

ERP, e-Commerce, Social Media and Absorptive Capacity of Greek Firms – An Empirical Investigation

Euripidis Loukis

University of the Aegean
Gorgyras and Palama 2
Karlovassi 83200, Samos, Greece
eloukis@aegean.gr

Spyros Arvanitis

ETH Zurich, Swiss Economic Institute
Leonhardstrasse 21, LEE F111
CH-8092 Zurich, Switzerland
arvanitis@kof.ethz.ch

Niki Kyriakou

University of the Aegean
Gorgyras and Palama 2
Karlovassi 83200, Samos, Greece
nkyr@aegean.gr

Anna Famelou

University of the Aegean
Gorgyras and Palama 2
Karlovassi 83200, Samos, Greece
icsd11170@icsd.aegean.gr

Michail Marios

Chatzianastasiadis
University of the Aegean
Gorgyras and Palama 2
Karlovassi 83200, Samos, Greece
mchatz@aegean.gr

Foteini Michailidou

University of the Aegean
Gorgyras and Palama 2
Karlovassi 83200, Samos, Greece
fmichailidou@aegean.gr

ABSTRACT

The absorptive capacity (ACAP), defined as firm's ability to identify useful knowledge in its external environment, assimilate it, transform it and finally apply it for achieving firm's objectives, has become quite important for the achievement of high financial performance of firms, and even their survival, and in the rapidly changing, competitive and 'knowledge intensive' modern economy. It has been recognized that information and communication technologies (ICT) can be quite useful for the enhancement of firm's ACAP. However, there has been no empirical investigation of the effects of the main types of information systems (IS) currently used by firms, aiming at efficiency improvements, on their ACAP. This paper makes a contribution towards filling this research gap, by empirically investigating and comparing the effects of the use of three important types of IS, the ERP and e-commerce ones, and also a recently emerged one, the social media (SM), on the ACAP of Greek firms. Our study is based on data collected through a survey from 122 Greek firms from both manufacturing and services sectors. It has been concluded that the use of ERP systems affects positively firms' ACAP, while this does not hold for the e-commerce ones. Furthermore, the use of external and internal SM both affect positively the ACAP, with the effect of the former being the strongest among the three examined IS types.

Keywords

Absorptive capacity; ERP; e-Commerce; Social Media.

1. INTRODUCTION

The absorptive capacity (ACAP), defined as firm's ability to identify useful external knowledge, assimilate it, transform it and

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finally apply it for achieving firm's objectives, has become quite important for the achievement of high financial performance of firms, and even for their survival, in the modern economy (Cohen and Levinthal, 1989 and 1990; Zahra and George, 2002; Lane et al., 2006; Camison and Fores, 2010). As the latter has become much more dynamic (with more frequent and fast changes in most industries, continuous emergence of new technologies and materials, new competitors, changes in customers' needs and preferences, strong demand for innovations in firms' products, services, and processes, etc.), and also complex and 'knowledge intensive' than in the past, it has become necessary for firms to develop their ability to search for and identify useful knowledge in their external environment, acquire it, assimilate and integrate it in their existing knowledge base, transform it and finally apply it for the development of innovations in processes, products and services, and in general for achieving firm's objectives. There has been considerable both theoretical and empirical literature arguing that in the modern economy ACAP is one of the main determinants of firm's innovation and finally financial performance (Cohen and Levinthal, 1990; Zahra and George, 2002; Lane et al., 2006; Leal-Rodríguez et al., 2014).

It has been recognized that information and communication technologies (ICT) can be quite useful for the enhancement of firm's ACAP (Malhotra et al., 2005; Roberts et al., 2012; Roberts, 2015). Some empirical research has been conducted concerning the effects of ICT on ACAP, which is briefly reviewed in section 2.2. However, the multiple types of information systems (IS) currently used by firms, most of them being oriented mainly towards efficiency improvement, have not been examined from this important knowledge management perspective; there has been no empirical investigation of the effects of the various types of IS currently used by firms on their ACAP. This paper contributes to filling this research gap, by empirically investigating and comparing the effects of the use of three important types of IS, the ERP and e-commerce ones, and also a recently emerged one, the social media (SM), on the ACAP of Greek firms.

The ERP systems constitute the most important type of IS used by firms, which increasingly becomes the backbone of the ICT infrastructures of firms of all sectors and sizes all over the world; they are defined as integrated software packages, consisting of modules

supporting transactions of various functions of a firm, such as sales, procurement, accounting, manufacturing and human resources management, integrated through a common shared database, and offering also some relevant data analysis and reporting capabilities (Bradford, 2010; Madapusi and D' Souza; 2012; Laudon and Laudon, 2014; Rainer et al., 2015). The high penetration of the Internet has led firms to use it as an additional channel of sales, characterized by low cost and wide reach; so another important type of IS increasingly used by firms are the e-commerce ones, which enable firms to receive electronic orders and payments for products and services from customers through the Internet (Turban and King, 2012; Loukis et al., 2013; Laudon and Laudon, 2014; Rainer et al., 2015). It is important to investigate the business impact of these widely used by firms types of IS beyond efficiency (which is usually the main motivation for adopting them.), on critical knowledge management capabilities of the firm, such as the ACAP.

Furthermore, more recently a new type of IS has emerged, which aims to promote the 'Web 2.0' principles: generation of content (e.g. text, images, video) by simple non-expert users, development of relationships and online communities among them, and extensive interaction, collaboration and sharing of content among them. Many different SM platforms have been developed for promoting these principles (such as Facebook, Twitter, YouTube, Blogger, etc.), and have been widely adopted, initially by individuals, and later by firms, for supporting communication, interaction and collaboration both with their external environment (e.g. customers, existing or potential), and also internally among their employees (O'Reilly, 2007; Ngai et al., 2015; Rainer et al., 2015; Schlagwein and Hu, 2016). It is important to investigate to what extent the use of external and internal SM by firms affects their ACAP.

This study is based on data collected recently through a survey from of 122 Greek firms from both manufacturing and services sectors. Our study has been conducted in a very interesting national context, which faces a deep and long economic crisis (since 2009), that has caused big losses of country's GDP, employment and consumption, and significant changes in consumers' needs and behaviour (Papadimitriou et al., 2013; Papageorgiou, 2015). Furthermore, Greece is characterized by a culture of lower propensity for innovation; according to the European Innovation Scoreboard 2015 Greece belongs to the third of the four categories of European countries with respect to innovation performance defined by this scoreboard, being characterized as 'moderate innovator' (see http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards/index_en.htm). It is quite useful from both researchers' and practitioners' perspectives to understand to what extent in this 'crisis-hit', rapidly changing and lower propensity for innovation national context the above three widely used types of IS are exploited by firms for enhancing this critical for innovation ACAP.

Our paper consists of six sections. This introductory section is followed by section 2 outlining the background of our study. Then in section 3 the research hypotheses are formulated, while in section 4 our data and method are described. In section 5 the results are presented, while the final section 6 summarizes the conclusions.

2. BACKGROUND

2.1 Absorptive Capacity

According to the original publications on ACAP by Cohen and Levinthal (1989 and 1990), the ACAP of a firm has three components/dimensions, which concern its ability to: i) recognize, acquire and understand potentially valuable new knowledge from outside the firm through exploratory learning; ii) assimilate this

valuable new knowledge through transformative learning; and iii) use the assimilated knowledge in order to create new knowledge and commercial outputs through exploitative learning. A subsequent reconceptualization of ACAP developed by Zahra and George (2002) proposes a more detailed set of the four components/dimensions: a) acquisition capacity: it is firm's ability to locate, identify, value and acquire external knowledge that is critical to its operations or/and products and services; b) assimilation capacity: it is firm's ability to absorb external knowledge; it can also be defined as the processes and routines that allow the new information or knowledge acquired externally to be analyzed, processed, interpreted, understood, internalized and classified; c) transformation capacity: it is firm's ability to develop and refine the internal routines that facilitate the combination of previous knowledge base of the firm with the newly acquired knowledge, and the discovery of novel associations between elements of the enriched firm's knowledge base, and in general new insights; d) application or exploitation capacity: it is the firm's ability to incorporate acquired, assimilated and transformed knowledge into its operations, not only in order to perfect, expand and leverage existing routines, processes, competences, and knowledge, but also to create new operations, competences, routines, and also new products and services.

2.2 ICT and Absorptive Capacity

As mentioned in the Introduction there has been some empirical research concerning the effects of some ICT related variables on ACAP. Liu et al. (2013), based on data collected through a survey from of 286 Chinese firms, found that ICT infrastructure flexibility (high levels of connectivity between its components, compatibility/data sharing ability among them and modularity) and ICT assimilation (i.e. high level of using ICT applications in firm's business processes, functional areas and management) affects positively firm's ACAP, as well as its supply chain agility, and through them firm's performance. Setia and Patel (2013), using a dataset collected from 153 USA manufacturing firms, conclude that integrated IS capability, defined as the "ability to provide integrated and consistent access to relevant information and to connect seamlessly with the organization's customers and supply chain partners", enhances the ACAP of the operations management department; furthermore, this effect is moderated positively by the business - ICT alignment (i.e. it is stronger in firms with higher level of business- ICT alignment in comparison with organizations with lower levels of business-ICT alignment). Jimenez-Castillo and Sanchez-Perez (2013), using data from 211 Spanish industrial firms, found that the use of integrated ICT for the provision of market-related information to employees increases their relevant ACAP. Bolívar- Ramos et al. (2013), using data from a sample of 160 European high technology firms, conclude that the mastery of ICT technical ICT skills and the use of ICT in interdependent tasks positively affect ACAP, which in turn enhances firm's performance. Recently, Iyengar et al. (2015), examine the use of ICT as a learning mechanism, through its effects on the knowledge transfer and ACAP; using data collected from a sample of 783 independently owned real estate franchisees, they have reached the conclusion that franchisee use of ICT provided by the franchisor impacts positively the effectiveness of knowledge transfers from the latter to the former, and through it the former, and finally their financial performance. Also, Roberts (2015), using a dataset collected from 178 high-tech USA firms, examines the effects of an ICT related variable, the data integration (defined as the provision to firm's employees of the capability of integrated access to customers, partners, industry and market data), and an organizational variable, the connectedness (defined as culture of communication and exchange of knowledge among employees

across functional units and hierarchical levels), on ACAP; he concludes that both these variables affect positively the ACAP.

In conclusion, previous relevant empirical research investigates mainly the effects of some characteristics and capabilities of firm's ICT infrastructure on its ACAP. However, despite the increasing adoption and use by firms of various types of IS, the latter have not been examined from an ACAP perspective: there has been no empirical investigation of the effects of the various types of IS currently used by firms on their ACAP. Our study contributes to filling this research gap, by empirically investigating and comparing the effect of the use of three important types of IS, two well established ones (ERP and e-commerce IS), and also a recently emerged one (SM), on the ACAP of Greek firms.

3. RESEARCH HYPOTHESES

Our first research hypothesis concerns the effect of the use of ERP systems on firm's ACAP. The ERP systems through their sales, service and procurement modules allow firms to collect large quantities of data about two highly important external entities: customers (such as quotations proposed to firm's customers or potential customers and their degree of acceptance, orders received from them, shipments, receivable invoices, payments from them, returns from them, etc.) and suppliers (quotations received from firm's suppliers or potential suppliers, concerning specific products and services, their characteristics, quality levels and prices, orders submitted to suppliers, receipts from them, payable invoices, payments to them, returns to them, etc.) (Bradford, 2010; Madapusi and D' Souza, 2012; Laudon and Laudon, 2014; Rainer et al., 2015). Furthermore, ERP systems provide some basic data analysis and reporting capabilities, which allow the extraction of useful knowledge from the above data concerning important aspects of firm's external environment: customers (and potential customers), market demand for firm's products and services, suppliers, procurement terms and conditions, and also time-wise fluctuations of them, or differences across geographic regions. Therefore, ERP systems support the acquisition of the above valuable external knowledge. These important data become accessible throughout the firm, to different functional units and hierarchical levels. This facilitates the wide dissemination of the knowledge hidden in them, and its integration in the existing knowledge base of the firm, as well as its transformation (as it is viewed through the different perspectives and knowledge structures of different firm's functions) and exploitation for innovations in firm's processes, products and services. For the above reasons our first research hypothesis is:

H1: *The use of ERP systems has a positive effect on firm's ACAP.*

Our second research hypothesis concerns the effect of the use of e-commerce systems on firm's ACAP. The e-commerce systems allow firms to collect large quantities of data about quite diverse customers' or potential customers' groups from a wider geographic area (usually beyond firm's location area or even country) concerning their needs, orders, comments, complaints, etc. (Turban and King, 2012; Loukis et al., 2013; Laudon and Laudon, 2014; Rainer et al., 2015). The basic data analysis and reporting capabilities that e-commerce systems provide allow the extraction of valuable knowledge from the above data about the needs and preferences of quite diverse and geographically dispersed customers' or potential customers' groups, as well as the identification of market segments with different needs and preferences, which might lead to important customizations or modifications of firm's products, services and marketing approaches, or even totally new ones. Therefore, e-commerce systems support the acquisition of the above valuable

external market related knowledge, which is characterized by higher richness, diversity and geographical scope than the corresponding customers related knowledge acquired through the ERP systems, as mentioned in the previous paragraph. This important knowledge can become easily accessible throughout the firm to different functional units and hierarchical levels, and this facilitates its assimilation, transformation and exploitation. For the above reasons our second research hypothesis is:

H2: *The use of e-commerce systems has a positive effect on firm's ACAP.*

Our third research hypothesis concerns the effect of the use of SM on firm's ACAP. Previous relevant literature has found that firms increasingly use SM in order to facilitate and support communication and interaction, initially with their external environment (=external SM), mainly with their customers or potential customers, and latter internally among their employees (e.g. based on Yammer, which is an internal social media platform increasingly used by firms (Rao, 2010) = internal SM) (Ngai et al., 2015; Rainer et al., 2015; Schlagwein and Hu, 2016). The external SM enable the easy and low cost collection of extensive users' generated content concerning opinions, remarks, complaints, etc. about firm's products/services, as well as weaknesses of the latter (or needs they do not fulfil), and comparisons with the ones of competitors. The processing of this content enables the acquisition of valuable external knowledge, which can be quite useful for the development of improvements in firm's products and services, and also totally new ones. According to a qualitative study described in Hu & Schlagwein (2013) and Schlagwein & Hu (2016) external SM enable extensive and deep dialogue with customers which promotes exploratory learning from them, and therefore improves firm's ACAP. Also, internal SM enable the easy and low cost dissemination of this external knowledge within the firm, and analysis of it from many different functional perspectives, exchange of views on it among employees, and finally collaboration among them for the exploitation of this knowledge for the development of products-services innovations. According to the abovementioned study internal SM enable extensive internal broadcast of knowledge, dialogue on it, knowledge management and collaboration for its exploitation; these promote exploratory, transformative and exploitative learning, and therefore improve firm's ACAP. For the above reasons our third research hypothesis is:

H3a: *The use of external social media has a positive effect on firm's ACAP.*

H3b: *The use of internal social media has a positive effect on firm's ACAP.*

4. DATA AND METHOD

This study has been based on data collected from 122 Greek firms through a survey concerning 'Innovation – Use of ICT and Cloud – Impact of the Economic Crisis on Greek Enterprises' between September 2015 and May 2016. An initial sample of 500 Greek firms from the most important sectors of the Greek economy was taken from ICAP, a leading Greek business information and consulting firm. The questionnaire of this survey was sent by e-mail to the CEOs of these firms, asking them to fill and return it within a month; reminder e-mails were sent and telephone calls were made to the firms that did not return filled questionnaire in time. 42.3% of the respondents were from manufacturing sectors, 41.5% from services and 16.2% from constructions. With respect to firm size, 40.3% of the respondents were small firms (with 5-49 employees),

41.2% were medium (with 50-249 employees) and the remaining 18.5% were large firms (with more than 250 employees).

In order to test the abovementioned research hypotheses H1 – H3, we estimated the following regression model:

$$ACAP = b_0 + b_1*IS + b_2*HQUAL + b_3*SIZE + b_4*SECTOR + e_i$$

The definitions of our variables (=questions of the abovementioned survey used in this study) are provided in the Appendix. The dependent variable is firm's ACAP, measured by the mean of the scores of four items assessing the main components/dimensions of it (ACAP_IDE, ACAP_DIFAN, ACAP_ASSIM and ACAP_EXPL) (based on Ettlie and Pavlou, 2006; Liu et al., 2013; Roberts, 2015). The independent variables included were measures of the extent of usage the examined types of IS: ERP, e-commerce, external SM (for the collection of views, opinions, remarks, complaints, etc. of customers concerning firm's products/services) and internal SM (for the support of internal exchange of information and views among firm's employees); as the above variables were correlated, we did not include all of them in the same model, in order to avoid 'multi-collinearity problems' (Gujarati, 2008; Greene, 2011), and entered them one by one. We also included as independent variables an important determinant of ACAP according to previous relevant literature, the intensity of human capital (Cohen and Levinthal, 1989 and 1990; Zahra and George, 2002; Lane et al., 2006), measured by the share of employees with tertiary-level education (HQUAL); and also controls for firm size (SIZE, taking values 1, 2 and 3 for small, medium and large firms as defined in the first paragraph of this section), and for sector affiliation (SECT, taking values 1, 2, 3 for construction, manufacturing and services firms respectively).

5. RESULTS

In Table 1 we can see the estimates for the ACAP models (1) to (4) having as IS variable the use of ERP, e-commerce, external SM and internal SM respectively (we can see the standardized b coefficients of independent variables). We can see that the use of ERP systems, external and internal SM have positive effects on firm's ACAP, while this does not hold for the e-commerce ones. The above results provide support for research hypotheses H1, H3a and H3b, but not for H2. By comparing the standardized coefficients of these four types of IS we can conclude that the use of external SM has the strongest effect on ACAP, followed by the use of ERP systems and internal SM having similar effects.

The above results reveal another aspect of the business value of the ERP systems beyond efficiency: their potential as tools for enhancing firm's ACAP. ERP systems can be useful tools not only for improving firm's efficiency, but also for improving the highly important external knowledge management capability of it. The large quantities of integrated data collected through the ERP systems about customers and suppliers, the wide accessibility to these data across functional units and hierarchical levels, and also the data analysis and reporting capabilities provided by the ERP systems, seem to be leveraged by the Greek firms, facing a 'crisis-hit' and rapidly changing national context (Papadimitriou et al., 2013; Papageorgiou, 2015), and having a lower propensity for innovation, in order to enhance this critical for innovation ACAP. However, this does not hold for the e-commerce systems; despite the large quantities of data collected through them about customers and markets, which are usually characterized by higher richness, diversity and geographical scope than the corresponding customers related data collected through the ERP systems, it seems that these

data are not leveraged for enhancing ACAP. Possible reasons for this might be the lack of mechanisms for wide accessibility to these data across functional units and hierarchical levels, and also the lack of integration of these data with the corresponding ones collected through other sales applications or ERP modules.

Table 1. Absorptive capacity models; OLS estimates

	(1)	(2)	(3)	(4)
HQUAL	0.170	0.127	0.142	0.124
ERP	0.228**			
ECOM		0.075		
EXT_SM			0.360***	
INT_SM				0.188*
SIZE	0.114	0.092	0.112	0.141
SECT	0.064	0.063	0.091	0.088
N	115	110	112	109
F	8.3**	4.8*	3.9*	3.7*
R ²	0.061	0.027	0.126	0.040

Note: Standardized b coefficients are shown; *, **, and *** denote statistical significance at the 10%, 5% and 1% test level respectively; constants are left out.

With respect to SM use our results indicate that both external and internal SM have a good potential as tools for enhancing firm's ACAP. Though according to relevant previous literature (Hu and Schlagwein, 2013; Rainer, 2015; Ngai et al., 2015; Schlagwein and Hu, 2016) firms initially use SM for the external broadcast of information about their products and services to customers and potential customers (one-way communication), it seems that SM are used by Greek firms in the opposite direction as well: for acquiring useful knowledge from the external environment (by processing views, opinions, remarks, complaints, etc. about firm's products/services, as well as weaknesses of the latter (or needs they do not fulfil), comparisons with the ones of competitors, etc., posted in firm's external SM), which enhances firm's ACAP. Furthermore, internal SM are used for the wide dissemination of this external knowledge within the firm, facilitating analysis of it from many different functional perspectives, for the exchange of views on it among employees, and finally for the collaboration among the latter for the exploitation of this knowledge for the development of products/services innovations; these also enhance firm's ACAP.

Another interesting finding is that firm's human capital, though according to previous relevant literature is an important determinant of ACAP (Cohen and Levinthal, 1989 and 1990; Zahra and George, 2002; Lane et al., 2006), is not leveraged by Greek firms for enhancing their ACAP. This is in agreement with conclusions of previous empirical studies conducted in Greece (e.g. Arvanitis and Loukis, 2009) concerning the under-exploitation of firms' human capital.

6. CONCLUSIONS

The ACAP has become a highly important capability for the achievement of high financial performance of firms, and even for their survival, in the rapidly changing, competitive and 'knowledge

intensive' modern economy. Though ICT has been recognized as having a good potential to assist firms in improving their ACAP, there are important gaps in relevant empirical literature. This paper contributes to filling these research gaps, by empirically investigating and comparing the effects of the use of three important types of IS, the ERP and e-commerce ones, and also a recently emerged one, the SM (external and internal), on the ACAP of Greek firms.

It has been concluded that the use of ERP systems affects positively firms' ACAP, but this does not hold for the e-commerce ones. Furthermore, the use of external and internal SM both affect positively the ACAP. A comparison of these effects leads to the conclusion that the use of external SM has the strongest effect on ACAP among the examined IS types, followed by the use of ERP systems and internal SM (having similar effects). Our results provide a first empirical evidence concerning the potential of two important types of IS used by firms, the ERP and SM ones, to support the increase of a quite important external knowledge management capability of the firm: its ACAP. They indicate that in the 'innovation averse' national context of Greece, which is experiencing a long and deep economic crisis, firms, facing a continuously decreasing demand for their products and services, and big changes in consumption patterns, needs and preferences, are leveraging an important and well-established type of IS, the ERP systems, which is oriented mainly towards efficiency improvement, as well as a recently emerged one, the SM, in order to enhance this critical innovation and adaptation related capability.

The findings of our study have interesting implications for research and practice. With respect to research they open up new directions of research concerning the effects and business value of the numerous types of IS used by firms, beyond efficiency improvement, with respect to the support and improvement of important knowledge creation and management processes. Furthermore, our findings have interesting implications for practice, as they reveal a new aspect of the business value generated by two out of the three examined types of IS: ERP systems and SM. So they are useful for firms that are users (or potential users) of these types of IS, in order to make a better exploitation of them and increase the business value generated by them, not only towards increasing efficiency, but also towards supporting critical knowledge creation and management processes. Further research is required in order to test our research hypotheses in other national contexts, and also examine the effects of other types of IS used by firms on their ACAP. Also, this quantitative research should be complemented by corresponding qualitative research in order to get a better and deeper understanding of how the use of these types of IS affects positively ACAP (which are the exact types of usage made, and which components/dimensions of ACAP are enhanced through each of them and how).

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Appendix: Questions Used

To what extent does your firm have the following capabilities of acquisition/management/exploitation of useful external knowledge (concerning the market, e.g. customers' requirements/preferences, products/services of competitors, etc., or new technologies and materials, legislation, opportunities, threats) (absorptive capacity)? Answer in a scale of 1 to 5, where: 5 = to a very large extent, 4 = to a large extent, 3 = to a moderate extent, 2 = to a small extent, 1 = not at all.

Can you recognize/ identify useful knowledge for your company from the external environment (e.g. suppliers, partners, research centers and universities, etc.) (ACAP_IDE)	1 2 3 4 5
It has internal practices and procedures for the internal dissemination and analysis of this external knowledge (ACAP_DIFAN)	1 2 3 4 5
It can absorb/assimilate this external knowledge and integrate it into the existing knowledge base of the company, so that it can be enriched and broadened (ACAP_ASSIM)	1 2 3 4 5
It can use/exploit this external knowledge, in combination with existing internal knowledge, for the improvement of the operation and competitiveness of the company, and the creation of innovative products/services – methods/procedures (ACAP_EXPL)	1 2 3 4 5

To what extent are ERP systems used in your firm? Answer in the same scale 1-5 (ERP)

Are you conducting electronic sales of products/services through the Internet ? (Yes/No) (ECOM)

To what extent are you using social media for the following purposes? Answer in a scale of 1 to 3, where: 3 = to a large extent, 2 = to a small extent, 1 = not at all

For the collection of views, opinions, remarks, complaints, etc. of customers concerning your products and services (SM_EXT)	1 2 3
For the support of internal exchange of information and views among firm's employees (SM_INT)	1 2 3

Provide the percentages of the following main educational categories in the personnel of your company:

- Graduates of Universities/Technological Education Institutes (TEI) _____%
- Graduates of Professional Training Institutes (IEK), Technical Schools or Vocational High Schools _____%
- Graduates of High School _____%
- Graduates of Elementary School _____%
- TOTAL 100%**