Innovative Characteristics of Small and Medium Enterprises

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Abstract

The purpose of the paper is to investigate the technological innovative characteristics in the Small and Medium Enterprises (SMEs) belonging to the Italian manufacturing sector. A survey based on e-mail and fax questionnaire of 285 SMEs was conducted with a response rate of about 45%. The methodology consisted in a descriptive analysis on general data and in a discriminant analysis on data related to the innovative activity and aimed at determine the factors distinguishing more and less innovative companies. On the basis of this survey, the innovative profile of SMEs has been highlighted as well as the factors and problems of the innovative process analyzed. The results show that innovative firms are market anticipation and customer focused, aiming at product enrichment in terms of different characteristics in respect to competitors' products in order to obtain a superior product in terms of quality. Innovation results to be part of their business strategy and to be based more on developing new ways of working than new product innovations.

Keywords: SMEs; Italy; manufacturing industry; innovation.

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Introduction

The world of business dictates that nowadays the dynamic nature of most markets seems to explain why it is nearly impossible to find an industry that is not engaged in innovation (Hurley and Hult, 1998).

Innovation can be considered as a necessary ingredient for firms to remain competitive (Darroch and McNaughton, 2002; Stock et al., 2002). To be successful, the main task of a firm is to determine the perceptions, needs and wants of the market in order to create products with a superior value.

Mosey et al. (2002) suggested that companies with aggressive growth ambitions that repeatedly introduced innovative new products thus opening up new market niches were also those that performed better.

In their study on innovative characteristics of small manufacturing firms, Laforet and Tann (2006) identified factors contributing to successful innovation. Specifically, they defined innovation as "seeking new or better products, processes and/or work methods".

Innovation is a complex concept because of its multidimensionality. The degree of newness – radical or incremental – could involve changes in very different aspects of a business that can range from externally visible modifications having to do with the marketing variables used to compete to internally adjustments that affect working standards in the company (Otero-Neira C. et al., 2008). According to several Authors, there are very different types of innovations (e.g., product innovation, process innovation, or market innovation), and these types of innovation can be classified by type, degree, impact, competence, and ownership (Narvekar and Jain, 2001, 2006).

The former refers to the improvements made on the mix of products of the company, the choice of new products and their development. Product innovation is often made by technology driven companies and helps companies in their competitive positioning while retaining market presence, not only in radically changed products but also in differentiating the offerings (Craig and Hart, 1992).

Process innovation embraces reengineering the business process (Cumming, 1998) and therefore implies the improvement of the internal operations and capacities.

The importance of process innovation is quite well understood, especially in companies under threat since it may help to improve the company productivity.

Finally, market innovation is concerned with the mix of markets of the company and how chosen markets are best served while accurately interpreting buying preferences (Johne, 1999). This directly influences the sales as well as the company results.

In the next sections we describe our research process: the literature review, the sample definition, the collection and analysis of data relating to manufacturing SMEs in Emilia Romagna region in Italy. Finally, we discuss the results in order to conclude with some general remarks and possible guidelines related to the innovative characteristics of manufacturing SMEs.

Literature review

Innovation has been studied in a variety of contexts, including in relation to technology, commerce, social systems, economic development, and policy construction. There are, therefore, naturally a wide range of approaches to conceptualising innovation in the scholarly literature.

However, a consistent theme may be identified: innovation is typically defined as the successful introduction of something new and useful, for example introducing new methods, techniques, or practices or new or altered products and services.

Various definition have been developed to explain innovation, and as a result, the term has gained greater ambiguity (Garcia and Calantone, 2002).

Going back to the roots, Joseph Shumpeter was first to define innovation in 1934 as "the creation of new combinations". Joseph Shumpeter (1934) defines innovation as "the creation of new combinations, that is the introduction of a new good, of a new quality of a good, or of new method of production, the opening of a new market, the conquest of a new source of supply of raw materials or half-manufactured goods, and finally the carrying out of the new organization of any industry". Today, the economic landscape has changed considerably in comparison to Shumpeter's time, nevertheless his work

remains topical. The European Commission Green Paper, proposes this definition of innovation: "the successful production, assimilation and exploitation of novelty in the economic and social spheres" (European Commission, 1995). Zaltman et al. (1973) describe innovation as "any idea, practice, or material artefact perceived to be new by the relevant unit of adoption", while Damanpour propose in 1991 the definition "the generation, development, and adaptation of novel ideas on the part of the firm". In general, regardless of the definition adopted, innovation can be new products, new methods of production, new sources of supply, the exploitation of new markets, new ways to organise business. In conclusion, it is possible to consider innovation as an idea, a practice or an object that are perceived as new by an individual or another action subject (Rogers, 1983; Chiesa, 2001).

With particular reference to the industry, innovation development within manufacturing enterprises has been studied with emphasis on the technology intensity of sector (Heidenreich, 2009; Kirner et al., 2009; Pavitt, 1984) while within service enterprises the emphasis has been on the knowledge intensity of sector (Amara et al., 2009; Miles, 2000; Leiponen, 2005). However, there are only few studies which have examined differences in innovation development across the different size categories within the manufacturing or service sectors.

Regardless, the industry, in the economic literature, various classifications of innovation have been developed and applied. Following Clarysse et al. (1998) and Lundvall (1992) classification, as well as the more recent work by Bigliardi and Dormio (2009), it is possible to identify four domains of innovation (Figure 1).
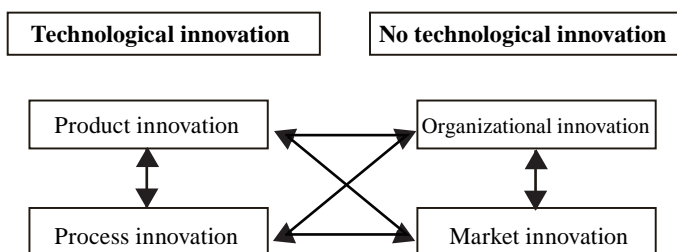
Technological innovation in particular has become a fundamental factor of competitive success: to innovate permits to maintain and acquire leadership positions in the market (De Toni et al., 1988). Thus, the purpose of this work is to focus on first type of innovation of the Figure 1, that is the technological one. Technological innovation includes products, services or processes introduced by the company that can be considered new or significantly improved, in respect to those previously available, in terms of technical and functional characteristics, performances, etc.

A technological innovation is realized in correspondence to its introduction in the market (product or service innovation) or to its use in the productive process (process innovation). Product and process innovations do not have to necessarily consist of totally new products, services or processes; it is in fact sufficient that they result new for the firm that introduces them.

Methodology

SMEs analyzed

The survey has been realized on a population of 285 SMEs belonging to the manufacturing sector in Emilia Romagna region in Italy. These SMEs differ in terms of sales and number of employees, as shown in Figure 2 and Figure 3.

Data collection

Once the sample has been defined, a set of interviews have been conducted based on a questionnaire specifically developed. This questionnaire has been extracted through an in depth literature review and a Delphi technique (Linstone and Turoff, 1975). Based on the findings from the literature review described in the previous paragraph, a panel of experts was set up to develop a structured questionnaire to be used for the interviews. Due to the multi-disciplinary nature of the problem examined, in setting up the panel an appropriate balancing between different skills was paramount. To this extent, the panel included:

• 3 academics, chosen among people whose research studies mainly focus on innovation of SMEs topics. Due to their expertise in such areas, academics could support the panel of experts during the decision making process;
• 15 members from as many regional SMEs. Panel members were selected among people directly interested by the matter of innovation of SMEs. They were asked to validate the questionnaire's content based on their "in field" experience.

Figure 1. Four fields of innovation (Clarysse et al. (1998), Lundvall (1992).

Academics initially proposed a viable set of items that could be used in the context of the SMEs, structured into an appropriate questionnaire to be sent to the panel members. Hence, a two-round Delphi was carried out to refine the proposed items. In the first round, the questionnaire was submitted to panel members. For each item, the panel members were asked to express their agreement with regard to the suitability of implementation in the SMEs context. Moreover, panelists could indicate the need for further specifications (if required), as well as the main strengths and weaknesses of each item proposed. The results of the first round of Delphi led to several modifications to the list of items originally proposed. Hence, a second questionnaire was organized, incorporating additional items proposed by the panelists and removing non relevant ones, and submitted to the panel members during the second round of Delphi. Again, panelists were asked to refine each item emerged in the first round, as well as to identify additional indicators suitable to be implemented in the SMEs sector. A general agreement was reached at the end of the second round. Then, the panel was involved in a final roundtable discussion, to confirm the agreements on the results of the second questionnaire. The final version of the questionnaire was structured in three sections: the former regarding the general information of the enterprises: business name, dimension in terms of number of employees and sales, type of legal and organizational structure, investments on innovative projects. The second section contained questions about the organizational characteristics, human resources, presence/absence of RandD function, competitive and technological strategy. The third section reported the innovation activity: principal innovations introduced in terms of product and process innovations and organizational and marketing innovations, informative source, motivations and principle obstacles. Almost all of the questions of section 2 and 3 were measured on a seven-point Likert scale, where 1 = completely disagree and 7 = completely agree.

The questionnaires have been sent through e-mail or fax. After a first return rate of responses of 10%, a follow-up, preceded by a short telephone call, has been necessary through a second sending.

After this second sending, the return rate obtained has been equal to about 45%: both response rate and sample dimension have appeared adequate for this type of survey (Barrow, 2001).

Data analysis

The responses were analyzed using both descriptive statistics for general information of the enterprises (by means of Microsoft Office Excel 2007 Software) and inferential statistics for questions on the company's new product development, systems and technology, process innovation, culture and ways of working as well as networking (by means of the 16th version of SPSS Software) to generate hypotheses and validate the results observed.

In order to provide a more in-depth analysis of the results, a discriminant analysis was also conducted. The objective of the discriminant analysis was to predict group membership from a set of the statistically significant predictors. The resulting discriminant model has allowed the identification of the variables associated with particular group membership (more and less innovative companies), thus allowing to find out which factors differentiated the more and less innovative firms. Discriminant analysis maximizes the between-groups differences on discriminant scores and minimizes the within-groups differences.

Results

Analysis of empiric results

On the 285 surveyed enterprises, 128 of them have completed the questionnaire in all its parts. A statistic-descriptive analysis on the data, coming from these questionnaires, has been carried out. The analysis has illustrated the general characteristic of the sample, as the company dimension in terms of sales and number of employees (Figure 2 and Figure 3), organizational and legal structure (Figure 4 and Figure 5), and other factors like age and cultural level of employees (Figure 6 and Figure 7). Specifically, Figure 2 and Figure 3 show that most of the SMEs investigated have sales between 2 and 10 millions of Euro. Relating to legal and organizational structure, it derives that surveyed SMEs are prevalently commercial or limited partnership companies with a functional or informal organizational structure. As far as the human resource of the analyzed sample is concerned, employee middle age has widely included between 35 and 39 years. From the employees cultural level analysis it resulted that only in the 8,2% of SMEs of the sample more than 20% of the employees has an academic title, while a percentage of employees inferior to 5% has an academic title in the 38,7% of cases.
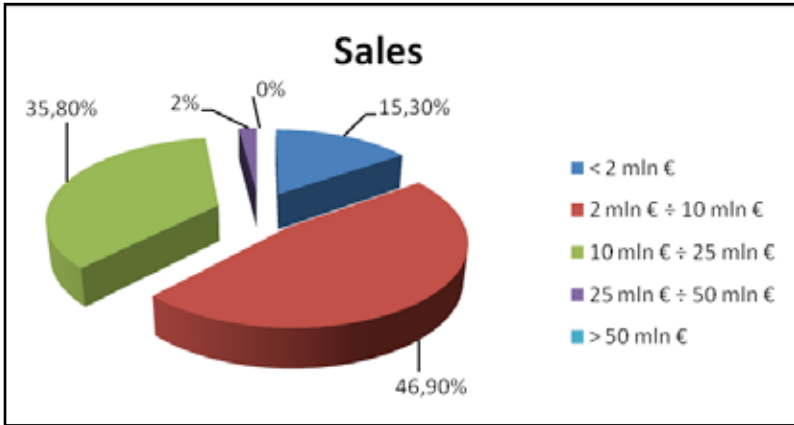
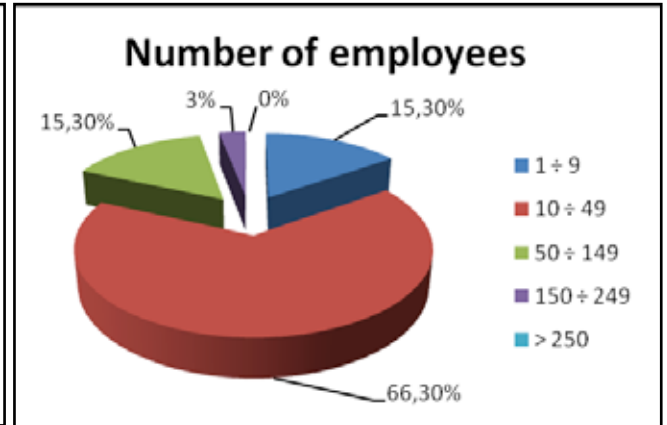Figure 2. Sales of investigated sample.

Figure 3. Number of employees in the enterprises of the sample.
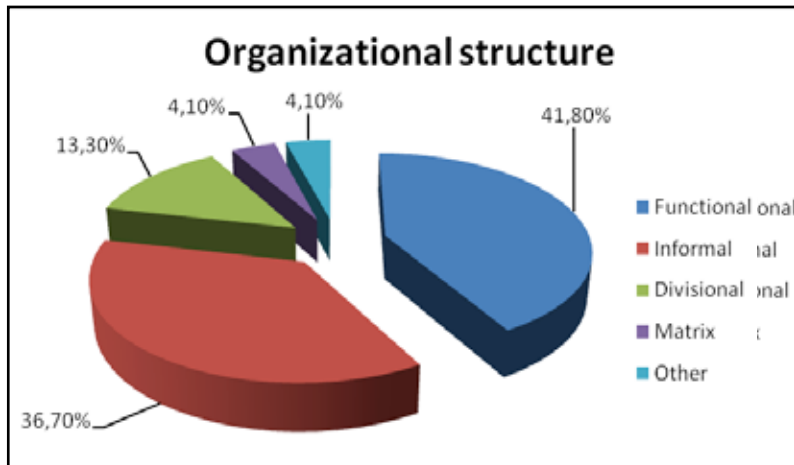

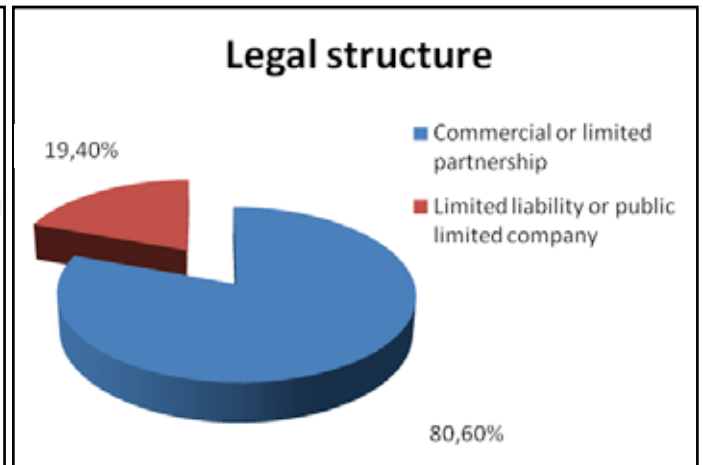Figure 4. Organizational structure of investigated sample.

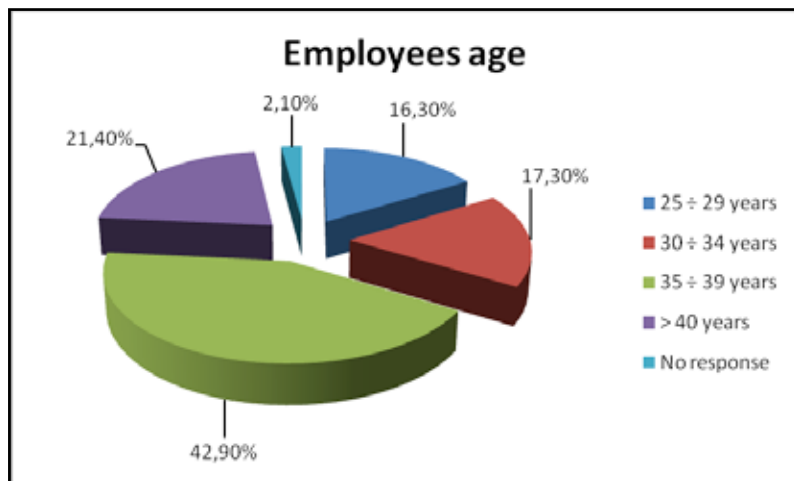Figure 5. Legal structure of interviewed sample.

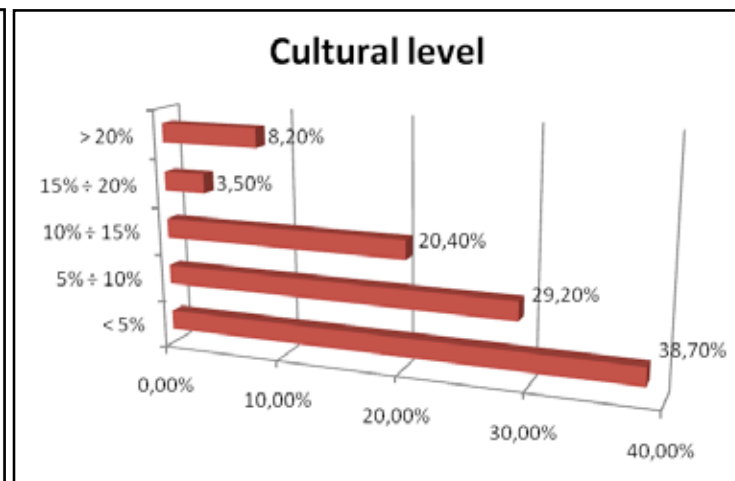Figure 6. Employees age in the enterprises of the sample.

Figure 7. Cultural level of employees in the sample.

Discriminant Analysis

Ten indicators have been used as an arbitral measure of company innovativeness and utilized as predictors in the discriminant analysis (Laforet and Tann, 2006):

• number of new product ideas a company had in last five years;
• number of new product(s) launched in last five years;
• number of product (s) improvement introduced in last five years;
• innovation prize(s);
• when the newest product introduced;
• the percentage of sales from this product;
• extent to which major customers provide specification for new product(s);
• level of investment in systems and technology for office;
• level of investment in systems and technology for shop floor;
• new or improved ways of working in last five years.

Top 20 per cent companies, which scored high on the ten criteria above, have been compared with the bottom 80 per cent companies, which scored low on the same criteria. The former companies are referred to in the following as "more innovative" companies, the latter as "less innovative" companies.

T-tests have been performed to determine whether any significant difference exists between means of responses from more and less innovative companies on a number of independent variables. The independent variables that resulted to be statistically significant in differentiating between more and less innovative companies were entered into the discriminant model. As there was no reason for assigning some predictors higher priority than others, the stepwise procedure has been applied (Tabachnik and Fidell, 2001, Panayide, 2004). The result from applying stepwise discriminant analysis (which also serves to avoid multicollinearity problems) shows for all companies that the predictors number of new product ideas a company had in last five years, number of new product(s) launched in last five years, level of investment in systems and technology for office and new or improved ways of working in last five years, are useful for discriminating between more and less innovative enterprises.

Although there are no rigid rules about the minimum value of discriminant loadings, the general guidelines suggest that values above 0,25-0,30 are satisfactory and acceptable (Hair et al, 1998). The results demonstrate that the discriminant power of the predictor variables surpasses the minimum value. Wilks' λ indicates how good the discriminating power of the model is. The value of Wilks' λ and $\chi2$ sig. resulted, respectively, 0,812 and 15,313 thus indicating the significance of the discriminant function. To establish the validity of the discriminant function a classification matrix has been constructed. Classification matrices provide an assessment of the discriminating power of the function by revealing how well the function classifies the units (Klecka, 1980). The classification analysis as reported in Table 1 indicates that a high proposition of more innovative enterprises (94,1%) and less innovative enterprises (96,2%) is correctly classified by the discriminant function.

| | | | Predicted Group Membership | | |
			Less innovative	More innovative	Total
		Companies			
Original	Count	Less innovative	96	6	102
		More innovative	1	25	26
	%	Less innovative	94,1	5,9	100
		More innovative	3,8	96,2	100

Table 1. Classification Results b. / b. 94,5% of original grouped cases correctly classified.

	More innovative (%)	Less innovative (%)	χ^2 sig.	T-test sig.
Commitment to innovation				
CEO involves in NPD	100	62%	0,016	0,01
CEO involves in developing new ways of working	100	90%	0,001	0,005
CEO involves in developing new processes	95%	80%	0,01	0,02
Product enrichment	95%	30%	0,02	0,04
Market anticipation				
Regularly study the market	95%	45%	0,01	0,02
Regularly study competitors	77%	33%	0,02	0,03
Customer dependency	95%	63%	0,002	0,01
Technology system				
Use of electronic production support systems (CAD, CAM)	89%	39%	0,01	0,02
Staff training				
In-house courses	45%	20%	0,02	0,05
Networking (Universities, Research centers, etc.)	22%	13%	0,001	0,005

Table 2. Factors differentiating the more and less innovative companies – chi-square and t-tests results.

The results, reported in Table 2, show that more innovative companies have higher commitment to innovation than in less innovative companies. In more innovative companies, the CEO/owner has been found more involved in developing new products, processes and ways of working than in less innovative companies.

The findings also show that more innovative companies study the marketplace, point to product enrichment and have a better systems and technology in place than less innovative companies. The main constraints to innovation of manufacturing SMEs consist in customer dependency and skills acquisition through training, poor learning attitude and networking. These findings also confirm previous research available in literature (Laforet and Tann, 2006).

Implications and conclusions

The factors discriminating between more and less innovative enterprises have been found through literature analysis and have been transformed in variables, inserted in the questionnaire used to conduct the statistical analysis. A first version of the questionnaire has been checked by a small sample of academics and random selected enterprises in the sample, in order to verify presence of complete and correct information contained in it. The final questionnaire has been sent to a sample of 285 firms, of which 44,9% has replied after an e-mail recall. Statistical analysis of data consisted in a preliminary descriptive statistical analysis that has pinpointed fundamental characteristics of the sample companies. T-tests has been performed to determine whether any significant difference exists between means of responses from more and less innovative companies on a number of independent variables, previously identified by means of an in depth literature review and a focus group organized with managers responsible of innovation activities in SMEs involved in the study.

Legal structure of the sampled companies appears to be mainly commercial or limited partnership while organizational structure generally resulted functional, informal or divisional. The age of employees is comprised between 35 and 39 years for the majority of the companies. As for the cultural level of employees, probably due to the previous finding, only a little percentage of employees stated to have a degree qualification. However, this cultural level results adequate to the companies needs.

Regarding to innovation, more than half companies turns out to own an internal RandD function and to introduce, in the last period, at least a technological innovation (product or process innovation). Innovations consist primarily in process innovation like innovations to logistics systems or production processes or, finally, maintenance activities. The main constraints to innovation of manufacturing SMEs of the sample consist in customer dependency and skills acquisition through training, poor learning attitude and difficulty in networking because of their tradition of being insular and autonomous. On the basis of conducted research, innovation of SMEs in the manufacturing industry carries on an incremental way. The information relative to companies number that have introduced an innovation in the last period has been confirmed by discriminant analysis. The analysis conducted has also allowed to outline the profile of innovative companies: they are market anticipation and customer focused, aim at the product enrichment in terms of different characteristics with respect to the competitors' products in order to obtain a superior product in terms of quality. Finally, the study has shown that the willingness to differentiate products, to increment processes efficiency and to enter in new markets, represent the main reasons that have driven companies of the sample to innovate.

Innovation results to be part of their business strategy and to be based more on the development of new ways of working than on new product innovations. The use of technology and process innovation was not uniform among more and less innovative companies.

One of the main obstacle met by companies during development and introduction of innovation is represented by the difficulties to establish partnership with other companies, by financial problems and lack of resources in the company. The analysis of the answers has revealed that innovations have been mainly obtained through know-how of users and suppliers. In the innovative processes an important role in terms of source of innovation is the use of sector specialized journal, and the figure of competitor. From the analysis of data, the weight of University and research centre know-how is resulted cheap inferior to the other informative sources upon exposed.

A limit of this work, that will foster a future research, concerns the role of user. It appears correct to attend that, particularly during first phase of innovative process, it takes on very importance the interaction between the manufacturing company and final user of its products. In fact, innovation derives from adaptation/improvement of existent machines or processes, adaptations/improvements relating to the product to achieve, and so first prompter of innovation results the user. Thus, next steps of the research would be the study the interaction between manufacturer company and user company, the relation between product innovation (the new machine for the manufacturer company) and process innovation (the same machine, considered as a new application of the customer company), in order to verify if these innovations are interconnected or independent.

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