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A model for the assessment and development of Internet-based information and communication services in small and medium enterprises

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Abstract

Young engineers understand technology very well, but they usually have poor skills on business practices. For this reason, they should appreciate tools that help in assessing small companies from a combined viewpoint of business and technology. In this article we present such a tool in the form of a model that helps to understand how an enterprise is using information and communication technologies (ICTs) and "how" and "when" a company should incorporate new technological elements. The model can also be applied to marketing research to understand the small and medium enterprises (SMEs) emergent market related to ICTs and to plan government policies devoted to fostering ICT introduction in SMEs. The model has been applied successfully in the assessment of 500 SMEs, and also as an innovative active learning tool for higher education.

Keywords: Information and communication technologies (ICT); Small and medium enterprises (SME); Entrepreneur; Market research; Innovation; Telecommunications; Information systems

1. Introduction

It is widely accepted that both "innovation in-house" and "innovative small and medium enterprises (SMEs) cooperation" require for SMEs to use information and communication technologies (ICTs). Moreover, ICT expenditures are productivity improvement drivers by themselves (Lapierre and Denier, 2005; Falk, 2005).

That is, the use of ICTs can be considered as key factors for innovation and entrepreneurship. ICTs are a must for SMEs to innovate.

In fact, a look over the fifth edition of the European innovation scoreboard (EIS) reveals that there is a big innovation gap between Europe and the US that is not closing (Trendchart Report, 2006). The EIS includes innovation indicators and trend analyses for all 25 European Union (EU) Member States, as well as for Bulgaria, Romania, Turkey, Iceland, Norway, Switzerland, the United States and Japan. It assesses five key dimensions of innovation: innovation drivers, knowledge creation, innovation and entrepreneurship, applications, and intellectual property.

The innovation and entrepreneurship dimension of innovation is supported by six indicators, which are mainly related to the innovation performance of SMEs.

Let us pay attention to three of the six indicators from the innovation and entrepreneurship dimension, which are (Trendchart Report, 2006):

- *SMEs innovating in-house*: This indicator measures the degree to which SMEs that have introduced any new or significantly improved products or production processes during the period have innovated in-house.
- *Innovative SMEs cooperating with others*: This indicator measures the degree to which SMEs are involved in

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innovation co-operation. Complex innovations, in particular in ICT, often depend on the ability to draw on diverse sources of information and knowledge, or collaborate on the development of an innovation. This indicator measures the flow of knowledge between public research institutions and firms as well as between firms and other firms.

- *ICT expenditures*: ICT is a fundamental feature of knowledge-based economies and the driver of current and future productivity improvements. An indicator of ICT investment is crucial in capturing innovation in knowledge-based economies, in particular due to the diffusion of new information technology (IT) equipment, services and software.

Besides, there is a need to foster young engineer's abilities and education towards technology-based and market-based innovations, mainly through the development of entrepreneur profiles or through the mentoring of young entrepreneurs. All the same, the entrepreneurship objective should also be extended to small organizations that need some help to foster their innovation abilities.

For this reason a good solution to innovation and entrepreneurship fostering could be to *instill* into the minds of young ICT engineers the idea of being the professionals that assist small enterprises on their way to innovation and competitiveness based on IT. Furthermore, these young professionals should be provided with a valuable tool (tricks, if you prefer) for the rapid assessment of the needs of SMEs. That way, both objectives could be achieved: the entrepreneurial character of young engineers would be developed, and also small enterprises could find in such professionals the support they need to improve their use of ITs for their sustainable and competitive growing.

Why is that consultancy field suitable for young engineers? The information and communication systems for the SME emergent market cannot be easily afforded (at least directly) by large IT providers or telecommunication operators. The reason is that the offer from large operators or providers is quite packetized, so personalization or configuration is only possible at a pure technical level, but not at a business level. There are so many business models, industries, company sizes, company structures or client typologies that off-the-shelf ICT business solutions *need necessarily* be adapted by a consultant. The question to be addressed is which types of ICTs should be used and how to introduce them in each specific SME. The model proposed in this article is an approximation to the answer.

2. Model description

Our model is based on the measurement of the degree of the introduction of ICT in SMEs, but also taking into consideration other enterprise strategies or circumstances (Martin and Matlay, 2001). For example, if an SME is intending to invest in ICT then they should seek out an adviser who can ensure the investment has a clear strategic focus and the business opportunity is enhanced (Morgan et al., 2006).

The model is based on the following hypothesis: Internet is the foundation of SMEs corporate networks and Internet-based services are the cornerstone of their information services. For this reason, ICT in SMEs should be analyzed from an Internet culture standpoint. Internet access, the use of basic Internet services, as well as the use of enterprise management, and trading information systems (e.g. e-commerce, e-procurement), should also be considered.

The above hypothesis also suggests that an SME should be assessed from three different fields: telecommunications, information systems, and corporate culture (human resources). The first two fields seem to be obvious, but some times the third is forgotten and it is extremely important in the case of SMEs (Mullins et al., 2001; Fulantelli and Allegra, 2003; Dagdilelis et al., 2003; Oyelaran-Oyeyinka and Lal, 2006).

Before going through a distinct analysis of these three fields, our model should determine which steps are to be followed by an SME when introducing ICTs. Since the network and services for SMEs are Internet-based, a good conceptual model should consider the evolution of Internet services inside a firm.

At the height of the dot-com bubble, the three Cs (*content*, *community* and *commerce*) were the valued proposition for web portals. Other authors have used an analysis based on up to eight C's (*connectivity, content, community, commerce, capacity, culture, cooperation* and *capital*) to address the success of ICT deployment (Rao, 2003), which is more than a web portal deployment. Our analysis, in fact, is very close to the "8 Cs" paradigm since our model addresses also connectivity (we call it *telecommunications*) and capacity–culture–cooperation (we call it *corporate culture*). Today, capital is not supposed to be an obstacle since information systems for SMEs are quite affordable.

Going back to the "3 Cs" analysis, we should define *content*, *community* and *commerce*—in a similar way to how Rao (2003) does—for the case of ICTs being applied by SMEs.

- *Content:* To provide basic (but complete) information about the firm and its products or services that can be downloaded by employees and also by customers.
- *Community:* To work together; this implies much more than information uploading and retrieving.
- *Commerce:* To get through to make business.

The model is also in accordance with Belussi (2005) who found that SMEs use ICTs for customer relationships (content) in an earlier stage than for providers' relationships (community) and also with Nuissl (2005) in the sense that making business together (commerce) is a consequence of trust (which is achieved by working together).

The above definition leads to a description of the way an SME should travel…step by step and conquering stages. That is, being careful not to build the house from the roof down. Putting everything together, the proposed stages, that comprise the model itself, are described in Table 1.

3. Application of the model

The SME under assessment is analyzed, for example, through a self-questionnaire or by interviewing the company managers. The objective is to determine the stage (Table 1) in which the SME is, and to measure how much of each stage the SME has. For example, if an enterprise scores 0% in stages 0, 1 and 4, but 40% in stages 2 and 3, and 20% in stage 5, then, in this case, the enterprise is between stages 2 and 3 because both stages are the most relevant.

Notice that the stage in which an SME is placed can be different for the telecommunications, information systems or corporate culture fields. Moreover, many enterprises cannot be placed in only one stage. It does not matter; in fact, it is valuable information for later advising.

The necessary company skills for the three fields, and for each stage, are shown in Tables 2–4. The tables are presented in the form of three questionnaires so that they can be used directly for assessment purposes. The skills are the minimum necessary to achieve the challenges described in Table 1 for each stage. There are 36 "mini-cases" in total (12 per questionnaire) that can be assessed by ranking the answers on a 1-to-5 scale, where a "1" punctuation means "I completely disagree with the situation depicted in the question" and a "5" punctuation means "I completely agree".

At the end, each SME is characterized by a table like the one shown in Table 5. Notice that the sum of each column must be 100%.

This table is the basis for SME advising. The rules to be followed by the firms in order to improve their ICT positioning in short terms are:

- The best situation is to burn stages, that is, not to travel through upper stages before having fulfilled lower ones. When a lower stage is fulfilled, it appears in Table 3 as a value near zero.
- The best situation is to be balanced, that is, for information systems, telecommunications and corporate culture to be at the same stage. If the SME is unbalanced, then the priority is to invest resources in balancing stages.
- It is very important not to incorporate elements from upper stages before becoming successfully balanced in the lower stages.

Once the stage of enterprise use of ICTs is determined, the consultant needs more information about the SME enterprise strategies in order to recommend a proper action plan. It is obvious that the technology needs of a

Table 1
Stages for the introduction of ICT and SMEs

Stage	Description
(0)	*Office automation* PC's, basic office automation programs (text processor, etc.), telephone and fax are available and are used regularly. Support management software is not used (accounting programs, payrolls, etc.). The company does not use Internet. The company employees that use computers only need to know their basic use and that of the basic office automation programs
(1)	*Information and communication* Computer management support programs are used (accounting, payrolls, inventories, etc.). Some company employees are already using Internet, especially electronic mail. The company has a basic corporate web. Employees that make use of the Internet know how to use electronic mail and web browsers
(2)	*Interaction from inside* What is fundamental in this stage is for employees to use electronic mail and corporate web and/or intranet as means for internal communication and information. This allows the internal sharing of customer information through data bases and favors cooperative relationship management with the customers. All of the employees must use electronic mail and web browsers with confidence. Management applications are integrated through an integral enterprise resource planning (ERP)
(3)	*Interaction from outside* Companies that are at this stage have reached three goals: (a) customers communicate directly through the corporate web, which can present an application of electronic trade directed to the consumer (B2C); (b) the different management applications are integrated and allow their remote access to the organization's personnel or to exchange data among branches; (c) they try to merge the different customer data bases into one. Specific training of certain employees in the use of management applications
(4)	*Working together* In the prior stages, customers started to find the way to relate with the company directly through a simple communication data system (corporate web). Also, the company integrated its different management applications. A small step further is taken in this new stage: the company's information systems are opened to its contributing companies (subcontractors, providers, distributors, etc.), allowing it to exchange information electronically with these agents. It has been possible to organize one sole source of information concerning the customers (customer relationship system—CRM). Massive training of employees in the use of management systems. Training collaborating companies in the use of the companies' systems
(5)	*Making business together* Structuring the company towards the integration of its management applications (Stage 2), the beginning of the implementation of customer relationships through the web page and the merging of their information into one sole data base (Stage 3), as well as the introduction of a culture of electronic relationship with subcontractors, providers and distributors (Stage 4), allow to undertake the complete integration of the value chain through electronic means (Stage 5). This implies training the employees and collaborating companies in regards to the impact of their activity in the final results of the company, as well as their introduction within the customer relationship management application, which allows an analysis of the commercial and marketing information. Also, the company has implemented applications, which allow it to consult and analyze its main indicators

Table 2
Questionnaire for information systems positioning

Stage	Question
(0)	1. I have the basic computer programs (text processor, spreadsheet, etc.). However, I do not have at my disposal the computer programs for the management of the company (accounting, payroll, warehouse, etc.) 2. I do not have a web page, or at the very least I have ''presence'' in the internet without my own domain
(1)	3. I have a web page with my own domain but I consider it too basic 4. I use computer programs that consist only of management applications (accounting, payroll, warehouse, etc.) and are only carried out through PC's; they are not integrated
(2)	5. I have a corporate web with a private zone (only for company personnel) that serves as document directory, source of information…or I have an internal net (intranet) with solutions for document management and application of workflow (if my sector requires it). I do not have a ''customer zone'' 6. I have some computer programs (data bases), which allow the maintenance of a certain structure of the final customer relationship information (beyond addresses and telephones) and it can be shared between several people, who can have access to the information through the Internet, even from their homes. Management computer programs (accounting, payrolls, production, etc.) are integrated (ERP)
(3)	7. My corporate web page has an access zone only for company personnel with telework applications, and another one ''only for customers'' (not for providers), whose task is to serve as the companies' information warehouse with each specific customer through the web page, being able to include an electronic commerce application directed towards the final consumer (b2c) 8. Computer programs directed to management are integrated (ERP) and allow me to send or consult management data with my employees or branches in a remote way. I am trying to merge the different data bases of my customers into one data base
(4)	9. I have programs that allow me to create one sole source of information concerning my customers, which facilitate sales, marketing and services through various channels (customer relationship management system—CRM) 10. Computer programs for management purposes (accounting, payroll, production, etc.) are integrated (ERP) and they also allow me to exchange information electronically with other companies (customers and providers) or my employees. I do not use electronic transactions or other means of electronic payments
(5)	11. I carry out electronic transactions with other companies—customers and/or providers—(b2b) integrating the payroll systems, the integral management systems of the company (ERPs) and the electronic exchange of mercantile documents through management supply chain tools (SCM), e-procurement, marketplaces, etc. 12. I have programs that allow me to create one sole source of information regarding customers, which facilitate sales, marketing and after-sales services (CRM) and allow me to provide detailed analyzed information to employees according to their role in the company (directors, sales, customer services, etc.) Also, the company can consult accessible data about its main indicators through computer applications in a remote way

manufacture company are not the same as those of services. In order to assess the firm strategy, the model looks over two company elements: the *competitive strategy* and the *value chain analysis*.

Table 3
Questionnaire for telecommunication positioning

Stage	Question
(0)	1. Electronic mail is not used in my company, or if so, there are only a couple of accounts for the whole company 2. We don't use Internet. Some employees may connect sporadically
(1)	3. Some of my employees have electronic mail 4. Some of my employees have access to Internet, and use it either for Administration purposes (b2: treasury, social security, etc.), administrative dealings (customers and providers), or for small market and competition research. Not for further use
(2)	5. Internet and electronic mail, within the management area, are used in the company's internal affairs or with the customers and providers of each employee 6. I have DSL, cable or similar and local net area in the main offices. I worry about quality access to Internet. The documents are mostly filed in each employee's PC
(3)	7. Electronic mail is regularly used, not only for internal affaires and with regular customers and providers, but as means for everyday communications in relationships with agents outside of the company. Internet is used as a customary work tool 8. My local net area has file servers where documents can be stored. Also, service quality in the data networks (in local net as well as Internet connection), is essential for my company's necessary transactions
(4)	9. I have some type of virtual private net to interconnect my offices, DSL and local nets in the main offices. I have file servers 10. I demand quality service agreements from operators and providers of information services
(5)	11. The quality service agreements are audited somehow (even in a simple way), and I have in agreement some type of penalty for breach of contract 12. Employees or authorized people have net access to all services and is done by any means (including people in motion)

3.1. Competitive strategy

The enterprise under assessment should now recognize the basic general strategy that the company follows. ICTs investments and actions details depend on enterprise competitive strategy.

There are three possible strategies:

- *Cost lowering*: Being the leader in production costs. Usually, there is no more than one cost leader in each market.
- *Differentiating products*: When the objective is that a relevant market segment perceives my product superior to others because of its functional characteristics, design, or brand relevance.
- *Special abilities*: This is the case when an organization competes thanks to some key abilities (usually from people), which allow the company to have a better chance when new and diverse competitive challenges arise.

Table 4
Questionnaire for corporate culture positioning

Stage	Question
(0)	1. My company employees, in general, do not know or need to know how to use Internet and electronic mail 2. Only those employees that work directly with computers need to know how they work, and only at a basic level (text processor, spreadsheets, etc.). The others do not even need it
(1)	3. Only specific employees know how to navigate through Internet and how to use electronic mail in an efficient way. Most of them do not know 4. Hardly anybody in the company has basic computer and telecommunication training
(2)	5. Practically all of the employees that carry out activities related to management know how to navigate through Internet and use electronic mail with confidence, though only some have specific training on the use of computer management applications 6. We have personnel who have basic knowledge on servers and computer net. However, they do not really know how to configure their computer services and applications
(3)	7. Many employees have specific training to efficiently use the different management computer applications, even though most of them are still not prepared for it. However, practically all of the employees know how to use Internet and electronic mail with confidence 8. Only some employees have basic knowledge on how to manage their computers with regards to the servers and applications configuration for remote access. For most of those who do not have this skill, we have company personnel who can help them
(4)	9. In general, all of my company employees are trained in the use of the different management computer applications, although they always need specific training when facing a new computer application 10. Most of my company employees have basic knowledge on how to manage their computers if they need it for their work, especially when dealing with the configuration of the servers and applications for remote access. However, they frequently have problems and need help
(5)	11. I believe that, in general, my employees have training in computer management, enough to work with any type of computer application without the need for specific training 12. I believe that, in general, my employees are capable of managing, without a problem or assistance, their computer and communication devices in the office as well as in a remote way (access through modem, connection to any net, file transmission, etc.)

Again, the enterprise competitive strategy could be a mixture of the above three. It is necessary to assess which percentage of the company strategy corresponds to each of the three.

3.2. Value chain analysis

In this case, the point of the value chain that the enterprise under study has the intention of focussing its efforts on should be determined. For the objective of our model there are five relevant possibilities:

- *Supplies*: To make raw materials and basic services supplies more efficient.
- *Production*: To optimize manufacturing processes and improve quality.
- *Retail channel*: To improve both, sales force management and retail channels.
- *Customer*: To better manage customer relationships, that is, better customer knowledge. The objective is to get a smart use of customer information in order to be able to offer the best product or services that match customer needs.
- *Outsourcing*: To make an intensive use of outsourcing and to improve contractor control up to a level in which contractors could be considered as an internal part of the company and thus be managed in that sense.

Table 5
Stage vision for a particular SME

Stage	Information systems (%)	Telecommunications (%)	Corporate culture and training (%)
0			
1			
2			
3			
4			
5			
	100	100	100

The best situation is when the SME is placed in the same stage for information systems, for telecommunications and for corporate culture and training.

Once more, the focussed efforts can be divided between the five possibilities mentioned above, but the percentage of the efforts corresponding to each one of the five possibilities should be determined.

Now that the small company is perfectly assessed, what can we do with this information? In the following sections two applications are reported: young entrepreneur ICT consultancy and market research.

4. Young entrepreneur SME ICT consultants

The entrepreneur professional walks through objectives beyond any obstacles…but minimizing risks. The entrepreneurs' attitude should be understood, put into value and fostered. In order to match entrepreneurs, both young and senior, with resources:

- Young entrepreneurs need valid references (persons and institutions) as well as resources.
- Senior entrepreneurs need to meet young entrepreneurs in order to go into new challenges (Landstrom, 1998).
- Finally, resources need entrepreneurs, both young and senior.

To conquer emergent markets (for example, SMEs) breakthrough innovations are more than necessary, but in

Table 6
General advising on information systems

You are in stage	What to do
(0)	• Use low cost computer management support programs (accounting, payroll, inventories, etc.) oriented to be used with PCs • Contract a basic corporate web and a domain name (www.yourcompany.com)
(1)	• If you have already contracted a basic corporate web and a domain name (www.yourdomain.com), add an "employee zone" to your corporate web in which, at least, there is possible access to common documents, different information sources and a shared contact agenda, or create an internal net (intranet) for your company employees • Start using data bases with your customers' information • Start changing your computer management support programs (accounting, payroll, inventories) in case they are now working separately. In other words, you must start changing these programs so that they function as a whole, making it an Integral Management System (ERP) (so that, for example, the payroll program exchanges information with the one for accounting)
(2)	• If you do not have a corporate web with private zone or an internal net, (intranet) install it. If your company's work requires it, install Document Management solutions or Workflow. Analyze, according to your sector, if the telework betters your competitiveness. Develop a customer zone within your corporate web; if you have one, study the feasibility of incorporating an electronic commerce application • If you have customer information data bases, try to merge them into one. If not, create a data base with your customers′ information • Integrate your management programs into an ERP. If you already have them integrated, incorporate applications that will allow you to send or consult management data to your employees or branches in a remote way
(3)	• Evaluate the applications that may allow your Integral Management system to exchange information electronically with other companies (customers and providers) or their employees • Analyze the benefits for your company of creating one sole source of information about your customers and the different programs (CRM applications) that exist in the market
(4)	• Automate all of your business processes with your customers, providers and employees using Internet as a tool, in such a way that it will allow the company to carry out the exchange of relevant information • Incorporate analytical applications inside your customer relations management system (CRM) or to allow control of your main indicators; if you do not have a customer relations management system (CRM) incorporated in your company, study the benefits shown in its possible incorporation
(5)	• Your Integral Management System (ERP) allows your customers, providers and employees to have immediate access to it so that your customers can enter your catalogues or receive estimates…, your providers can track an order or process bills…, and your employees can keep contact information or qualifications… • Update your computer equipment and your office automation applications

the form of breakthrough "market-based" innovations. For that purpose, enterprises should foster an entrepreneurial orientation of their strategies (Zhou et al., 2005).

The scenario depicted in the above paragraphs suggests that developing entrepreneur skills in young engineer graduates are very valuable, both for society and for the young professionals themselves (Ulhoi, 2005).

As it was stated at the beginning of this article, the information and communications systems for SMEs emergent markets cannot be easily afforded by large IT providers or telecommunication operators. Consultants are needed to make ICT plans for SMEs, which is very costly if operators or providers have to do this each time an ICT system is purchased.

Moreover, in general, enterprises cannot make the conversion from ICT strategies, for example like those explained in Carbonara (2005) for SMEs, to actual and operative technology deployments. External help is needed to assess the best strategic solutions (Azumah et al., 2005). SMEs managers have indeed poor skills to reflect upon their companies strategically (Vos, 2005).

The solution is for each SME to have its own consultant for all ICT purchases or ICT deploying plans. This consultant would be a kind of "family-doctor" who is continuously assessing the company and, thus, is able to advise a client in an efficient way in terms of time spent for the consultancy.

This "ICT family-doctor" profile is very suitable for young entrepreneurs whose education is nearer to telecommunications and information systems. Unfortunately, technical education does not usually come with business education (Wang and Wong, 2004) and young engineers feel limited when assessing an SME.

Our model serves for the purpose of helping young engineers understand the business of their clients in terms of being able to make ICT evolving plans. The study and application of the model, together with their previous knowledge about the effective use of ICT within SMEs, produces a similar effect in their skills development than the long-life learning programmes explained in Morgan et al. (2006).

The model has been applied to three sets of 70 students (210 in total) from the final course of Telecommunications

Engineering. The students had previously learned about the different telecommunication and information systems for enterprises, and knew the technology and its applications, but had poor results when they were asked to make an ICT deployment plan for an SME business case.

After they learned the model presented in this article, they not only improved the business case exercise but also accepted the challenge of looking for a real SME, assessing it and making an ICT deployment plan.

In order to help them center on ideas, they were given a set of tables (Tables 6–10) in which general advices were stated as a function of the phase (telecommunications, information systems and corporate culture) and the SME business strategy.

The resulting plans were so professional that many of them were implemented by the assessed SME. It was, in

Table 7
General advising on telecommunications

You are in stage	What to do
(0)	• Try for some of your employees to have personal electronic mail at their disposal • Make it possible for some of your employees to have Internet access, and for them to use it for administrative affairs and for minor market and competition researches
(1)	• All of the employees associated with the company's management must have electronic mail at their disposal. Electronic mail must be regularly used for internal affairs as well as with customary customers and providers • Use Internet in your company, in a customary way, even if it still does not constitute a customary work tool • Contract DSL access or something similar. Install a local net area in the main offices. Worry about contracting telecommunication servers that offer a certain quality. Be careful because the cheapest ones may not cover your needs
(2)	• Try for your employees to use electronic mail as a normal communication means, internal as well as external • Try for those employees who have computers, to use Internet as a customary work tool • Add a file server to your local net area. Make it easy for your employees to be able to have access to this file server from outside the office (for example, from their house) • Carry out a search for a telecommunication server that offers quality in DSL, the local net as well as in other services
(3)	• Only accept telecommunications servers that offer quality service agreements, even if they are not objectively auditable • Contract a Private Virtual Net to connect your main offices • Consider the possibility for your employees to have access to the Private Virtual Net from outside the office (for example, from their house)
(4) and (5)	• Demand quality service agreements for your telecommunication services, but only accept those agreements that are objectively auditable (even in a simple way) • Try for employees and other authorized people to have net access to all the services in the corporate net • Start considering the need to substitute DSL access or similar for other types of data nets. If you still do not have a Private Virtual Net service to connect your main offices, contract it. It is now very convenient for your employees to have access to the Private Virtual Net from outside the office (for example, from their house)

Table 8
General advising on corporate culture and training

You are in stage	What to do
(1)	• Try for some employees to learn how to navigate through Internet in an efficient way, and to correctly use electronic mail
(1)	• Have all the employees carrying out activities related to management learn how to navigate through Internet and use electronic mail with confidence • Try for all key employees to have basic training in computers and telecommunications and for one employee to be capable of doing basic management of the servers as well as of computer nets
(2)	• Apart from the skills in stage one, train enough employees in the use of management applications • Try to have some of the employees that work outside the office know how to configure remote or local access of their own computer to the corporate net
(3)	• Train ALL of your employees in the use of Internet and electronic mail • Have ALL of your employees associated in management fields, trained in the use of the different management applications (even if they need specific training when facing a new computer application) • Try for ALL employees that work outside the office to know how to configure remote or local access of their own computer to the corporate net (though they might frequently have problems and need help) • Have one of your employees be capable of doing basic management of the servers as well as of the computer net
(4) and (5)	• Apart from the skills in stage three, try for ALL your employees to have basic training in computers and telecommunications, and for those employees associated in management fields to have enough knowledge for them not to need specific training when using a new application • The same objective in respect to those employees that work outside the office when configuring their computer for remote access: they should not need help

Table 9
General advising considering enterprise strategy

	Telecommunications	Information systems	Corporate culture
Cost	Try for your company to have enough communication and quality means for local communications as well as for your collaborating companies and Internet	Stress the use of computer applications whose objectives are the integration of all value chain processes and their automation	Use Internet and management applications with confidence
Differentiation	Idem	Stress the use of computer applications for computer assisted design, in computer applications for business intelligence, and in computer applications that allow improvement in customer management and their needs (relationships with distributors, direct customer service, management marketing force, etc.)	Understand the meaning of the company's data bases
Abilities	Try for all of your company's employees and collaborators to have electronic mail and the possibility of Internet access (controlling its use as you think necessary) at work as well as at home	Stress the use of computer applications that allow relations among people and the exchange of information among them, inside the organization as well as with subcontractors and collaborating companies in any field (maintenance technicians, people who deal directly with the customer, sellers, etc.)	When the strategy is based on skills, training in computer and telecommunication use has to be very broad and outstanding. Training in the possibilities that data analysis offers facing business intelligence. Understanding the ways to compile customer information. Learning the efficient communication of R&D departments. People in your organization and the organizations with whom you collaborate, must consider data communication as the most effective way to communicate

fact, a very good exercise for entrepreneurship learning and a gate to the virtuous cycle of entrepreneurship (Venkataraman, 2004).

5. Market research

A regional official association of enterprises (*Consejo Regional de Camaras Oficiales de Comercio*) developed a project in which the model was applied to 587 small companies from that Spanish region (Castilla y Leon). Data was collected from a questionnaire that was filled out from a web page. The questionnaire was filled out directly by the company managers or by a person from the project (an agent) who assisted them. The companies that requested advising also received an ICT deployment plan from the agents.

There are 151,448 enterprises (2003 data) in the region under study, so the sampling error is 4% for a trust level of 95%, which means that the conclusions of the study are relevant.

SMEs were assessed from three different standpoints:

- *Telecommunications*: Infrastructures and the use of telecommunications tools such as connectivity, electronic mail, networks, or quality of service needs, are assessed.
- *Information systems*: Infrastructures and information systems hardware, as well as different types of business management software applications.
- *Corporate culture and staff training*: Enterprise position on ICT introduction and fostering among employees. Staff training is also considered.

The introduction of ICT is a gradual process in which enterprises adopt ICTs step by step. First, they usually incorporate ICT to support administrative processes (e.g. accounting or billing), and only in a second stage they will include ICT technologies related more directly to business competitiveness such as agility, costs or quality improvements and product customization. Some enterprises use ICT only in the more advanced stages as a key element for company redesigning: new products that are based more on information, new channels for commerce, new models of networking organization with customers or providers, knowledge management, and training.

Next, the results of the study were presented in order to show which type of quantitative conclusions can be extracted from a market study using our model.

Needless to say that the results can be used not only for marketing purposes (market segment assessment) but also for helping governments in their strategic and tactic planning of policies to foster the use of ICT in SMEs (Cuadrado-Roura and Garcia-Tabuenca, 2004).

Table 10
General advising considering value chain analysis

	Telecommunications	Information systems	Corporate culture
Supplies	Try for your company to have enough means of quality communication, for local communications as well as towards your collaborating companies and Internet	Stress the automation of your buying processes with proper computer programs. Use platform headquarters for Internet buying and auctions. Try to integrate your information systems with those of your providers: they will find added values and will be able to transfer them little by little to their employees. Providers usually find benefits if they are given automized information that allows them to optimize their logistic costs	The will to entirely use information systems, your own as well as those of the companies or intermediaries with whom you deal
Production	Idem	Stress the automation of your production processes with adequate computer programs. Automize relationships between departments that are not related to production and those related with it. Automize relationships between R&D and production departments	The capability to quickly understand your own company's management systems and those of other companies with whom you have relationships
Retail channel	Idem	Automize relationships with your distributors and their own marketing force. Establish feedback mechanism systems by which the distributors as well as your own marketing force can obtain information about the customer	The use of Internet and management applications with confidence
Customer	Idem	Install computer applications to centralize all of the company's relationships with the customer. Install mechanisms by which the dealings of any person in the company with a customer are registered and available for other people who will have to deal with that customer	The use of Internet and management applications with confidence. Assume the importance of making the most out of each contact with the customer to compile information and diligently place this information in the company's data base
Outsourcing	Idem	Automize the relationships with your subcontractors, and outsourcing in general, as well as with your collaborating companies. Establish feedback mechanism systems by which your subcontractors and collaborating companies can obtain information about the customer	The use of Internet and management applications with confidence

Enterprises were divided into three segments:

- Very small enterprises: 0–9 employees (57%).
- Small enterprises: 10–49 employees (37%).
- Medium enterprises: 50–250 employees (6%).

When comparing enterprises, taking into consideration their size in terms of number of employees, the analysis of the results suggests the following conclusions:

- The bigger gaps were found in the Telecommunications and information systems fields: the stage in which enterprises are located is related to the size in terms of number of employees.
- The staff of very small companies (less than 10 employees) is not trained enough to deal with the information and telecommunications systems that are available in the company. Personnel from companies with more than 10 employees are trained enough with respect to the technological stage in which the company is.
- Upper stages are very infrequent in all companies (very small, small and medium) but the stage for information systems tends to be higher for bigger companies.

Figs. 1–3 depict the stage as a function of company size (very small, small, and medium) and as a function of the

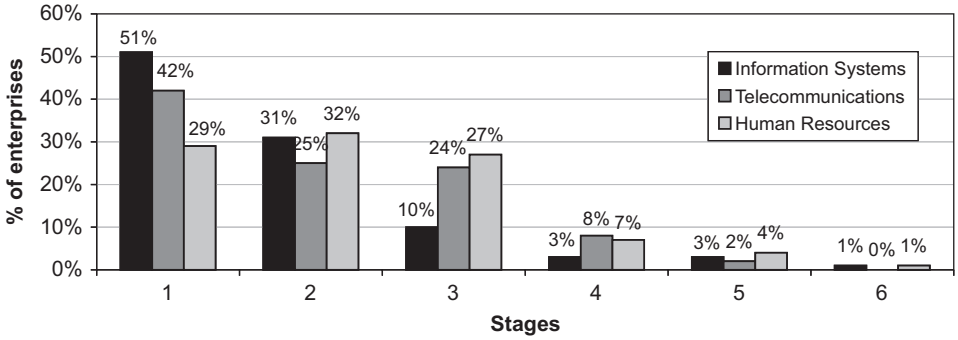

Fig. 1. Stage as a function of the considered field for very small enterprises.

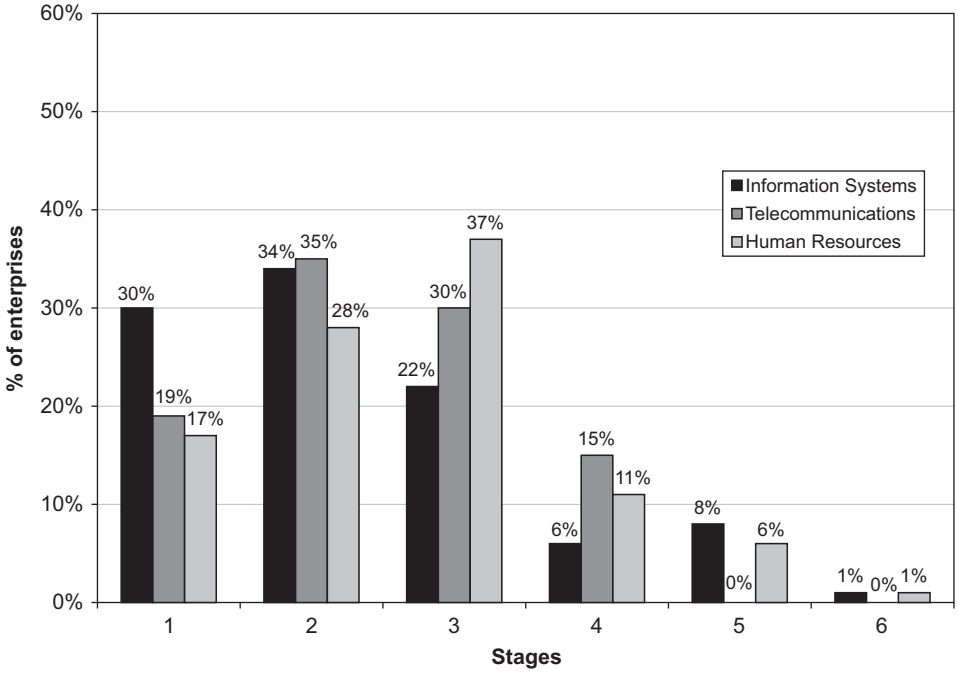

Fig. 2. Stage as a function of the considered field for small enterprises.

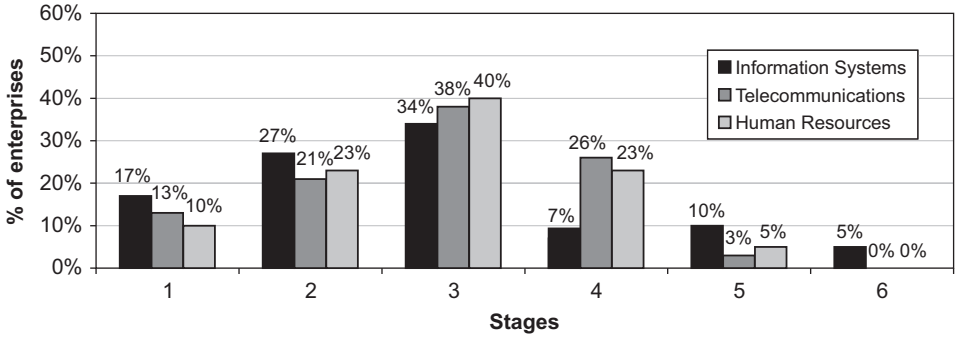

Fig. 3. Stage as a function of the considered field for medium enterprises.

considered field (telecommunications, information systems or human resources/corporate culture).

It can be seen that very small companies are really out of the ICT world, while small companies are on stage 1 in terms of technology but, fortunately, the staff is prepared to upgrade to a technological transition up to stage 2 in most of them. The bad news is that, today, being on stage 1 does not seem to be enough to afford a reliable competitive positioning.

With respect to medium enterprises (50–250 employees), it can be seen that most of them are on stage 2, but many of them are already in lower stages. Also notice that almost

three quarters of the employees that work for medium enterprises are not prepared to afford stage 4.

Since the different stages are well characterized, it is straightforward to understand the reality of the market.

The study can also lead to conclusions as a function of enterprise sector. In the case of the region under study, our conclusion is that the real state industry and the other services industry are the most advanced (one stage forward).

6. Conclusions

The tables included in this article, which define the model, were constructed from the authors' experience in the introduction of Information Society in small and medium enterprises (SMEs) since 1995. Furthermore, the contents of the model were reviewed by a set of experts in SMEs and information and communication technologies (ICTs) from the telecom industry.

Nevertheless, the contents of the tables should only be taken as the basis for constructing your own model. That is, you should consider the model not only as a tool to apply directly to your client assessment and further advising, but also as methodology for constructing your own vision.

In fact, we have changed the model ourselves to adapt it to other consultancy environments in which the standpoints were different. It worked well. With very little mind effort we reached successful results. Some of our ex-students are also using this way of thinking about their client's business and they have received very good feedback. Nevertheless, the model can be considered as a think tank.

It is true that SMEs have different characteristics since the nature of work varies with industry, and so it could be thought that someone without business administration knowledge cannot benefit from the model proposed in this paper. Nevertheless, the consultancy works of 210 last year's students, who applied the model to 210 real small enterprises, show that young telecommunication engineers can.

Putting an SME in the way to Information Society or in the way to making the best ICT investment in terms of economic return through company benefits is more of an art than engineering. Of course the ICT consultant, as the artist, must master the colors but, no doubt, the final picture is a result of a deep comprehension of the landscape plus a ninety percent of technical skills… and a ten percent of inspiration. The only aim of the present article is to show you how to comprehend landscapes at a first glance; the rest is up to you. You can do it yourself.

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