EFFECTS OF INNOVATION TYPES ON FIRM PERFORMANCE*

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ABSTRACT

Innovation is broadly seen as an essential component of competitiveness, embedded in the organizational structures, processes, products, and services within a firm. The objective of this paper is to explore the effects of the organizational, process, product, and marketing innovations on the different aspects of firm performance, including innovative, production, market, and financial performances, based on an empirical study covering 184 manufacturing firms in Turkey. A theoretical framework is empirically tested identifying the relationships amid innovations and firm performance through an integrated innovation-performance analysis. The results reveal the positive effects of innovations on firm performance in manufacturing industries.

Keywords: Innovation types; Innovativeness, Firm performance; Structural equation modeling; Empirical study.

* Published in *International Journal of Production Economics*, 133, pp. 662-676, 2011.

1. Introduction

Innovativeness is one of the fundamental instruments of growth strategies to enter new markets, to increase the existing market share and to provide the company with a competitive edge. Motivated by the increasing competition in global markets, companies have started to grasp the importance of innovation, since swiftly changing technologies and severe global competition rapidly erode the value added of existing products and services. Thus, innovations constitute an indispensable component of the corporate strategies for several reasons such as to apply more productive manufacturing processes, to perform better in the market, to seek positive reputation in customers' perception and as a result to gain sustainable competitive advantage. Particularly over the last two decades, innovativeness has turned into an attractive area of study for those researchers who tried to define, categorize and investigate its performance impacts, especially due to its practical relevance. Innovations provide firms a strategic orientation to overcome the problems they encounter while striving to achieve sustainable competitive advantage (e.g. Drucker, 1985; Hitt et al., 2001; Kuratko et al., 2005).

Innovation as a term is not only related to products and processes, but is also related to marketing and organization. Schumpeter (1934) described different types of innovation: new products, new methods of production, new sources of supply, the exploitation of new markets, and new ways to organize business. Drucker (1985) defined innovation as the process of equipping in new, improved capabilities or increased utility.

In this research, OECD Oslo Manual (2005), which is the primary international basis of guidelines for defining and assessing innovation activities as well as for compilation and use of related data, has been taken as the fundamental reference source to describe, identify and classify innovations at firm level.

In the OECD Oslo Manual (2005), four different innovation types are introduced. These are product innovation, process innovation, marketing innovation and organizational

innovation. Product and process innovations are closely related to the concept of technological developments. *A product innovation is the introduction of a good or service that is new or significantly improved regarding its characteristics or intended uses; including significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics* (OECD Oslo Manual, 2005). Product innovations can utilize new knowledge or technologies, or can be based on new uses or combinations of existing knowledge or technologies. The term product covers both goods and services. Product innovation is a difficult process driven by advancing technologies, changing customer needs, shortening product life cycles, and increasing global competition. For success, it must involve strong interaction within the firm and further between the firm and its customers and suppliers (Akova et al., 1998).

A process innovation is the implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software. Process innovations can be intended to decrease unit costs of production or delivery, to increase quality, or to produce or deliver new or significantly improved products (OECD Oslo Manual, 2005). Fagerberg et al. (2004) stressed that while the introduction of new products is commonly assumed to have a clear, positive effect on the growth of income and employment, process innovation, due to its cost-cutting nature, can have a more hazy effect.

A marketing innovation is the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing (OECD Oslo Manual, 2005). Marketing innovations target at addressing customer needs better, opening up new markets, or newly positioning a firm's product on the market with the intention of increasing firm's sales. Marketing innovations are strongly related to

pricing strategies, product package design properties, product placement and promotion activities along the lines of four P's of marketing (Kotler, 1991).

Finally, *an organizational innovation is the implementation of a new organizational method in the firm's business practices, workplace organization or external relations. Organizational innovations have a tendency to increase firm performance by reducing administrative and transaction costs, improving workplace satisfaction (and thus labor productivity), gaining access to non-tradable assets (such as non-codified external knowledge) or reducing costs of supplies* (OECD Oslo Manual, 2005). Examples would be the introduction of practices for codifying knowledge by establishing databases of best practices, lessons learnt and other knowledge, so that they are more easily accessible to others; the introduction of training programs for employee development and improved employee retention; or the initiation of a supplier development program. Thus, organizational innovations are strongly related with all the administrative efforts of renewing the organizational routines, procedures, mechanisms, systems etc. to promote teamwork, information sharing, coordination, collaboration, learning, and innovativeness.

One of the primary research areas in the recent innovation literature aims to find out the acknowledged relations between innovation types and firm performance. Although there are quite numerous conceptual studies, analytical and empirical studies are limited both in terms of numbers and the extent and depth of the analysis. Only a few studies have intimately examined the relationship between innovation types and firm performance as Jin et al. (2004) stated. The empirical studies focused on the relations between a few dimensions of innovation types and/or a single performance aspect.

In this study, we aim to explore innovations and their effects on firm performance by examining product, process, marketing and organizational innovations, as well as by focusing on various aspects of firm performance such as innovative performance, production

performance, market performance and financial performance. Therefore the main contribution of this study is the comprehensive innovation-performance analysis based on empirical data, which not only revealed the positive effects of innovation types on firm performance but also yielded a path of relations among these variables using structural equation modeling approach.

This paper has five sections. Following the introduction section, we briefly present in the second section the research background and our hypotheses. In the third section, the empirical data and research methodology are presented. The fourth section introduces the findings. Finally, in the fifth section the discussion of findings, conclusions and final remarks are given.

2. Research Background and Hypotheses

Conjectural studies are the pioneers of the innovation literature that has been grown and matured by the research which tried to elucidate the innovation concepts by defining organizational policies, processes, and characteristics whereby companies test and realize their efforts for innovative and creative ideas regarding their products, processes, and markets (Pinchot, 1985; Stevenson and Jarillo, 1990; Hitt, et al., 2001).

The global competition, which became particularly tough after 80's, forced the companies focus on their business strategies, especially on innovations (Kuratko and Hodgetts, 1998). At the present time, due to the tough global competition, both individuals and companies begin to evaluate and to apply their innovation strategies and entrepreneurial abilities with the purpose of gaining competitive advantage (Drucker, 1985; Hult et al., 2003).

Formally, innovation is considered as developments and new applications, with the purpose of launching newness into the economic area. It can be conceived as the transformation of knowledge to commercial value. Innovation has great commercial importance due to its potential for increasing the efficiency and the profitability of companies.

Actually, the key reason for innovativeness is the desire of firms to obtain increased business performance and increased competitive edge. Companies procure additional

competitive advantage and market share according to the level of importance they give to innovations, which are vital factors for companies to build a reputation in the marketplace and therefore to increase their market share. Metcalfe (1998) stated that when the flow of newness and innovations desiccates, firms' economic structure settles down in an inactive state with little growth. Therefore, innovation plays a significant role in creating the differences of performance and competition among firms, regions and even countries. For instance, the study by Fagerberg et al. (2004) revealed that innovative countries had higher productivity and income than the less-innovative ones. OECD reports pointed out that companies that developed innovations in a more decisive way and rapidly, had also more qualified workers, paid higher salaries and provided more conclusive future plans for their employees. In fact, the effects of innovations on firm performance differ in a wide spectrum from sales, market share and profitability to productivity and efficiency (OECD Oslo Manual, 2005).

McAdam and Keogh (2004) investigated the relationship between firms' performance and its familiarity with innovation and research. They found out that the firms' inclination to innovations was of vital importance in the competitive environments in order to obtain higher competitive advantage. Geroski (2005) examined the effects of the major innovations and patents to various corporate performance measures such as accounting profitability, stock market rates of return and corporate growth. The observed direct effects of innovations on firm performance are relatively small, and the benefits from innovations are more likely indirect. However, innovative firms seem to be less susceptible to cyclical sectoral and environmental pressures than non-innovative firms.

2.1. Interactions among the Innovation Types

It is obvious that firms have different levels of innovative capabilities, nonetheless innovative activities need to be focused on many aspects simultaneously such as new products, new organizational and marketing practices or administrative systems, and new process

technologies (Drejer, 2002; Garcia and Calantone, 2002; Johannessen et al., 2001; Lin and Chen, 2007). Moreover, as Damanpour and Evan (1984) stated a balanced rate of adoption of administrative and technical innovations are more effective in aiding firms to preserve and improve their level of performance than implementing them alone. Although innovation literature does not reveal a conclusion whether a specific innovation type is likely to provide more or less an impact on corporate performance, it can be concluded that innovations influence each other and need to be implemented in conjunction (Walker, 2004).

In this study therefore we discuss the relationships among the four types of innovation that we try to measure. Findings in the previous research imply that organizational (re)structuring leading to administrative and structural renewal or improvement is a facilitator for the other types of innovations. For instance, Damanpour et al. (1989) found that administrative innovations led to technical innovations in public libraries; they also suggested conducting further research in other types of firms to generalize their findings. Similarly, Staropoli (1998) emphasized the importance of cooperative organizational rearrangements and coordination mechanisms to enhance technological innovations in the pharmaceutical industry, while Germain's study (1999) revealed that organizational structural characteristics might be significant predictors of process innovations in the logistics sector. More recently and specifically, Walker (2008) announced that organizational, marketing and service (or product) innovations were found to be interrelated in a study on public organizations, and that additional research was required to clarify these findings.

Considering the existing descriptive and empirical literature, we argue that organizational innovations, or in other words, organizational renewal in the form of structural improvements leading to the betterment of intra-organizational coordination and cooperation mechanisms would contribute to the formation of a suitable inner environment for the other

types of innovations -namely process, product and marketing- to flourish. Therefore we hypothesize that:

Hypothesis 1: There is a positive relationship between the organizational innovation and other innovation types.

H1a: *The higher the level of organizational innovation, the higher the level of product innovation.*

H1b: *The higher the level of organizational innovation, the higher the level of process innovation.*

H1c: *The higher the level of organizational innovation, the higher the level of marketing innovation.*

Li et al.'s (2007) study on Chinese firms showed us that process and product innovations were significantly correlated to each other. However, recent literature does not provide us with explicit empirical results for the direction of this relationship. Still, some indirectly related recent findings may exist. For instance, Oke's study on British firms (2007) revealed that developing formal implementation processes was necessary to pursue incremental product or service innovations, implying that the improvement of the processes is a driving force for the success of the output (product and/or service) innovations. Thus innovative solutions providing the steps of the production processes with newly improved advantages -such as production quality, value, speed, and low cost- can increase the chance of the product's new components, ingredients, technical specifications, functionalities, etc. to meet the needs and desires of the customers better than before. Hence, the following hypothesis follows:

Hypothesis 2: The higher the level of process innovation, the higher the level of product innovation.

Regarding marketing–product innovation relationship, we could not find a study explicitly investigating the marketing–product innovation interaction. There is indeed a mutual support between these two types of innovations but it is more common that product innovations are shaped through changes in the markets and customer expectations. Customer driven markets have assigned increased importance to the marketing function. Customer need is tried to be fulfilled through marketing activities and innovations, which create possibilities for further product innovations. Therefore we hypothesize that:

Hypothesis 3: The higher the level of marketing innovation, the higher the level of product innovation.

2.2. Impacts of Innovations on Firm Performance

Innovations can actually enhance the firm performance in several aspects. Particularly, four different performance dimensions are employed in the literature to represent firm performance (Narver and Slater, 1990; Barringer and Bluedorn, 1999; Antoncic and Hisrich, 2001; Hornsby et al., 2002; Hagedoorn and Cloodt, 2003; Yilmaz et al., 2005). These dimensions are innovative performance, production performance, market performance and financial performance.

Innovation has a considerable impact on corporate performance by producing an improved market position that conveys competitive advantage and superior performance (Walker, 2004). A large number of studies focusing on the innovation-performance relationship provides a positive appraisal of higher innovativeness resulting in increased corporate performance (Damanpour and Evan, 1984; Damanpour et al., 1989; Deshpande et al., 1993; Dos Santos and Peffers, 1995; McGrath et al, 1996; Gao and Fu, 1996; Han et al., 1998; Olson and Schwab, 2000; Hult and Ketchen, 2001; Du and Farley, 2001; Calantone et al., 2002; Garg et al., 2003; Wu et al., 2003). But these researches are generally conceptual in

nature and/or focus only on a single type of innovation rather than considering all four innovation types already defined, and then explore its impact on performance. Process and product innovations are the most common innovation types examined. The studies by Marcus (1988), Ittner and Larcker (1997), Whittington et al., (1999), Olson and Schwab (2000), Knott (2001) and Baer and Frese (2003) focus merely on process innovations while studies of Atuahene-Gima (1996), Subramanian and Nilakanta (1996), Han et al., (1998) and Li and Atuagene-Gima (2001) report on product innovations. Many of these research embrace more or less a positive association between innovations and firm performance, but there are also some studies indicating a negative link or no link at all (Capon et al., 1990; Chandler and Hanks, 1994, Subramanian and Nilakanta, 1996).

As Miller (2001) stated most firms seek technological innovation to gain competitive advantage in their market. Hence, all these efforts made require to be supported by marketing and organizational measures. Generally, researchers neglect organizational and/or marketing innovations, which are equally essential to the growth and effective operation of a firm (e.g. Damanpour and Evan, 1984, Damanpour 1991). Relatively few studies on innovation capabilities advocate organizational and marketing innovations. They indicate that more innovative firms place more emphasis on management techniques (Baldwin and Johnson, 1996) and reach sustainable levels of higher performance (Han et al., 1998; Ravichandran, 2000; Hult and Ketchen, 2001; Guan and Ma, 2003). Wolff and Pett (2004) and Walker (2004) conducted comparative research for the effects of product and process innovations on firm performance. They indicated that particular product improvements are positively associated with firm growth. Gopalakrishnan (2000) broadened the topic while emphasizing that innovation speed and innovation magnitude were also relevant innovativeness features both of which had a positive effect on firm performance.

Despite the weak link they found, Lin and Chen (2007) associated innovations with increased firm sales; and they argued that organizational innovations rather than technological innovations appeared to be the most vital factor for total sales. On the other hand, Johne and Davies (2000) ensured that marketing innovations increase sales by increasing product consumption and yield additional profit to firms. Moreover, Oke (2007) in a recent empirical study on British firms showed that different types of innovations were found to be related to innovative performance.

Innovative performance is the combination of overall organizational achievements as a result of renewal and improvement efforts done considering various aspects of firm innovativeness, i.e. processes, products, organizational structure, etc. Therefore innovative performance is a composite construct (Hagedoorn and Cloodt, 2003) based on various performance indicators pertaining, for instance, to the new patents, new product announcements, new projects, new processes, and new organizational arrangements.

In the light of the above discussions, we are now ready to propose that all the different types of innovations have positive effects on firm innovative performance. Then the indirect effects of these four types of innovations can be expected to lead to improvements in production and market performances through the mediation of innovative performance. In this respect, innovative performance plays the role of an effective hub that carries the positive effects of innovations to the various aspects of firm performance. Accordingly, our basic hypothesis on the relationship between innovations and innovative performance is as follows (items for firm performance and innovation measures are displayed in the appendix.):

Hypothesis 4: Higher levels of innovations are associated with improved innovative performance.

H4a: *The higher the level of organizational innovation, the greater of innovative performance improvement.*

H4b: *The higher the level of product innovation, the greater of innovative performance improvement.*

H4c: *The higher the level of process innovation, the greater of innovative performance improvement.*

H4d: *The higher the level of marketing innovation, the greater of innovative performance improvement.*

Innovative performance is seen in the literature as one of the most important drivers of other aspects of organizational performance thanks to the formation of an organizational learning climate and/or orientation with continuous efforts for improvements, renewals, exploration, and learning from failures and adaptation to rapidly changing competitive environment. For instance, Han et al. (1998) emphasized that innovative performance as the synergetic combination of the results of technical and administrative innovations contributes positively to organizational growth and profitability. They assert also that innovative performance is the missing link between organizational strategic orientations and performance.

Damanpour and Evan (1984) indicated that organizations can cope with environmental challenges by successfully integrating technical or administrative changes into their organizational structure that improve the level of achievement of their goals. Accordingly, innovations are done in general to meet such production and marketing goals as improvement in product quality, reduction in production cost, increase in market share, creation of new markets, and increase in production flexibility (Quadros et al., 2001).

Innovative performance can exert then positive effects on firms' production, market and financial performances in the long-term; however, in the short run, initiated investments and internal resource usages might cause possible losses at first. Lawless and Anderson (1996) stated that adoption of new technologies for innovations involves an initial penalty. Similarly Damanpour (1984) emphasized that generally a serious time period may pass to observe positive impacts of innovations on firm performance. For this reason, impacts of innovative

performance are firstly associated to the non-financial aspects of corporate performance, such as increased customer satisfaction or production speed, which will lead to higher financial returns later on. In brief, once the innovative performance improves, production and marketing performances will also ameliorate and then through their mediation the financial performance will start to improve.

Innovative performance especially in the form of new product success is linked in the literature to an increase in sales and market shares, since it contributes considerably to the satisfaction of existing customers and gaining of new customers (e.g. Pelham, 1997; Wang and Wei, 2005). It is also possible to assert that in addition to new product success, success in marketing, process and organizational innovations together lead to a general increase in customer satisfaction and direct more customer attention towards the innovative firm.

Elements of production or operations performance, i.e. speed, quality, flexibility, and cost efficiency, seem to be highly related to the firm performance in administrative, process, and product innovations according to the past literature (e.g. Quadros et al., 2001). For instance, according to Koufteros and Marcoulides (2006) continuing efforts and higher performance in innovations foster organizational learning and increase the speed and quality of the operations. Thus accordingly technological advancements can easily be incorporated and any design or quality deficiencies are overcome faster than the competitors.

Moreover, López-Mielgo et al. (2009) reported that especially process innovations exert a positive influence on the total quality management efforts of the organizations. Beside the speed and quality aspects, innovative performance is also related to the two other elements of production performance; namely, flexibility and cost efficiency. Success in the renewal efforts especially in administrative mechanisms, production processes, and new products can contribute extensively to the dissemination of knowledge and effectiveness of coordination within the organization, which are necessary for operational flexibility and decreased related

costs (Koufteros and Marcoulides, 2006). In this regard, Liu et al. (2009) confirm in an empirical study the positive relationship between operational flexibility and new product success. As for the production cost reduction effects, Peters (2008) purports that not all the process innovations lead to cost savings, but some do and allows the organization to market products at competitive prices. Therefore, we can argue that the production performance, which is the combination of the achievements in such performance indicators as speed, quality, flexibility, and cost efficiency, is positively affected by the innovative performance.

Hypothesis 5: Higher innovative performance improvement results in improved production and market performances.

H5a: *The greater the innovative performance improvement, the greater the market performance improvement.*

H5b: *The greater the innovative performance improvement, the greater the production performance improvement.*

Gonzalez-Benito (2005) pointed out the potential of the production and operations function as a source of competitive advantage for the company. Production performance as a combination of organizational success in improving speed, quality, flexibility, and cost efficiency in the daily operations would lead logically to the betterment of market position and financial returns. The past empirical literature already confirms that the motivation behind setting and implementing such operations goals as increasing flexibility for external adaptation, quality for customer satisfaction, speed for dependability, and cost reduction for profitability is to try to increase overall firm performance at the end (e.g. Alpkan et al., 2002; Alpkan et al., 2003). Specifically for the production–market performance relationship, Li (2005) reported that manufacturing capabilities -such as productivity, speed of delivery, etc.- contribute to the market performance by increasing satisfaction of the customers and by improving customer relations.

Production performance, as a combination of achievements done in of all its elements - cost efficiency, quality, flexibility, speed- is also seen as one of the direct drivers of profitability (e.g. Chenhall, 1997), thus effectiveness and efficiency in production would lead to profitability. Further empirical studies confirm this assertion (e.g. Worthington, 1998). For instance, Fullerton and McWatters (2001) indicated that firms that have invested more in quality practices benefit from significantly higher financial rewards. Similarly, Fullerton and Wempe (2009) in a recent study, find a positive relationship between non-financial manufacturing performance and financial performance.

Hypothesis 6: Higher production performance improvement results in improved market and financial performances.

H6a: *The greater the production performance improvement, the greater the market performance improvement.*

H6b: *The greater production performance improvement, the greater financial performance improvement.*

In today's customer-driven market, where customer base is a key to achieving better financial results, marketing competence is seen as one of the most important sources of financial performance (e.g. Li, 2000) since, market share and sales growth may directly contribute to the financial goals thanks to the increasing amount of price premiums and sales revenues and decreasing amount of marginal unit costs leading to a significant increase in the overall profitability (e.g., Buzzel and Gale, 1987; Venkatraman and Prescott, 1990, Wang and Wei, 2005).

Hypothesis 7: Higher market performance improvement results in improved financial performance.

Derived from the existing literature, the proposed relationships among innovations and firm performance are discussed and hypotheses related to these variables are developed. The research framework generated in this study is illustrated in ***Figure 1***. This framework briefly proposes that the four different types of innovations implemented in manufacturing firms will enhance their innovative performance which will then improve production, market and financial performances.

[Insert Figure 1 here]

3. Data and Methodology

3.1 Sample

In order to explore empirically what the main innovation drivers are and what the impact of innovations is on the performance of manufacturing firms, a questionnaire was developed and a survey was conducted in the years 2006/2007 within a period of 7 months. The survey includes 311 individual questions designed to assess firm's business strategy, innovativeness efforts, competitive priorities, market and technology strategy, in-firm atmosphere, market conditions and corporate performance. The initial survey draft was discussed with firms' executives and it was pre-tested by 10 pilot interviews to ensure that the wording, format and sequencing of questions were appropriate.

Firms to be contacted were selected randomly from the database of the Union of Chambers and Commodity Exchange (TOBB) and Istanbul, Kocaeli, Tekirdag Cerkezkoy and Sakarya Industry Chambers and member lists of various Industry Parks in Northern Marmara region. The sample consists of manufacturing firms drawn from six main manufacturing sectors in Northern Marmara region within Turkey: textile, chemical, metal products, machinery, electrical home tools and equipments (domestic appliances) and automotive industries. These industries set to be major manufacturing sectors in an emerging country

such as Turkey. A total of 1674 firms were selected randomly where the number of firms selected from each sector and province covered in the study is representative of the number of firms in that sector and province.

Afterwards, the questionnaire was applied simultaneously through mail surveys and face-to-face interviews to the sample. The respondents were asked to complete the questionnaire in consultation with the rest of the management, since the questions asked cover a wide spectrum of disciplines regarding every area of the company. To motivate a timely and complete response, the respondents were promised a summary of research findings and the promise was indeed fulfilled at the end of the study.

For the mail survey, questionnaires were mailed to all the firms in the sample. Each mail package contained a questionnaire, a pre-paid envelope for the return of the questionnaire and a cover letter addressed to the General Manager. After two rounds of mailings, follow-ups and periodic notifications, a total of 83 usable and complete questionnaires were returned by the firms.

Randomly selected face-to-face interviews were arranged concurrently with the mail application. The dispersion of the firms to the sectors and control variables such as firm size was considered in order to obtain a true randomized and representative sample while interviews appointments had been arranged. Appointments were requested by phone from the top managers. Interviews were conducted by one or more of the authors and one or two respondents from the top level management. Questionnaires were given to the interviewees and the survey questions were asked in the same order as on the questionnaire. From 120 invitations extended, a total of 101 interviews were performed. Hence, we obtained 184 usable questionnaires resulting in a response rate of 11%.

The degree by how much the sample consisting of 184 firms is representative of the population is addressed by carrying out a series of comparative tests regarding firm

distributions according to sectors and firm size. For that purpose, the numbers of firms that must be present according to sector weights in selected provinces were calculated. For each sector, number of firms in the sample turned out to be representative, since no significant difference has been detected between the population and sample percentages.

The data was also controlled with t-test procedure for non-respondent bias (randomness of the data) and no significant difference ($p \leq 0.05$) was found between the interview and mailing data sets' responses both in terms of the questionnaire items and constructs, i.e. innovation and firm performance variables as well as in terms of control variables. In the analyses, variables such as firm size, firm age, ownership status and foreign investments in the company were examined as control variables, since these organizational variables may have possible effects both on innovative capabilities and firm performance.

Moreover, the issue of Common Method Variance (CMV) was also attended. Based on the classification by Podsakoff et al. (2003) potential common method bias in this research might arise from common rater effect and same measurement time effect. However, it is important to note that we have taken some procedural precautions to minimize CMV such as using established scales, some methodological separation of measurement, counterbalancing question order, improving scale items and protecting anonymity. Additionally, the observed correlations between the innovation types and performance types vary substantially, ranging from 0.066 to 0.405. Another important argument is related to Harman's single-factor test, which is arguably the most widely known approach for assessing CMV in a single-method research design (Podsakoff et al. 2003, Podsakoff and Organ 1986). Typically, in this single-factor test, all of the factors in a study are subjected to exploratory factor analysis (EFA). Then, CMV is assumed to exist if (1) a single factor emerges from unrotated factor solutions, or (2) a first factor explains the majority of the variance in the variables (Podsakoff and Organ 1986, p. 536). In our case, when we employ EFA for the performance items as well for the

innovation items, neither of these two conditions are observed. Hence, these arguments constitute strong evidence for the lack of common method bias in our results.

All the respondents completing the questionnaire were from the top (52%) or middle management (48%). The firms surveyed are distributed among the sectors included as follows: Textile (20%), chemical (18%), metal products (19%), machinery (15%), domestic appliances (8%) and automotive industries (20%).

Figure 2 depicts a profile of the resulting sample, illustrating its diversity in terms of annual sales volume, firm size (in terms of number of employees) and firm age. Firm size is determined by the number of full-time employees (up to 50: small; between 50 and 250: medium; 250 and above: large) and firm age is determined by the year production has started (before 1975: old; between 1975 and 1992: moderate; 1992 and later: young). Annual sales volume is divided into 5 categories: less than 1M Euro; between 1M Euro and 5M Euro; between 5M Euro and 20M Euro; between 20M Euro and 50M Euro; and 50M Euro or more.

[Insert Figure 2 here]

Table 1 provides several characteristics of the respondents firms. These statistics indicate that the sample tends towards middle sized and rather successful manufacturing companies with an average market share 31.1%, annual sales revenue growth 23.9% and innovation expenses growth rate 31.9%. On account of the diversity of the organizational structures, where corporate strategies are developed, a manufacturing business unit was selected as the unit of analysis.

[Insert Table 1 here]

After the data collection stage, multivariate statistical analyses via SPSS v13 software package were conducted in order to validate the research framework. Occasional missing data are randomly distributed (MAR) on items, and it was handled by list wise deletion.

3.2 Measurement of Variables

Innovation measures for each innovation types are designed considering theoretical and operational definitions and particularities of the four innovation types as stated in the OECD Oslo Manual (2005). Each innovation construct is measured by original measurement items, which were developed accordingly. Therefore, innovations measures used in this research are new for the literature and hence need to be validated.

In many recent studies, different criteria of performance are used to measure firms' competitiveness, productivity and efficiency. Financial, marketing, production and innovative performance constitute quantitative firm performance measures. Frequently, financial measures such as Return on Sales (ROS), Return on Investments (ROI) and Return on Assets (ROA) are favored for performance evaluation. Yet, certain thriving innovative managerial efforts can not be measurable with such financial performance indicators (Zahra, 1993). In fact, the discussion of how to measure innovativeness is a lasting subject in innovation literature. Damanpour (1990) claimed that the strength of innovation and firm performance relationship depends on how performance is measured. The innovation and economics studies consider the number of patented or patentable innovations (new processes, products or technologies) as an important factor in order to compute the creativity and innovative performance of an organization (Hagedoorn and Cloodt, 2003). Jaumotte and Pain (2005) added that countries with the highest patents per capita are characteristically ones with the highest levels of business R&D intensity. Generally accepted innovation performance measures are R&D expenditures, the numbers of patented or patentable process and products, and the new product announcements to the market (Alpkan et al., 2005).

In this research, a similar approach to Hagedoorn and Cloodt (2003) is followed in order to evaluate the in-firm innovation environment, and the innovative performance of companies. According to this approach, innovativeness broadens the innovative outcomes of firms'

activities and applications in a given period. For specifying such a period, the last three years appears to be a proper choice. The respondents are requested to compare the perceived average performance of their firm in the last three years to the perceived average performance prior to this period. In addition to these perceptual measures, respondents are asked to provide objective data (sales, exports, total sales, market share, and innovation outlay) for the last three years.

Particularly, four different performance measures are employed to expose the effects of realized innovations to firm performance. An innovative performance scale consisting of seven criteria have been adapted from Antoncic and Hisrich (2001), and Hagedoorn and Cloodt (2003). Production performance, market performance and financial performance scales have been reconstructed by adapting from existing academic literature with four, three and four criteria respectively. The base of items asked regarding these performance criteria are adapted mainly by research of Barringer and Bluedorn (1999), Hornsby et al. (2002), Narver and Slater (1990) and Yılmaz et al. (2005).

The questions about firm performance are asked employing a 5-point Likert scale, in which 1 indicates extremely unsuccessful, 2=unsuccessful, 3=similar, 4=successful and 5=extremely successful. Such subjective measures possibly bring in manager bias, but are widespread practice in empirical research (Khazanchi et al., 2007). The reason behind using such a subjective scale is that the firms are reluctant to disclose exact performance records, and managers are less willing to share objective performance data (Boyer et al., 1997; Ward and Duray, 2000). Conversely, top managers, who are well-acquainted with performance data, can present a precise subjective evaluation (Choi and Eboch, 1998). Moreover, objective measures could limit the comparability and accuracy of responses (Dess and Robinson, 1984; Porter, 1979).

Similarly, for innovation measures, the respondents are asked to indicate on a 5-point Likert scale to what extent the related applications and practices were implemented in their organizations. Items for firm performance and innovation measures are displayed in the Appendix.

4. Analysis and Findings

In order to extract the relationships presented in ***Figure 1***, multivariate data analysis is performed in two stages. The first stage is about extracting the factor structure of research framework. We aim to apply a principal component analysis (PCA) in order to reduce the larger set of variables into a more manageable set of scales, since the initial number of variables is too large to conduct an analysis of individual linkages (Flynn et al., 1990; Benson et al., 1991; Saraph et al., 1989). A PCA with varimax rotation is conducted to find out the underlying dimensions of innovations and firm performance. The title for each factor is selected to represent the included variables as closely as possible. This stage is concluded by exploring internal consistency and reliability (content validity) among the items of each construct via Cronbach α (Carmines and Zeller, 1979) and unidimensionality tests. Moreover, discriminant validity between the innovation constructs are also examined and verified by the average-variance extracted (AVE) test.

The second stage involves the analysis of the relationships between these factors using structural equation modeling (SEM) approach. In this stage, the findings and results of SEM analysis are also presented.

Stage 1: Factor structures

The purposes of factor analysis in this study are to explore how various items within each of the constructs (innovations, firm performance and innovation determinants) interact

with one another; and to develop scales (by combining several closely correlated items) to be used in the following analysis on linkage (Kim and Arnold, 1996).

Factor analytic methods are useful to observe the underlying patterns or relationships for a large number of variables and they determine whether the information can be condensed or summarized in a smaller set of factors or components. PCA with varimax rotation is performed separately on the innovations and firm performance in order to extract the dimensions of each construct. Factors with eigenvalues (the amount of variance accounted for by a factor) larger than 1 were carried for further analysis (Kim and Mueller, 1978).

As a result of the PCA on innovations 4 factors for innovations are extracted. These four factors are respectively labeled based on the items included in each. The total variance explained is 59%. The Cronbach α values for the underlying factors range from 0.90 to 0.76 suggesting satisfactory levels of construct reliability, since for Cronbach α values greater than 0.70, the scale is accepted as reliable (Nunnally, 1978; Hair et al., 1998; Streiner, 2003).

Similarly, PCA produced 4 factors, which explained 67% of the observed variance for firm performance. One of the innovative performance items, namely "ability to introduce new products and services to the market before competitors" is left outside the analysis as it is not categorized under an appropriate factor and failed the internal structure face validity check. Cronbach α for the underlying factors range from 0.93 through 0.71 again indicating reliability of factors.

Table 2 and ***Table 3*** display the results of PCA for innovations and performance items respectively. It is found that all factors are practically significant regarding the sample size employed (Hair et al., 1998, p.111-112). AVE scores for constructs range from 0.761 to 0.908 demonstrating discriminant validity. Finally, factors are controlled for normality, randomness and independency assumptions and thus data is validated for statistical tests. The scale value of each factor is determined by a simple average of the included items

[Insert Table 2 here]

[Insert Table 3 here]

Before beginning to analyze the hypothesized relationships, we also intent to explore via independent-samples *t*-test procedure, the difference of performance created by the "ability to introduce new products and services to the market before competitors", which is clearly an important item but failed to become part of the factor structure. The finding reveals that Ho ($\mu_{extremelysuccessful} = \mu_{others}$) should be rejected, and that the firms, which indicated they are very successful in launching new products into market in a shorter period of time than their competitors (=5 in the scale), perform better than others in achieving high outcomes for the innovative, production, and market performances ($p<0.01$).

Stage 2: Relationship analysis

The correlation analysis indicates a strong positive association between factors **(*Table 4*)**. All the hypotheses are supported regarding correlations. Therefore, we can generally deduce that higher product, process, marketing, and organizational innovation capabilities are associated with increased innovative, production, and market performances.

[Insert Table 4 here]

Correlation analysis presents not only significant relationships among almost all variables, but it also exhibits a complex web of associations. These findings infer the existence of mediating effects of some innovation types on innovation-performance relationships. In order to discover these possible mediations, we could conduct multiple hierarchical regression analyses following the procedure developed by Baron and Kenny (1986), which proposes to check if an already significant factor's performance impact disappears with the overshadowing effect of a stronger performance driver that intervenes in

the regression model. However, due to the complexity and multiplicity of the mediating effects amid the innovation types and performance aspects, in order to reveal the best fit structure of complex relations among our variables, we prefer to carry out SEM approach, since SEM procedure obtains weights, loadings and path estimates while performing an iterative scheme of multiple regressions until a solution converges on a set of weights used for estimating the latent variables scores. Hence, a single-step SEM analysis is performed with the simultaneous estimation of both measurement and structural models by AMOS v4 and analyzed according to goodness-of-fit indices.

The measurement model of SEM is performed using maximum likelihood estimation and it is based on the comparison of variance-covariance matrix obtained from the sample to the one obtained from the model (Bollen, 1989a). The results consistently support the factor structure for all the factors in the PCA stage. The entire model is also supported with the goodness-of-fit indices (***Table 5***).

[Insert Table 5 here]

These indices conform to the acceptable standards with the value of $\chi 2/df$ ratio of 1.79. This ratio shows the appropriateness of the model and should be within the range of 0-5, where lower values indicate a better fit (Wheaton et al., 1977). In addition, the goodness-of-fit indices include the comparative fit index (CFI; Bentler, 1990), the normed fit index (NFI; The Bentler-Bonett, 1980), the relative fit index (RFI; Bollen, 1986), the incremental fit index (IFI; Bollen, 1989b), and Tucker-Lewis coefficient (TLI; Bentler and Bonett, 1980). All these indices indicate a very good fit when close to 1. Also, Browne and Cudeck (1993) stated that a value of about 0.08 or less for the root mean square error of approximation (RMSEA) would indicate a reasonable error of approximation. Hu and Bentler (1999) suggested that for continuous data, RMSEA<0.06, TLI>0.95, CFI>0.95 are necessary values for the model fit.

The goodness-of-fit indices exhibited in ***Table 5*** demonstrate an acceptable level of overall fit for the research model.

The structured model of SEM investigates the impacts of innovation types on firm performance and proposes a theoretical scheme for such a web of relationships as it is presented in ***Figure 1***, which is our research model.

As a result, the proposed paths of relations matching innovation types to firm performance components are analyzed and all hypotheses (except three sub-hypotheses, **H1a**, **H4c**, and **H6b**) are validated regarding their high and significant (p<0.05) path estimates. ***Figure* 3** summarizes main findings of SEM analysis. ***Table 6*** shows the standardized path estimates and p-values for the structural model.

[Insert Figure 3 here]

[Insert Table 6 here]

Furthermore, all the arrows in ***Figure 3*** except those corresponding to **H1a**, **H4c**, and **H6b**, which symbolize the supported associations, are all significant (p<0.05). Consequently, our hypotheses proposing the existence of a significant relationship between innovations and performance are supported. Moreover, the analysis yields some interesting findings beyond the general confirmation of the hypothesized relations.

The SEM model divulges the product innovation mediated marketing and process innovations' effects on innovative performance. The findings expose that innovative performance is directly and positively affected by the organizational, product and marketing innovations. Process innovation, which is already found to be significantly correlated to innovative performance, influences it through product innovation. In addition, organizational and marketing innovations have both direct and indirect (through product innovation) effects on innovative performance. Also, according to regression estimates in the SEM model,

organizational innovation is observed to be the strongest driver of innovative performance. Furthermore, it is found that production and innovative performances have indirect positive impact on financial performance via market performance, which is the main contributor to it. The model verifies that innovations support innovative performance, which sustains production performance and market performance, which directly stimulates financial performance. Therefore, we can acknowledge the existence of a resulting innovativeness path beginning with organizational innovations leading ultimately to higher financial performance.

Finally, independent-samples *t*-test procedure is also applied to explore the probable effects of innovations on quantitative performance measures. The results disclose that innovative firms have higher sales and exports. Also, higher product innovation is correlated with higher market share. Innovative firms especially those with a higher innovativeness score for product, process, and organizational innovations have significantly higher total sales and exports ($p<0.01$).

5. Conclusion

This paper reports on an innovativeness study in the Turkish manufacturing industry, drawing on a sample of 184 manufacturing firms. A theoretical framework has been empirically tested identifying the relationships amid innovations and firm performance. Our study not only discloses how four innovation types affect diverse firm performance aspects, but it also points out that innovative performance exerts a mediator role between innovation types and performance aspects.

The findings support the claim that innovations performed in manufacturing firms have positive and significant impacts on innovative performance. There are also various associations between four innovation types. Thus, hypotheses **H1b**, **H1c**, **H2**, **H3**, **H4a**, **H4**b, and **H4d** are supported. But the relationship between organizational and product innovations (**H1a**) and process innovations and innovative performance (**H4c**) are not found to be

significant, although there are significant positive correlation between these items. Due to the introduction of other variables in the path model analysis the relationships observed through correlation analysis cease to be direct and become of a mediating nature leading the hypotheses involved not to be supported. The results of the analyses also reveal that financial performance is an output of innovative, production, and market performances and hypotheses **H5a**, **H5b**, **H6a** and **H7** are supported indeed. Although the direct relationship between production and financial performances (**H6b**) is not found to be significant, the impact of production performance on financial performance is mediated over the market performance.

On the other hand, when objective firm data is considered, we observe that innovative firms have higher market share, total sales and exports. For these market and financial criteria, all four innovation types play significant positive role.

These findings substantiate our conceptual model and offer several managerial implications. First, managers of firms should put additional emphasis on innovations as they are important instruments for achieving sustainable competitive power. Improved innovative performance is contingent upon the degree of implementation of innovations. Firms that are endowed with resources to improve their innovative capabilities could expect a more significant improvement of their production and market performance, if they encourage and implement a high level of innovation activities. It is also observed that market performance indicators such as sales, exports and market share are supported by innovation types performed.

Besides the finding that all individual innovation types are more or less positively and significantly associated with some aspects of firm performance, we have also observed that organizational innovations play a fundamental role for innovative capabilities as it has the greatest regression coefficient with innovative performance. This finding is also compatible with that by Lin and Chen (2007). Organizational innovations do not only prepare a suitable

milieu for the other innovation types, but also have a strong and direct impact on innovative performance. Therefore, it is safe to suggest that managers need to pay more attention to organizational innovations, which have a crucial role for innovative capabilities.

Product innovation also appears as a critical driver for innovative performance, which also acts as a bridge carrying positive impacts of process innovations to innovative performance. For these reasons, managers ought to invest more on innovative capabilities and support new attempts of introducing innovations of each type. Innovative performance could play the most important role in this scheme since, it acts like a hub, where positive effects of innovation types are gathered and then conveyed to production, market, and financial performances.

However, a certain amount of time might be necessary in order to observe the reflection of positive effects of innovative performance on financial performance. A time lag effect between innovations and financial performance is already stated in the literature (Zahra and Sidhartha, 1993; Teece, 1988; West 1992). This fact explains why top managers frequently complain about stating they do not harvest enough positive results of their innovative efforts. Boston Consulting Group's Annual Innovation Report (Andrews, 2007) following a senior management survey attests to the same fact. Although innovation remains a top strategic focus for the majority of companies and the spending on innovation has an increasing trend year by year, many executives -over half of those surveyed- remain unsatisfied with the financial returns on their company's investments in innovation.

Actually, although our study is not a longitudinal data analysis, we have a clue to elucidate this time lag issue. While financial performance – and also market and production performance – is positively linked to innovations, innovative performance acts as a mediator for their positive effects. Possibly, the direct positive impact of innovations on production, market, and financial performances is overshadowed by innovative performance. It is

foreseeable that increased financial performance occurs as the results of increased market and production performances, which depend on obtaining higher innovative capabilities.

Our findings support the fact that innovation strategy is an important major driver of firm performance and should be developed and executed as an integral part of the business strategy. Managers should recognize and manage the innovations in order to boost their operational performance. Having a clear understanding of the exact nature of innovations will help firms to prioritize their market, production and technology strategies, to be followed by appropriate subsequent action plan.

Acknowledgment

This study was supported by a grant from The Scientific and Technological Research Council of Turkey (TUBITAK-SOBAG-105K105). We would like to thank to Prof. M. Atilla Oner and Dr. Cagri Bulut for their contribution in the initial phases of this research.

References

Akova, B., Ulusoy, G., Payzin, E., Kaylan, A.R., 1998. New product development capabilities of the Turkish electronics industry. Fifth International Product Development Management Conference, 863-876, Como, Italy.

Alpkan, L., Ceylan, A., Aytekin, M., 2002. Relationships among environmental factors, manufacturing strategies and performance. 2nd International Conference on Responsive Manufacturing, 435-440, Gaziantep, Turkey. [in Turkish]

Alpkan, L., Ceylan, A., Aytekin, M., 2003. Performance impacts of operations strategies: A study on Turkish manufacturing firms. International Journal of Agile Manufacturing 6 (2), 57-65.

Alpkan, L., Ergun, E., Bulut, C., Yılmaz, C., 2005. Effects of corporate entrepreneurship on corporate performance. Doğuş Üniversitesi Dergisi 6 (2), 175-189. [in Turkish]

Andrews, J. P., Sirkin, H. L., Haanæs, K., Michael, D.C., 2007. Innovation 2007: A BCG senior management survey. Boston Consulting Group Report, August.

Antoncic, B., Hisrich, R.D., 2001. Intrapreneurship: Construct refinement and cross-cultural validation. Journal of Business Venturing 16, 495–527.

Atuahene-Gima, K, 1996. Market orientation and innovation. Journal of Business Research 35, 93-103.

Baer, M., Frese, M., 2003. Innovation is not enough: Climates for initiative and psychological safety, process innovations, and girm performance. Journal of Organisational Behavior 24, 45-68.

Baldwin, J.R., Johnson, J., 1996. Business strategies in more- and less-innovative firms in Canada. Research Policy 25, 785-804.

Baron R., Kenny D., 1986. The moderator-mediator variable distinction in social psychological research. Journal of Personality and Social Pyschology 51, 1173-1182.

Barringer, B.R., Bluedorn, A.C., 1999. The relationship between corporate entrepreneurship and strategic management. Strategic Management Journal 20, 421-444.

Benson, P.G., Saraph, J.V., Schroeder, R.G., 1991. The effects of organizational context on quality management: an empirical investigation. Management Science, 7 (9), 1107-1124.

Bentler, P.M., 1990. Comparative fit indexes in structural models. Psychological Bulletin 107, 238–246.

Bentler, P.M. Bonett, D.G., 1980. Significance tests and goodness of fit in the analysis of covariance structures. Psychological Bulletin 88, 588–606.

Bollen, K.A., 1986. Sample size and Bentler and Bonett's nonnormed fit index. Psychometrika 51, 375–377.

Bollen, K.A., 1989a. Structural Equations with Latent Variables. John Wiley and Sons, New York, NY.

Bollen, K.A. 1989b. A new incremental fit index for general structural equation models. Sociological Methods and Research 17, 303–316.

Boyer, K.K., Leong, G., Ward, P.T., Krajewski, L., 1997. Unlocking the potential of advanced manufacturing technologies. Journal of Operations Management 15 (4), 331–347.

Browne, M.W. Cudeck, R., 1993. Alternative ways of assessing model fit. In: Bollen, K.A and Long, J.S., (Eds.) Testing Structural Equation Models, 136-162. Sage, Beverly Hills, CA.

Buzzell, R.D, Gale, B.T., 1987. The PIMS Principles: Linking Strategy to Performance. Free Press, New York, NY.

Calantone, R.J., Cavusgil, S.T., Zhao, Y., 2002. Learning orientation, firm innovation capability, and firm performance. Industrial Marketing Management 31, 515-524.

Capon, N., Farley, J.U., Hoenig, S., 1990. Determinants of financial performance: a meta-analysis. Management Science 36 (10), 1143-1159.

Carmines, E.G., Zeller, R.A., 1979. Reliability and Validity Assessment, Sage, Newbury Park, CA.

Chandler, G.N., Hanks, S.H., 1994. Market attractiveness, resource-based capabilities, venture strategies, and venture performance. Journal of Business Venturing 9 (4), 331-349.

Chenhall, R.H., 1997. Reliance on manufacturing performance measures, Total Quality Management and organizational performance. Management Accounting Research 8 (2) 187-206.

Choi, T.Y., Eboch, K., 1998. The TQM paradox: Relations among TQM practices, plant performance and customer satisfaction. Journal of Operations Management 17 (1), 59-75.

Damanpour, F., 1990. Innovation effectiveness, adoption and organizational performance. West, M.A., Farr, J.L. (Eds), Innovation and Creativity at Work, John Wiley and Sons, 125-141.
Damanpour, F., 1991. Organizational innovation: a meta-analysis of effects of determinants and moderators. Academy of Management Journal 34 (3), 555-590.
Damanpour, F., Evan, W.M., 1984. Organisational innovation and performance: the problem of "organisational lag". Administrative Science Quarterly 29 (3), 392-409.
Damanpour, F., Szabat, K.A., Evan, W.M., 1989. The relationship between types of innovation and organisational performance. Journal of Management Studies 26 (6), 587–601.
Deshpande, R., Farley, J.U., Webster, F.Jr., 1993. Corporate culture, customer orientation, and innovativeness in Japanese firms: A quadrate analysis. Journal of Marketing 57, 23–27.
Dess, G.G., Robinson, R.B., 1984. Measuring organizational performance in the absence of objective measures: The case of the privately-held firm and conglomerate business unit. Strategic Management Journal 5 (3), 265-273.
Dos Santos, B.L., Peffers, K., 1995. Rewards to investors in innovative information technology applications: first movers and early followers in ATMs. Organisation Science 6, 241-259.
Drejer, A., 2002. Situations for innovation management: Towards a contingency model. European Journal of Innovation Management 55 (1), 4-17.
Drucker, P.F., 1985. Innovation and Entrepreneurship. Butterworth-Heinemann, Oxford.
Du, R., Farley, J., 2001. Research on technological innovation as seen through the Chinese looking glass. Journal of Enterprising Culture 9 (1), 53-89.
Fagerberg, J., Mowery, D.C., Nelson, R.R., 2004. The Oxford Handbook of Innovation. Oxford University Press, USA.
Flynn, B.B., Sakakibara, S., Schroeder, R.G., Bates, K.A., Flynn, E.J., 1990. Empirical research methods in operations management. Journal of Operations Management 9 (2), 250-284.
Fullerton, R.R., McWatters, C.S., 2001. The production performance benefits from JIT implementation. Journal of Operations Management 19 (1), 81-96.
Fullerton, R.R., Wempe, W.F., 2009. Lean manufacturing, non-financial performance measures, and financial performance. International Journal of Operations and Production Management 29 (3-4), 214-240.
Gao, J., Fu, J., 1996. Key issues on technological innovation in Chinese enterprises. Science and Technology Policy and Management 1, 24-33.
Garcia, R., Calantone, R., 2002. A critical look at technological innovation typology and innovativeness terminology: A literature review. The Journal of Product Innovation Management 19 (2), 110-132.
Garg, V.K., Walters, B.A., Priem, R.L., 2003. Chief executive scanning emphases, environmental dynamism, and manufacturing firm performance. Strategic Management Journal 24, 725-744.
Germain, R., 1996. The role of context and structure in radical and incremental logistics innovation adoption. Journal of Business Research, 35 (2), 117-127.
Geroski, P., 1995. Innovation and competitive advantage. Working Paper No. 159, OECD, Paris.
Gonzalez-Benito J., 2005. A study of the effect of manufacturing proactivity on business performance. International Journal of Operations and Production Management, 25 (3-4), 222-241.
Gopalakrishnan, S., 2000. Unraveling the links between dimensions of innovation and organizational performance. The Journal of High Technology Management Research 11 (1), 137-153.
Guan, J. Ma, N., 2003. Innovative capability and export performance of Chinese firms. Technovation 23, 737-747.
Hagedoorn, J., M. Cloodt., 2003. Measuring innovative performance: is there an advantage in using multiple indicators?. Research Policy 32, 1365–1379.
Hair, J.F., Anderson, R.E., Tatham, R.L., Black, W.C., 1998. Multivariate Data Analysis. Fifth Edition, Prentice-Hall, NJ.
Han, J.K., Kim, N., Srivastava, R.K., 1998. Market orientation and organisational performance: is innovation the missing link? Journal of Marketing 62 (4), 30-45.
Hisrich, R.D., Peters, M.P., 1986. Establishing a new business venture unit within a firm. Journal of Business Venturing 1, 307-322.

Hitt, M.A., Ireland, R.D., Camp, S.M., Sexton, D.L. 2001. Guest editors' introduction to the special issue strategic entrepreneurship: entrepreneurial strategies for wealth creation. Strategic Management Journal 22, 479–491.
Hornsby, J.S., Kuratko, D.F., Zahra, S.A., 2002. Middle managers' perception of the internal environment for corporate entrepreneurship: assessing a measurement scale. Journal of Business Venturing 17, 253–273.
Hu, L.T., Bentler, P.M., 1999. Cutoff criteria for fit indices in covariance structure analysis: Conventional criteria versus new alternatives. Structural Equation Modeling, 6, 1–55.
Hult, G.T., Ketchen Jr., D.J., 2001. Does market orientation matter? A test of the relationship between positional advantage and performance. Strategic Management Journal 22, 899-906.
Hult, G.T., Snow, C.C., Kandemir, D., 2003. The role of entrepreneurship in building cultural competitiveness in different organizational types, Journal of Management 29 (3), 401–426.
Ittner, C.D., Larcker, D.F., 1997. The performance effects of process management techniques. Management Science 43, 522-534.
Jaumotte, F., Pain, N., 2005. Innovation in the business sector. OECD Economics Department Working Papers, no:459.
Jin, Z., Hewitt-Dundas, N., Thompson, N.J., 2004. Innovativeness and performance: Evidence from manufacturing sectors. Journal of Strategic Marketing 12 (4), 255-266.
Johannessen, J., Olsen, B., Lumpkin, G.T., 2001. Innovation as newness: what is new, how new, and new to whom?. European Journal of Innovation Management 4 (1), 20-31.
Johne, A., Davies, R., 2000. Innovation in medium-sized insurance companies: how marketing adds value. International Journal of Bank Marketing 18 (1) 6-14.
Khazanchi, S., Lewis M.W., Boyer K.K., 2007. Innovation-supportive culture: the impact of organizational values on process innovation. Journal of Operations Management 25 (4), 871–884.
Kim, J.S., Arnold, P., 1996. Operationalizing manufacturing strategy. International Journal of Operations and Production Management 16 (12), 45-73.
Kim, J.O., Mueller, C.W., 1978. Introduction to Factor Analysis, Sage, Newbury Park, CA.
Knott, A.M., 2001. The dynamic value of hierarchy. Management Science 47, 430-448.
Kotler, P., 1991. Principles of Marketing. Prentice Hall, NJ.
Koufteros, X., Marcoulides, G.A., 2006. Product development practices and performance: A structural equation modeling-based multi-group analysis. International Journal of Production Economics 103 (1), 286-307.
Kuratko, D.F., Hodgetts, R.M., 1998. Entrepreneurship: A Contemporary Approach. Dryden Press, Fort Worth.
Kuratko, D.F., Ireland, R.D., Covin, J.G., Hornsby, J.S. 2005. A model of middle-level managers' entrepreneurial behaviour. Entrepreneurship Theory and Practice 29 (6), 699-716.
Lawless, M.W., Anderson, P.C., 1996. Generational technological change: effects of innovation and local rivalry on performance. Academy of Management Journal 39, 1185-1217.
Li, H., Atuagene-Gima, K., 2001. Product innovation strategy and the performance of new technology ventures in China. Academy of Management Journal 44 (6), 1123-1134.
Li, L., 2000. An analysis of sources of competitiveness and performance of Chinese manufacturers. International Journal of Operations and Production Management 20 (3-4), 299-315.
Li, L., 2005. Assessing intermediate infrastructural manufacturing decisions that affect a firm's market performance. International Journal of Production Research 43 (12), 2537 - 2551.
Li, Y., Liu, Y., Ren, F., 2007. Product innovation and process innovation in SOEs: Evidence from the Chinese transition. Journal of Technology Transfer 32, 63–85.
Lin, C.Y., Chen, M.Y. 2007. Does innovation lead to performance? An empirical study of SMEs in Taiwan. Management Research News 30 (2), 115-132.
Liu, Y., Li, Y., Wei, Z.L., 2009. How organizational flexibility affects new product development in an uncertain environment: Evidence from China. International Journal of Production Economics 120 (1), 18-29
López-Mielgo, N., Montes-Peón, J.M., Vázquez-Ordás, C.J., 2009. Are quality and innovation management conflicting activities? Technovation 29 (8), 537-545.
Marcus, A.A., 1988. Responses to externally induced innovation: Their effects on organisational performance. Strategic Management Journal 9, 387-402.

McAdam, R., Keogh, K., 2004. Transitioning towards creativity and innovation measurement in SMEs. Creativity and Innovation Management 13 (2), 126-141.
McGrath, R.G., Tsai, M.H., Venkataraman, S., MacMillan, I.C., 1996. Innovation, competitive advantage and rent: A model and test. Management Science 42, 389-403.
Metcalfe, J. S., 1998. Evolutionary Economics and Creative Destruction. Routledge, London.
Miller, W.L., 2001. Innovation for business growth. Research Technology Management 44 (5), 26-41.
Narver, J.C., Slater S.F., 1990. The effect of a market orientation on business profitability. Journal of Marketing 54, 20-35.
Nunnally, J.C., 1978. Psychometric Theory. McGraw-Hill, New York, NY.
OECD, 2005. Oslo Manual: Proposed Guidelines for Collecting and Interpreting Technological Innovation Data. Paris.
Oke, A., 2007. Innovation types and innovation management practices in service companies. International Journal of Operations and Production Management, 27 (6), 564-587.
Olson, C.A., Schwab, A., 2000. The performance effects of human resource practices: the case of interclub networks in professional baseball, 1991-1940. Industrial Relations 39, 553-577.
Pelham, A.M., 1997. Mediating influences on the relationship between market orientation and profitability in small industrial firms. Journal of Marketing Theory and Practice 5 (3), 55–76.
Peters, B., 2008. Innovation and firm performance: An empirical investigation for German firms. Working Paper, Center for European Economic Research, Mannheim, Germany.
Pinchot, G., 1985. Intrapreneuring: Why You Don't Have to Leave the Corporation to Become and Entrepreneur. New York, NY Harper and Row Publishers.
Podsakoff, P.M., Organ, D.W., 1986. Self-reports in organizational research: Problems and prospects. Journal of Management 12, 531 - 544.
Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., Podsakoff, N. P., 2003. Common method biases in behavioral research: A critical review of the literature and recommended remedies. Journal of Applied Psychology 88, 879-903.
Porter, M.E., 1979. The structure within industries and companies' performance. Review of Economics and Statistics 61, 214–227.
Quadros, R., Furtado, A., Roberto B., Franco, E., 2001. Technological innovation in Brazilian industry: An assessment based on the São Paulo innovation survey. Technological Forecasting and Social Change 67, 203–219.
Ravichandran, T., 2000. Swiftness and intensity of administrative innovation adoption: An empirical study of TQM in information systems. Decision Sciences 31 (3), 691-724.
Saraph, J.V, Benson, P.G., Schroeder, R.G., 1989. An instrument for measuring the critical factors of quality management. Decision Sciences, 20 (4), 810-812.
Schumpeter, J.A., 1934. The Theory of Economic Development. An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle. Harvard University Press, Cambridge.
Staropoli, C., 1998. Cooperation in R&D in the pharmaceutical industry - The network as an organizational innovation governing technological innovation, Technovation, 18 (1), 13-23.
Stevenson, H.H., Jarillo, C.J., 1990. A paradigm of entrepreneurship: entrepreneurial management. Strategic Management Journal, 11 (5), 17-27.
Streiner, D.L., 2003. Starting at the beginning: An introduction to coefficient alpha and internal consistency. Journal of Personality Assessment 80 (1), 99-103.
Subramanian A., Nilakanta, S., 1996. Organisational innovativeness: Exploring the relationship between organisational determinants of innovation, types of innovations, and measures of organisational performance. Omega, 24 (6), 631-647.
Teece, D.J., 1988. Capturing value from technological innovation: integration, strategic partnering, and licensing decision. Interfaces 18 (3), 46-61.
Venkatraman, N., Prescott, J.E., 1990. Environment-structure co-alignment: An empirical test of its performance implications. Strategic Management Journal 11, 1-23.
Walker, R.M., 2004. Innovation and organizational performance: Evidence and a research agenda. Advanced Institute of Management Research Working Paper, WP No: 002-June.
Walker, R.M., 2008. An empirical evaluation of innovation types and organizational and environmental characteristics: Towards a configuration framework, Journal of Public Administration Research and Theory, 18 (4), 591-615.

Wang, E.T.G., Wei, H.-L., 2005. The importance of market orientation, learning orientation, and quality orientation capabilities in TQM: An example from Taiwanese software industry. Total Quality Management 16 (10), 1161–1177.
Ward, P.T., Duray, R., 2000. Manufacturing strategy in context: environment competitive strategy and manufacturing strategy. Journal of Operations Management 18 (3), 123-138.
West, A., 1992. Innovation Strategy. Prentice-Hall International, London.
Wheaton, B., Muthén, B., Alwin, D.F., Summers, G.F., 1977. Assessing reliability and stability in panel models. Sociological Methodology 8, 84–136.
Whittington, R., Pettigrew, A., Peck, S., Fenton, E., Conyon, M., 1999. Change and complementarities in the new competitive landscape: A European panel study, 1992-1996. Organisation Science 10, 583-600.
Worthington, A., 1998. Testing the association between production and financial performance evidence from a not-for-profit, cooperative setting. Annals of Public and Cooperative Economics 69 (1), 67-84.
Wu, F., Mahajan, V., Balasujbramanian, S., 2003. An analysis of e-business adoption and its impact on business performance. Journal of the Academy of Marketing Sciences 31, 425-447.
Yilmaz, C., Alpkan, L., Ergun, E., 2005. Cultural determinants of customer- and learning-oriented value systems and their joint effects on firm performance. Journal of Business Research 58, 1340-1352.
Zahra, S.A. 1993. Environment, corporate entrepreneurship and financial performance: a taxonomic approach. Journal of Business Venturing 8 (4), 319-340.
Zahra, S.A., Sidhartha, R.D., 1993. Innovation strategy and financial performance in manufacturing companies: An empirical analysis. Production and Operations Management 2 (1), 15-37.

FIGURES

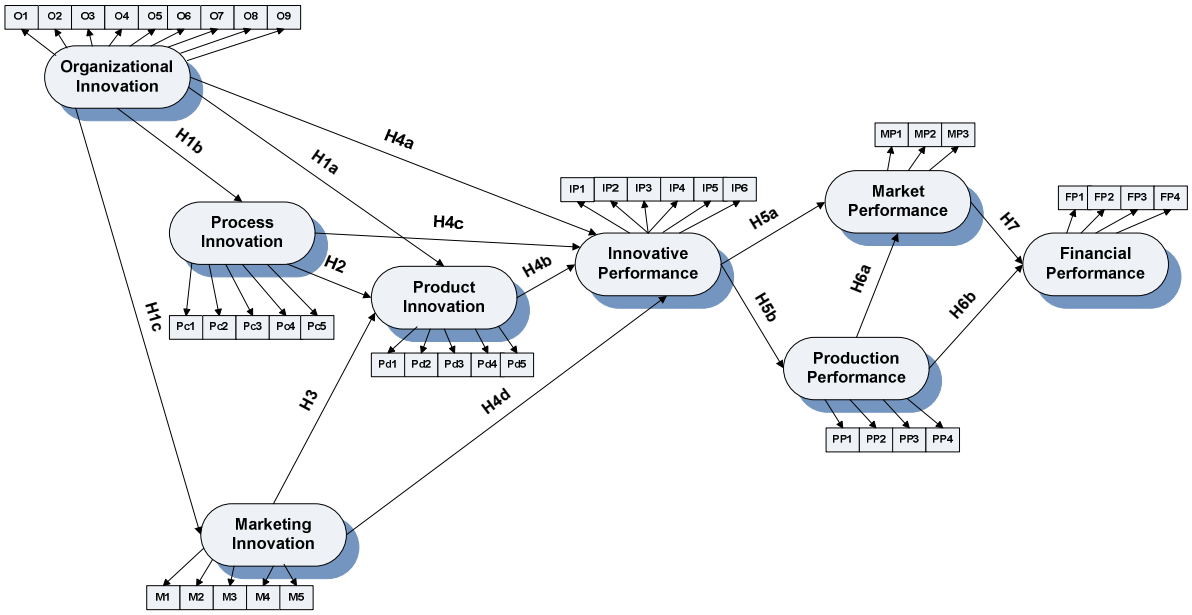

Fig. 1: Research Framework and Hypotheses.

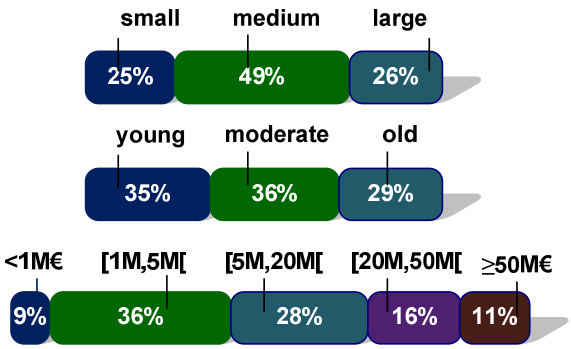

Fig. 2: Sample Profile

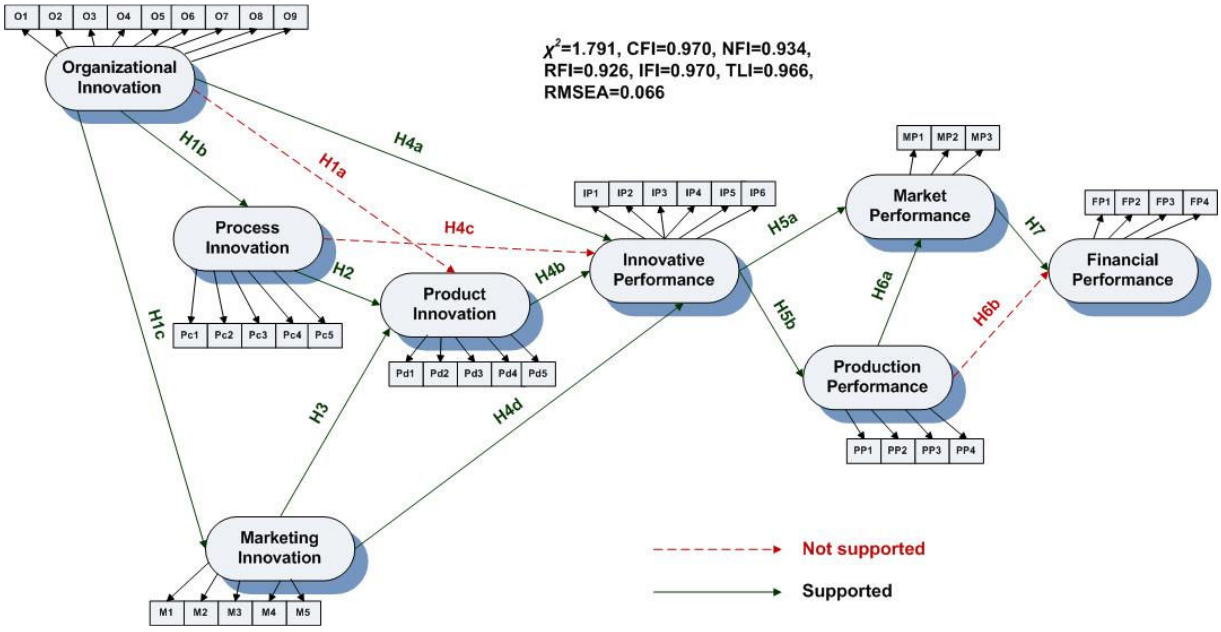

Fig. 3: The Results Concerning the Hypotheses

TABLES

Table 1: Respondent Business Profiles

Indicator	Mean	Median	Std. Deviation
Annual sales revenue (€ million)	45.53	6.47	196.02
Growth rate of annual sales revenue (%)	0.24	0.18	0.30
Annual export revenue (€ million)	15.20	1.12	72.39
Growth of annual export revenue (%)	0.18	0.15	0.33
Market share of primary product (%)	0.31	0.27	0.25
Growth of market share of primary product (%)	0.12	0.00	0.29
Innovation expenses (€ million)	1.31	0.21	34.3
Growth rate of innovation expenses (%)	0.32	0.18	0.69
Number of employees	342.25	108.00	899.19
Share of R&D employees (%)	0.13	0.10	0.12
Sample size = 184			

Table 2: PCA of Innovations

Factors	Factor Loads	Eigen-value	Cum. % variance explained	Cronbach α	AVE
Factor 1: Organizational Innovations		8.982	37.425	0.896	0.761
Renewing the organization structure to facilitate teamwork.	0.763				
Renewing the production and quality management systems.	0.754				
Renewing the organization structure to facilitate coordination between different functions such as marketing and manufacturing.	0.722				
Renewing the routines, procedures and processes employed to execute firm activities in innovative manner.	0.719				
Renewing the human resources management system.	0.682				
Renewing the supply chain management system.	0.672				
Renewing the organization structure to facilitate project type organization.	0.664				
Renewing the in-firm management information system and information sharing practice.	0.584				
Renewing the organizational structure to facilitate strategic partnerships and long-term business collaborations.	0.456				
Factor 2: Marketing Innovations		2.160	46.425	0.833	0.767
Renewing the product promotion techniques employed for the promotion of the current and/or new products.	0.748				
Renewing the distribution channels without changing the logistics processes related to the delivery of the product.	0.730				
Renewing the product pricing techniques employed for the pricing of the current and/or new products.	0.660				
Renewing the design of the current and/or new products through changes such as in appearance, packaging, shape and volume without changing their basic technical and functional features.	0.658				
Renewing general marketing management activities.	0.599				
Factor 3: Process Innovations		1.795	53.903	0.819	0.811
Determining and eliminating non value adding activities in delivery related processes	0.731				
Decreasing variable cost and/or increasing delivery speed in delivery related logistics processes.	0.726				
Increasing output quality in manufacturing processes, techniques, machinery and software.	0.655				
Decreasing variable cost components in manufacturing processes, techniques, machinery and software.	0.635				
Determining and eliminating non value adding activities in production processes	0.543				
Factor 4: Product Innovations		1.229	59.023	0.758	0.750
Developing new products with technical specifications and functionalities totally differing from the current ones.	0.708				
Developing newness for current products leading to improved ease of use for customers and to improved customer satisfaction.	0.706				
Developing new products with components and materials totally differing from the current ones.	0.623				
Decreasing manufacturing cost in components and materials of current products	0.540				
Increasing manufacturing quality in components and materials of current products	0.455				
K-M-O Measure of Sampling Adequacy = 0.901; Bartlett Test of Sphericity = 2203.054; p<.000.					

Table 3: PCA of Firm Performance

Factors	Factor Loads	Eigen-value	Cum. % variance explained	Cronbach α	AVE
Factor 1: Financial Performance		5.998	35.282	0.930	0.788
Return on assets (profit/total assets).	0.918				
General profitability of the firm.	0.910				
Return on sales (profit/total sales).	0.893				
Cash flow excluding investments.	0.777				
Factor 2: Innovative Performance		2.588	50.506	0.816	0.908
Renewing the administrative system and the mind set in line with firm's environment.	0.755				
Innovations introduced for work processes and methods.	0.736				
Quality of new products and services introduced.	0.701				
Number of new product and service projects.	0.657				
Percentage of new products in the existing product portfolio.	0.651				
Number of innovations under intellectual property protection.	0.562				
Factor 3: Production Performance		1.676	60.362	0.711	0.824
Production (volume) flexibility.	0.729				
Production and delivery speed.	0.697				
Production cost.	0.677				
Conformance quality.	0.661				
Factor 4: Market Performance		1.152	67.136	0.766	0.764
Total sales	0.729				
Market share	0.727				
Customer satisfaction	0.606				
K-M-O Measure of Sampling Adequacy = 0.839; Bartlett Test of Sphericity = 1692.874; p<.000					

Table 4: Descriptive Statistics and Correlation Analysis

	Mean	S.D.	Product Innov.	Process Innov.	Mar. Innov.	Org. Innov.	Innovative Perf.	Production Perf.	Market Perf.	Financial Perf.
Product Innov.	2.94	1.00	1	0.524**	0.531**	0.496**	0.313**	0.227**	0.137‡	0.126‡
Process Innov.	2.89	1.03		1	0.419**	0.600**	0.292**	0.198**	0.149*	0.188*
Mar. Innov.	2.56	1.12			1	0.580**	0.216**	0.153*	0.066	0.121
Org. Innov.	2.86	0.99				1	0.405**	0.188*	0.126‡	0.131‡
Innovative Perf.	3.62	0.66					1	0.366**	0.510**	0.294**
Production Perf.	3.89	0.56						1	0.478**	0.318**
Market Perf.	3.90	0.69							1	0.459**
Financial Perf.	3.27	0.91								1

****:** Correlation is significant at the 0.01 level; ***:** at the 0.05 level; **‡:** at the 0.1 level.

Table 5: Goodness of fit indices

Goodness of fit indices	Construct	Reference value
χ^2 / degree of freedom	1.791	$1< \chi^2 / df <5$
CFI (Comparative Fit Index)	0.970	0.95<CFI<1
NFI (Normed Fit Index)	0.934	0.90<NFI<1
RFI (Relative Fit Index)	0.926	0.90<RFI<1
IFI (Incremental Fit Index)	0.970	0.95<IFI<1
TLI (Tucker-Lewis Fit Index)	0.966	0.95<TLI<1
RMSEA (Root Mean Square Error)	0.066	RMSEA<0.08

Table 6: Structural model path coefficients

Hypothesis		Path	Standardized Path Estimate	p-value	Result
H1	a	Organizational Inn. – Product Inn.	-0.102	0.444	Not Supported
	b	Organizational Inn. – Process Inn.	0.698	<0.01	Supported
	c	Organizational Inn. – Marketing Inn.	0.662	<0.01	Supported
H2		Process Inn. – Product Inn.	0.506	<0.01	Supported
H3		Marketing Inn. – Product Inn.	0.499	<0.01	Supported
H4	a	Organizational Inn. – Innovative Per.	0.537	<0.01	Supported
	b	Product Inn. – Innovative Per.	0.431	0.018	Supported
	c	Process Inn. – Innovative Per.	0.210	0.206	Not Supported
	d	Marketing Inn. – Innovative Per.	0.344	0.037	Supported
H5	a	Innovative Per. – Market Per.	0.386	<0.01	Supported
	b	Innovative Per. – Production Per.	0.432	<0.01	Supported
H6	a	Production Per. – Market Per.	0.401	<0.01	Supported
	b	Production Per. – Financial Per.	0.083	0.418	Not Supported
H7		Market Per. – Financial Per.	0.517	<0.01	Supported

APPENDIX – Measurement of Variables

Product Innovation Measures

To what extent were the product innovations implemented in your organization in the last three years related to the following kinds of activities? (Five -point scales ranging from 1= 'not implemented', 2= 'imitated from national markets', 3= 'imitated from international markets, 4= 'current products were improved', 5= 'original product innovations were implemented')

Q#	Variables	Mean	Std. Dev.
1	Increasing manufacturing quality in components and materials of current products	3.19	1.25
2	Decreasing manufacturing cost in components and materials of current products	3.22	1.23
3	Developing newness for current products leading to improved ease of use for customers and to improved customer satisfaction.	3.10	1.41
4	Developing new products with technical specifications and functionalities totally differing from the current ones.	2.72	1.57
5	Developing new products with components and materials totally differing from the current ones.	2.50	1.52

Process Innovation Measures

To what extent were the following kinds of process innovations implemented in your organization in the last three years? (Five-point scales ranging from 1= 'not implemented', 2= 'imitated from national markets', 3= 'imitated from international markets, 4= 'current processes were improved', 5= 'original process innovations were implemented')

Q#	Variables	Mean	Std. Dev.
1	Determining and eliminating non value adding activities in production processes.	3.01	1.34
2	Decreasing variable cost components in manufacturing processes, techniques, machinery and software.	2.99	1.32
3	Increasing output quality in manufacturing processes, techniques, machinery and software.	3.14	1.24
4	Determining and eliminating non value adding activities in delivery related processes.	2.75	1.41
5	Decreasing variable cost and/or increasing delivery speed in delivery related logistics processes.	2.57	1.43

Marketing Innovation Measures

To what extent were the following kinds of market innovations implemented in your organization in the last three years? (Five-point scales ranging from 1= 'not implemented', 2= 'imitated from national markets', 3= 'imitated from international markets, 4= 'current marketing practices were improved', 5= 'original marketing innovations were implemented')

Q#	Variables	Mean	Std. Dev.
1	Renewing the design of the current and/or new products through changes such as in appearance, packaging, shape and volume without changing their basic technical and functional features.	2.63	1.50
2	Renewing the distribution channels without changing the logistics processes related to the delivery of the product.	2.32	1.42
3	Renewing the product promotion techniques employed for the promotion of the current and/or new products.	2.38	1.43
4	Renewing the product pricing techniques employed for the pricing of the current and/or new products.	2.69	1.42

5	Renewing general marketing management activities	2.76	1.41

Organizational Innovation Measures

To what extent were the following organizational innovation items implemented in your organization in the last three years? (Five-point scales ranging from 1= 'not implemented', 2= 'imitated from national markets', 3= 'imitated from international markets, 4= 'current organizational practices were improved', 5= 'original organizational innovations were implemented')

Q#	Variables	Mean	Std. Dev.
1	Renewing the routines, procedures and processes employed to execute firm activities in innovative manner.	3.29	1.24
2	Renewing the supply chain management system.	2.75	1.39
3	Renewing the production and quality management systems.	3.31	1.20
4	Renewing the human resources management system.	2.76	1.40
5	Renewing the in-firm management information system and information sharing practice.	3.21	1.26
6	Renewing the organization structure to facilitate teamwork.	2.99	1.39
7	Renewing the organization structure to facilitate coordination between different functions such as marketing and manufacturing.	2.93	1.38
8	Renewing the organization structure to facilitate project type organization.	2.47	1.46
9	Renewing the organizational structure to facilitate strategic partnerships and long-term business collaborations.	2.07	1.37

Innovative Performance Measures

How would you rate the level of achievement of the following innovative performance items in your organization in the last three years compared to the previous years? (Five-point scales ranging from 1= 'very unsuccessful' to 5= 'very successful')

Q#	Variables	Mean	Std. Dev.
1	Ability to introduce new products and services to the market before competitors.	3.57	0.88
2	Percentage of new products in the existing product portfolio.	3.65	0.85
3	Number of new product and service projects.	3.74	0.83
4	Innovations introduced for work processes and methods.	3.73	0.90
5	Quality of new products and services introduced.	4.02	0.74
6	Number of innovations under intellectual property protection.	2.97	1.14
7	Renewing the administrative system and the mind set in line with firm's environment.	3.57	0.92

Production Performance Measures

How would you rate the level of achievement of the following production performance items in your organization in the last three years compared to the previous years? (Five-point scales ranging from 1= 'very unsuccessful' to 5= 'very successful')

Q#	Variables	Mean	Std. Dev.
1	Conformance quality.	4.05	0.70
2	Production cost.	3.73	0.84
3	Production (volume) flexibility.	3.84	0.71
4	Production and delivery speed.	3.96	0.77

Market Performance Measures

How would you rate the level of achievement of the following market performance items in your organization in the last three years compared to the previous years? (Five-point scales ranging from 1= 'very unsuccessful' to 5= 'very successful')

Q#	Variables	Mean	Std. Dev.
1	Customer satisfaction.	4.08	0.69
2	Total sales.	3.88	0.92
3	Market share.	3.72	0.90

Financial Performance Measures

How would you rate the level of achievement of the following financial performance items in your organization in the last three years compared to the previous years? (Five-point scales ranging from 1= 'very unsuccessful' to 5= 'very successful')

Q#	Variables	Mean	Std. Dev.
1	Return on sales (profit/total sales).	3.33	1.01
2	Return on assets (profit/total assets).	3.25	0.98
3	General profitability of the firm.	3.21	1.05
4	Cash flow excluding investments.	3.27	0.96