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ICT and Innovation in Small Companies

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Abstract

The small business sector is very important to most economies generating significant wealth and employment. It has generally been accepted that small business owners are less likely to embrace innovation and less likely to have a well-defined business strategy. Yet for companies to grow and continue to be successful innovation is critical. Given the importance of this sector there is a need for governments and policy makers to understand innovation in small business particularly in terms of ICT implementation and use in order to formulate appropriate programs and policies. There have been few studies reported in the literature however, that have looked at innovation in the small business sector. This study investigated small Swiss businesses with 10 to 49 employees. A survey of 389 small businesses found that most see themselves as innovative and most use IT to support innovation. Further the study found a strong link between companies who invest in ICT, how these companies use ICT and their level of innovativeness. The study supports a hypothesis model which describes the features of innovative companies, how they use ICT for innovation and strategies they employ for gaining competitive advantage.

Keywords: information technology, ICT, innovation, small business.

1 INTRODUCTION

Porter (2001) argues that today the issue for organisations is not the acquisition and deployment of technology but rather how companies innovate. “Companies must be able to innovate on a global frontier. They must create and commercialize a stream of new products and processes that shift the technology frontier, progressing as fast as their rivals catch up.” Porter was referring to large organisations, however his comments are no less true for small businesses.

The ability to innovate is critical to achieving competitive advantage (Porter 1990; Hadjimanolis 2000). We use Roger’s (2003) definition of innovation in this context which is “an idea, practice, or object that is perceived as new to an individual." (p. 137) Innovation however is no less important for small organisations as it is for large corporations particularly in terms of continuing business viability (Geogellis et al. 2000). A recent European Commission report (2003) discusses in detail the role of innovation and SMEs. The report begins with the statement “Entrepreneurship and SMEs have emerged as the engine of economic and social development throughout the world.” (European Commission 2003, p. 9)

The sector of small and medium-sized enterprises (SME) is a significant sector for most developed Western economies (Beaver and Prince 2004; Meckel et al. 2004). Whilst there is significant literature on large organisations, to date however, there has been limited research that has investigated specifically the application of ICT in small businesses (Hussin et al. 2002; Riemenschneider et al. 2003). What has been produced, Beaver and Prince (2004) suggest has been of varying quality. The research reported in this paper was part of a larger study that investigated the importance and use of information and communication technology in Swiss small and medium-sized companies. This paper focuses on a particular part of the study, namely the responses from *small* business (10 to 49 employees) only.

2 SMALL BUSINESS AND INNOVATION

Consistent with the EU definition of small and medium-sized enterprises (SMEs) (European Commission 2003, p. 26) a small business was defined as employing between 10 and 49 people and medium-sized enterprise is defined as employing between 50 and 250 people. The EU report (2003) states that the “vast majority of enterprises in Europe (99.8%) are SMEs”, and SMEs are crucial for continuing strong economic performance in Europe. The importance of the SME as a sector cannot therefore be underplayed and it is highly relevant to study this sector.

Innovation, as mentioned, is regarded as a significant factor in determining a firm’s success (Pratali 2003). Innovation, for this study relates directly to technology. Roger’s (2003) theory of Diffusion of Innovations one of the most well-known and used theories in the area, identifies three variables related to organisational innovativeness. One variable, “internal characteristics of organisational structure” (Rogers 2003, p. 411) is described as consisting of six sub variables. *Centralization* is the level to which leaders in an organisation have power. *Complexity* relates to knowledge and expertise of staff and how difficult an innovation is to use. *Formalization* consists of procedures put in place by an organisation. *Interconectedness* links social networks of staff with the organisation. *Organizational slack* relates to the level of resources available for innovation and company *Size* is measured by number of staff and budget size.

Firm size is a critical factor often discussed in the literature as to why small-business is not innovative (Hussin et al. 2002; Hadaya, 2006). Rogers (2003) cites a number of studies indicating that larger organisations are more likely to be innovative than smaller ones. He does however qualify this, suggesting that size is an easy measure to use and suggests that there are significant other unidentified variables at play, that are perhaps not well understood and rarely used as measures. The specific

variables Rogers identifies are the characteristics of the leader, the characteristics of the internal structure (including size) and characteristics external to the organisation. The European Commission (2003, p. 20) report confirms the importance of size, suggesting "the likelihood of an enterprise not innovating decreases with enterprise size. For example, 52 % of enterprises with fewer than 50 employees were not innovative." Although this reports on research published in 1996, there is little recent research that disconfirms these results. One large study of small companies by Burke (2005) did find that there was no significant difference in Internet use between the larger and smaller companies.

Planning helps small-business owners to innovate (Beaver and Prince 2004). In particular through the planning process small-business owners are more likely to identify issues around the need for new technology and training to help the business grow. Geogellis et al. (2000) suggest for a small business to successfully innovate, planning, competencies for planning and managing innovation and fostering a culture of entrepreneurship are important.

Another challenge for SMEs to be innovative is resources particularly in relation to the economies of scale. Small businesses have less money and therefore less to invest in ICT (Aragón-Sánchez and Sánchez-Marín 2005; Burke 2005). Research conducted by Hadjimanolis (2000) examined innovativeness from the perspective of resources. His findings suggest that small firms lack resources and bargaining power which hinders their ability to be innovative and he established that the size of the firm did impact on the availability of resources, resources including ICT, expenditure on training, and research and development. Other factors impacting on small-business innovativeness, identified by Hadjimanolis (2000), include the personality of the owner, flexibility of the organisation, informal processes and the internal culture of the business. He concludes therefore that the acquisition of resources and capabilities are important for a small firm for managing technological innovation.

A small business cannot simply be regarded as a scaled-down large business. It is often the case that a theory designed for large organisations cannot be applied to small-business (Thong et al. 1996). Beaver and Prince (2004) warn against thinking of small businesses as a homogeneous group. They argue that "By their very nature, small firms are different and have special characteristics, operating contexts, objectives and qualities." Of the research produced to date, Beaver and Prince (2004) argue much in this area has failed "to recognise and accommodate the special problems in researching small-business issues and contexts". This is reinforced by others such as Thong (1996) who argue that small businesses often have structures that are simple but highly centralised.

Research in the area of ICT and SMEs as mentioned is not extensive (Riemenschneider et al. 2003). Even less research has focused on small businesses and IT (Hussin et al. 2002). Hussin et al (2002), surveyed managers of small firms in the UK employing between 50 and 150 people. The study looked at IT alignment and they had 256 responses. Research by Georgellis et al (1999) again in the UK, involved a telephone survey of 300 small businesses employing less than 25 people. The survey specifically looked at entrepreneurship, innovation and business performance. Hadjimanolis's (2000) case study research, as discussed above, looked at 25 small manufacturing firms in Cyprus employing less than 100 people. Innovation was one of the dimensions of his research.

The remainder of the paper is structured as follows: First we present the research questions which we sought to explore in this study. Research hypotheses and underlying research model are presented. Methodology and research steps are explained. In the main chapter we present the survey data in the light of the research model. We discuss the interrelation between innovation and ICT in the surveyed SMEs. In the final chapter we summarize the findings and draw conclusions.

3 RESEARCH MODEL AND HYPOTHESES

As described earlier there is limited research reported in the literature on innovativeness, particularly in relation to small companies and their use of ICT. Of the empirical studies that have been reported very few studies have attempted to identify the factors relating to innovation in small businesses. Our

research tries to fill part of this gap following two steps: In the first step, based on the literature discussed above, we analyse the following questions:

- What is the level of *ICT skills* of staff and management in small organisations?
- How has ICT helped small companies achieve their *operational targets*?
- What is the *resulting benefit* (value) of ICT to small companies?

In the next step, we relate these questions to the phenomenon of innovation (cf. right side of the research model, Figure 1). For this reason, the questions (factors) were grouped into three blocks (cf. left side of the research model, Figure 1). In our research we tested if the factors influence

1. the internal power for achieving innovation through the use of ICT (E1) and
2. the perception of innovation by the customers (E2).

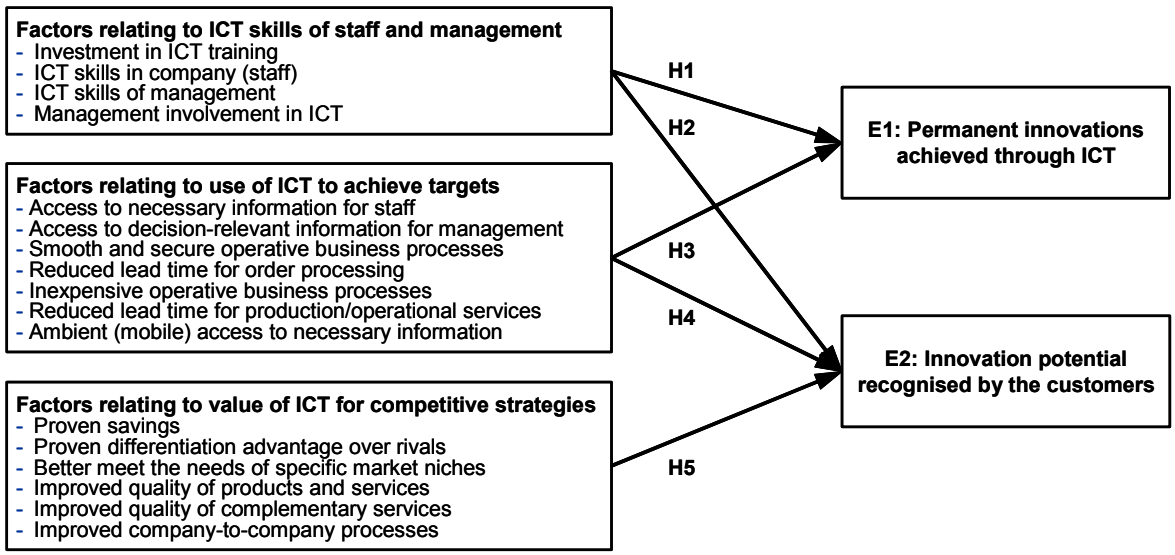

Figure 1: Research model and underlying hypotheses

All hypotheses shown in Figure 1 assume positive relationships between the independent and dependent variables. The hypotheses are described in detail in the following sections.

3.1 ICT skills of staff and management

Complexity, Rogers (2003) says, relates to the knowledge and expertise of employees. He argues that in companies where employees have knowledge and expertise they are more likely to grasp innovation. The skills of both staff and management will therefore have an impact on the level to which a small business can be innovative. Hadjimanolis (2000) argues that because small companies do not have the resources less is spent on training. It is also more likely that smaller companies will employ generalist rather than specialist staff (Thong 1996) thereby impacting on staff skills. Hence, we decided to examine the following two hypotheses which are:

H1: A high level of ICT skills in staff and management and the involvement of management in ICT have a positive influence on a company's ability for innovation through ICT.

H2: If the level of ICT skills in staff and management and the involvement of management in ICT are high, the company is recognised as innovative by its customers.

3.2 Use of ICT to achieve operational targets

There is evidence in the literature relating to the importance of information both in terms of business planning and innovation for SMEs (Georgelllis et al 2000). Rogers (2003, p. 172-173) argues that

knowledge or information is needed to use an innovation and to understand how an innovation works. Following this line of thought, the next two hypotheses to be analysed are:

H3: A high degree of access to relevant information and ICT-improved operational business processes has a positive influence on a company's ability for innovation through ICT.

H4: If the degree of access to relevant information is high and operational business processes are improved by ICT the company is perceived as being innovative by its customers.

3.3 Value of ICT for developing competitive strategies

Again, the literature argues strongly that business strategy is important for companies to achieve innovation. The importance of being able to plan ahead was identified by Georgellis et al. (1999) who distinguished entrepreneurial businesses from the rest. They argue that "Without this capacity to plan, it seems that innovations in new products or services were less likely" (Georgellis et al. 1999, p. 12). Research relating to SMEs and strategy by Duhan et al (2001) argues that there is a need to view competitive advantage from the perspective of resources, particularly information systems resources. Hadjimanolis (2000) argues from the results of his research that technological resources are amongst the most important factors for innovativeness. Hence, the final hypothesis is:

H5: If a company manages to achieve competitive advantages with the use of ICT the company is perceived as being innovative by its customers

The following sections describe the development of the research questionnaire and the selection of the survey sample that we used to validate our research model and to test the hypotheses.

4 RESEARCH STEPS AND METHODOLOGY

SMEs in Switzerland were the focus of this study. Porter (2001) argues that location is important. The external environment, he suggests, is as important as internal factors when considering innovation. Porter's (2001) National Innovative Capacity Index, compiled in 1996, ranked Switzerland third of OECD countries. The study of ICT and innovation in small businesses in Switzerland provides an excellent opportunity to look at innovation in a country where the external environment is considered by Porter, to be very favourable to innovation.

Further, the use of ICT and mobile technology in Switzerland is quite advanced compared with other OECD countries. In 2003, Switzerland had the highest per-capita spending for ICT followed by the USA and Scandinavian countries (Swiss Federal Office for Statistics 2004). The implementation and use of computer equipment and modern software applications in companies is also very high (Dettling et al. 2005, Schubert et al. 2006).

This research conducted in 2005, focused on small and medium-sized companies and organisations (e.g. hospitals, public administration, schools). The Swiss Federal Office for Statistics drew a stratified and weighted control sample of 5,796 companies based on sector and company size from a universal set of 38,016 companies. The business sectors "industry" and "services" were selected which represent 94 % of Swiss companies with ten or more employees and constitute therefore a large proportion of Swiss business.

As mentioned earlier, many studies have focused on large organisations which are different in structure, management and resources compared with SMEs (KPMG 2005; Impulse 2005; IBM 2005). Very small or micro businesses with 0 to 10 employees also differ in conditions and structures. Often a micro business has no employees at all (European Commission 2003). Both of these "marginal groups", large companies and micro businesses, were therefore excluded from this study.

4.1 Survey design

The basis of the survey used a standardised online questionnaire in German and French with predominantly closed questions. The questionnaire was developed in cooperation with business partners and trialled several times in pre-test interviews. The survey was aimed at members of senior management in small and medium-sized Swiss companies and other organisations. Because of extensive Internet access in Swiss SMEs both an Internet-based and a print version (on request) of the survey were provided. Initial contact with the companies and an invitation to participate was made by post. Companies who were prepared to be interviewed were directly interviewed following the original questionnaire. Figure 2 illustrates the research steps undertaken for this survey.

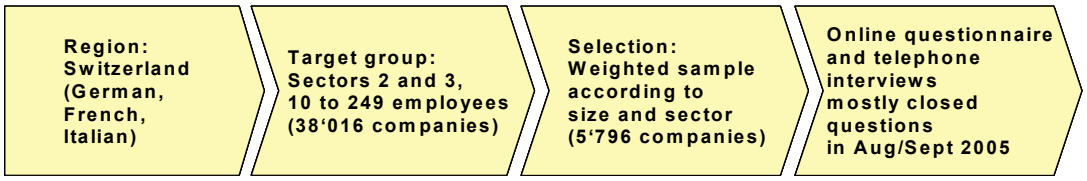

Figure 2: Research Steps

The questions and statements in the survey required a response on a scale where 1 was lowest and 4 highest. This approach is similar to and consistent with other reported research in the area of SMEs and technology (Hussin et al. 2002; Aragón-Sánchez and Sánchez-Marín 2005; Geogellis et al. 2000).

4.2 Selection and characterisation of the control sample

Altogether, 1,101 companies participated in the study either by completing the questionnaire (638) or by being interviewed (463). Of these, 989 questionnaires were usable representing a 17.1% response rate. The results presented in this paper focus on small businesses, that is, companies with 10 to 49 employees. There were 392 responses from small businesses representing 39.6% of the responses received. Not every company answered every question; this means the given number of valid datasets (N) in the graphics and tables is sometimes smaller.

Most of the respondents were members of senior management. Respondents to the full study were CIOs (35 %), CEOs (30 %), and other executives in commercial and technical areas (24%). In the small businesses (10 to 49 employees), the majority of the respondents were CEOs (42 %).

The largest proportion of responses came from businesses in *Manufacturing and industry* (30.4%), followed by *Trade and repair of used goods* (10.3 %) as well as *Public Administration* (10.0%)

4.3 Analysis of data

SPSS was used to analyse the data this included the calculation of frequencies and cross tabulations. Cross tabulations were used to demonstrate "the presence or absence of a relationship" (Bryman and Cramer 1992, p. 153). In some cases, a test of homogeneity was performed. A nonparametric Pearson's chi-square test was applied to determine the significance of the results (Backhaus et al. 1996; Sachs 1992). The results are regarded as significant in the case that the probability of error (α) is equal or smaller than 0.05 (5%). In the case of independence tests, Pearson's contingency coefficient was used to establish the strength of the relationship between two variables (Bryman and Cramer 1992, pp.106).

5 RESEARCH FINDINGS

The results focus on small businesses in particular on some of the factors Rogers (2003) describes as "internal characteristics of organisations". These are Centralization, Complexity, Organizational Slack and Size. The factors Formalization and Interconnectedness were not relevant to this study as they do not specifically relate to ICT.

5.1 Overview

Figure 3 describes the industry sectors in which these small-business respondents are active. The distribution of the sectors in the sample is similar to the distribution of the sectors in the Swiss economy.

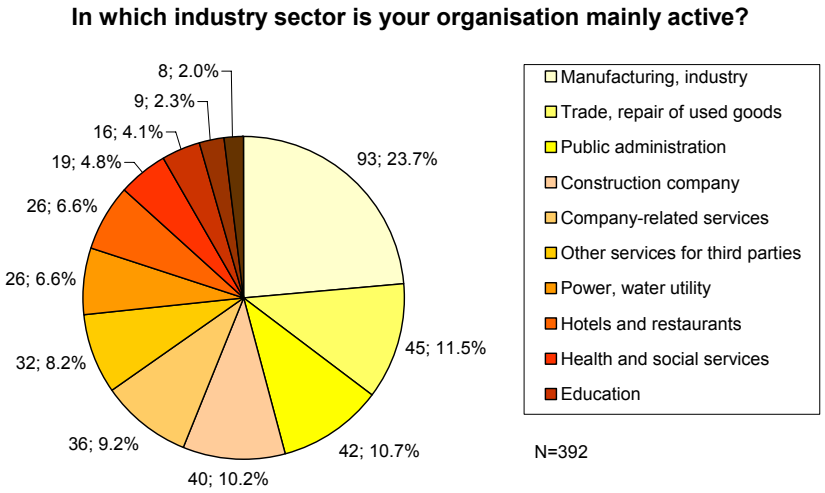

Figure 3: Responses of small business (10 to 49 employees) by industry sector, N=392

As can be seen in Figure 3, the majority of small businesses are in the manufacturing sector followed by trade and public administration.

5.2 Factors contributing to the power of innovation (hypotheses tests)

The survey explored a number of areas relating to SMEs and ICT. The questions explored the target markets of the business, the application and organisation of information technology, current and future spending on ICT as well as general information about the organisation such as turnover. As already shown in the research model (cf. Figure 1) we selected two specific statements from the total set of questions in the survey, that were most representative for the measurement of the power of innovation (E1: ”Permanent innovations achieved through ICT” and E2: ”Innovation potential recognised by the customers”). Figure 4 displays the level of agreement of the companies in the sample with E1 and E2.

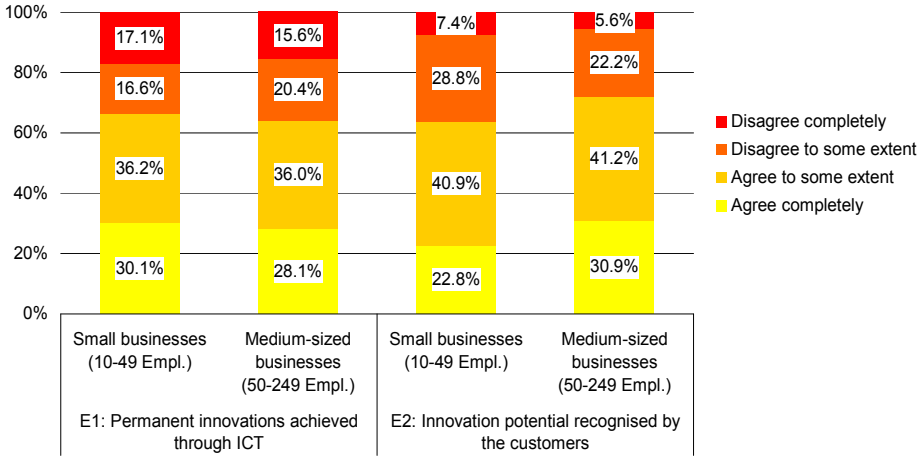

Figure 4: Level of innovation, a comparison of small and medium businesses

Table 1 provides an overview of the results of these two statements. For comparison, the responses from the larger companies included in the complete survey are shown.

	Company size							
	Small businesses (10-49 Empl.)		Medium-sized businesses (50-249 Empl.)					
Innovation	**Mean°)**	**SD °)**	**Mean°)**	**SD °)**	**N**	**X² *)**	**df **)**	**α ***)**
E1: Permanent innovations achieved through ICT	2.79	1.054	2.77	1.027	915	2.308	3	n.s.
					915	0.483	1	n.s.
E2: Innovation potential recognised by the customers	2.79	0.879	2.97	0.870	854	9.396	3	0.024
					854	6.631	1	0.010

°) On a four point scale of 1 = Disagree completely to 4 = Agree completely; SD = Standard deviation
*) Pearson's Chi-square; homogeneity test; n.a. = test not applicable
**) Degrees of freedom; merging of cells leads to a lower degree of freedom
***) Residual probability of error α, asymptotic, 2-sided test; n.s. = not significant

Table 1: Level of innovation, a comparison of small and medium businesses

Regarding the second indicator (E2), the innovativeness of a company as perceived by the clients, the group of small enterprises with 10 to 49 employees and the group of medium-sized enterprises (50-249 employees) are significantly different ($\chi^2 = 9.396$, $\alpha = 0.024$) from each other (Table 1). The zero hypothesis that these groups are homogenous must be declined (using a homogeneity test). This means that the medium-sized companies are perceived to be more innovative than the smaller companies. This result is even more evident when we combine the answers "agree completely" and "agree to some extent" (assuming these are the innovative candidates) and "disagree to some extent" and "disagree completely" (= non-innovative ones) on the other hand ($\chi^2 = 6.631$, $\alpha = 0.01$). Note that the χ^2–Value is smaller in the latter case only because the number for the degrees of freedom is smaller.

Although the two groups differ in terms of how customers perceive their innovativeness they are homogeneous in terms of realizing innovation with ICT (E1). As Table 1 illustrates there is little difference between small businesses and medium-sized businesses in terms of the level to which they use ICT to support innovation. The zero hypothesis of homogeneity cannot be rejected.

In order to test the five hypotheses, the two statements (E1 and E2) were cross tabulated against a number of other survey items. The purpose of the cross tabulations was to identify the factors leading to innovative companies. The following sections will discuss the findings of the cross tabulations.

5.2.1 ICT skills and management (hypotheses 1 and 2)

Rogers (2003) says complexity is how easy an innovation is to understand and use and relates to the knowledge and expertise of an organisation's members. Centralization, according to Rogers is how much power is concentrated in a few individuals in an organisation. We have therefore determined that the knowledge and expertise of staff and management are a measure of "*Complexity*". "*Centralization*" was measured by the level to which those making ICT decisions were also involved in management.

Respondents were presented with a series of statements and asked questions related ICT in the company (responses were measured on a four point scale of "disagree completely" to "agree completely"). Table 2 presents the results of the first group of statements cross tabulated against the two measures of innovation described in Figure 4.

H1				E1: Permanent innovations achieved through ICT		
Factors relating to ICT skills of staff and management	**N**	**X^2 *)**	**df **)**	**α ***)**	**CC ****)**	**Association**
Investment in ICT training	356	71.344	9	0.0005	0.409	very strong
ICT skills in company (staff)	353	72.941	9	0.0005	0.414	very strong
ICT skills of management	353	42.268	9	0.0005	0.327	strong
Management involvement in ICT	330	53.335	9	0.0005	0.373	strong
H2				E2: Innovation potential recognised by the customers		
Factors relating to ICT skills of staff and management	**N**	**X^2 *)**	**df **)**	**α ***)**	**CC ****)**	**Association**
Investment in ICT training	336	24.253	9	0.0040	0.259	medium
ICT skills in company (staff)	334	37.221	9	0.0005	0.317	strong
ICT skills of management	336	24.623	9	0.0030	0.261	medium
Management involvement in ICT	318	18.614	9	0.0290	0.235	medium

*) Pearson's Chi-square; n.a. = test not applicable
**) Degrees of freedom
***) Residual probability of error α, asymptotic, 2-sided test; n.s. = not significant
****) Pearson's contingency coefficient

Table 2: ICT skills and innovation (hypotheses 1 and 2), company size: 10-49 empl.

In Table 2 we can see that ICT skills of staff and management (E1) are strongly connected with the company's ability to innovate. The results show that ICT skills play an important role for a company to sustain a competitive market position especially in industries where innovation is key to company success. It is good news for educational institutions such as universities especially the factor "investment in ICT training" which has a strong influence on the ability to innovate (CC > 0.4).

Also interesting is that skills also influence the way the company is perceived by its customers (E2). Especially the ICT skills of the staff show a strong correlation (CC > 0.3). This is not surprising as the most prominent interface between the company and its customers are the contacts with its people.

→ *Hypotheses 1 and 2 can thus be confirmed.*

5.2.2 Use of ICT to achieve operational targets (hypotheses 3 and 4)

H3				E1: Permanent innovations achieved through ICT		
Factors relating to the use of ICT to achieve operational targets	**N**	**X^2 *)**	**df **)**	**α ***)**	**CC ****)**	**Association**
Access to necessary information for staff	349	6.097	3	n.s.		
Access to decision-relevant information for management	347	7.722	3	n.s.		
Smooth and secure operative business processes	348	4.859	3	n.s.		
Reduced lead time for order processing	337	9.188	3	0.0270	0.163	medium
Inexpensive operative business processes	344	18.960	3	0.0005	0.229	strong
Reduced lead time for production/operational services	316	18.769	3	0.0005	0.237	strong
Ambient (mobile) access to necessary information	334	9.771	3	0.0210	0.169	medium
H4				E2: Innovation potential recognised by the customers		
Factors relating to the use of ICT to achieve operational targets	**N**	**X^2 *)**	**df **)**	**α ***)**	**CC ****)**	**Association**
Access to necessary information for staff	332	5.267	3	n.s.		
Access to decision-relevant information for management	334	6.992	3	n.s.		
Smooth and secure operative business processes	335	5.303	3	n.s.		
Reduced lead time for order processing	324	3.057	3	n.s.		
Inexpensive operative business processes	331	7.783	3	n.s.		
Reduced lead time for production/operational services	304	7.465	3	n.s.		
Ambient (mobile) access to necessary information	321	5.891	3	n.s.		

*) Pearson's Chi-square; n.a. = test not applicable
**) Degrees of freedom; merging of cells leads to a lower degree of freedom
***) Residual probability of error α, asymptotic, 2-sided test; n.s. = not significant
****) Pearson's contingency coefficient

Table 3: Use of ICT to achieve operational targets and innovation (hypotheses 3 and 4), company size: 10-49 empl.

The results displayed in Table 3 are interesting to interpret. There seems to be little correlation between the innovation potential of a company and its improvement of operational processes. A closer look reveals that information to relevant information (as promoted by the research field of Business Intelligence) does not have an influence on neither internal innovation power (E1) nor perceived innovation potential (E2). Nevertheless, we can see that the factors relating to the value-generating processes of the companies are strongly correlated to the internal power for innovation (E1). The results indicate these positive correlations as we expected that permanent innovation leads to better processes (and thus reduced time and cost of production). The test fully confirmed this assumption.

In this context it is interesting to note that improved internal processes are connected to the internal power of innovation (E1) on the one hand but that they do *not* positively influence the external customers' perception of innovation. Companies that manage to optimize their *production processes* (time and cost) are *not* perceived to be more innovative but companies with a high level of staff ICT skills are seen to be more innovative (as per the previous section). We could conclude that it is easier to get a feeling about the ICT skills of a supplier than about his internal operational processes.

→ *Hypothesis 3 can be partly confirmed. Hypothesis 4 was not confirmed.*

5.2.3 Value of ICT

H5			E2: Innovation potential recognised by the customers			
Factors relating to the value of ICT for competitive strategies	**N**	**X² *)**	**df **)**	**α ***)**	**CC ****)**	**Association**
Proven savings	324	20.041	9	0.0180	0.241	medium
Proven differentiation advantage over rivals	313	61.855	9	0.0005	0.406	very strong
Better meet the needs of specific market niches	322	37.211	9	0.0005	0.322	strong
Improved quality of products and services	330	25.651	9	0.0020	0.269	medium
Improved quality of complemantary services	322	24.045	9	0.0040	0.264	medium
Improved company-to-company processes	321	32.373	9	0.0005	0.303	strong

*) Pearson's Chi-square; n.a. = test not applicable
**) Degrees of freedom
***) Residual probability of error α, asymptotic, 2-sided test; n.s. = not significant
****) Pearson's contingency coefficient

Table 4: Use of ICT to achieve operational targets and innovativeness (hypothesis 5), company size: 10-49 empl.

The results from Table 4 are, also interesting. Whereas, as mentioned earlier, the achievement of *operational* targets does not influence the perception of innovation (E2), we can now see that the achievement of *competitive* strategies changes the way customers perceive innovation potential. This is important for business strategists. It means that innovation (or at least the assessment of innovation) is influenced by improvements in competitive *strategy* not by *operational* improvements. Proven differentiation advantages over rivals is the top factor. Successfully meeting market niches and improved B2B processes are also strongly related (two factors easily monitored by customers).

All factors relating to ICT strategic use are correlated to the perception of innovation by customers – only to a different extent. Companies that have managed to effectively support their competitive strategy with ICT are perceived as more innovative by their clients as compared to companies that do *not* manage to gain such a benefit from ICT. This could mean that the innovative orientation is a prerequisite to be able to use ICT for an effective support of competitive strategy. However, it could also mean that the mere use of ICT makes an enterprise look more innovative to customers.

→ *Hypothesis 5 can thus be confirmed.*

5.3 Other factors that contribute to innovation

Besides the factors portrayed in the research model there were other factors which could be related to innovation. The following sections comment on ICT cost expenditure, use of business software, and company turnover.

5.3.1 ICT cost expenditure

Rogers (2003, p 412)argues that "why organizational size is so highly related to innovativeness is that larger organisations have more slack resources". For this study, ICT investment is used to measure "*Organizational slack"*. We concede there may be other measures, however organisations that invest in ICT must have the financial capacity to do so. Companies were asked to indicate, on average, their total ICT costs from 2003 to 2005. A total of 356 small companies responded to this question. Table 5 presents the results. All financial values are listed in Swiss Francs (1 CHF = 0.63 Euro)

Total expenditure	Frequency		Total expenditure	Frequency	
in Swiss Francs (CHF)	absolute	in %	in Swiss Francs (CHF)	absolute	in %
0 per year	2	0.6%	100'000 to under 250'000 per year	52	14.6%
1 to under 25'000 per year	140	39.3%	250'000 to under 500'000 per year	18	5.1%
25'000 to under 50'000 per year	84	23.6%	500'000 to under 1 Mill. per year	8	2.2%
50'000 to under 100'000 per year	47	13.2%	1 Mill. or more per year	5	1.4%

Table 5: Expenditure on ICT 2003-2005, company size: 10-49 empl., N=356

Respondents were asked to indicate how much on average was spent on ICT. Table 5 shows that over 60% of all small businesses spent *at least* 25,000 CHF on ICT over the last three years and 36.5% of organisations spent more than 50,000 CHF. There was no statistical difference between innovative companies and the others on the question of expenditure. This statement is only correct for small enterprises, the larger companies are different. The survey also asked companies about their expected ICT expenditure over the next three years (2006 to 2008), including staff costs, external services, hardware, software and networking. The results indicate no statistically significant difference between those companies who say they use ICT for innovation and those who are not using ICT for innovation based on expenditure. There was however a statistically significant difference between those companies who consider themselves as innovative and the level of expenditure on internal staff training. Companies who were innovative were more likely to spend more on staff training (P=<.001).

5.3.2 Use of Business Software

The survey asked respondents to indicate on a four point scale of "no support (1)" to "intensive support (4)" which areas of the business were supported with ICT. Table 6 presents the list of areas included and the results presented as a mean, highest to lowest.

	Level of ICT support 1 = No support, 4 = Intensive support			
Business areas	N	Mean	Median	SD °)
Finance and accounting	384	3.73	4	0.601
Human Resources Management	380	3.23	3	0.859
Management	379	3.08	3	0.886
Customer service	363	2.85	3	0.982
Production/operational goods and services	344	2.81	3	1.064
Marketing and distribution	338	2.77	3	0.981
Procurement/Purchasing	365	2.75	3	1.051
Internal Services, e.g. ICT services, infrastructure mgt., maintenance	367	2.73	3	1.043
Material and merchandise management, incl. logistics	339	2.70	3	1.111
Product development	311	2.45	2	1.157
°) SD = Standard deviation				

Table 6: Business areas and level to which they are supported with ICT, company size: 10-49 empl.

Not surprising is that finance and accounting is the area where ICT is applied most frequently across all organisations. Product development however is the area where ICT is least likely to be applied. The statement "Our clients recognise that we are an innovative company" was cross tabulated with the question relating to the extent to which ICT was used to support the different business areas (as described in Table 6). Finance and accounting was the only area where there was no statistical significance in the cross tabulation. For most other areas, it was highly statistically significant (P <= 0.001) that companies who saw themselves as innovative were more likely to use ICT to support

different areas of their business. The only exceptions were Internal services (P = 0.05) and Material and merchandise management (P = 0.007).

5.3.3 Company turnover

From a business perspective companies who saw themselves as innovative were more likely to have had an increase in turnover in the last 3 years in comparison with the rest of the industry sector. 16.7% said turnover rose annually whereas only 8.3% of the non-innovative companies reported an increase in turnover over the last 3 years. However a small number of innovative companies also registered a decrease in turnover in the last 3 years. 12.8% said turnover decreased whereas non innovative companies only 5.2% said turnover decreased by 2 to 6% annually. This suggests there are risks to innovation but overall more likely to lead to increase in turnover. This was statistically significant. 6.8% said turnover rose more than 6% compared with non innovators where rise of 6% experience by less than 1%. While not statistically significant, it is interesting to note that overall 29% of companies describing themselves as innovative reported a rise in turnover compared with non innovative companies where only 14% had a rise.

6 DISCUSSION OF FINDINGS AND CONCLUSIONS

Porter's (2001) work highlights the importance of location when it comes to successful innovation. Switzerland, says Porter (2001), is a country where the internal factors have resulted in a high degree of innovation. This study is interesting because location is removed as an impediment to innovation. Four of the factors examined through this research related to a company's internal characteristics which Rogers (2003) identifies as important for innovativeness. The following section discusses the findings in relation to these four factors.

Size: Much of the reported research suggests that size is an important predictor of innovativeness (Aragón-Sánchez, 2005; Hadjimanolis 2000). A recent European Commission report (2003, p. 20) suggested that 52% of companies with less than 50 employees were not innovative. The results from our study indicate that at least in Switzerland, this is not the case. Two measures were used to establish innovativeness. One measure was the external perception of a company's innovativeness ("Our clients recognise that we are an innovative company. We are usually first to market with our innovations"). 63% of small businesses and 72% of medium businesses agreed to some extent or agreed completely with that statement. The second measure was the use of ICT to enable innovation ("The application of ICT enables us repeatedly to achieve innovations, e.g. our E-shop, electronic invoicing"), 66% of small businesses and 64% of medium businesses agreed to some extent or agreed completely with the statement.

Centralization: Rogers (2003) argues that for companies to be innovative power should not be concentrated as this restricts ideas. The measure used in this research was the extent to which companies included on the management team those responsible for the ICT function. When a company includes in their decision making process those responsible for ICT, they are likely to explore and implement innovative uses of technology. We found that innovative companies were those companies who included on their management teams employees involved in managing ICT.

Complexity: "… the degree to which an innovation is perceived as difficult to understand and use" (Rogers 2003, 16) and "the degree to which organisations members possessed a relatively high level of knowledge and expertise" (p 412). In this study, complexity was measured through the level of skills of staff and management. We argue that where staff and management are more skilled in ICT they are more likely to see the value of innovation. This research found that innovative companies had staff and management with strong ICT skills and invested comparatively heavily in training of their staff.

Organizational slack: Rogers (2003) argues that size might be an indicator of the power to be innovative because it is also highly related to the level of resources the company has available for innovation. This research did not support this. There was no statistically significant difference in the

amount spent on ICT over the previous three years between companies employing between 10 and 50 people and companies employing between 50 and 250 people. Further, there was no statistical significance in relation to size and innovativeness.

There is little reported in the literature on studies relating to innovation and small businesses of the size that were the focus of this study. Our study therefore provides an interesting picture of innovation in small business. It has taken place in a country where traditionally the factors that support innovation are present, the size of a company is not a factor and ICT expenditure between medium and small businesses also was not significant. What we therefore have are results that provide some insight into features of innovative companies. This study is also important because of the paucity of research reported in the literature relating to small businesses, those employing between 10 and 49 people, and the application and use of ICT.

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