it the reason number five on the list.

Last, not least, the SMEs seemed to expect high latencies from SaaS. More than half of the respondents (56.4 %) found this quite an important reason (ratings 4–5) for not using cloud software, a fact that makes a strong case for CSPs to provide maximum performance. At the same time, the SMEs planning on using SaaS must ensure that their Internet connection has enough bandwidth to support the expected usage, which may be a problem for some enterprises based in structurally weak, e. g., rural areas.

Interestingly, the group of SMEs that already use SaaS on a regular basis regards the reasons for not using SaaS generally less significant than those having only tried it or not using it at all. Table 5 shows the reasons with relevant discrepancies in the average ratings of these three groups (reasons not shown had similar ratings across the groups). For example, SaaS users rate the latency issue only with 2.00 on average, whereas testing users or non-users rated it significantly higher (3.89/3.86). On the other hand, the technical implementation is seen as no real problem for users who use or have tried SaaS, whereas non-users see this as problematic.

**Table 5.** Mean ratings  $\bar{x}$  of reasons for not using SaaS, layered by the current state of SaaS usage in the enterprise (ordering matches that of Table 4)

Reason for not using SaaS	Usage in enterprise		
	Regularly	Testing	None
Loss of control over access to data	2.62	3.40	3.90
Data Migration from existing application too tedious	2.92	3.10	3.87
High latency when using software (page loads)	2.46	3.80	3.87
Less control over backups of data	2.31	3.10	3.73
Permanent broadband Internet connection required	2.00	3.22	3.17
Lack of acceptance among employees	1.69	2.30	3.24
Technical implementation too much effort	1.23	1.90	2.63
Restrictions from existing contracts	1.67	1.67	2.40
Benefits of SaaS are not seen	1.31	1.70	2.70

## 5 Discussion of Derived Results and Limitations

The empirical results show that SaaS is still “terra incognita” for many SMEs: It is currently hardly used and most of them have no plans to introduce it. In this respect, the IT services industry is at the front line, using more SaaS than all other industries. Most likely, this is due to the service portfolio, which requires those SMEs to keep up with current developments in this field. Still, even for IT services, slightly more than half of the SMEs are not using any kind of SaaS yet,

and there are general reservations against using cloud software, mainly because of security concerns.

An interesting finding in this respect is that SMEs do not trust CSPs. Even though they expect very high levels of security from CSPs, they are still not willing to trust them with their data – something they would usually do with traditional outsourcing providers [9,16]. This line of thought is supported by the SMEs' fear of losing control over their data when it is sent "into the cloud". So, even though the CSPs are putting much effort into providing high security standards on the technological level, SMEs are reluctant to trust them. In addition, current means of certifying cloud security (e.g., SAS 70) are not recognized by the SMEs. These are strong indications that the problem is not purely technical, but also a problem of the organizational and possibly of the legal level. We thus argue:

**H1:** *Building trust into a CSP cannot be achieved by technological means alone. Instead, additional instruments, specifically at the organizational and legal levels, have to be considered in the engineering of cloud services to convince SMEs.*

Almost as important as the security and trust aspect are issues concerning the availability and performance of the SaaS. These are perceived as insufficient by many respondents and thus considered reasons not to use SaaS. SMEs are expecting both availability and performance to match that of a locally operated application, which poses a difficult challenge to SaaS providers. On the contrary, these reservations are less pronounced for those enterprises that had already used SaaS regularly. There are many possible explanations for this, including, e.g., SMEs having an unjustly negative view of SaaS that is ameliorated when cloud software is put to the test, but also that only those cloud applications that provide good performance are actually put to use in SMEs. Our data, however, does not allow any specific conclusions in this respect.

The ratings of the perceived advantages of SaaS were not as conclusive. The main advantages seen by SMEs were related to improved security, better scalability, and less maintenance effort. This is rather surprising because the CSPs' main argument is usually that cloud services cut costs [15]. Coinciding with this, SMEs had not generally adopted any novel pay-per-use license models; less than 10 % made use of them. We suspect that SMEs regard SaaS as a means of improving the overall IT situation, but not as a fundamentally new concept. More generally, the results suggest that SMEs, who are mostly operating their servers on premise, can increase the quality of service in all regards, especially with regard to disaster prevention and recovery, relying on professional CSPs without increasing the IT spending. Hence, we argue:

**H2:** *SMEs do not see SaaS as a means for quick wins or cutting costs, but as an instrument for sustainable improvements in the IT landscape supporting their business. Hence, short-term commitments are less interesting for them than long-term relationships to CSPs.*

SaaS is standard software by nature and matches well the main type of software used in SMEs. However, each SME has individual requirements for SaaS, e. g., concerning the migration of data or integration into other software, but also individual qualifications, e. g., the knowledge of its IT staff. It is, thus, a vital aspect that the software offers customization abilities [1,26]. Especially the integration with other software seems to be a concern for SMEs. For the SMEs in our sample, the integration into non-cloud software was much more important than that into other SaaS products. This is probably so because most software currently used in the enterprises is still non-SaaS and, thus, there is not much need for integration with other SaaS products. This also indicates that the majority of the SMEs does not regard SaaS as an isolated addition to the existing application landscape, but rather as a true alternative to existing software that is often tightly integrated with other systems in the enterprise. Independently of the question of how high the individual complexity of the software integration is, the results indicate that SMEs generally require the possibility of integration from the CSP – and assess current solutions as insufficient. Hence, providers should work on better ways of easy integration, e. g., by stringent application of service orientation. It therefore also makes sense that CSPs offer additional services, such as help with data migration from legacy applications or custom integration solutions, in order to facilitate the deployment of SaaS in the SMEs. We therefore argue:

**H3:** *The best product for SMEs contains both the customizable SaaS and additional services that facilitate the deployment within the enterprise, both on a technical and organizational level.*

It is clear that the limited size as well as the regional focus of our sample inhibit a deduction of any results representative for all SMEs in the federal state of North-Rhine Westphalia, let alone all of Germany or beyond. Especially when trying to identify groups within the sample, the small size does not allow many meaningful results, e. g., about certain industries apart from the IT services industry. In addition, the voluntary participation in the survey makes it likely that the sample is biased in the sense that the respondents are already working the topic “cloud computing” or are at least very interested in doing so. All in all, only trend statements can be drawn from the data we have collected. Nevertheless, the statements made in this paper can be seen as good indicators for the general mindset of SMEs towards SaaS and provide some helpful insights for cloud service designers. Even though the sample is restricted to German SMEs, we believe the results will be of interest for the international community as well.

## 6 Conclusion and Future Work

In spite of obvious limitations w.r.t. a generalization of our results, some important insights can still be elicited. It is apparent that SaaS is not going to be a “revolution in business” for SMEs for the foreseeable future. However, it is

becoming an important concept in the IT architecture of the enterprises and offers a large market, especially when CSPs succeed in motivating the SMEs from industries other than IT services to adopt SaaS. Developing IS in the cloud asks for better integration with non-cloud and even legacy applications as well as for a more fine-grained security approach, possibly complemented by organizational or legal activities.

Still, there is need for future work. First, we plan on verifying our hypotheses by conducting focused interviews and follow-up studies. In addition, it will be important to apply the findings to existing CSP to identify specific areas for improvement, particularly at an organizational level.

## References

1. Altaf, F., Schuff, D.: Taking a flexible approach to asps. *Commun. ACM* 53, 139–143 (2010), <http://doi.acm.org/10.1145/1646353.1646389>
2. Armbrust, M., Fox, A., Griffith, R., Joseph, A.D., Katz, R., Konwinski, A., Lee, G., Patterson, D., Rabkin, A., Stoica, I., Zaharia, M.: A view of cloud computing. *Commun. ACM* 53, 50–58 (2010)
3. Ayyagari, M., Beck, T., Demircuc-Kunt, A.: Small and medium enterprises across the globe. *Small Business Economics* 29(4), 415–434 (2007)
4. Ballantine, J., Levy, M., Powell, P.: Evaluating information systems in small and medium-sized enterprises: issues and evidence. *European Journal of Information Systems* 7, 241–251 (1998), <http://dx.doi.org/10.1038/sj.ejis.3000307>
5. BMWi: Action program cloud computing. Federal Ministry of Economics and Technology (BMWi) (October 2010) (in german)
6. Chen, L., Haney, S., Pandzik, A., Spigarelli, J., Jesseman, C.: Small business internet commerce: A case study. *Information Resources Management Journal (IRMJ)* 16(3), 17–41 (2003)
7. Clasen, J.P.: Small and medium enterprises in a crisis: An entrepreneurial concept of turnaround management as an option of coping with the crisis. Ph.D. thesis, Hochschule St. Gallen, Bamberg (1992) (in German)
8. Currie, W.L.: A knowledge-based risk assessment framework for evaluating web-enabled application outsourcing projects. *International Journal of Project Management* 21(3), 207–217 (2003)
9. Dibbern, J., Goles, T., Hirschheim, R., Jayatilaka, B.: Information systems outsourcing: a survey and analysis of the literature. *SIGMIS Database* 35, 6–102 (2004)
10. Dimopoulos, V., Furnell, S., Jennex, M., Kritharas, I.: Approaches to it security in small and medium enterprises. In: *Australian Information Security Management Conference*, Perth (November 2004)
11. EU: Commission recommendation 2003/361/ec. *Official Journal of the European Union* 124, 36 (May 2003)
12. Geisen, B., Hebestreit, R.: Mid tier businesses: The power of diversity. In: *Federal Ministry of Economics and Technology (BMWi)* (March 2009) (in german)
13. Grandon, E.E., Pearson, J.M.: Electronic commerce adoption: an empirical study of small and medium us businesses. *Information & Management* 42(1), 197–216 (2004), <http://www.sciencedirect.com/science/article/B6VDO-4C4BNWB-2/2/e053b8d5%85e4fcd9405f1f90b35e60f5>

14. Hamer, E.: The economic role of small and medium enterprises (in german). In: Pfohl, H.C. (ed.) *Business Economics of Small and Medium Enterprises*, 4th edn., pp. 25–50. Erich Schmidt Verlag (2006) (in German)
15. Kittlaus, H.B., Schreiber, D.: Saas – how can smes benefit? *Wirtschaftsinformatik & Management* (02), 36–42 (2010) (in German)
16. Lee, J.N., Huynh, M.Q., Hirschheim, R.: An integrative model of trust on it outsourcing: Examining a bilateral perspective. *Information Systems Frontiers* 10(2), 145–163 (2008)
17. Ma, D., Seidmann, A.: The pricing strategy analysis for the “Software-as-a-service” business model. In: Altmann, J., Neumann, D., Fahringer, T. (eds.) *GECON 2008*. LNCS, vol. 5206, pp. 103–112. Springer, Heidelberg (2008)
18. Mather, T., Kumaraswamy, S., Latif, S.: *Cloud Security and Privacy*. O’Reilly Media, Sebastopol (2009)
19. Mell, P., Grance, T.: The nist definition of cloud computing v1.5. Tech. rep., National Institute of Standards and Technology (NIST) (2009), <http://csrc.nist.gov/groups/SNS/cloud-computing/> (online)
20. Menken, I.: *SaaS – The Complete Cornerstone Guide to Software as a Service Best Practices*. Emereo Pty Ltd (November 2008)
21. Münzl, G., Przywara, B., Reti, M., Schäfer, J., Sondermann, K., Weber, M., Wilker, A.: *Cloud computing - evolution in technology, revolution in business*. BITKOM Guide (October 2009) (in german)
22. Patnayakuni, R., Seth, N.: Why license when you can rent? risks and rewards of the application service provider model. In: *Proceedings of the 2001 ACM SIGCPR Conference on Computer Personnel Research*, SIGCPR 2001, pp. 182–188. ACM, New York (2001), <http://doi.acm.org/10.1145/371209.371233>
23. Rittinghouse, J., Ransome, J.F.: *Cloud Computing: Implementation, Management, and Security*. CRC Press Inc., Boca Raton (2009)
24. Röpke, C.: *Software-as-a-Service for small and medium enterprises*. Bachelor thesis, Westfälische Wilhelms-Universität Münster (November 2010) (in German)
25. Santos, N., Gummadi, K.P., Rodrigues, R.: Towards trusted cloud computing. In: *HOTCLOUD, USENIX* (2009)
26. Schubert, P.: Personalizing e-commerce applications in smes. In: *Proceedings of the Ninth Americas Conference on Information Systems (AMCIS)*, Tampa, FL, pp. 737–750 (2003)
27. Sun, W., Zhang, K., Chen, S.K., Zhang, X., Liang, H.: Software as a service: An integration perspective. In: Krämer, B.J., Lin, K.-J., Narasimhan, P. (eds.) *ICSOC 2007*. LNCS, vol. 4749, pp. 558–569. Springer, Heidelberg (2007)
28. Vaquero, L.M., Roderio-Merino, L., Caceres, J., Lindner, M.: A break in the clouds: Towards a cloud definition. *Computer Communication Review* 39(1), 50–55 (2009)
29. Velte, T., Velte, A., Elsenpeter, R.C.: *Cloud Computing: A Practical Approach*. McGraw-Hill Professional, New York (2009)