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Entrepreneurship and Innovation Strategies in ICT SMEs in Enlarged Europe (EU25)

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Abstract
Innovation strategies of entrepreneurs are mapped with growth and performance of their firms in this study. Findings of the study are based on the data collected from 1238 small ICT firms located in 25 member states of European Union. The survey was conducted during October 2006 and March 2007. Results of Logit analysis suggest that firms that pursued continuous innovation strategies experienced more employment growth, higher profitability, and better sales dynamics than those that adopted occasional innovation approach. Market growth of continuous innovating firms realized faster pace than other type of firms. Another distinguishing characteristic of two types of firms emerged is market preference. Target market of continuous innovating firms has been European or global markets while innovative activities of other firms targeted domestic market. The study concludes that European innovation policies should be focused towards continuous innovation activities with due attention at human resource development policies.

Keywords: dynamic capabilities, continuous innovation, occasional innovation, competitiveness, human resources, internationalization

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INTRODUCTION

Continuous innovation is a central theme in the literature of strategic knowledge management and in the literature of organizational learning. Continuous innovation can be understood as continuous improvement or as a proactive attitude towards the external world.

Based on the distinction between continuous and occasional innovation, rich typologies of entrepreneurs and organizational learning systems can be found in the literature. In this paper we investigate empirically the innovation behavior of entrepreneurs in small and medium sized enterprises in the ICT sector of the European Union. The attitude of entrepreneurs towards innovation and learning is very significant for the performance of the whole enterprise. A well known distinction in innovation behavior is given by Porter (1979), it ranges from the innovating entrepreneurs via the imitating ones to the followers. Other authors make the distinction between prospectors and defenders entrepreneurs. The crucial difference between these two types is contained in their attitude and in their management qualities: the innovative prospector compared to the non-innovative defender type of entrepreneurs (O'Regan and Ghobadian, 2004). Earlier survey studies came up with 'silver spoons' these entrepreneurs have been at the firms for substantially longer than average, worked fewer hours than their innovative counterparts (called the Young Turks and Blue Chips) and exhibited further low management qualities while their product- and marketing- strategies were engineered long ago and continued to serve them well. The environment had no significant impact on the 'silver spoon' type of entrepreneurs, while especially the innovative entrepreneurs as the Blue Chips perceived the environment as of great importance for their innovations (Kahn and Manopichetwattana, 1989). The innovative small and medium sized enterprises

(SMEs) were either characterized as led by ‘young Turks’ or ‘blue chips’ and these firms were younger, more proactive and more prone to risk taking and also exhibiting more product differentiation and higher R&D spending (Kahn and Manopichetwattana, 1989).

The attitude towards innovation is also seen as a part the entrepreneurs’ strategic orientation and perception of the environment (O’Regan and Ghobadian, 2004) especially knowledge intensive firms exhibit an international growth orientation which is neglected in the literature (Nummela, Puumlainen and Saarenketo, 2005).

Continuous improvement is very much related to continuous innovation and the former goes back to managerial decision making in the Japanese scale-intensive industries. ‘Kaizen’ or continuous improvement is rooted in the design of socio-technical systems, human relations and the discussion surrounding lean and mean manufacturing **(**Imai, 1986; Baba, 1989). Once the capability to continuously improve is established, it can easily contribute to continuous innovation. (Bessant, et al. 2001) Innovation is not done in isolation, relationships also matter and a high level of strategic interdependence grew among groups of firms, hardware and ICT service providers alike. This is especially true for ICT production due to the modular and complementary character of the (interoperating) components produced in the ICT industries. Therefore inter-company collaboration and company networks in many industries are essential for surviving harsh competition (Chapman and Corso, 2005). This fuels continuous innovation which is firmly based on dynamic capabilities of firms (Teece et al., 1997); knowledge creation and absorption, knowledge integration and knowledge reconfiguration (Verona and Ravasi, 2003). Continuous innovation is also connected to the firms’ knowledge management systems and processes (Chapman and Hyland, 2004). Extra alertness due to Original Equipment Manufacture (OEM) relationships and pressure from internationalization causes long term

investment in sustainable competitive advantage mainly in R&D and innovation (Knight, 2001).

International business for a long time was the territory of multinational enterprises, but recent evidence shows that SMEs are internationally active. Spontaneous decisions by managers reacting to business opportunities often play a big role, and management decisions are always heterogeneous and this might be particularly true for the ICT sector (Lacity and Willcocks, 2000).

Perceptions of the environment impact the innovation strategy of SMEs. SMEs that feel pressurized to innovate by the environment and react by modifying existing products rather than introducing new ones. SMEs that have a strong external orientation and continuously look for opportunities are much more likely to be engaged in new product development or management practices (O'Regan and Ghobedian, 2004).

High entry barriers and highly concentrated industries are thought to be engaged in creative accumulation while easy to enter markets populated by many small enterprises are characterize by Schumpeterian creative destruction. In the market of ICT SMEs the entry barriers are low and as a consequence the market is populated by many small enterprises. Hence creative destruction might be a good description of technological development in this sector.

Goal of this paper

In this paper we address the innovation strategies of SMEs engaged in the production of ICT products and services. We base our conclusions on an analysis of primary data collected in a survey of 1238 ICT small and medium sized firms in all EU25 Member States, held between October 2006 and March 2007.

This paper is organized as follows. In the first section we present and discuss the characteristics and profile of ICT SMEs in Europe. In the second section

characteristics of sample firms are presented. Hypotheses are formulated in Section three. Statistical results are presented and discussed in Section four. In Section five the complicated structure of EU policies aimed at ICT SMEs is discussed and we end with some recommendations to enhance the impact of these policies on innovation behavior of ICT SMEs in the last section.

ICT SMEs IN EU25 AND THE SURVEY

ICT SMEs make up a considerable part of the total population ICT enterprises in Europe. The share of ICT SMEs in total ICT employment in EU25 is 44% for ICT manufacturing and 52% for ICT services (see Table 1.) In terms of value added these shares are 35% and 33% respectively. Hence ICT services SMEs exhibit a productivity level that equals 63% of the average for total ICT service sector while ICT manufacturing SMEs reach the 80% mark. Therefore scale economies might be present in ICT services but are likely to be absent in ICT manufacturing.

Insert Table 1

Due to the relatively low level of labor productivity in ICT services the smaller SMEs we might a-priori expect to encounter less innovative ICT service SMEs in the smaller size classes than ICT manufacturing SMEs because the level of productivity depends on past (process) innovations (Parisi et al., 2006). The relatively low level of labor productivity in ICT services SMEs is mainly the consequence of the extraordinary high level of labor productivity of the largest firms coinciding with a relatively high share of micro firms (firms with between 1 and 9 employees) in ICT services in Europe (see table 1 A.).

Insert Table 1A

Large enterprises in ICT services are 1000 times as large as the smallest enterprises measured in terms of value added per enterprise, in ICT manufacturing this ratio is only 66.

The data used in this paper is obtained from the population of small and medium sized enterprises (SMEs) that are active in the ICT sectors in EU25 by means of an interview by telephone. The firms in the sample are all ICT SMEs, i.e. employ more than one and less than 250 employees and produce ICT hard- and/or software and services. All firms that are included in the sample also have invested (internally or externally) in R&D, and the majority (84%) of these firms introduced a least one product or service innovation new for the firm not necessarily for the market in the year 2005 preceding the year the interview was held. As a consequence of the screening on R&D expenditure and or innovations all firms in the survey can be regarded as innovative. However conceptually a definition of innovative firm is problematic because what should be measured is something that is either 'new' or an improvement of an existing product or service. Measuring innovation thus implies commensurability and novelty and these are basic problems for innovation indicators in general (Smith, 2005). The (European) Community Innovation Survey (CIS3)[3] indicators are problematic because they are designed to measure innovation in manufacturing inspired by the OSLO manual and not innovative services (OECD, 1992). These indicators measure not only the input of R&D but also the existence of 'new' activities and products as the result of a firm's investment in tangible as well as

[3] The Community Innovation Survey (CIS) is the main statistical instrument of the European Union that allows the monitoring of innovation in Europe. The CIS creates a better understanding of the innovation process and facilitates the analysis of the effects of innovation on the economy. The CIS has been carried out for the first time in 1992. CIS2 took place in 1996 and CIS3 in 2001. Since 2000, the CIS has become a major data source of the "European Innovation Scoreboard", which basically is a measurement and coordination tool and stimulates typically European open coordination of innovation among the Member States.

intangible assets. Especially measuring innovation in the more heterogeneous service sector is a Herculean task of measuring the immeasurable i.e. the intangibles.

Therefore we define “innovative ICT SMEs” in this study in terms of input (performing R&D) as well as output indicators (having produced an innovation). Firms included in the sample are firms that belong to the ICT sector and exhibit -at the time of the interview- engagement in innovative activities or having the capacity to perform research and technology development (RTD) activities and supplying innovative ICT products and services as a main element of their business offerings. Furthermore our approach to innovative SMEs is firmly based on financial and economic performance of ICT manufacturing and services firms rather than on innovation inputs or outputs. We therefore define the successful innovative ICT SME as a firm that shows excellent financial and economic performance in the first place. Other relevant characteristics are the ones used in the CIS3 for manufacturing firms that are more adaptive to the service firm, like productivity levels, supplier, customer or network oriented production and the mode of innovation being continuous or occasional.

HYPOTHESES AND THEORETICAL FRAMEWORK

Innovativeness has always been in the centre of the economic development and the adoption of new technologies. During 1980s and early 1990s innovation was the key driving force for large enterprises and Multinational Corporations. With the advent of more affordable and reliable communication and information networks in the late 1990s the effect of innovations can be easily seen on small firms. Although governments in developing and developed countries have been engaged in providing support to small enterprises so that they can survive onslaught posed by globalization,

the death rate of SMEs has been significant particularly in developing countries (Oyelaran-Oyeyinka and Lal, 2007).

One of the main reasons cited for exit of firms is the inability of firms to innovate (Cefis and Marsali, 2006). However factors of lack of innovation in large and small firms are very different. In large firms innovation activities are constrained by lack of vision, management structure, growth strategies, and monopoly power of firms whereas small firms could not engage in innovation activities due to resource crunch and protection of their market. In the era of the globalised information society the factors impacting innovations became more similar in large firms as well as small. Large firms do not enjoy monopoly any more and small firms became more exposed to external factors. However, availability of financial and human resources are several such factors that still affect large and firms differently.

An essential difference between large and small firms is that large firms have material advantages, while small firms' advantages are behavioral: the motivation of the owner and the flexibility of the firms (Nooteboom, 1993). In small firms the decisions are usually taken by a single individual who owns the firms whereas in large firms decisions are taken by a group of people. Risk absorbing capacity of firms also influences the decision making process. Since the objective of the paper is to identify the factors that influence the innovation strategies in small firms, hypotheses and theoretical framework are aimed in that direction.

Hypothesis I: *innovation strategies are influenced by entrepreneurship*

The role of the entrepreneur in a firm is described in the literature as the 'leader', the manager and coordinator and the one who carries out new combinations and is responsible for the direction the firms goes. This traditional Marshallian-Schumpeterian-Knightian description is mainly tagged with small businesses. For instance the entrepreneur is often defined as one who starts his own, new and small

business for his own risk. Entrepreneurship has been a driving force in the growth of firms even during the era of protectionism (Drucker, 1993). Intense competition and globalization have put innovation in the forefront of industrial development. However lack of risk absorbing capacity and uncertainty involved in successful innovation many times inhibit small firms to be innovative. Governments in Europe support actively the formation and growth of entrepreneurship with industrial (enterprise) and cohesion policies (De Propris, 2007). By definition the entrepreneur has to take risks in carrying out new combinations while success is measured in terms of profitability (Schumpeter, 1943).

Irrespective of the type of innovation, i.e. process or product, risk taking ability and leadership of the entrepreneur determines success. Choice of innovation is often determined by the market in which the firm operates. For less cost sensitive markets product innovation may be preferred while process innovations are aimed at flexibility in production processes, improvement in quality and reliability, and for productivity gains in quality sensitive markets. Whatever be the case an entrepreneur has to have innovation strategies for growth and survival of firms in the era of globalization. *Hence we hypothesize that innovation strategies are influenced by entrepreneurship.*

Hypothesis II: *management structure might influence innovation strategies*

We intend to identify the relationship between management structure and innovation strategies. Small firms are usually individually owned firms. They are less likely to be public limited firms. Hence the decision to be more innovative or less innovative lies with the single individual. However, in case of firms that are private limited liability[4] corporations, decision about innovation strategies is very likely not taken by a single

[4] A private limited liability company comes in three types of which we mean the first two: private limited liability company by shares or Pty. Ltd, by guarantee (not in shares but with members liable to a fixed amount) and by publicly traded shares or PLC.

individual but collectively in a committee of executives. Outcome of both the decision making processes has advantages as well as disadvantages. Individually owned firms can take quick decision, employ motivated people, and have unique or scarce competencies (Nooteboom, 1993). But the decision taken by small firms is not debated so misapprehensions go unopposed, absorption capacity is very limited. On the other hand decisions taken by a committee are thoroughly debated and are based on inputs of several persons. The possibility of unopposed misapprehension in lager firms is less likely. *Hence it is hypothesized that management structure might influence innovation strategies.*

Hypothesis III: *market preferences and actual network relations influence choice of innovations*

Geographical market preference is also expected to have impact on innovation strategies. If a firm steps into the international markets, it must meet requirements of those markets such as international quality of products, modular products, international network of economic agents etc. whereas in local markets, firms need to concentrate on local requirement (e.g. customized products/services) in terms of product characteristics, quality and local standards. One of the main reasons for firms going global is the higher profit margins and outsourcing of inefficient production processes. For firms operating in local markets the pressure for innovations may not be intense. On the other hand firms dealing in international markets are subjected to intense competition from international firms and hence they need to have regular innovation strategies. *Based on these arguments we hypothesize that market preferences and actual network relations influence choice of innovations.*

Hypothesis IV: *performance of firms and innovation strategies mutually reinforce each other*.

Firms need to carry out innovations because of several reasons such as competitiveness, reduction in input factor prices, miniaturization of products, search for new products and markets, productivity gains, growth of firm, and better performance etc. We will prefer to limit our discussion to the factors related to 'better performance'. Performance of firms can be measured by several variables such as growth of employment, higher sales turnover, higher profit margins, increase in market share, creation of new markets etc. The relationship between innovations strategies and performance is not straight forward. Usually innovative firms perform better than others but in the process they acquire more resources to be more innovative. If things go well they are in a virtuous circle, on the other hand less innovative firms remain caught in a vicious circle.

Several studies have investigated the relationship between innovativeness and profitability (Lööf, et al., 2001; Gellatley and Baldwin, 2003, and others). Lööf et al. (2001) use CIS data for Finland Norway and Sweden and conclude that there is strong positive relationship between innovation and labor productivity. Innovativeness was measured with the number of patents applications as a proxy for the degree of innovativeness. Gellatley and Baldwin (2003) argued that innovation is the lifeblood of a market economy. They illustrate that being innovative is the only way for small firms to survive in globalized economy. *Based on the empirical literature on innovativeness and performance and theoretical arguments, we hypothesize that performance of firms and innovation strategies mutually reinforce each other*.

Based on the above hypotheses a theoretical framework used in the study is depicted in

Figure 1.

Insert Figure 1.

As shown in the

Figure 1 the causal relationship between innovation strategies and factors affecting it is not always unidirectional. For instance innovation strategies are influenced by entrepreneurship and management structure of firms whereas choice of market influences as well as influenced by innovation activities. Choice of markets and the preference to network are also interrelated and jointly or apart these forces impact the firm's innovation strategy. Similarly the causal relationship between performance indicators and innovation strategies is bidirectional as a consequence of the feedback of performance variables on the future innovation strategies.

DATA AND SAMPLE FIRMS' CHARACTERISTICS

Computer Assisted Telephonic Interview (CATI) technique was used to collect data from sample firms located in 25 member states[5]. The details of sample size in each member state are presented in Appendix II. The survey was conducted during October 2006 and March 2007. The sample consists of firms belonging to both ICT manufacturing as well as ICT service sectors. Distribution of sample firms by technological area and NACE classification, a Classification of Economic Activities in the European Community, is presented in Appendix I. Purposive sampling technique was applied to identify sample firms. All sample firms fall in the category of SMEs, i.e. firms employing less than 250 persons. Although definition of SMEs is not uniform across all member states, we followed the definition of the Commission[6] for sampling.

Sample firms were grouped in two categories, namely; (1) firms that were only occasionally engaged in innovative activities and (2) firms that pursued continuous innovation strategies. Selected characteristics of sample firms classified by innovation

[5] In 17 member states CATI was applied, while in Cyprus, Malta, Baltic Republics, Slovenia and Slovakia local IDC representatives conducted the interviews

[6] Although the European Commission's definition also includes criteria for balance sheets and annual sales these criteria were not included in the interviews for reasons of efficiency.

strategies are presented in Table 2. It can be seen from the table that type of ownership does not differ much between two types of firms though fairly large percent of firms were either Ltd. Companies or stock companies irrespective of the innovation strategies adopted by the firms.

Insert table 2

Table 2 shows that the level of educational attainment of the managing directors (MDs) of two types of firms differs considerably. Roughly 87 per cent of firms that adopted occasion innovation approach were being managed by the person with higher education whereas the percentage of such managers was more than 90 per cent in firms that followed continuous innovation strategies. There was no noticeable difference in two types of firms related to management structure.

Innovation strategies are significantly influenced by the market preference of firms. This is captured by the data presented in Table 2 were it can be seen that firms that preferred local markets adopted ad hoc innovation approach. This is reflected by the fact that merely 8.26 per cent of continuous innovation strategy firms preferred local market whereas the percentage of other type of firms was more than double that had similar market preference. On the other hand the market preference of 32.23 per cent of continuous innovating firms was global while merely 12.01 per cent of occasional innovating firms targeted global markets. Networking with other enterprises is not very different for continuous or occasional innovators

Performance of firms classified by their innovation strategies is presented in **Error! Reference source not found.**. Sales dynamics, employment dynamics, profitability dynamics, and market growth have been used as indicators of performance. It can be seen from **Error! Reference source not found.** that there is a noticeable difference in sales dynamics of two types of firms. Roughly 15 per cent of

O[7] firms experienced more than 10 per cent of growth in sales turnover in the last three years whereas more than double of this (31.84 per cent) of C[8] firms realized the growth of this magnitude.

Insert Table 3

Error! Reference source not found. also shows that employment dynamics followed the similar pattern as sales dynamics. It is the C type of firms that created more jobs than others. Profitability dynamics followed more or less the similar trend to that of sales and employment dynamics except that "up to 5%" category of profitability dynamics. Percentage of C firms is less than O type of firms in this category though difference is marginal. Scenario for market growth is by and large is similar to that of other performance indicators except that both type of firms experienced decline in market growth. Surprisingly both type of firms experienced similar market decline rate (more than 5 per cent. One firm which is categorized as C type experienced fast market decline. The firm might have lost market because of other factors rather than economic.

STATISTICAL ANALYSIS

Subsequently statistical analysis of data was carried out. Data were analyzed using univariate and multivariate methods. Univariate analysis (T-test) results are presented in

[7] Firms that adopted occasional innovation approach.
[8] Firms that followed continuous innovation strategy

Table 4. Before an interpretation of the results it is important to discuss measurement of variables used in the analysis.

Innovation type variable was measured on a binary scale, i.e. value 0 was assigned for O and 1 for C type of firms. Ownership was measured on a three point Lickert scale, quantified as 1 for Single Private Owner, 2 for Ltd. Company, and 3 for Stock Company. Education which has been used as a proxy of entrepreneurship in this paper was also measured on a three point Lickert scale, quantified as 1 for Higher Education, 2 for Secondary, and 3 for Primary Education. Management structure variable has been quantified as 1 for Hierarchical/bureaucratic, 2 for Flat/Project oriented, and 3 for other. Annual RTD budget and RTD employees are measured in Euros and numbers. Five types of target markets were considered and values assigned to them are: 1 for Local, 2 for Regional, 3 for National, 4 for EU, and 5 for Global. Employment, Sales, and Profitability dynamics variables were quantified as 1 for 10+ % growth, 2 for 5-10% growth, 3 for up to 5% growth, 4 for No Change, 5 for Decline up to 5%, 6 for Decline 5 – 10%, 7 for Decline 10+%. Market growth was measured on a five point Lickert scale namely; 1 for Fast Growth, 2 for Growth, 3 for No Change, 4 for Decline, and 5 for Fast Decline, without specifying these categories in cardinally.

Insert Table 4

It can be seen from

Table 4 that management structure, the annual RTD budget and the scale of operation measured by the sales turnover did not differ significantly in two types of firms. Results presented in

Table 4 suggest that the educational attainment of managing directors of C type of firms is higher than in O type of firms, though the level of significance was 10%. O types of firms were dominated by single private ownership while the majority of C types of firms were either Ltd. or stock company, though the difference was significant at 5 %. Rest of the variables were significantly (1 % level) different between two type of firms. However the results do not capture the relative importance of variables in differentiating O and C types of firms. In order to show the relative impact of a variable we analyzed the data in a multivariate framework.

The binary logistics function provides estimates that must lie in the range between 0 and 1 and the accompanying cumulative density function in explicit form would be:

$$P(X) = (1 - e^{-f(X)})^{-1},$$

with X the set of variables: {OWNER, MEDU, MAN_STRU, RTD_EMP, TAR_MAR, SAL_DYN, EMP_DYN, PRF_DYN, MAR_GR, STO_EUR, NET_ENT}[9]

The odds ratio is a log linear function and is given by its Logit transformation:

$$\ln[p/(1-p)] = \beta_0 + \beta_1 OWNER + \beta_2 MDEDU + \beta_3 MAN\_STRU + \beta_4 RTD\_EMP + \beta_5 TAR\_MAR + \beta_6 SAL\_DYN + \beta_7 EMP\_DYN + \beta_8 PRF\_DYN + \beta_9 MAR\_GR + \beta_{10} STO\_EUR + \beta_{11} NET\_ENT$$

We choose to apply maximum likelihood estimation for estimating the parameters in the model since it requires no restriction on the characteristics of the independent variables. Hypotheses are:

$H_0 : \beta_i = 0$

$H_1 : \beta_i \neq 0$

[9] The variables appear in the order of table 4. OWNER is the first variable in table 4 indicating ownership, while NET_ENT is the last variable in table 4.

Logit analysis results are presented in Table 5. As can be seen from the table that four different models have been tried. This was necessary to control for multicollinearity caused by EMP_DYN, SAL_DYN and PRF_DYN. In Model I all the variables except those that were insignificant in univariate analysis were specified while in other models different combinations of explanatory variables have been specified. In Logit analysis sales turnover (STO_EUR) was converted into EUR million.

Insert Table 5

Results of the first Logit model suggest that only three variables, namely; target market (TAR_MAR) employees in RTD departments (RTD_EMP) and networking with other enterprises (NET_ENTR) were significantly different in the two types of firms. Results are by and large according to our expectation. Emergence of TAR_MAR as significant (1% level) determinant suggest that firms that target EU or global market preferred continuous innovation strategies whereas firms whose orientation was local or regional markets preferred need based innovation strategies. Networking is not preferred by C type of firms. On the other hand O type of firms are more inclined to network with others firms. It was further found during the analysis that employment; sales, and profitability dynamics, target market variables were highly correlated with each other. Hence to identify the parameters better, profitability dynamic and target market variables were dropped in the second specification. Management structure which was insignificant in univariate test was also drooped. In addition ownership variable was also removed in the Model II.

Parameter estimates of Model II suggest that educational attainment of the managing directors (MD_EDU) and sales dynamics variables (SAL_DYN) were added in the list of significant determinants of type of innovation strategies followed

by sample firms. Literature on growth of firms suggests that it is the academic background and qualification of managing directors that helps them understand the benefits of continuous innovation and globalization. Several earlier studies (Lal, 2002; Cohen, 1995) have also found the critical role being played by the knowledge base of entrepreneur in the performance of firms. Hence emergence of MD_EDU as a key determinant of innovation strategies is in line with the existing literature and is according to our expectation. Findings of the study that continuous innovating firms experienced better sales dynamics is as hypothesized. It seems that continuous innovating firms have been able to increase their sales turnover by targeting global markets. This might have been possible by manufacturing market-specific products. This could have been achieved by continuous innovations.

In Model III we retained only market growth (TAR_GR) and profitability dynamics (PRF_DYN) variables. We had to treat employment dynamics (EMP_DYN) variable separately because of its high correlation with sales dynamics (SAL_DYN) as can be concluded from Appendix III. This was done in specification of Model IV. The results of Model III and IV suggest that all the three variables emerged significant determinant of innovation strategies. Although MAR_GR emerged significant, the level of significance is 10%. As the correlation analysis suggests, all performance indicators are related to each other. And the same explanation can be used to justify the better performance of continuous innovating firms. The results suggest that continuous innovating firms experienced higher market growth than the rest. This could be partly because of market preference. Market preference of C type of firms has been EU or global. Major growth in market share might have come from demand in East European markets or developing countries' markets.

EU INNOVATION POLICIES AIMED AT ICT SMEs

The unifying principle of the single market of the European Union is the free movement of labor, capital, goods and services, delivering the free circulation of knowledge in the EU. Important players on the large single European market are the SMEs, and they are considered by the European Commission (EC) as important drivers of innovation, employment as well as social and local integration in Europe. Therefore SMEs need the best possible environment a goal set by the EC and explained in the "European Charter for Small Enterprises"[10] and in the Communication "A Modern SME Policy for Growth"[11].

Because ICT has been broadly embraced as a key element in the so-called renewed Lisbon strategy, which essentially is a growth and competitiveness strategy aiming at job creation and boosting productivity eventually determining EU's capacity to innovate[12] and compete. This has led to the promotion of the development, production and use of ICT which became a policy line of its own. This policy line is broadly accepted by the Member States and implemented in National Information Society and Innovation policies. Furthermore the ICT Policy Support Programme (ICT PSP) is one of the means to support the renewed Lisbon stressing the ICT dimension explicitly. It will build on the lessons learned from previous programmes like eTen[13], eContent[14] and MODINIS[15] whilst improving synergies between them and improving their impact.

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[10] This Charter was adopted at the Feira Economic Council, 19-20 June 2000, http://ec.europa.eu/enterprise/enterprise_policy/charter/docs/charter_en.pdf

[11] Modern SME policy for growth and employment, COM (2005) 551 final

[12] *i*2010: A European Information Society for Growth and Employment, COM (2005) 229 final, for a theoretical undertanding of the impact of ICT on growth and jobs: Dunnewijk, Meijers and van Zon, 2006 and for the policy implications Barrios and Burgelman, 2007.

[13] eTEN (formerly TEN-Telecom) was supporting the deployment of trans-European e-services in the public interest. The programme aimed to accelerate the take-up of services to sustain the European social model of an inclusive, cohesive society. eTEN's six themes included eGovernment, eHealth, eInclusion, eLearning, Services for SMEs and Trust & Security. Admitted projects can have up to 50% of the costs or 30% of initial deployment costs eligible for refunding.

[14] The *e*Content*plus* Programme, (2005-2008) aims to support the development of multi-lingual content for innovative, on-line services across the EU; part of the *e*Content*plus* Programme is the Digital Libraries Initiative.

[15] A multi annual programme (2003-2005) for the monitoring of eEurope 2005 action plan, dissemination of good practices and the improvement of network and information security (MODINIS), see Official Journal of the European Union 23.12.2003, L 336/1-5

Despite the awareness of the importance of innovation, knowledge and ICT for productivity and competitiveness investment in R&D and ICT in Europe is persistently lower than in the US. The reason for this lagging behind in ICT is burdensome market regulation in the EU. Labor market rigidities and the highly regulated services sector prevent a larger contribution of ICT to GDP in Europe (Barrios and Burgelman, 2007)

To stimulate innovation in SMEs in general and lower the hurdles that SMEs face with regard to access to capital and finance the EC developed specific policies aimed at ICT SMEs along three lines; namely: Policies aimed at improving access to markets and finance: cheaper and faster start-ups, better access to loans, more efficient taxation and less burdensome regulation[16] , Policies aimed at boosting public and private R&D, technology development, and innovation including absorption capacity of SMEs and top class SME support for these matters, policies aimed at human capital: entrepreneurship[17], skills and training[18].

These three policy lines are supported in several Community spending programmes. In the near future more emphasize will be given to SMEs in these programmes (for 2007-2013) and more funds will be channeled towards SMEs. The most important programmes/policies are: Cohesion (Regional) policies the largest funding instruments for SMEs in general: € 59 billion. The 7-th Framework (Research) Programme (FP7: € 9 billion for 2007-2013) as well the Competitiveness and Innovation Framework Programme (CIP: € 0.7 billion), SAFER Internet Plus and

[16] The European Council (Spring 2006) agreed to take the following priority actions to unlock unleashed potentials of SMEs in the Union by lowering administrative hurdles: one stop shopping for setting up a company, encourage entrepreneurship, recruitment of a first employee should not involve more than one public administration point, think small as a guiding principle and facilitate SMEs to access to public procurement.

[17] In the Community Integrated Guidelines for Growth and Jobs especially guideline 10 calls for a more entrepreneurial culture and create a supportive environment for SMEs. The SME dimension in EU's innovation policy is especially present in the Entrepreneurship and Innovation Programme (EIP)

[18] For an overview of these SMEs policy projects see: http://ec.europa.eu/enterprise/entrepreneurship/support_measures/index.htm

MEDIA (€ 0.7 billion for 2007-2013), are also important. In these programmes access to finance and the conditions to support SMEs are much better than before. More than €2 billion is available for ICT R&D from FP7 (for the period 2007-2008) and more than €1 billion has been earmarked for financial instruments within the CIP framework programme (from the total of €3.6 billion for the period 2007-2013). This amount will enable financial institutions to provide about €30 billion of new finance to SMEs. The so-called JEREMIE initiative, jointly launched by EC, the European Investment Bank (EIB) and the European Investment fund (EIF), in October 2005, improve the availability of sustainable finance for SMEs considerably. In addition to FP7 and CIP there is the PRO INNO Europe initiative[19] which is a focal point for innovation policy analysis, learning and development in Europe. One of the dedicated themes is gazelles, i.e fast growing SMEs and several actions are focusing on networking and design in SMEs.

The main research and innovation policies in the EU are embedded in FP7 and CIP. SMEs are increasingly encouraged to participate in research actions, also by means of innovation vouchers[20]. The proposed rules for participation in FP7 specify a funding rate of 75% for research and development activities of SMEs, rather than the 50% currently applicable in FP6. This should make it more attractive for SMEs to participate in the FP7 by lowering their financial burden. FP7 builds on the aims of the previous programmes and will support the aims of the new integrated strategy i2010 - European Information Society 2010.

In order to help innovation communities in Europe to coordinate their efforts and align it with the common strategic research agendas European Technology Platforms (ETP) have been established by the EC. Each ETP represents all major

[19] http://www.proinno-europe.eu/
[20] See: SME TechWeb at http://ec.europa.eu/research/sme-techweb/index_en.cfm

stakeholders including SMEs and the knowledge of each stakeholder is brought into the platform. The four most relevant platforms for ICT SMEs in Europe cover 87.6% of their activities. (See Figure 2): software, grids and dependability (35.2% of the firms in the sample), the communication networks (19.8%) and nanotechnology, electronics, components, the and micro systems (15.3%) and the embedded systems, computing and controlling (7.3%).

It might be clear that EU's policies aimed at innovative ICT SME's are rather complicated and very versatile, these policies and initiatives are recently introduced and are implemented now or in the near future. Therefore we cannot expect them to have much impact right now. Most important is that Member States align their innovation and information society policies with those of the EC. At the moment the differences between the National and Regional policies are large and we cannot speak of a level playing field as far as these policies are concerned. This is an important source of differences in participation of SMEs in the above mentioned programmes.

Insert Figure 2

According to national policy makers and representatives of SMEs, national innovation policies aimed at ICT SMEs have a very high relevance in Sweden, and are highly relevant in Denmark, Finland, France, Germany, Luxembourg, Spain and the UK, while these policies are absent in the New Member States like Cyprus, Czech Republic, Estonia, Lithuania, Malta, Poland and Slovakia. This can be taken as an indication that sophisticated policies grow with technological progress, thus we can expect these polices to become more sophisticated in the course of time due to the catching up and convergence in New Member States. In this respect the EU can gain

substantially if the new Members States develop more sophisticated policies that enhance innovation in ICT SMEs.

This short overview of EC initiated policies to stimulate innovation in SMEs shows clearly the complicated structure of these policy measures[21]. Several web portals exist to provide information for financial assistance suitable for ICT SMEs in EU[22].

From all ICT SMEs in the sample only 22.2% received funding from an EU sponsored programme (see Table 6). Thus getting funding is a real problem especially for the smaller SMEs, while protection of their property rights is insufficient guaranteed if an SME takes part in a research programme carried out by a consortium.

As an intermediate conclusion we can say that participation of SMEs in EU sponsored programmes is rather low and there are serious hurdles for SMEs to take part in EU sponsored RTD projects.

Insert table 6

From Table 6 we can conclude that the funded enterprises exhibit higher growth rates and these enterprises are the ones that bring the Lisbon agenda closer to reality, not because they spend so much on R&D but because by growing faster more jobs will be created.

SUMMARY AND CONCLUSIONS

[21] It is beyond the scope of this paper to elucidate the inns and outs of EU policies aimed at innovative ICT SMEs; more information is contained in the full study.
[22] See e.g. www.eib.org and www.eurograntsadvisor.ie

The study aims at identifying and analyzing firm specific characteristics that influenced the decision of entrepreneurs to pursue different innovation strategies. The study is based on the data collected from 1238 small firms located in 25 Member States of European Union. The survey was conducted during October 2006 and March 2007. Computer Assisted Telephonic Interview (CATI) method was used to survey sample firms. Sample consists of innovative small and medium-sized firms engaged in manufacturing and services in the field of ICTs. Firm specific data on various aspects such as background of firm, product profile, innovation strategies, performance, and market preferences were collected through a semi-structured questionnaire.

Sample firms were grouped in two categories based on their innovation strategies. First category of firms is those that adopted occasional innovation approach. Innovation activities of such firms were ad hoc in nature. They were engaged in innovation activities as and when there were external pressures to do so. Effectively their innovation strategy was focused on need-based. They tend to follow market trends. On the other hand there were firms that had continuous innovation programs and were classified in the second category. In addition to follow market trends their innovation activities aimed at new, differentiated, and modular products. It was found during the survey that second category of firms paid attention to developing market-specific products.

Logit analysis was used to identify factors that affected firms to follow different innovation strategies. Results suggest that firms that adopted continuous innovation strategy were being managed by higher educated and better informed managers than the rest. Academic background of managers has been used as a proxy of entrepreneurship. The study substantiates the findings of earlier studies that reported entrepreneurial characteristics of managers influenced the strategies of firms (Lal, 2002; Cohen 1995).

It was also found that market preference coincides with a specific kind of innovation strategy of firms. Firms that targeted markets at arms length such as local or regional markets adopted occasional innovation policies. It seems such firms carried out innovations as and when there was threat to their existence. Moreover the markets for such firms seem to be in some extent protected and they followed an occasional innovation strategy. On the other hand firms that targeted European or global markets followed continuous innovation approach; they are more able to absorb the relevant knowledge. This kind of innovation strategy is inevitable for firms that have global orientation. This is because firms operating in global markets face more stiff competition than those doing business in domestic market. They face more severe price as well as non-price competitions. In addition to competitive pressures, globally oriented firms need to develop market-specific products to serve a particular market. That can only be done through continuous innovation.

Several performance indicators such as sales, employment, and profitability dynamics, market growth were included in the analysis. The findings of the study suggest that performance of continuous innovative firms was better than others. Performance variables were measured on a qualitative scale and converted to quantitative scale for the analysis. But we had one quantitative variable, i.e., sales turnover of firm in 2005. Surprisingly this variable was not significantly different in the two types of firms. One of the possible explanations could be the presence of outliers. There were few occasionally innovating firms whose sales turnover was very high. This was captured by the large variance of sales turnover of these firms. These outliers had a kind of monopoly power in domestic market and hence performing well without regular innovation activities.

One of the major policy implications of the study is the pursuance of different kinds of innovation programs by the European Commission. There have been several incentives and initiatives by the Commission to encourage innovation in small firms

as explained in the previous section. Most of the programs have been very successful. But they may no longer be enough as the globalization is the landscape of markets. Firms can no longer enjoy market protection. One of the possible ways to face the onslaught of globalization is target international markets. This can only be achieved by encouraging small firms not just to be innovative but the continuity in innovation activities. Without institutional support small firms may not be able to become globally competitive as their risk absorbing capacity is low.

Therefore we conclude that policy makers need to focus on policies towards small firms that ensure the continuity of innovation activities in EU industrial policies. ICT SMEs cannot afford any more to focus on local markets only, globalization demands exposure to international trade leading to ever increasing specialization. Policy makers should take into account that combining cluster polices aimed at the technological areas (see Figure 2) together with innovation policies that discriminate against occasionally innovating ICT SMEs will bring the Lisbon agenda a bit closer to reality.

Acknowledgement

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Table 1 Share in Employment and Value Added of ICT SMEs in ICT manufacturing and services in EU25 (2002/3)

	ICT manufacturing	ICT services
employment	44%	52%
value added	35%	33%
labour productivity (av=100)	80%	63%

source: UNU-MERIT

Table 1A. Value added per employee and per enterprise in ICT manufacturing and ICT service in EU25 (2005)

	size classes			
	1_9	10_49	50_250	>250
ICT manufacturing				
value added per employee	€ 29,911	€ 39,282	€ 46,208	€ 57,023
value added per enterprise	€ 71,950	€ 750,588	€ 4,724,541	€ 4,776,737
share in value added	6.52%	10.64%	18.15%	64.69%
ICT services				
value added per employee	€ 47,044	€ 55,131	€ 63,905	€ 120,449
value added per enterprise	€ 135,795	€ 1,102,358	€ 6,294,017	€ 137,228,779
share in value added	8.38%	11.58%	13.25%	66.79%

Source: UNU-MERIT

Figure 1 Theoretical Framework

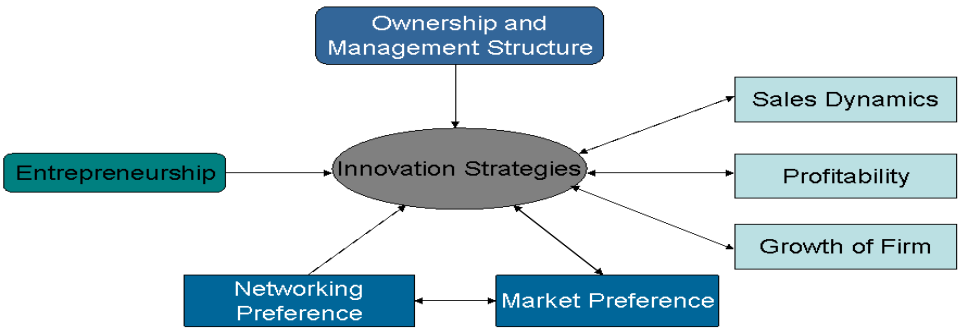

Table 2 Selected Firms' Characteristics and Distribution of Firms

Firm Characteristics	Innovator Type				Total
	Occasional		Continuous		
1. Ownership Type	No.	Percent	No.	Percent	
Single Private Owner	115	28.82	187	26.30	302
Ltd. Company	220	55.14	364	51.20	584
Stock Company	64	16.04	160	22.50	224
Total	399	100.00	711	100.00	1110
2. Education Level of Entrepreneur					
Higher Education	345	86.47	635	90.20	980
Secondary	48	12.03	63	8.95	111
Primary	6	1.50	6	0.85	12
Total	399	100.00	704	100.00	1103
3. Management Structure					
Hierarchical/bureaucratic	176	44.44	303	42.44	479
Flat/Project oriented	211	53.28	392	54.90	603
Other	9	2.27	19	2.66	28
Total	396	100.00	714	100.00	1110
4. Target Market					
Local	73	17.89	60	8.26	133
Regional	69	16.91	74	10.19	143
National	145	35.54	226	31.13	371
EU	72	17.65	132	18.18	204
Global	49	12.01	234	32.23	283
Total	408	100.00	726	100.00	1134
5. Networking with Other Enterprises					
Yes	145	35.54	268	36.76	413
No	263	64.46	461	63.24	724
Total	408	100.00	729	100.00	1137

Note: Percent→ Column percent for each variable

Table 3 Performance of Firms and Choice of Innovation

Variables	Innovator Type				
	Occasional		Continuous		
Sales Dynamics for the last 3 Years	No.	Percent	No.	Percent	Total
10 + %	60	15.11	227	31.84	287
5 - 10 %	176	44.33	295	41.37	471
up to 5 %	72	18.14	92	12.90	164
No change	69	17.38	86	12.06	155
Decline up to 5%	11	2.77	7	0.98	18
Decline 5 - 10 %	4	1.01	3	0.42	7
Decline 10 + %	5	1.26	3	0.42	8
Total	397	100.00	713	100.00	1110
Employment Dynamics for the last 3 Years					
10 + %	54	13.43	146	20.53	200
5 - 10 %	120	29.85	202	28.41	322
up to 5 %	57	14.18	118	16.60	175
No change	146	36.32	216	30.38	362
Decline up to 5%	15	3.73	20	2.81	35
Decline 5 - 10 %	8	1.99	4	0.56	12
Decline 10 + %	2	0.50	5	0.70	7
Total	402	100.00	711	100.00	1113
Profitability Dynamics for the last 3 Years					
10 + %	43	11.00	132	19.02	175
5 - 10 %	148	37.85	286	41.21	434
up to 5 %	78	19.95	122	17.58	200
No change	104	26.60	131	18.88	235
Decline up to 5%	12	3.07	13	1.87	25
Decline 5 - 10 %	5	1.28	6	0.86	11
Decline 10 + %	1	0.26	4	0.58	5
Total	391	100.00	694	100.00	1085
Market Growth					
Fast Growth	52	12.81	134	18.69	186
Growth	181	44.58	339	47.28	520
Stability	148	36.45	207	28.87	355
Decline	25	6.16	36	5.02	61
Fast Decline			1	0.14	1
Total	406	100.00	717	100.00	1123

Note: Percent→ Column percent for each variable

Table 4 Univariate Analysis (T-test)

Variables	Innovator Type			
	Occasional Mean	Continuous Mean	T-value	Sig.
Ownership	1.87	1.96	2.135	0.033
Education level of entrepreneur	1.15	1.11	-1.859	0.063
Management Structure	1.58	1.61	0.901	0.368
Annual RTD budget in EUR	597,635.33	633,233.96	0.105	.916
RTD employees in 2005	3.59	8.51	5.242	0.000
Target market	2.89	3.56	8.678	0.000
Sales dynamics for the last 3 Years	2.56	2.12	-6.127	0.000
Employment dynamics for the last 3 Years	2.95	2.71	-3.034	0.002
Profitability dynamics for the last 3 Years	2.78	2.48	-4.049	0.000
Market growth	2.36	2.21	-3.122	0.002
Sales turnover in 2005 in EUR	3,113,358	3,871,854	-1.040	0.299
Networking with other Enterprises	1.42	1.47	-0.412	0.681

Note: Numbers are mean values of the variables

Table 5 Logit Analysis

Independent Variables	Dependent variable: Innovation choice			
	Model I		Model II	
	Coeff.	Z	Coeff.	Z
Intercept	0.3124		0.5386	
OWNER	-0.0190	-1.517		
MD_EDU	-0.1406	-0.399	-0.4529	-1.758*
MAN_STRU	0.3053	1.249		
RTD_EMP	0.0349	2.088**	0.0269	2.367**
TAR_MAR	0.3087	2.951***	0.3161	4.237***
SAL_DYN	-0.0299	-0.196	-0.2880	-3.092***
EMP_DYN	-0.0799	-0.656	0.0709	.801
PRF_DYN	-0.1060	-0.747		
MAR_GR	-0.1592	-0.941		
STO_EUR	-0.0135	-1.080		
NET_ENT	-0.4889	-1.886*		
Observations	308		606	
Log Likelihood	-180.0214	[0.00005]	-351.0783	[0.0000]
Classification power of the model	69.48		70.63	

Note: Figures in square brackets are level of significance of the function; *→ 10%, **→ 5 %, ***→ 1% level of significance

Table 5: Logit analysis (Contd.)

Independent Variables	Dependent variable: Innovation choice			
	Model III		Model IV	
	Coeff.	Z	Coeff.	Z
Intercept	1.3587		0.9907	
OWNER				
MD_EDU				
MAN_STRU				
RTD_EUR				
TAR_MAR				
SAL_DYN				
EMP_DYN			-0.1486	-3.014***
PRF_DYN	-0.1791	-3.075***		
MAR_GR	-0.1408	-1.656*		
Observations	1077		1113	
Log Likelihood	-696.0054	[0.0001]	-723.4375	[0.0025]
Classification power of the model	63.69		63.61	

Note: Figures in square brackets are level of significance of the function; *→ 10%,

→ 5 %, *→ 1% level of significance

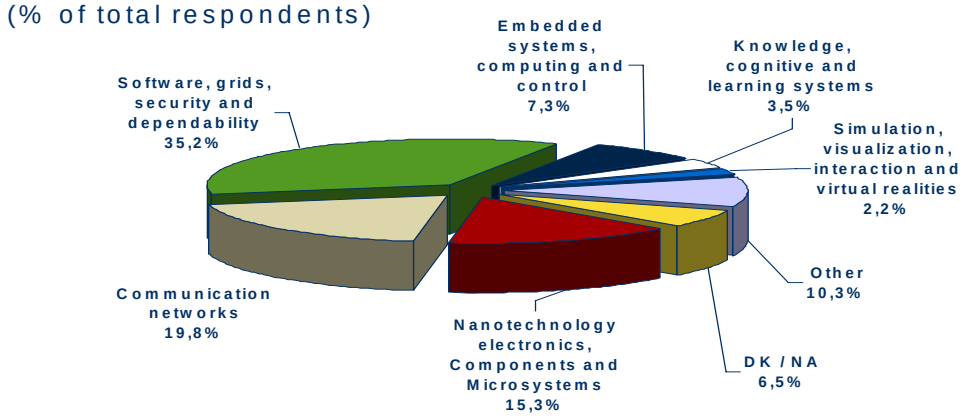

Figure 2 Distribution of ICT SMEs by Technology Area

Base=1,238,
Source: Inventory of Innovative ICT SMEs in Europe

Table 6 Funding of ICT SMEs in relation to source of funding and destination of high, medium and low growth firms

	Total[a]	High growth (>10%)	Medium growth (5-10%)	Low growth (>0-5%)	No growth (<=0%)	No Answer
Did not received Funding	77.8%	24	40	14	17	5
Received Funding	22.2%	28	44	12	8	8
EC	8.9%					
National	10.4%					
Regional	5.7%					
Local	3.6%					

Appendix I: Distribution of Firms by NACE Classification

NACE Classification	Innovator Type				Total	Technological Area
	Occasional		Continuous			
	No.	Percent	No.	Percent		
Manufacturing						
300	25	36.23	44	63.77	69	Office, accounting and computing machinery
313	4	33.33	8	66.67	12	Insulated wire and cable
321	28	45.16	34	54.84	62	Electronic valves and tubes and other electronic components
322	3	18.75	13	81.25	16	Television and radio transmitters and apparatus for line telephony and line telegraphy
323	7	43.75	9	56.25	16	Television and radio receivers, sound or video recording or reproducing apparatus and associated goods
332	11	24.44	34	75.56	45	Instruments and appliances for measuring, checking, testing, navigating, and other purposes, except industrial process equipment
333	20	35.71	36	64.29	56	Industrial process equipment
Total Manufacturing					276	
Services						
642	44	36.36	77	63.64	121	Telecommunications
720	4	30.77	9	69.23	13	Computer and related activities
721	26	46.43	30	53.57	56	Hardware consultancy
722	115	35.11	261	69.41	376	Software consultancy and supply
723	17	32.08	36	67.92	53	Data Processing
724	7	33.33	14	66.67	21	Database activities
725	13	48.15	14	51.85	27	Maintenance and repair of office, accounting and computing machinery
726	84	43.30	110	56.70	194	Other computer related activities
Total Services					861	
Total	408	37.38	729	64.12	1137	

Appendix II: Member State Distribution of Firms

Member State	Firms	
	No.	Percent
Austria	51	4.12
Belgium	50	4.04
Cyprus	30	2.42
Czech	30	2.42
Denmark	50	4.04
Estonia	30	2.42
Finland	50	4.04
France	100	8.08
Germany	100	8.08
Greece	30	2.42
Hungary	30	2.42
Ireland	50	4.04
Italy	99	8.00
Latvia	30	2.42
Lithuania	30	2.42
Luxemburg	30	2.42
Malta	30	2.42
Netherlands	48	3.88
Poland	30	2.42
Portugal	30	2.42
Slovakia	30	2.42
Slovenia	30	2.42
Spain	100	8.08
Sweden	50	4.04
UK	100	8.08
Total	1238	100.00

Appendix III: Correlation Matrix

	OWNER	MD_EDU	MAN_STRU	RTD_EMP	TAR_MAR	SAL_DYN	EMP_DYN	PRF_DYN	MAR_GR	STO	NET_E
OWNER	1.000										
MD_EDU	0.041										
MAN_STRU	0.013	0.064									
RTD_EMP	-0.026	-0.094	-0.053								
TAR_MAR	0.018	-0.152	0.062	0.265							
SAL_DYN	0.004	-0.080	0.004	-0.010	-0.109						
EMP_DYN	-0.004	0.015	0.026	-0.075	-0.170	0.597					
PRF_DYN	0.022	-0.060	0.069	-0.016	-0.062	0.658	0.518				
MAR_GR	0.030	0.108	-0.007	-0.010	-0.164	0.340	0.360	0.299			
STO	-0.025	-0.078	-0.002	0.335	0.208	0.0008	-0.032	0.035	0.0004		
NET_ENT	-0.042	-0.0007	-0.063	-0.026	-0.045	-0.070	-0.032	-0.105	0.015	-0.103	1.000

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