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A Comparison between Germany and New Zealand

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SaaS Cloud Computing in Small and Medium Enterprises: A Comparison between Germany and New Zealand

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Abstract

Cloud sourcing and cloud computing have become de-facto standards in recent years for a range of applications. Cloud solutions are attractive for a number of reasons including ease of use, pricing, availability, scalability, and reliability. In particular, small and medium enterprises (SMEs) whose core competencies do not include Information Technology (IT) can benefit from cloud sourcing, since they can essentially outsource their IT to an external provider. Previous empirical research on cloud sourcing in SMEs, including work by one of the authors, has largely focused on single context (country) cloud adoption issues. This research makes a significant contribution to this emerging field by conducting an international survey of cloud computing adoption and perspectives of SMEs, across two countries: Germany and New Zealand, and seeks to clarify and compare their views of cloud sourcing. Starting with the actual IT situation, we show the prerequisites as well as the reasons in favour of and against a use of the cloud. We then show that the views of SMEs differ in some significant respects between the two countries, and we draw conclusions that can help towards a better design and delivery of cloud software and services that suit SMEs.

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1 Introduction

Cloud computing in general and Software-as-a-Service (SaaS; Sun et al., 2007) in particular have become attractive models for Small and Medium Enterprises (SME) that wish to minimise costs and at the same time increase the flexibility of their IT environment (Mather, 2009; Santos, 2009). An earlier survey by [authors], (2011) conducted three years ago found that SaaS was becoming an important concept in the IT architecture of enterprises and offers a large market, especially when cloud service providers (CSP) succeed in motivating the SME from industries other than IT services to adopt SaaS. It also found that security issues were the most limiting factor, and that developing information systems in the cloud asks for better integration with non-cloud and even legacy applications as well as for a more fine-grained security approach. This survey not only tries to shed light on the question of whether, and if so, how, this situation has changed in recent years, but also compares the situation in two countries from opposite ends of the planet.

In cloud computing a CSP provides IT resources flexibly and on-demand as a service over a network, usually the Internet (Mather 2009). IT resources include CPU time, network bandwidth, storage space, and also application instances (Vaquero et al., 2009). All aspects of deployment, operation, maintenance, and software updates as well as backups, lie with the CSP (Armbrust et al., 2010). Cloud services are commonly categorized (Mather et al., 2009; Mell and Grance, 2009) into IaaS (Infrastructure-as-a-Service), where the CSP provides virtualized hardware resources that can be used in place of physical infrastructure; PaaS (Platform-as-a-Service), where the CSP sells access to a software platform which allows building and executing custom logic in a cloud environment; and SaaS, where the CSP offers a software to the end user that can be accessed via a Web browser.

SMEs are generally considered to benefit most from SaaS products (BMWi, 2010; Currie, 2003; BITKOM, 2009; Münzl et al., 2009). Indeed, the online survey we conducted among 55 German enterprises in 2011 ([authors], 2011) showed that the top three prerequisites for using SaaS were: confidentiality of data with respect to 3rd parties; permanent availability of the software; and confidentiality of data with respect to CSP. Moreover, the top three reasons for using SaaS were: high level of security from professional data centre operation; easy access to software through a Web browser; and the fact that a CSP handles all tasks related to data/storage, including backups. On the other hand, it also showed that the top three reasons for not using SaaS were: that SaaS does not work well with other software; a loss of control over access to data; and the perception that data migration from existing application was too tedious. In the survey reported in this paper we study whether and how the IT situation in SME in Germany has meanwhile changed with respect to SaaS, and how it compares to the one in New Zealand.

The remainder of this paper is organized as follows: In Section 2 we briefly characterize SMEs, which not surprisingly are based on different size parameters within the European Union and in (the much smaller country of) New Zealand. In Section 3 we outline our research methodology and in Section 4 our findings. Section 5 discusses key issues from our findings, including perceived drawbacks of cloud sourcing, and Section 6 concludes the paper.

2 Cloud Computing in Small and Medium Enterprises

SMEs play a very important role worldwide, both socially and economically. In Germany alone, they represent 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 according to Geisen et al. (2009). SMEs typically have very strong regional ties, forming a more robust financial foundation than large enterprises for the local communities in question (Hamer, 2006). Apart from that, SMEs contribute significantly to the social security system. In essence, SMEs play a crucial role for the stability of the many national economies through their large number, their independence, and their heterogeneity.

There are several definitions of what a SME is, with only slight variations (Ayyagari et al., 2007). For this study, we have chosen the SME definition by the European Union (EU, 2003), 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 (frequent) lack of an IT strategy, limited financial resources, limited information skills, and often the presence of a solitary decision maker, i. e., the owner (Chen et al., 2003; Clasen, 1992). The benefits of cloud computing for SMEs are quite similar to those for any other type of company (Armbrust et al., 2010; Velte et al., 2009). 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 costs for the enterprise, mainly because investments into hardware and maintenance can be reduced (Altaf and Schuff, 2010; Brumec and Vrček, 2013). This also lowers the amount of money bound in capital expenditure, which is effectively converted into smaller periodic subscription payments to the CSP, a model usually referred to as pay-per-use (Vaquero et al., 2009) or pay-as-you-go (Armbrust et al., 2010). 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 centres (Ma and Seidmann, 2008; Patnayakuni and Seth, 2001). In addition, providing the typical cloud characteristics such as elasticity and short-term contracts (Mell and Grance, 2009), cloud software can bring more flexibility for the SMEs.

Software-as-a-Service is essentially the successor of the older application service provider (ASP) concept (Altaf and Schuff 2010). A broad investigation of this was performed by Grandon and Pearson (2004) 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. In contrast, our results showed that security was the number one concern for SMEs from our sample. Notwithstanding this divergence, our findings align with the evidence from Altaf and Schuff (2010) that SMEs expect their CSPs to offer highly customizable software.

Security issues are regularly discussed within the cloud computing literature (e.g., Kshetri, 2013; Jamil and Zaki 2011; Zissis and Lekkas, 2012) and also with specific reference to SMEs (e.g. Trigueros-Preciado et al., 2013; Gupta et al., 2013). What does appear evident from this SME-specific literature, that, for reasons that are not entirely clear, security-related issues appear less relevant than the perceived benefits the technology might offer. The raises the question as to whether there is in face some difference in the views around security threats in smaller organisations. If there is indeed a difference, what might be the reason for this? This research attempts to address this question.

3   Research Methodology

The primary aim of this exploratory descriptive study was to elicit the general perceptions around SaaS, how/where it is used, and to identify perceived problems with SaaS in SMEs, to find out where and how the situation in Germany has changed over the past three years, and to compare Germany with New Zealand. For that, we conducted an online survey using Qualtrics[1] during a 6-week period in January and February 2014.

3.1 Survey Instrument

Because of the apparent early stage of adoption of SaaS within small and medium enterprises, an exploratory survey was identified as providing an appropriate balance of breadth and depth of response. Because a similar study had previously been carried out in Germany three years earlier, this was seen as an excellent opportunity to conduct a longitudinal study comparing how attitudes and practices had changed. New Zealand was identified as a nation that, while being a first-world country, due to its small population and geographical location, might not be at the same level of technology adoption/sophistication as is the case with German SME's.

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 favour of and against it. For each prerequisite, the respondent had to specify the relevance of the item on a Likert scale ranging from 0 ("irrelevant") to 5 ("indispensable"). Consequently, we asked to assess the relevance of the reasons in favour 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 (expert blogs, online reports) as well as preliminary expert interviews conducted by the authors. The lists were consequently reduced by fusing similar items. The survey instrument was presented in both English and German.

Ethical approval was sought, and granted, by the Human Research Ethics committee of the researchers' institutions.

3.2 Sampling

The survey was open to invited participants only. Invitations were sent to the following groups. In New Zealand, participants from two (non-mutually exclusively) sources were invited to participate: (S1) 5,546 New Zealand SME Business Network group members on business social media site LinkedIn and (S2) 544 followers of New Zealand SME Business Network on Facebook. In Germany, three separate participant sources were used: (S1) 600 Members of the mailing list of the regional chamber of industry and commerce (IHK Nord-Westfalen) were we randomly selected from all industries, mostly from the Emscher-Lippe and the Münsterland regions. (S2) The German Computer Science Society (GI) sent out invitations to a few hundred SMEs in and around the

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[1] www.qualtrics.com

state of Northrhine-Westfalia. (S3) The German Oracle User Group (DOAG) sent invitations to its members in Germany.

In each case, the recipients were informed that the questionnaire required knowledge about the IT landscape and the business side of the enterprise and were asked to forward the invitation to a more suitable person if necessary. In order to ensure a common understanding of the term Software-as-a-Service, the survey included a concise definition. It is important to note that it was clearly stated that the survey focused on small and medium enterprises (SMEs); however, because there are many different definitions of what constitutes a SME, and because number of employees is just one possible measure, we left it to the invited participants to decide whether they felt their business was a SME. This has resulted, especially in the German sample, a number of businesses with more than 250 employees. It is important that this be taken into account when results are interpreted.

The results were analysed using methods from descriptive statistics, primarily uni- and multivariate frequency distributions. More complex analyses were not deemed feasible due to the relatively low number of responses. Moreover, the research was largely exploratory in nature, with the purpose of uncovering the key issues rather than providing statistically significant results.

Key background statistics are provided now, while specific cloud computing findings are presented in the next section.

3.3 Background Statistics

In total, 60 enterprises from Germany and 28 from New Zealand participated in the survey. The categorisation into size classes was performed exclusively along the dimensions "number of employees" and "annual turnover" using the limits set by the European Union because data about the total assets was not available. Due to missing data, six enterprises were categorised based on the numbers of employees only and one enterprise was categorized based on revenue only. Table 1 shows the complete sample by country and enterprise size.

Table 1: The SME sample by origin and size

Size	DE	NZ
Micro (1-9)	11%	67%
Small (10-49)	20%	23%
Medium (50-249)	26%	5%
Large (250+)	43%	5%

Table 1 clearly shows the difference between Germany and New Zealand in terms of organization size. In New Zealand overall, 97.2% of firms have fewer than 20 employees (Statistics New Zealand, 2002). It should be noted that the three broad parameters which define SMEs are the European Commission parameters. In New Zealand any company with 19 or fewer employees is considered to be a SME.

Participants we asked to consider the overall spending of their organization on IT related expenses. It was decided that this would likely illicit more specific responses than asking specifically about cloud spending, and also that this would give a base-line for which cloud spending might be associated. The uni-variate frequency data is provided in Table 2.

Table 2: Proportion of total costs relating to Information Technology (IT)

	<10%	10-30%	30-50%	50-70%	>50%	Unsure
NZ	36%	36%	9%	0%	9%	10%
DE	32%	21%	8%	0%	4%	36%

The most significant observation from this data is the level of uncertainty relating to IT spending in German companies. A viable explanation of this is that with much larger companies participating from Germany, the likelihood of the respondent knowing such information is less than might be the case with the New Zealand sample. Overall, it is a fair summation that German companies allocate, on average, a greater percentage of spending to IT-related activities.

The figures provided by Table 2 are further supported when participants are asked to report the number of staff working in IT. Given that many New Zealand SME's are in fact microbusinesses, it is not surprising to observe that 55% of the New Zealand respondents had just one or two staff working in IT, as shown in Table 3. It is also equally unsurprising to note that a quarter of the responding New Zealand companies engaged external contractors to manage their IT functions.

Table 3: Number of staff working in IT

	1-2	3-4	5-10	11-10	>20	External staff
NZ	55%	5%	5%	5%	5%	25%
DE	19%	19%	24%	7%	27%	4%

The researchers were also interested in knowing the background of the main IT decision maker of the company. While not always the case, the view was taken that an IT background would likely result in greater knowledge of key issues for IT adoption, including adoption of cloud computing. Table 4 presents a summary of the results pertaining to this issue. The difference between New Zealand and Germany is stark and, again, likely reflective of the typical company size in the two countries. Almost two thirds of the German companies had qualified computer scientists in charge of their IT. This is almost three times the figure in New Zealand. Further, almost half of the New Zealand firms, probably due to their small size, had no qualified IT staff and instead left this important role to the business owner.

Table 4: Background of the person responsible for company IT

	Qualified Computer Scientist	Business Owner	Manager	Administrator	External Contractor	Temporary Staff Member
NZ	24%	43%	10%	5%	19%	0%
DE	60%	7%	7%	24%	0%	2%

Study participants were asked whether their company employed its own data centre. In hindsight, it was recognised that there might have been some confusion over the definition of a data centre (vs. a computing centre), so the results to this question need to be treated with some caution before too many conclusions can be drawn. As shown in Table 5, German companies were more likely to have at least one computer-run data centre than New Zealand companies (57% vs. 37%). This was an expected result, as was the fact that 14% of New Zealand firms were not sure whether they did or not.

Table 5: Company-run data centre usage

	Yes (one)	Yes (many)	No	Not sure
NZ	32%	5%	50%	14%
DE	35%	22%	43%	0%

A useful background to understanding cloud computing adoption and perceptions is the manner by which software is acquired within a SME. Participants were asked to categorise their primary approach to software acquisition, across three main categories, as shown in Table 6. The results, again, demonstrate the differences in size between the New Zealand and German firms. For New Zealand companies, standard off the shelf software that has not been customised is more common than the other two alternatives combined. German companies do not appear to have a singular approach to software acquisition and often have a combination of approaches.

Table 6: Approaches to Software Acquisition

	Individual Software (programmed specifically for the company)	Customized Software (standard software adapted to the company)	Standard off the shelf software (non-customized)	Combination of these
NZ	27%	27%	59%	5%
DE	16%	14%	32%	38%

One of the key selling points of cloud computing is the ability to involve multiple access devices, including the current wave of mobile/smart devices (Zhang et al., 2010). Table 7 provides a summary of the devices used in both countries. Respondents were asked to identify all devices they used, not just the type used most, so as a result, rows in Table 7 do not sum to 100%. This was the first question where no discernible differences in results could be noted between the two nations. There was greater reported use of fixed workstations and laptop/tablets in the German SME's, but not to any significant degree.

Table 7: Devices used to use/access software

	Fixed location workstation	**Mobile laptop/tablet**	**Small mobile device (e.g. smartphone, PDA)**	**Specialized device (e.g. RFID reader)**
NZ	67%	57%	38%	0%
DE	80%	78%	38%	13%

Having identified the similarities and differences between SME's in New Zealand and Germany, with a particular emphasis on technology-related issues, Section 4 presents the key cloud-computing findings of the study.

4   Findings

The key findings of our study are presented in the following four subsections: 4.1, Client Server Usage; 4.2, Software Pricing; 4.3, Software as a Service (SaaS) Basics; and 4.4, Adoption Issues. All are related to SaaS cloud computing, yet 4.3 and 4.4 provide the most subject-relevant results.

4.1 Client Server Usage

Participants were asked of their company's use of client-server architecture. While client-server architecture has been around for many years, it might be viewed as one of the precursors to cloud computing. It was considered interesting to see whether there existed any sort of relationship to client-server adoption and cloud computing adoption. Table 8 shows a clear difference between the two countries. Overall, 97% of participating German SME's employed some form of client-server architecture. This contrasts with New Zealand firms, where only 63% used any form of client-server architecture, and just 32% reported that this was hosted and managed in-house.

Table 8: Use of client-server architecture

	Yes, managed in-house	Yes, hosted externally but managed in-house	Yes, hosted and managed externally	No
NZ	32%	11%	20%	37%
DE	74%	10%	13%	3%

For those companies, both in New Zealand and Germany, that employed some form of client-server architecture, roughly the same percentages (67% vs 64%) access this software via a Web browser, see Table 9. This would suggest that at least two thirds of the SME's from both countries are using software in a way that is structurally very similar to SaaS cloud computing. It is not unreasonable to suggest that SaaS usage should be similar to these client-server adoption figures.

Table 9: Client-server software access via a Web browser

	Yes	No
NZ	67%	33%
DE	64%	36%

4.2 Software Pricing

Cloud computing typically involves the "pay as you go" pricing model, and to a lesser degree, fixed or subscription based pricing. Companies that have not yet adopted any sort of cloud architecture may in fact be employing a very similar payment model with their existing software, without actually knowing it. Table 10 summarises the responses of participants on the pricing models they currently use - whether that be for cloud computing or more traditional software acquisition. Because multiple pricing models are possible, participants were allowed to select more than one option. Two key results emerged: Firstly, almost all (85%) of German companies used a subscription software pricing model, this being the traditional software licensing approach. More surprisingly, only 3% of these firms reported use of the pay-per-use pricing model. The possible reasons for this needs to be explored, but it may be that the unpredictability of the pay-per-use model is less attractive to German companies.

Table 10: Software pricing models employed

	Open source	One-off payment, no maintenance costs	Subscription model	Pay-per use
NZ	24%	29%	57%	20%
DE	38%	33%	85%	3%

4.3 Software as a Service (SaaS) Basics

Before looking at issues of adoption of SaaS cloud computing, the research sought to assess the level of knowledge of the approach. It was not really feasible to administer a formal test on this, but it was possible to ask the participants to assess their knowledge. Figure 1 provides the average response from the two nations to this question. The difference is actually quite significant and suggests that German companies have a greater level of knowledge of SaaS cloud computing. This is not surprising, given the size of the country and the significant technological infrastructure the country has.
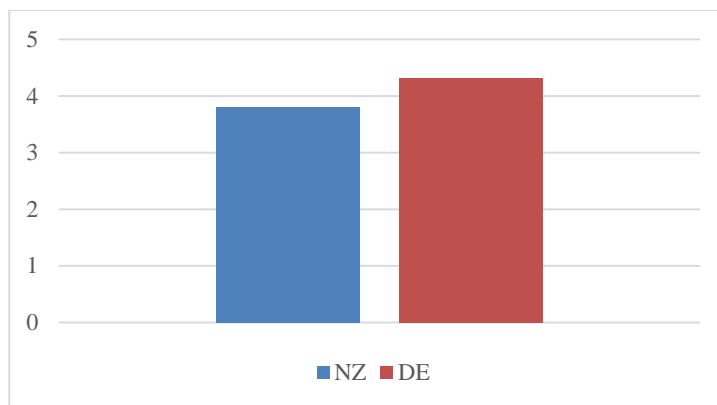
Figure 1: Average knowledge of SaaS (0=no knowledge, 5=very good knowledge)

One way in which knowledge of SaaS might be developed is through personal use. Many of the key SaaS cloud computing applications (e.g., email, file sharing, social media, etc.) have been in existence in the personal space much longer than in a business environment.

Table 11 suggests there is little difference between the two countries in terms of personal use, with perhaps New Zealanders having a slight advantage.

Table 11: Personal use of SaaS

	Yes, regularly	Yes, tried	No
NZ	57%	24%	19%
DE	46%	29%	25%

The key focus of the research was on SaaS within an organisational context, specifically SMEs. Respondents were asked to express their views on the impact SaaS solutions have had in their organisation. Obviously, given that not all responding companies had yet implemented SaaS, some respondents were unable to answer this question. But from those that did, some very interesting results emerged. Figure 12 contrasts the impressions of respondents across a five-point Likert scale. The graph unambiguously shows that the New Zealand respondents have a much more positive view on SaaS than their German counterparts. This is a particularly relevant statistic that is discussed further in Section 5.
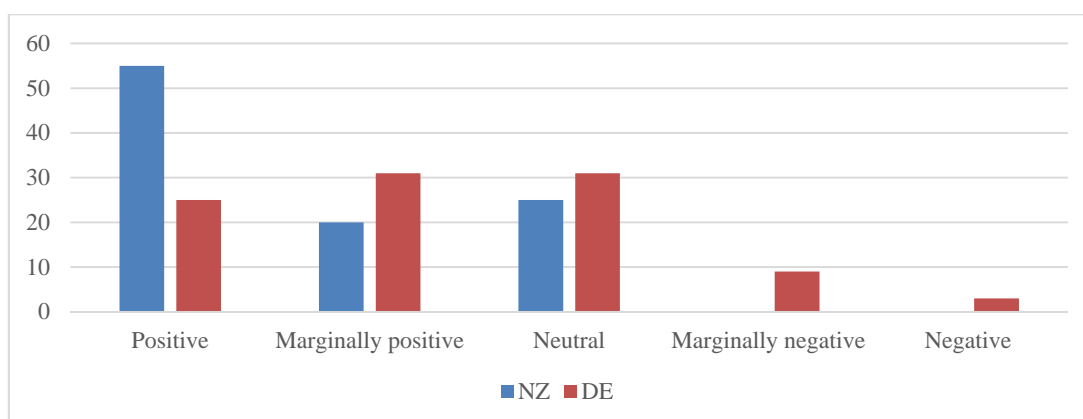
Figure 2: Impression of SaaS in the Company

Participants were asked to consider their views on a number of issues pertaining to SaaS. There were no significant differences for a number of these, however several issues, shown in Figure 3, are worthy of comment. The first two indicate the willingness of the company of be influenced by the views of external sources. In both cases, New Zealand firms reported that they were willing to be influenced more than their German counterparts. The third part of the figure indicates that New Zealand SME's have a greater level of trust around SaaS security. Of course this could also be viewed as the German firms having a far greater awareness of the security risks associated with SaaS. Finally, the New Zealand firms appeared to have more positive views on the role SaaS can have in improving their competitiveness.
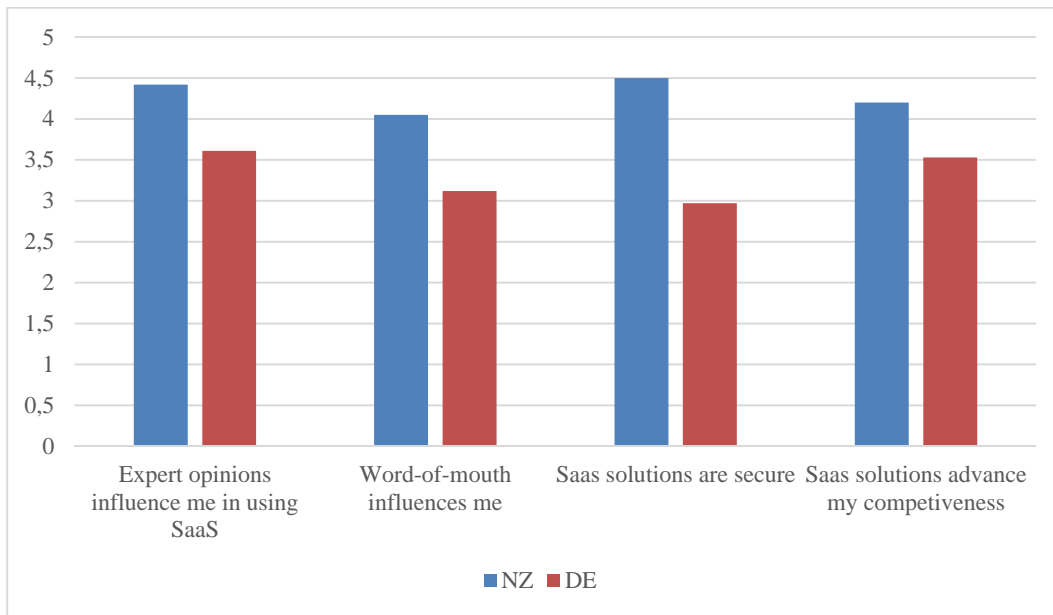
Figure 3: Views on SaaS

In order to provide some context to questions regarding the views of an organization on SaaS cloud computing, each respondent was asked about the current usage of SaaS in their company. The results, shown in Table 12, indicate that more than 50% of German companies use SaaS solutions, to some degree. This compares to 38% in New Zealand. However, the major difference appears in terms of adoption intentions. Almost half of the NZ companies are considering adoption, whereas a significant number (28%) of German firms have no intention to adopt any time soon.

Table 12: Is SaaS being used in your company?

	Yes, regularly	Yes, occasionally	No, but being considered	No, and not foreseeable
NZ	38%	0%	48%	14%
DE	31%	25%	16%	28%

To explore the above differences further, those who had not yet adopted SaaS were asked to comment on when adoption might occur. As shown in Figure 4, New Zealand firms, on average, appear to intend to adopt sooner than German firms.
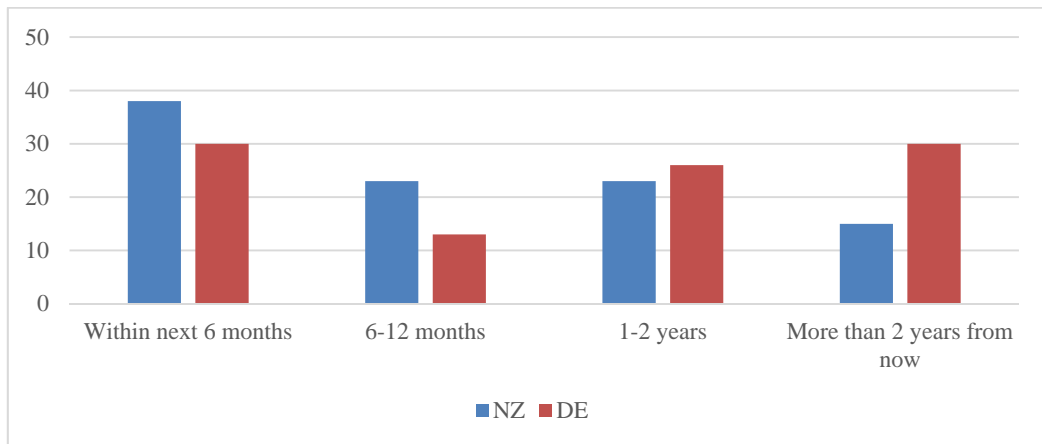
Figure 4: Timeline of future SaaS adoption

4.4 Adoption Issues

Results shown in Section 4.3 suggest there is some degree of hesitation around SaaS adoption, particularly with the German respondents. This section seeks to confirm this and will then look at other important adoption issues.

Respondents were asked simply, is there fundamental hesitation within your company around the use of SaaS? The differences between the countries' responses were glaring, as can be seen in Figure 5. Further, there was a stark difference between the NZ and DE respondents when asked the reason behind this hesitation. The NZ respondents noted issues concerning cost, staff training and the fact that the current systems were adequate. The German responses to the same question were primarily focused around security and privacy concerns. This is discussed further below in Section 5.2.
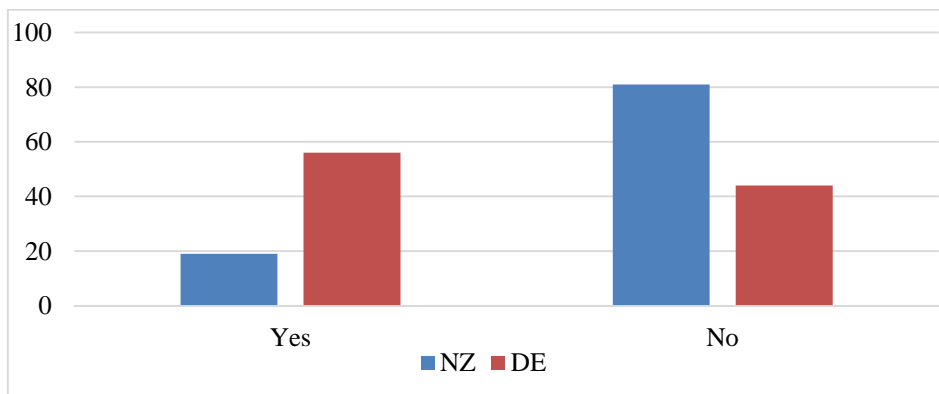
Figure 5: Fundamental hesitation around using SaaS?

Issues surrounding SaaS solution provider preferences were also explored. There were noticeable differences between the two countries, as shown in Figure 6. NZ firms appear to have a relatively strong preference for working with existing providers, suggesting that relationship management will serve those companies well. German companies are more concerned with the size and reputation of the provider, although there are likely to be many larger, well-known providers in German than in NZ. It was reassuring to see that there was little support from either group for using low-cost providers, indicating the quality is important.
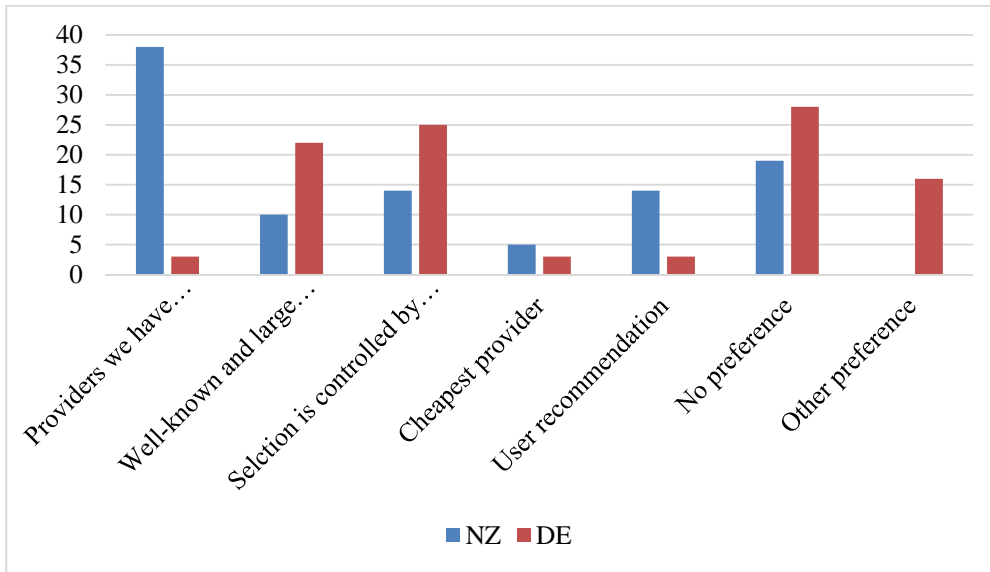
Figure 6: Preference for SaaS solution provider

At the time the survey was to be administered, a lot of media attention was being given to cases of global surveillance, spying, the NSA scandal etc. It was especially newsworthy in Germany given the targeting of the German Chancellor. Because of the importance of data security and confidentiality, participants were asked about the importance of data confidentiality both from the 3rd party access and also provider access. Figures 7 and 8 contrast the responses from the two groups of respondents. It shows that there appears to be significant differences in the importance placed on data confidentiality across the two countries. This will also be further discussed in Section 5.
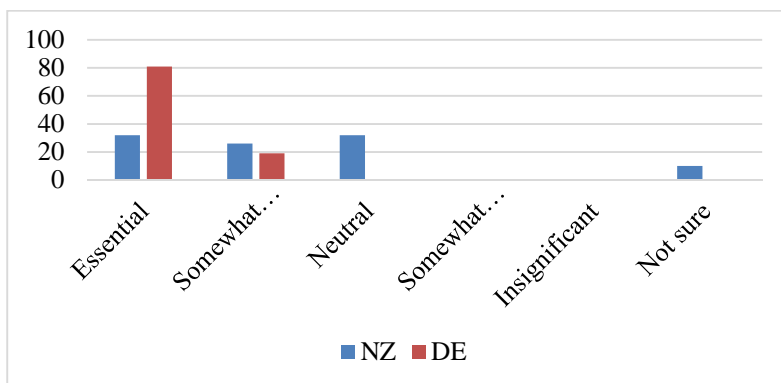
Figure 7: Importance of Confidentiality of data (protected from 3rd party access)
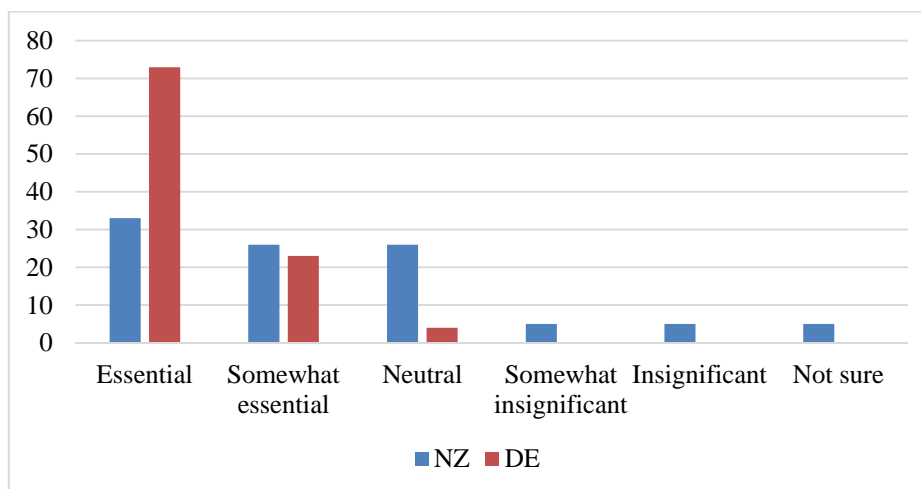
Figure 8: Importance of Confidentiality of data (protected from provider access)

5 Discussion of Key Issues

The findings reported in Section 4 highlight two general areas worthy of discussion. The research has uncovered key differences between SMEs in New Zealand and Germany in terms of their knowledge of cloud of computing - in particular SaaS, and most importantly, perceptions around the risks of security and confidentiality breaches.

5.1 Cloud Computing Knowledge

The German respondents appear to be more knowledgeable of cloud computing, including the benefits as well as the drawbacks that may come with it, than their NZ counterparts. This is supported by the fact that NZ firms appear quite happy to take the advice of others around SaaS adoption. Apart from a few exceptions like SAP or Software AG, Germany is not a country with a significant software industry. Thus, software is mostly bought by or licensed to companies, and professional customers have developed a variety of standards that software offerings have to comply with, or procedures software companies have to follow during a bidding competition. When it comes to cloud computing, associations like BITKOM[2] or GI[3] have started to provide informational services to customers thereby improving their knowledge. Also, significant funding has been invested in the topic in recent years (e.g., the federally funded Trusted Cloud or Future Business Clouds projects[4], which have resulted in widespread cloud issue awareness. This has not been the case in New Zealand. From a provider's perspective, New Zealand is a small market, and unlikely (yet) to be a major target market. New Zealand is not alone in this however, Lin and Chen (2012) found that Taiwanese managers had a general lack of understanding of cloud

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[2] www.bitkom.org

[3] www.gi.de

[4] http://www.trusted-cloud.de/, http://www.acatech.de/?id=2121

computing. This was also noted by Trigueros-Preciado et al., (2013) in their survey of Spanish SMEs.

The other likely reason for the difference in knowledge between the two countries is the size of SMEs in each. As has been mentioned earlier, and supported by the results, New Zealand SME's are much smaller than those in Germany, and rarely have dedicated IT staff. There is simply much less resource within New Zealand firms to develop technological expertise around the likes of cloud computing.

It was noted that there was generally a greater level of awareness from the German respondents since the last survey was conducted three years ago. This suggests companies, perhaps the larger companies at least, are now much more comfortable with the technology and what its strengths and weakness are.

5.2   Perceived Risks

In comparing the German results of this study with those of the previous study carried out by one of the authors [authors], the attitude to security-related risks has not diminished – if anything the level of concern has increased, perhaps in response to recent security attacks in the country. However it seems that New Zealand firms are not significantly concerned about information security and data confidentiality, do not consider they have information worth protecting, or are simply not aware of the security risks they face. It is hard to believe that they do not know the risks associated with cloud services, such as the perceived loss of control over the access to the enterprise data, the constant danger of security breaches (in addition to technical issues such as the fact that cloud software might not work well together with other software in the enterprise or the efforts that need to go into a migration to the cloud), yet their reservations associated cloud-based services are considerably less than in Germany. One reason for this may also lie in the fact that the New Zealand government has been among the first in the world to adopt a "cloud first" strategy[5], which may have resulted in a kind of reassurance for private enterprises.

Again, we see a link between risk perception and company size. The average size of German companies that responded was significantly larger than the New Zealand sample. This interpretation is in line with Repschlaeger et al, (2013) who found widespread ambivalence to security issues when they surveyed startups from around the world, including Germany, with a maximum size of 50 employees. Further support for this view is provided by Sahandi, et al (2013) who, in a survey dominated by companies with *more* than 50 employees, found that security was a serious concern. A fair conclusion therefore is that small SME's are typically less concerned about security threats, in part because they don't have dedicated IT staff and the associated internal knowledge that goes with that.

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[5] http://ict.govt.nz/programmes/government-approach/

6 Conclusion

In this paper, we report on the results of a study that compares SaaS cloud computing in Small and Medium Enterprises in Germany and New Zealand. The interest in such a study lies in the fact that not only the geographical locations of these two countries are vastly different, with the consequence, for example, that both look at different sets of foreign markets, e.g., for export, but also the structure of their "business worlds." While both countries have a similar penetration with present-day technology in general and with the Internet and the Web in particular, their SMEs exhibit many differences, as do they ways in which their SMEs perceive their IT business.

The findings of our study suggest that New Zealand SMEs are different to their German counterparts in a two key ways:

1. As smaller companies, they do not have dedicated IT staff and, as a result, are reliant on the advice they receive from so-called cloud computing experts, who would naturally present the technology in a positive light.
2. There have been few, at most, well-publicised security breaches involving cloud services in New Zealand. It is not a significant target of industrial espionage or hacking, and as such, is probably not at the forefront of the minds of New Zealand SMEs.

However there are also significant commonalities between the results of the two countries, which is equally, if not more, interesting, especially in light of the noted differences above.

Acknowledgement

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Appendix: The Questionnaire

Welcome

Thank you for your interest in this study! This study on the topic of "Cloud Computing" with particular emphasis on "Software-as-a-Service" is being conducted by Chenyao (Sarah) Wang, a student at the Waikato Management School of the University of Waikato. This study is particularly interested in the specific situation of small and medium-sized enterprises (SMEs). Your responses to this questionnaire will help me understand the specific opportunities and challenges associated with the use of cloud computing services, in particular Software as- a-Service (SaaS).

To show my appreciation for completing the questionnaire I am happy to provide you with the results of the study. If you are interested, please leave your e-mail address on the last page of the questionnaire. If you feel that you are not the right person to answer questions about the IT of your company, I would appreciate it if you could forward the link to this questionnaire on to the appropriate person. The response to the questionnaire is completely anonymous. All answers will be confidential and will be used exclusively for this study. Other parties have no access to the individual responses. This study may be published further in the academic literature. Answering the questions will take about 10-15 minutes.

About the company and yourself

Q1 What industry is your business part of?

- ○ Agriculture, forestry, fishing and hunting (1)
- ○ Mining (2)
- ○ Manufacturing (3)
- ○ Electricity, gas and water supply (4)
- ○ Construction (5)
- ○ Wholesale trade (6)
- ○ Retail trade (7)
- ○ Accommodation, cafes and restaurants (8)
- ○ Transport and storage (9)
- ○ Communication services (10)
- ○ Finance and insurance (11)
- ○ Property and business services (12)
- ○ Government administration and defence (13)
- ○ Education (14)
- ○ Health and community services (15)
- ○ Cultural and recreational services (16)
- ○ Personal and other services (17)

Q2 What was the approximate revenue of your company in the past financial year?

- ○ Up to $ 10,000 (1)
- ○ $ 10,000 to $ 250,000 (2)
- ○ $ 250,000 to $ 500,000 (3)
- ○ $ 500,000 to $ 1 million (4)
- ○ $ 1 million to $ 2 million (5)
- ○ $ 2 million to $ 5 million (6)
- ○ $ 5 million to $ 10 million (7)
- ○ $ 10 million or more (8)
- ○ Don't know, or not willing to disclose (9)

Q3 What proportion of your total costs relate to Information Technology (IT)?

- ○ Up to 10% (1)
- ○ 10% to 30% (2)
- ○ 30% to 50% (3)
- ○ 50% to 70% (4)
- ○ More than 70% (5)
- ○ Don't know. (6)

Q4 How many staff members are employed in your company?

- ○ 0-5 (1)
- ○ 5-9 (2)
- ○ 10-19 (3)
- ○ 20-49 (4)
- ○ 50-99 (5)
- ○ 100-249 (6)
- ○ 250 or more (7)

Q5 IT Staff: How many employees do you have involved in the design, operation and maintenance of your IT infrastructure?

- ○ 1-2 employees (1)
- ○ 3-4 employees (2)
- ○ 5-10 employees (3)
- ○ 11-20 employees (4)
- ○ More than 20 employees (5)
- ○ Only external staff (6)

What is the background of person responsible for your company's IT?

○ Specialist (computer scientist with university / college degree, computer specialist with specific years of training) (1)
○ Business owner (2)
○ Manager (3)
○ Administrator (4)
○ Temporary staff (5)
○ External contractors (6)
○ Don't know. (7)

Q6 Do you run your own data centre for your business?

○ No (1)
○ Yes, one (2)
○ Yes, several (enter number) (3) _____
○ Not sure. (4)

Q7 About You: In which department of the company do you work?

○ IT Department (1)
○ Functional Division (2)
○ Management (3)
○ Other (4)

What is your position title in the company? (E.g. IT Department Manager):

How long have you worked in the company?

○ Less than 6 months (1)
○ 6 to 12 months (2)
○ 1 to 2 years (3)
○ 2 to 5 years (4)
○ 5 to 10 years (5)
○ More than 10 years (6)

Software Support in your Company

Q8 Which type of software do you mainly use in your company?

❑ Individual software (programmed specially for the company) (1)
❑ Customized software (standard software adapted to the company) (2)
❑ Standard off the shelf software (without adjustments) (3)
❑ Mixture of the above categories without clear focus (4)

Q9 How many employees use the above software in your company?

❍ 0-5 users (1)
❍ 5-9 users (2)
❍ 10-19 users (3)
❍ 20-49 users (4)
❍ 50-99 users (5)
❍ 100-249 users (6)
❍ 250 or more users (7)

Q10 Through which devices do users primarily have access to software?

❑ Workstation with fixed location (1)
❑ Laptops/ Tablet PCs without fixed location (2)
❑ Standardised mobile devices (smart phones, PDAs) (3)
❑ Special devices (such as mobile RFID readers, specialized terminals, special rugged PDAs) (4)

Q11 Are any of your any applications based on client-server architecture? (this is where the software is not "hosted" on local computers, but instead installed on a central server)

❍ No, there is no central server used. (1)
❍ Yes, the server or servers are housed and administered by my company in its own data centre or server room. (2)
❍ Yes, the one or more servers are deployed in an external data centre and managed by my company. (3)
❍ Yes, the servers are completely provided and managed by an external provider. (4)
❍ Don't know. (5)

Is the software partially or totally accessed through a Web browser?

❍ Yes (1)
❍ No (2)

Q12 What pricing models underlay the software in your organization? (tick all that apply)

❑ Free model (e.g. open source) (1)
❑ One-off payment of license fees, no maintenance contracts (2)
❑ Subscription model (3)
❑ Pay-per-use model (4)

Q13 How are the costs (percentage) of the software products used distributed?

_____ One-time costs for license acquisition and Software Development or adaptation (customizing) (1)

_____ Annual license or usage fees (2)

_____ Annual maintenance costs (3)

Knowledge with respect to SaaS   In order to make sure that we achieve a uniform understanding of "SaaS", The brief definition of this term is provided as below: Software-as-a-Service (SaaS) is one of three Cloud Computing services. The idea is to provide, operate and maintain software as service over the Internet. Usage is typically via a Web browser. Service utilisation is charged periodically and usage-dependent. A user only needs a minimal IT infrastructure for accessing the software provided. Example SaaS offerings include Google Mail, Zoho Office Suite, Salesforce CRM and Xero.

Q14 How would you classify your knowledge regarding SaaS?   5 means you have a very good knowledge of SaaS, and 0 means you have no knowledge of SaaS.

	0 (1)	1 (2)	2 (3)	3 (4)	4 (5)	5 (6)
SaaS knowledge (1)	○	○	○	○	○	○

Q15 Are you using or have you used SaaS offerings in your personal life?

○ Yes, regularly (1)
○ Yes, tried (2)
○ No (3)

Q16 Based on prior experience, what is your impression of SaaS solutions used in your company?

○ Positive (1)
○ Marginally positive (2)
○ Neutral (3)
○ Marginally negative (4)
○ Negative (5)

Q17 What is your view on SaaS solutions?

	Not Sure (1)	Disagree (2)	Somewhat Disagree (3)	Neutral (4)	Somewhat Agree (5)	Agree (6)
Using SaaS solutions is attractive to me. (1)	❍	❍	❍	❍	❍	❍
Using SaaS solutions is cost-effective. (2)	❍	❍	❍	❍	❍	❍
Using SaaS solutions is easy. (3)	❍	❍	❍	❍	❍	❍
Expert opinions influence me in using SaaS solutions. (4)	❍	❍	❍	❍	❍	❍
The word-of-mouth influences me in using SaaS solutions. (5)	❍	❍	❍	❍	❍	❍
The security of data backups is a key determinant in using SaaS solutions. (6)	❍	❍	❍	❍	❍	❍
Service stability is a key determinant in using SaaS solutions. (7)	❍	❍	❍	❍	❍	❍
The application compatibility is a key determinant	❍	❍	❍	❍	❍	❍

in using SaaS solutions. (8)						
SaaS solutions are secure. (9)	○	○	○	○	○	○
SaaS solutions are trustworthy. (10)	○	○	○	○	○	○
SaaS solutions enable me to do things faster. (11)	○	○	○	○	○	○
SaaS solutions improve my performance. (12)	○	○	○	○	○	○
SaaS solutions advance my competitiveness. (13)	○	○	○	○	○	○
The functionality of SaaS solutions satisfies me. (14)	○	○	○	○	○	○
The user interface of SaaS solutions is friendly. (15)	○	○	○	○	○	○
It is easy to use SaaS. (16)	○	○	○	○	○	○
SaaS is useful. (17)	○	○	○	○	○	○

Role of SaaS in your company :

The following questions always refer to software in your company.

Please briefly explain your negative expectations (if they are negative):

Q18 Are SaaS offerings already being used in your company?

❍ Yes, regularly (1)
❍ Yes, occasionally (2)
❍ No, but their usage is being considered (3)
❍ No, their usage is not foreseeable at this stage (4)
If yes, which ones?

If you are yet to adopt SaaS, at what approximate time do you expect that solutions will be introduced?

❍ Within the next 6 months (1)
❍ In 6 to 12 months (2)
❍ In 1 to 2 years (3)
❍ Later than 2 years (4)

Q19 Is there a fundamental hesitation about using SaaS in your company which prevents its introduction?

❍ Yes (1)
❍ No (2)
If yes, what are the hesitations in your opinion?

Q20 If your existing software was replaced by a SaaS solution, would there be a basic preference for a particular provider?

❍ Software provider we have already worked with. (1)
❍ Well-known and large software vendor (2)
❍ Provider selection is limited by general rules of the IT department (3)
❍ Cheapest provider (4)
❍ User-recommended provider (e.g. via discussion forums) (5)
❍ No special preference (6)
❍ Other preference (7)

Q21 If new software was introduced as a SaaS solution, would there be a basic preference for a particular provider?

- ○ Software provider we have already worked with. (1)
- ○ Well-known and large software vendor (2)
- ○ Provider selection is limited by general rules of the IT department (3)
- ○ Cheapest provider (4)
- ○ User-recommended provider (e.g. via discussion forums) (5)
- ○ No special preference (6)
- ○ Other preference (7)

Reasons for and against SaaS solutions: On the next page, firstly I will ask you about the requirements for a SaaS product or provider has to meet before its employment are possible. Afterwards, questions will asked on the reasons which in your opinion for or against the use of SaaS products in your company; this is about the advantages and disadvantages of the use of SaaS products.

Q22 Please rate the importance of the following conditions for usage of SaaS.

	Not Sure (1)	Insignificant (2)	Somewhat Insignificant (3)	Neutral (4)	Somewhat Essential (5)	Essential (6)
Confidentiality of data to third parties (regardless of whether the provider can view the data) (1)	○	○	○	○	○	○
Confidentiality of data to the provider (the provider technically has no possibility to view the data) (2)	○	○	○	○	○	○
Operating concept of SaaS software similar to classical desktop applications (drag & drop, windows, etc.) (3)	○	○	○	○	○	○
Possibility to change the SaaS provider (4)	○	○	○	○	○	○
Performance of the application (presentation, interaction	○	○	○	○	○	○

and processing without delay) (5)						
Stability of prices for software (6)	○	○	○	○	○	○
Constant availability of the software (7)	○	○	○	○	○	○
Possibility of a complete data export (database dump, CSV download, etc.) (8)	○	○	○	○	○	○
Customized service level agreements (SLAs) (9)	○	○	○	○	○	○
Warranty for storage of data within certain geographical limits (e.g., data may not be stored outside New Zealand) (10)	○	○	○	○	○	○
Possibility of a local installation of SaaS software on your own infrastructure	○	○	○	○	○	○

(11) Possibility of integration with other SaaS offerings (also other providers) (12)	○	○	○	○	○	○
Possibility of integration into existing (non-SaaS) software (13)	○	○	○	○	○	○
Provider is certified according to SAS 70 (14)	○	○	○	○	○	○
Provider is certified according to ISO / IEC 27001 (15)	○	○	○	○	○	○
Provider based in New Zealand. (16)	○	○	○	○	○	○
Provider has the "Safe Harbour" seal (17)	○	○	○	○	○	○
Provider has the "Privacy Mark" seal (18)	○	○	○	○	○	○
Provider has a well-defined backup	○	○	○	○	○	○

strategy (19)						

Q23 From your point of view, if there are any additional conditions for the use of SaaS products in your business, please note them here:

Q24 What are the reasons, in your opinion, in favour of using SaaS solutions, and how relevant are these to your company?

	Not Sure (1)	Insignificant (2)	Somewhat Insignificant (3)	Neutral (4)	Important (5)	Very Important (6)
Software scales better: consistent performance of software even with increasing number of users and amount of data (1)	❍	❍	❍	❍	❍	❍
Software access from anywhere, with only a Web browser and an Internet connection needed (2)	❍	❍	❍	❍	❍	❍
Simpler way to later change the SaaS provider (3)	❍	❍	❍	❍	❍	❍
High safety standards in professionally operated external data centres (4)	❍	❍	❍	❍	❍	❍
No additional hardware investments needed for your own	❍	❍	❍	❍	❍	❍

infrastructure, because the software runs on external infrastructure (5)						
Periodic billing according to usage instead of a traditional license model (6)	○	○	○	○	○	○
Software protected against problems in your own infrastructure (server crash, etc.) (7)	○	○	○	○	○	○
The new SaaS software is ready to use, and faster than traditional software (8)	○	○	○	○	○	○
No maintenance: upgrades / patches are directly installed by providers and without impairing usage (9)	○	○	○	○	○	○
Software	○	○	○	○	○	○

provider takes care of all aspects of data management including backups (10)						
No license / software problems with hardware exchange (11)	○	○	○	○	○	○
Access to software via mobile devices (smartphone, mobile phone, tablet) (12)	○	○	○	○	○	○
Short-term use of the software for clearly defined project period (e.g. software that is required exclusively in the next 3 months) (13)	○	○	○	○	○	○
Risk-free testing of new software without complex installation before deciding for	○	○	○	○	○	○

or against a product (14)						
Software functions similar to the Web sites (15)	○	○	○	○	○	○
Most partners and competitors are using SaaS solution (16)	○	○	○	○	○	○

Q25 In your opinion, if there are other reasons encouraging the use of SaaS solutions, please enter them here:

Q26 What, in your opinion, are the reasons against the use of SaaS solutions, and how relevant are these to your company?

	Not Sure (1)	Insignificant (2)	Somewhat insignificant (3)	Neutral (4)	Important (5)	Very Important (6)
Operation in the browser is less convenient in comparison with desktop solution (1)	○	○	○	○	○	○
High latency when using ("long loading times") (2)	○	○	○	○	○	○
Lack of employee acceptance (established work processes, familiarization with new software) (3)	○	○	○	○	○	○
Benefits of SaaS is not visible (4)	○	○	○	○	○	○
Costly data migration when replacing existing software (5)	○	○	○	○	○	○
Interaction problems with other software (6)	○	○	○	○	○	○
Always-on broadband	○	○	○	○	○	○

Internet connection required (7)						
Complex technical implementation (8)	○	○	○	○	○	○
Restrictions by existing contracts (9)	○	○	○	○	○	○
Acquisition costs for existing software and hardware must first be remunerated (10)	○	○	○	○	○	○
Control of access to the data is out of your control (11)	○	○	○	○	○	○
Less control over protection against loss of data (backup) (12)	○	○	○	○	○	○
Billing by use of SaaS solutions is not attractive (13)	○	○	○	○	○	○
SaaS solutions do not contain all the features that the company requires (14)	○	○	○	○	○	○

Q27 If there are other reasons which, in your opinion, are against the use of SaaS products, please enter these here:

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Working Papers, ERCIS

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