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DOCTORAL THESIS SUMMARY

CONTRIBUTIONS REGARDING OPERATIONS STRATEGY IMPROVEMENT IN INDUSTRIAL FIRMS

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KEYWORDS:

Industrial firm, strategic management, operations strategy, competitive priorities, competitive advantage, financial performance

INTRODUCTION

The doctoral thesis belongs to the scientific domain of Operations Management which represents a domain with powerful traditions, but also one with great actual relevancy among managerial domains. Having its origins in the Scientific Management of F. Taylor and Gilbreth from the beginning of the 20th century, this domain showed a constant evolution after the 2nd World War. Initially referred to as Industrial Management or Production Management, the domain was mostly preoccupied with mathematical optimization problems of production processes (Chopra et al., 2004). Starting with the '80s the domain went through a radical change, the pure mathematical view was changed to a more managerial perspective involving the usage of both quantitative and non-quantitative instruments (Craighead & Meredith, 2008). This radical change of thinking also includes the fact that academics recognized that the production of goods should not be treated separately from offering services (industrial firms being involved in both areas), and that managerial tools and instrument and the dominant logic of Production Management can also be applied to services. Consequently, by including services in this field of study, the name of Production Management (PM) was slowly changed to Production and Operations Management (POM), and later only referred to as Operations Management (OM).

This doctoral thesis looks at a specific domain of Operations Management, referred to as *operations strategy*. Operations strategy concerns the strategic vision of all activities and processes (operations) in a firm, which have the final purpose of delivering products and services to the customer by transforming the input resources of the system. Starting from the seminal work of professor Skinner (1969) of the Harvard Business School, the concept of operations strategy received a distinguished attention from OM researchers worldwide. The work of Skinner proved to be an inspiring source for many theoretical and practical studies and articles. A major part of theoretical and empirical studies in this domain have the objective to outline that operations strategy could represent a differentiating factor in market competition (de ex. Keong Leong & Ward, 1995, Jalham & Abdelkader, 2006, Corbett, 2008). While the majority of the articles and studies are based on the investigation of the link between operations strategy and firm competitiveness (presented in *Section 4.6.* of our study), there is only a limited number of articles which establish a clear relationship between operations strategy and the financial performances of firms. Similarly, the analysis of literature showed us that articles studying operations strategy in Eastern Europe or other developing regions, or specifically of Romanian firms, is even more scarce.

Consequently, the *main objective* of our study is to illustrate the role of operations strategy by which it can contribute to increasing competitveness and financial performances of industrial

firms. We follow our main objective by offering a greater attention to the operations strategy of Romanian industrial firms.

Specific objectives, subordinated to the main objective of the doctoral thesis, are the following:

1. To emphasize the relevance of the research topic from a macroeconomic perspective, by outlining the contribution of the industrial sector to the economic growth of Romania in the last two decades;
2. To offer a theoretic foundation of the unit of analysis of this doctoral research: the industrial firm;
3. To offer a theoretic foundation of concepts regarding the operations strategy of industrial firms;
4. Emphasizing the relationship between operations strategy and competitiveness and the business performances of the firm;
5. To offer a theoretic foundation of concepts regarding operations strategy improvement;
6. To offer a comparative analysis of operations strategy and methods of operations strategy improvement in Romanian industrial firms, by comparing their practices to an international sample;
7. To offer and empirically validate a managerial decision tool which is able to contribute to the improvement of economic efficiency of operations strategy improvement.

In order to reach the objectives of our study, we apply analysis of relevant literature (objectives 2, 3, 4 and 5), statistic and econometric analysis (objective 1) and survey research, and the analysis of data obtained (objectives 6 and 7). The analysis of scientific literature includes the review of relevant articles, studies and works from Romania and from internationally recognized journals and research centers. The statistic and econometric analysis regarding the industrial sector of Romania is based on data obtained from the National Statistical Institute of Romania, as well as data from the Tempo database administered by the same institution.

The survey based research in Romania was carried out by the author of this thesis in 2010, and with the help of the data gathered we were able to join an international research network specialized in this domain (*IMSS – International Manufacturing Strategy Survey*). Members of this

research group have access to similar data from different countries worldwide[1]. Consequently, in this thesis we were able to comapare data regarding Romanian industrial firms to an international sample of comapnies. International data not only represents a good benchmark of Romanian operations strategies and practices, but it also helps to increase the generalizability of the results. Data used in this research was analyzed with the help of SPSS software, version 17.0.

The doctoral thesis contains six chapters followed by conclusions and further research possibilities. The six chapters can be grouped into three main parts. The first part conteins the first two chapters, and focuses on offering a theoretical foundation for the concepts regarding the industrial firm, and to stress their important role in the national economy. The second part contains chapters 3-5, all of which focus on a specific aspect of operations strategy. The last part, chapter 6, contains the empirical research and aims to analyze operations strategies of Romanian industrial firms, and to emphasize the relationship between operations strategy and firm competitiveness, including the financial performances of the industrial firm. Similarly, in this part we offer and empirically test a managerial instrument, known as the importance-performance matrix, which according to our conception can contribute to the efficiency of operations strategy improvement and – implicitly – to the improvement of financial performances of the industrial firm.

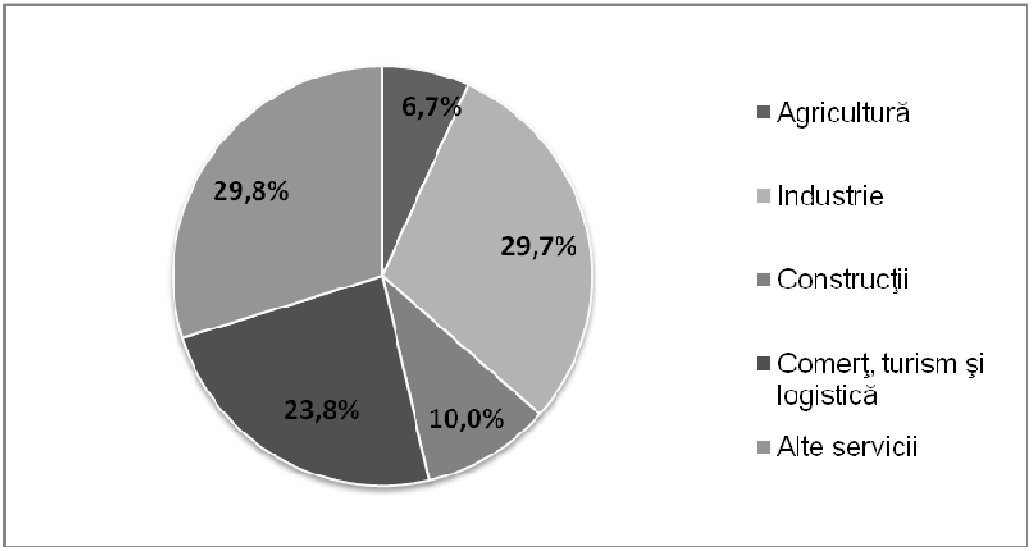
[1] Belgium, Brazil, Canada, China, South Korea, Denmark, Switzerland, Estonia, Germany, Hungary, Ireland, Italy, Japan, United Kingdom, Mexico, Netherlands, Portugal, Spain, USA, Taiwan

1. THE INDUSTRIAL SECTOR – A BASIC COMPONENT OF THE NATIONAL ECONOMY

The first chapter of the thesis is concerned with Romanian industrial firms from a macroeconomic point of view. Besides presenting the evolution of the Romanian industrial sector in the last two decades and its current state, the main objective of this part of our study is to emphasise and quantify the influence of industrial firms on the economic growth of Romania. Besides a detailed analysis of statistical data regarding the Romanian industrial sector, in this chapter we estimate an econometric model of linear regression to quantify the effect of the evolution of industrial producion on the economic growth of the country.

The industrial sector is frequently thought of as the "motor" of a national economy and economic growth, being a sector which produces vital resources for other sectors of the national economy (Naghi & Szász, 2010). From another perspective, the industrial sector represent a sector with major influence on economic growth, having a contribution of almost 30% to the gross domestic product of Romania. The structure of Romanian GDP in 2010 on industrial categories is presented on *Figure 1*.

Figure 1. The contribution of industrial sectors to Romanian GDP (2010)

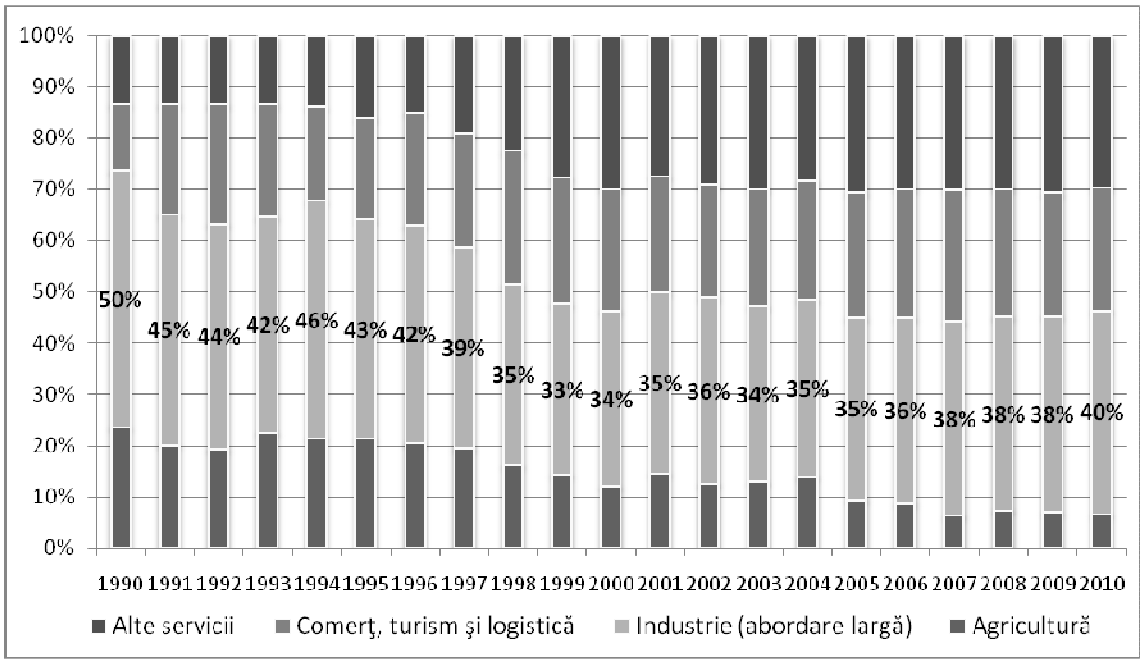


(Source: own calculations based on data provided by insse.ro[2])

[2] Buletin Statistic Lunar, aprilie 2011 (provisional data)

In a broad perspective, the industrial sector (including the construction industry) has a major share in Romanian GDP, with a contribution of almost 40%. This share showed a strong decreasing tendency in the 1990-2000 period and a slow but steady increase in the new millenium. The significant share of 40% and the slow increasing trend in the last period emphasize that industrial performances represent a factor of major influence on general performances of the national economy. The evolution of different sectors' contribution to the Romanian GDP in tha last 20 years is illustrated on *Figure 2*.

Figure 2. Evolution of industrial contribuition to the Romanian GDP (1990-2010)

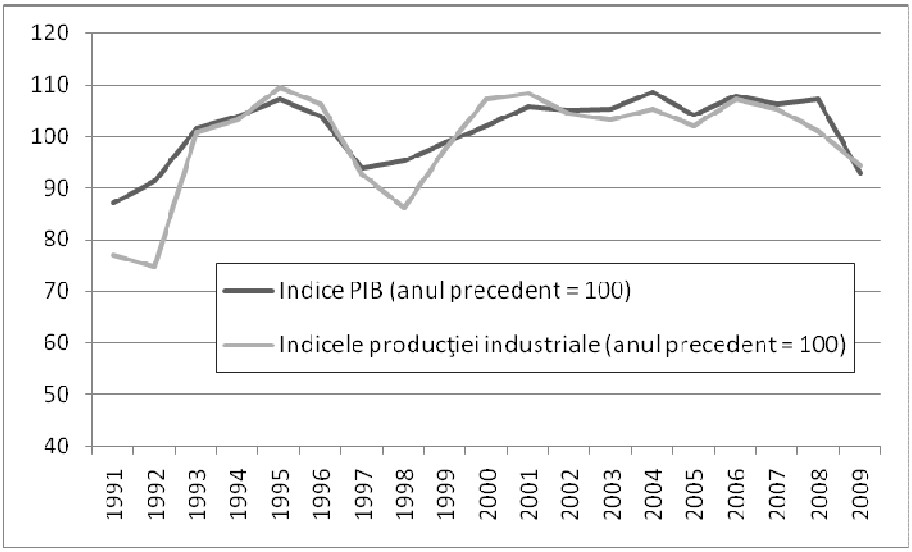


(Source: TEMPO-Online database of the National Institute of Statistics)

To emphasize the role of industrial production in national economic growth we will analyze the relationship between the increase of industrial production, on one hand, and economic groeth of Romania, on the other hand (Mereuţă, 2004). This relationship is shown on **Error! Reference source not found.**, which contains both the evolution of the industrial production index, and the evolution of Romanian GDP index. A strong relationship can be observed between these two variables with a high value of the correlation coefficient[3] of 0,905355. This strong correlation was also identified by other studies in this field (Mereuţă, 2004; Mereuţă, 2007).

[3] The coefficient of correlation is a statistical tool which measures the extent of linear dependance between two variables. A values close to 1 represents a strong linear correlation between the two variables, while the value of one represents the perfect correltion (Ramanathan, 2003: 50).

Figure 3. The (co)evolution of the industrial production index and the GDP index



(Source: TEMPO-Online database of the National Institute of Statistics)

To quantify the effect of industrial production on economic growth, we estimate and aim to validate an econometric model, by building a simple linear regression model[4]. In the model defined (Naghi & Szász, 2010):

- GDP index (*dPIB*) represents the dependent variable,
- Industrial production index (*IPI*) represents the independent variable,
- In this simplified model we do not aim to focus on the contribution of other economic sectors on the evolution of national economic performances, our main objective being only to emphasize that the industrial sector represents an important influencing factor of economic growth.

Having the two variables (*dPIB* and *IPI*), the relationship between them can be formulated as follows:

$$dPIB_t = f(IPI_t) \quad (1)$$

Assuming that relation (1) is not deterministic, bur stohastic, the linear relationship (1) can be represented as follows:

$$dPIB_t = \alpha \cdot dIPI_t + \beta + \varepsilon_t \quad (2)$$

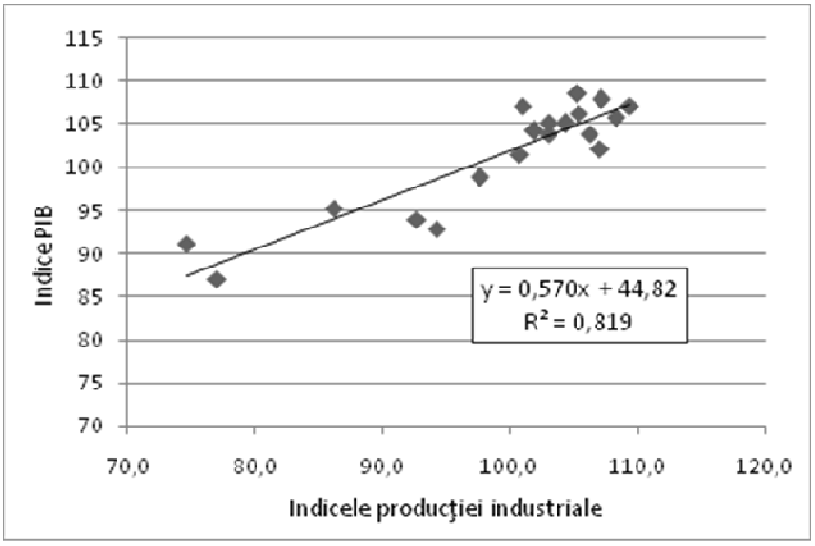
[4] To define the regression model we used „gretl (GNU Regression, Econometric and Time-series Library)" software, downloaded form the site: http://gretl.sourceforge.net/ on 10.09.2008.

In relationship (2), α and β represent the parameters of the regression equation, while ε_t is the stochastic error term, the residual variable which quantifies the influence of all the factors excluded from the model (agriculture, commercial services, other services etc.) on the explained variable (Maddala, 2001). To determine the exact value of the regression equation parameters the *OLS – Ordinary Least Squares method* was used. Using statistical data from the 1990-2009 period, the ordinary least squares method estimates the following regression parameters:

$$dPIB_t = 0{,}57042 \cdot dIPI_t + 44{,}8232 + \varepsilon_t \qquad (3)$$

The linear relationship, conforming to the model defined, is illustrated on **Error! Reference source not found.**.

Figure 4. Linear relationship between the Industrial Production Index and the GDP index



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In order to validate the regression model (3) we carried out following tests (Andrei & Bourbonnais, 2008: 44): test for normality of the residual variable ε_t, test of the homoskedasticity hypothesis, test of the autocorrelation hypothesis of the error term ε_t. Results of these tests indicated that the model defined is valid.

In conclusion, results of our analysis showed that there is a strong relationship between the evolution of industrial production in Romania and the country's economic growth. Even if this traditional sector in the Romanian economic history shows an almost constantly decreasing tendency in the last 20 years regarding the procentual contribution to the Romanian GDP – from 44% in 1990 to 27% in 2009 –, the industrial sector continues to represent a motor of economic

groeth. This statement is also strengthened by the results of our linear regression model, which establishes a linear relationship between the evolution of the industrial sector and the evolution of general economic performances, measured by the GDP index. Even if national economies are becoming worldwide more and more dominated by services (Spohrer & Maglio, 2008; Ostrom et al., 2010), the industrial sector remains a fundamental sector which is responsible for producing those material goods which are necessary for an efficient operation of other sectors of the national economy. Hence, even if service firms are usually dominating the market, the industrial sector remains an important influencing ractor of economic growth.

2. INDUSTRIAL FIRMS – FUNDAMENTAL COMPONENTS OF THE INDUSTRIAL SECTOR

To offer a clear image regarding different aspects of the industrial firms, and its production and operations function, we have to begin with a clear definition and with the offering of detailed fundamentation of the concept of economic firm. In economic literature we can find a series of different definitions and perspectives on the concept of economic firm, without having at the moment a single definition which would totally cover all the aspects of this concept.

The firm can be defined as being an economic and social entity, which produces goods and services for the market, in order to satisfy consumer needs and to obtain profits. It represent the basic component of one or more national economies and is composed of a group of individuals that are organized according to specific legal, economic and technological requirements, and carry out work processes by using specific resources (Crăciun et al., 2003).

To advance towards a better understanding of the different aspects of the main concept of this chapter, and to analyse its evolution in economic history, we will review in the following different theories form the domain of the *Economics of the Firm.* We will review the most important theories of the firm and analyze them and compare them with each other. Theories of the firm represent a relatively nem area in economic theory which offers many research possibilities. These theories do not have a consensus neither regarding the definition of the firm, nor the classification of them (Chikán, 2008: 67). In the following we define classic theories of the firm in which the firm appears as a "black box", and modern theories of the firm which analyze the concept of the firm as a complex system.

This chapter presents and critically analyzes following theories of the firm:

- the neoclassical theory
- the principal-agent theory
- the transaction costs theory
- Behavioural theory of the firm
- Resource-based theory of the firm
- Stakeholder theory of the firm

The concept of industrial firm

Industrial firms, as a specific form of firms, can be defined as being the basic units, building blocks of a national economy, which posess material, human and financial resources used by a group of individuals to carry out production processes based on efficiency and profitability criteria, to produce material goods, and offer industrial services which satisfy the needs of customers on internal and/or external markets (Bărbulescu, 2000: 19). This chapter presents two main perspectives regarding industrial firms: systemic view and functional view.

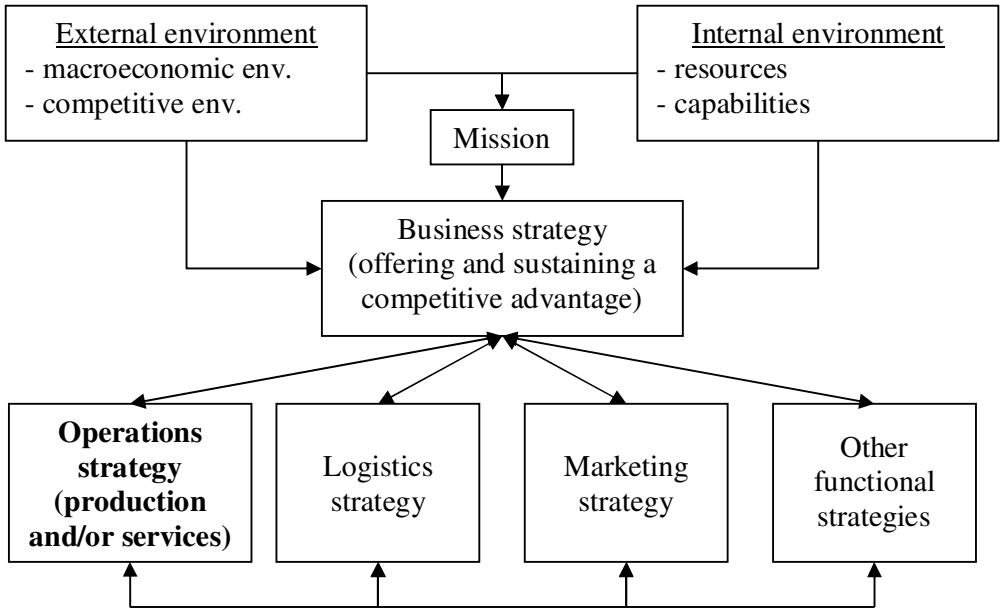
Based on the functional view we also present the process view of the firm, which is frequently mentioned as being the basic view underlying production and operations management theories. Based on this view, the processes of the firm represent the unit of analysis that offer a more relevant view regarding all the activities of the firm, then the functional view of the firm. Processes are nor limited to functional departments and may use resources belonging to several functional units (Krajewski et al., 2007: 5). In this view, the industrial firms represents a chain of these processes, having the main objective to create value for the customer and to efficiently coordinate all the processes.

3. STRATEGY AND STRATEGIC MANAGEMENT OF INDUSTRIAL FIRMS

This chapter reviews the basic concepts of strategic management which are necessary to arrive to the central concept of this thesis, operations strategy. Based on the literature strategy represents a plan of concrete actions and methods of resource allocations, carried out in order to reach the long term objectives of the firm. Strategic management represents a complex decisional and managerial process, which – through a detailed analysis of internal and external factors – has the purpoes of formulating, implementing and controlling the strategy of the firm. A well formulated strategy and an efficient strategic management represents a force that can offer a sustainable competitive advantage for the firm.

The figure below summarizes all the concepts presented in this chapter, starting from the influential factors of firm strategy and arriving at the functional strategies of the firm, including operations strategy – the central concept of this study.

Figure 5. The complex relationship of concepts detailed in thi chapter



(Source: adapted from Chikán & Demeter, 2003: 21)

4. STRATEGIA OPERAŢIONALĂ A ÎNTREPRINDERILOR INDUSTRIALE

This chapter deals with the central issue of this study – *operations strategy* of the firm –, which has the main purpose to contribute to the achievement of goals set by top management both on organizational and functional levels.

By definition, *operation strategy* represents the means by which the operations function implements the firm's corporate strategy and helps to build a customer-driven firm and offers resources and capabilities which help reaching a sustainable competitive advantage on the market (Krajewski et al., 2007: 46).

Since the early article of Skinner (1969) it has been widely recognized that operations strategy can largely contribute to the competitiveness and to the business performance of a company. Several studies have been focusing on the relationship between operations strategy and the competitiveness and business performance of a company (e.g. Swamidass and Newell, 1987, Kim and Arnold, 1992, Ketoviki and Schroeder, 2004).

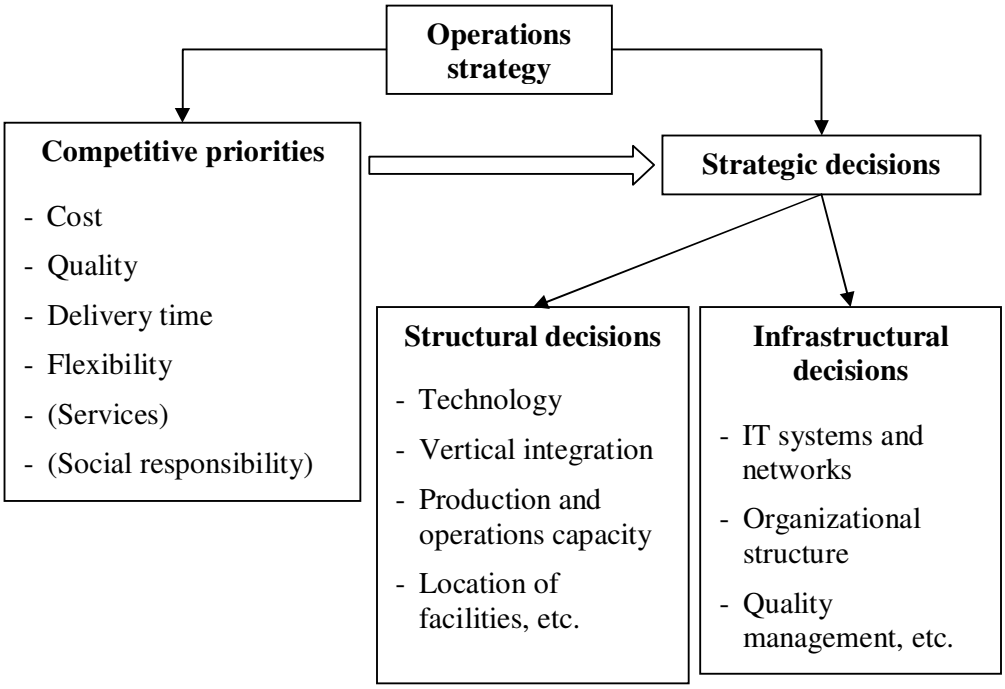
The majority of researchers state that a proper definition of the concept of operations strategy shoul contain at least two elements: competitive priorities, and strategic decision areas. *Competitive priorities* represent a set of objectives followed by the operations function of the firm, that are identified in concordance with the major objectives of organizational and business strategies. *Decision areas* represent those directions of action which have the main purpose to fulfill the objectives set by operations strategy, in particular, and by organizational strategy, in general (Hayes & Wheelwrigth, 1984; Christiansen et al., 2003: 1164; Martin-Pena & Diaz-Garrido, 2008: 457).

In our research we approach operations strategy from the perspective of manufacturing competitive priorities. Manufacturing competitive priorities are elements of manufacturing strategy content, and represent performance objectives in which a company needs to develop its capabilities (Hayes and Pisano, 1994) and enhance its performance in order to successfully compete on the marketplace, given its overall business strategy (Miller and Roth, 1994). Manufacturing competitive priorities need to support the firm's business-level strategic objectives in order to enhance its competitiveness and business performance (Hayes and Wheelwright, 1984, Brown and Blackmon, 2005). Manufacturing competitive priorities traditionally include cost, quality, delivery and flexibility dimensions (e.g. Hayes and Wheelwright, 1984). The list of priorities has been

subsequently completed with such elements as after-sales services (Miller and Roth, 1994), innovation capabilities (Ward et al., 1996, Noble, 1997) or environmental performance (de Burgos Jimenez and Cespedes Lorente, 2001, Johansson and Winroth, 2010). Enhancing performance on one or more of these competitive capabilities may lead to an increase in the firm's business performance. Consequently, our research aims to investigate the relationship between operations competitive priorities and business performance, adopting an importance-performance approach as described later on.

The main concepts presented in this chapter are summarized on the figure below.

Figure 6. Elementele componente ale strategiei de producţie



(Source: author's illustration)

5. OPERATIONS STRATEGY IMPROVEMENT IN INDUSTRIAL FIRMS

An important stream of manufacturing strategy literature – that related to the concept of production competence - has been intensively analyzing the relationship between manufacturing capabilities and business performance of the company.

The construct of production competence was first introduced by Cleveland et al. (1989) who defined it as being the "manufacturing's overall ability to support and prosecute the business strategy". They identified nine different competitive areas as elements of production competence and found that it has a positive influence on business performance. Their results suggest that companies that perform well in strategically important areas are able to deliver higher performances than their competitors.

In his work, Vickery (1991) refined the previous construct further strengthening the relationship between production competence and business performance, but argued that the concept of production competence does not consider the "match or fit of the firm's business strategy to its external, competitive environment".

Apart from this drawback, several empirical studies were carried out using larger samples of company data and a better operationalization of production competence measures in order to strengthen the validity of the theoretical construct (Vickery et al., 1993, Vickery et al., 1994, Dröge et al., 1994, Narasimhan and Jayaram, 1998).

In reviewing production competence theory, Safizadeh et al. (2000) argue that production competence measures combine performances in different manufacturing areas (i.e. manufacturing capabilities) with the strategic importance of those factors (i.e. competitive priorities). However, based on the results of an empirical study of 144 manufacturing plants, they conclude that relationship between production competence and business performance is dependent upon the manufacturing process choice and may only hold in case of batch processes.

In a more recent article Schmenner and Vastag (2006) critically revised the work of Cleveland et al. (1989) and Safizadeh et al. (2000), and attempted to align previous findings on production competence. Relying on a large dataset from two different databases they found that production competence positively relates to business performance irrespectively of manufacturing process choice of companies. In assessing business performance, however, they did not rely on financial performance measures and used instead such operational performance measures as product

quality or delivery speed, arguing that these represent good proxies for financial and business performance measurement.

Based on our review of the production competence literature we draw following conclusions which are considered to be relevant for our research:

- Manufacturing strategy literature strongly supports the relationship between production competence and business performance;
- Generally, within the construct of production competence, interrelation/fit between the strategic importance and the achieved performance of different competitive factors is investigated;
- Importance of competitive factors is usually derived from the business strategy of the company, while actual performance is usually compared to the performance of main competitors or to a desired performance level;

As importance of competitive priorities is determined based on general business strategy, we argue that production competence literature places a greater emphasis on competitors, while market requirements and especially the "sound of customers" receives less attention - a critique also formulated by Vickery (1991). Coates and McDermott (2002), for example, directly define competence as "a bundle of aptitudes, skills, and technologies that the firm performs better than its competitors". A possible reason for the sharper focus on competitors is that business strategies are usually defined based on Porter's classic work (Porter, 1985) where companies are preoccupied with producing at lower costs or differentiating themselves relative to competitors. However, in case fit between customer requirements and business strategy is not assured, production competence theory may lead to less effective strategic decisions in manufacturing and lower business performance.

Therefore, setting manufacturing competitive priorities in accordance with market requirements should be one of the most important tasks of manufacturing strategy. Manufacturing companies have to deliver what customers want and, additionally, deliver it in a better way than competitors do. This reasoning can be related to the order winner and order qualifier framework (Hill, 1993) according to which companies have to outperform competitors in respect of those factors which are the most highly valued by its customers. Thereby, a company can gain customer orders on the market, increase its market share (da Silveira, 2005) and achieve higher business performance.

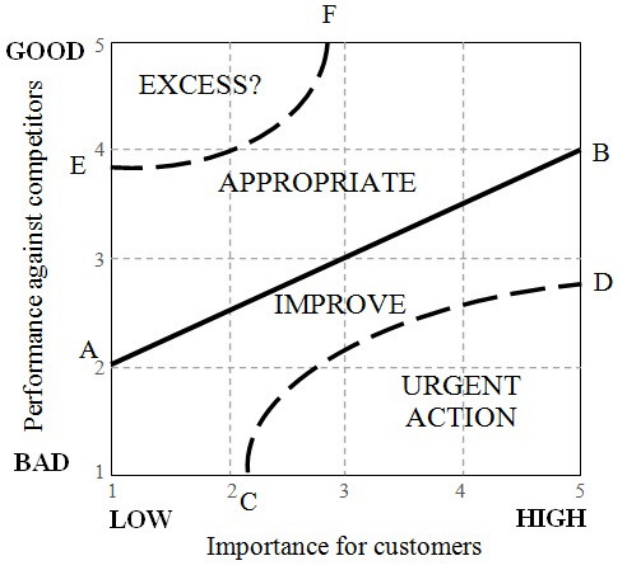
6. EMPIRICAL STUDY OF OPERATIONS STRATEGY IMPROVEMENT IN INDUSTRIAL FIRMS

6.1. RESEARCH DESIGN AND METHODOLOGY

According to the conclusions drawn from our review of production competence literature, an importance-performance analysis (IPA) framework is adopted in our study. In this framework manufacturing competitive priorities are determined in respect of both their importance for customers and the current performance of the company against its competitors.

IPA has been first introduced by Martilla and James (1977) and, since then, has been widely used mainly in quality management, service management and marketing research, usually focusing on customer satisfaction issues (Bacon, 2003, Tontini and Picolo, 2010). IPA applications in the manufacturing and operations management literature have been relatively scarce. An exception is Slack's (1994) article who proposed a modified importance-performance matrix in order to prioritize the improvement of different competitive factors. However, the connection between importance-performance matrix positions and business performance was not included in his study. Figure 1 shows a slightly altered importance-performance matrix, where the two variables – performance against competitors and importance for customers – are measured on a 5-point scale (proportionally converting Slack's 9-point scale to a 5-point scale), according to the measurement used in the questionnaire applied in our research.

Figure 7. The importance-performance matrix



(Source: Slack, 1994)

Slack's importance-performance matrix identifies four zones (Slack, 1994):

- "*Urgent action*" zone (delimited by the curve CD) refers to competitive factors that are very important for customers (i.e. order winners) but the company's performance on these factors is lagging behind competitors;
- In the „*Improve*" zone (delimited by the curve CD and the diagonal AB) the lag between importance and performance is smaller but still exists;
- The „*Appropriate*" zone (delimited by the curve EF and the diagonal AB) is the ideal place, where performance against competitors slightly exceeds importance;
- Finally, in the „*Excess?*" zone (delimited by curve EF) the company provides an even higher performance than required by customers.

Apart from some methodological papers (e.g. Hajirezaie and Husseini, 2009) IPA applications and their empirical investigations in the manufacturing strategy literature are generally scarce. Therefore, our paper aims to demonstrate the usefulness of the importance-performance matrix in strategic manufacturing decisions by linking it to business performance indicators. We formulate our research hypotheses based on the zoning of the importance-performance matrix.

- *H1: Manufacturing companies having competitive factors positioned in the "Urgent action" zone are able to deliver lower business performances.*
- *H2: The "Excess?" zone of the matrix does not imply higher business performances than the "Appropriate" zone.*
- *H3: Manufacturing companies that can be positioned in the "Appropriate" zone in the matrix are able to earn higher business results than companies from the "Improve" zone of the matrix.*

Research methodology

For the empirical analysis data from the fifth round of the International Manufacturing Strategy Survey (IMSS V) are used. The IMSS V database includes information about 750 manufacturing companies, belonging to the ISIC Rev. 4, Division 25-30 (manufacture of fabricated metal products, machinery and equipment). IMSS is carried out by an international network of researchers focusing on manufacturing strategies, practices and performance of organizations from all around the world. The fifth round of the survey was carried out during year 2009 in 19 countries. The current version of the database includes responses from 21 countries using data from two additional countries collected during the first half of 2010. In each country mainly medium and large sized manufacturing companies were included in the database reaching an average company size of 2095 employees. Global response rate, calculated as the ratio between the numbers of

collected and distributed questionnaires, equals 16.8%.Clearly, the advantage of using such a large database, which covers a wide geographical area, is that researchers can formulate more general hypotheses and draw more generalizable conclusions.

Table 1. IMSS V sample composition by countries

No.	Country	No. Of companies	Pct. Of total	No.	Country	No. Of companies	Pct. Of total
1.	BELGIUM	36	4,8%	12.	KOREA	41	5.5%
2.	BRAZIL	37	4,9%	13.	MEXICO	17	2.3%
3.	CANADA	19	2,5%	14.	NETHERLANDS	51	6.8%
4.	CHINA	59	7,9%	15.	PORTUGAL	10	1.3%
5.	DENMARK	18	2,4%	16.	ROMANIA	31	4.1%
6.	ESTONIA	27	3,6%	17.	SPAIN	40	5.3%
7.	GERMANY	38	5,1%	18.	SWITZERLAND	31	4.1%
8.	HUNGARY	71	9.5%	19.	TAIWAN	31	4.1%
9.	IRELAND	6	0.8%	20.	UK	30	4.0%
10.	ITALY	56	7.5%	21.	USA	73	9.7%
11.	JAPAN	28	3.7%	TOTAL		750	100.0%

(Source: IMSS database)

Based on IMSS V questionnaire data, importance for customers of different competitive factors is derived from the order-winner framework: respondents had to indicate on a 5-point scale the importance of 12 different competitive priorities in winning the orders of major customers (1=not important, 5=very important). On the other hand, respondents had to assess on a 5-point scale how their current performance compares with main competitors in several manufacturing-related areas (1=much worse, 3=equal, 5=much better). To be able to plot importance and performance of different competitive factors in the same matrix, manufacturing performance measures included in the questionnaire were grouped according to the 12 identified competitive priorities (*Table 1*).

Table 2 – Aligning importance and performance measures

Importance measures (competitive priorities)	**Performance measures (manufacturing performance)**
Lower selling prices	Unit manufacturing cost Procurement costs Manufacturing overhead costs
Superior product design and quality	Product quality and reliability
Superior conformance to customer specifications	Manufacturing conformance
More dependable deliveries	Delivery reliability
Faster deliveries	Delivery speed Manufacturing lead time
Superior customer service	Customer service and support
Wider product range	Product customization ability Mix flexibility
Offer new products more frequently	Time to market
Offer products that are more innovative	Product innovativeness
Greater order size flexibility	Volume flexibility
Environmentally sound products and processes	Environmental performance
Committed social responsibility	Social reputation

Business performance is measured in terms of four different performance indicators: sales, market share, return on sales (ROS) and return on investment (ROI). Business performances were also measured in the form of perceptual measures: respondents were asked to rate their performances relative to their main competitors on a 5-point scale (1=much worse, 3=equal, 5=much better).

Further on, geometrical analysis is applied in order to determine the boundaries of different zones in the importance-performance matrix, on the one hand, and to quantify positions and distances of competitive factors in the matrix, on the other hand. In testing our hypotheses variance analysis (ANOVA) is used to determine differences in respect of the selected business performance measures between the zones of the matrix.

Analysis and findings

In order to test our research hypotheses, we selected those manufacturing companies that had complete data regarding both the importance and the performance of different competitive factors. After this process 490 firms remained in the sample, 260 being filtered out due to missing or incomplete data.

To investigate our first research hypothesis the 490 manufacturing firms were grouped into two distinct categories:

- *Urgent action needed*: manufacturing companies having at least one competitive priority in the "Urgent action" zone of the importance-performance matrix (total 193 firms),
- *No urgent action needed*: manufacturing companies having no competitive factor in the "Urgent action" zone of the matrix (total 297 firms).

Exact boundaries of the "Urgent action" zone (see Figure 1, curve CD) were determined based on Slack's delimitation (Slack, 1994). Then, the two categories were developed. For example, if a firm had at least one competitive priority rated as important for customers (receiving 4 points on the 5-point scale, a possible order winner), but its performance lagged behind competitors (receiving 2 points or even less), it was included in the "Urgent action needed" group (Note that on Figure 1 point (4,2) falls inside the area delimited by curve CD).

Having the two categories described above, variance analysis was applied in order to determine significant differences in respect of the selected business performance indicators. Results are summarized in Table 3.

Table 3 – Business performance indicators of the two groups of companies

	"Urgent action needed"	*"No urgent action needed"*	Sig.
Sales	3.08	3.50	0.000*
Market share	3.13	3.47	0.000*
ROS	2.98	3.37	0.000*
ROI	3.02	3.32	0.000*

** The mean difference is significant at the 0.05 level*

Results of the analysis suggest that *H1* can be accepted. Companies having at least one competitive factor in the "Urgent action" zone realize significantly lower business performances relative to their competitors than those who possess competitive factors exclusively outside of the "Urgent action" zone.

To test our second research hypothesis (*H2*) we first eliminated all manufacturing companies that had at least one competitive factor in the "Urgent action" zone of the matrix. By this step we eliminated the distorting effect of the "Urgent action" zone which has a negative influence

on the firms' business performance. The remaining 297 companies were then grouped into the following two categories:

- *Excess performance*: manufacturing companies having at least one competitive priority in the "Excess?" zone of the importance-performance matrix (total 115 firms),
- *No excess performance*: manufacturing companies having no competitive factor in the "Excess?" zone of the importance-performance matrix (total 182 firms).

A similar logic was applied as in the previous case to classify companies into the two groups described above. A company having at least one factor positioned, for example, in point (1,4) in *Figure 1* – i.e. a factor rated not important for customers, but performance being higher than that of main competitors – was included in the "Excess performance" category. Based on the two categories described above, variance analysis was applied in order to determine significant differences in respect of the selected business performance indicators. Results are summarized in *Table 4*.

Table 4 – Business performance indicators of the two groups of companies

	"Excess performance"	*"No excess performance"*	Sig.
Sales	3.56	3.46	0.295
Market share	3.52	3.43	0.412
ROS	3.44	3.33	0.255
ROI	3.40	3.27	0.188

Results of the analysis confirm *H2*. Manufacturing companies positioning at least one competitive priority in the "Excess?" zone of the matrix are not able to harvest higher financial benefits than those who are positioned in the "Appropriate" (or even in the "Improve") zone of the matrix. Thus, outperforming competitors in less important competitive factors for customers does not imply significantly higher business performance.

To test our third research hypothesis (*H3*) manufacturing companies that had at least one competitive factor in the "Urgent action" zone of the matrix were, again, filtered out. Then, for the remaining 297 companies the following two categories were developed:

- *Overall appropriate:* the average position of all competitive factors of these companies falls in the "Appropriate" zone of the importance-performance matrix (total 215 firms),

- *Overall improve:* the average position of all competitive factors of these companies falls in the "Improve" zone of the matrix (total 82 firms).

To determine the average position of all competitive factors of a company, the distance of each competitive factor from the diagonal of the matrix (line AB in *Figure 1*) had to be determined. To calculate these distances, geometrical analysis was applied. In a coordinate system in which the lower left corner of the importance matrix has the coordinates (1,1), while the upper right corner receives coordinates (5,5), the equation of the diagonal AB can be computed using the standard straight-line equation that passes through 2 different points. In our case points A(1,2) and B(5,4) were used. This is represented by equation (1).

$$\text{AB: } x - 2y + 3 = 0 \qquad (1)$$

Using the point-line distance formula, the distance (*Dist*) from the diagonal AB of the matrix of any competitive factor with the coordinates (*x0, y0*) is given by equation (2).

$$\text{Dist} = \frac{|x_0 - 2y_0 + 3|}{\sqrt{1^2 + 2^2}} \qquad (2)$$

In case the average distance of competitive factors falls below the diagonal AB of the matrix, the average distance measure (*Dist*) is multiplied by -1 in order to differentiate between positive (above the diagonal) and negative (below the diagonal) distances. Positive distances correspond to the "Appropriate" zone, while negative ones correspond to the "Improve" zone of the matrix. Using equations (1) and (2) the average position of each company was determined, and, accordingly, "Overall appropriate" and "Overall improve" categories were developed. Having these two categories, variance analysis was applied in order to determine significant differences in respect of business performance indicators. Results are summarized in *Table 5*.

Table 5 – Business performance indicators of the two groups of companies

	"Overall appropriate"	*"Overall improve"*	Sig.
Sales	3.62	3.19	0.000*
Market share	3.60	3.13	0.000*
ROS	3.49	3.08	0.000*
ROI	3.43	3.06	0.000*

** The mean difference is significant at the 0.05 level*

Results of the analysis indicate that *H3* is also confirmed. The diagonal of the importance-performance matrix, which separates the "Appropriate" and "Improve" zones of the matrix, also separates better and worse business performances, even if we eliminate the distorting effect of the "Urgent action" zone of the matrix. This confirms our expectations that companies who make efforts to increase their performances on competitive factors that are positioned in the "Improve" zone of the matrix will probably enhance their general business performances in respect of sales, market share, return on sales and return on investments.

Discussion and conclusion

The analysis of the empirical data presented above supports the general connection between operations strategy and business performance. Improving performances on different manufacturing competitive factors accordingly to the logic of the importance-performance matrix can contribute to an increase in the firm's business performance.

First, results of our analysis suggest that the "Urgent action" zone of the matrix has to be avoided. Factors in this zone are the most critical to improve. Manufacturing companies that are able to increase performances in those competitive dimensions which currently fall in the "Urgent action" zone of the matrix will significantly increase their business performance.

After avoiding the "Urgent action" zone of the matrix decision makers should aim to improve performances in respect of those factors which are positioned in the "Improve" zone of the matrix. However, investing too many resources in those competitive priorities which are considered less important factors by the customers does not necessarily lead to higher business performance. If the importance of that competitive factor is not expected to increase in the future, managers should try to reallocate resources invested in the "Excess?" zone of the matrix towards improving factors from the "Urgent action" and "Improve" zones.

Consequently, managerial implications of our research are clear; first, decision makers of manufacturing companies need to assess importance for customers of different competitive factors, and improve performances accordingly. Having a multitude of competitive factors, the zoning of the importance-performance matrix can help managers to prioritize between improvement tasks, concentrating on the most urgent ones. Managers should aim to improve manufacturing by "shifting" competitive priorities towards the "Appropriate" zone of the matrix, thereby being able to increase the business performance of the company.

From a theoretical point of view the most important contribution of our paper to existing literature is that it links manufacturing competitive priorities to company-level business performance measures, using an importance-performance analysis approach. To the best of our knowledge, this research represents the first broad empirical analysis of the importance-performance matrix in manufacturing strategy literature, and it demonstrates its usefulness and efficiency by linking the logic of the matrix to business performance measures.

CONCLUSION AND FURTHER RESEARCH

The subject of this doctoral research is part of the domain of operations management, and it deals with a specific topic within this field – the operations strategy. Based on solid theoretical foundations, the main objective of this study was to emphasize the contribution of operations strategy to the competitiveness of the firm and its financial performances.

The first chapter had the main objective of emphasizing the relevance of the research topic and the importance of studying industrial firms. Consequently, this chapter offers a macroeconomic view of industrial firms, presenting the evolution of the industrial sector of Romania in the 1990-2009 period. The last section of this chapter presents a linear regression model which aims to demonstrate the importance of the industrial sector, which represents a major influencing factor of economic growth.

After presenting the macroeconomic relevance of the research topic, *the second chapter* turns to a microeconomic view, offering a theoretical founding for the unit of analysis of this research – the industrial firm.

Starting with a broad view, *the third chapter* presents the main elements of corporate strategy and other strategic management concepts. This chapter emphasizes the role of operations strategy, as a functional strategy, in the system of strategies of an industrial firm, arguing that its main purpose is to create and sustain a competitive advantage on the market.

The forth chapter defines and analyzes the concept of operations strategy of industrial firms, arriving to the main conclusion that operations strategy can not be treated separately from corporate strategy, and it has to support the strategic objectives defined on corporate level. This chapter identifies the set of competitive priorities as being the connection between corporate and operations strategy. This connection and interdependence of operations and corporate strategy represents the premise of the fact that operations strategy may become a major force in creating a sustainable competitive advantage for the firm.

The *fifth chapter* deals with the concepts of economic efficiency and operations strategy improvement, as well as the connection between these two concepts. The main objective of operations strategy improvement is to increase the competitiveness of the firm, and this broad objective can be broken down into several objectives, which aim to improve performances on one or more categories of competitive priorities, like production costs, quality of products and processes, flexibility, reducing delivery time or increasing the level of services offered.

The last chapter contains the empirical research of the doctoral thesis. The analysis of the empirical data presented above supports the general connection between manufacturing strategy and business performance. Improving performances on different manufacturing competitive factors accordingly to the logic of the importance-performance matrix can contribute to an increase in the firm's business performance.

First, results of our analysis suggest that the "Urgent action" zone of the matrix has to be avoided. Factors in this zone are the most critical to improve. Manufacturing companies that are able to increase performances in those competitive dimensions which currently fall in the "Urgent action" zone of the matrix will significantly increase their business performance.

After avoiding the "Urgent action" zone of the matrix decision makers should aim to improve performances in respect of those factors which are positioned in the "Improve" zone of the matrix. However, investing too many resources in those competitive priorities which are considered less important factors by the customers does not necessarily lead to higher business performance. If the importance of that competitive factor is not expected to increase in the future, managers should try to reallocate resources invested in the "Excess?" zone of the matrix towards improving factors from the "Urgent action" and "Improve" zones.

From a theoretical point of view the most important contribution of our study to existing literature is that it links competitive priorities to company-level business performance measures, using an importance-performance analysis approach. To the best of our knowledge, this research represents the first broad empirical analysis of the importance-performance matrix in manufacturing strategy literature, and it demonstrates its usefulness and efficiency by linking the logic of the matrix to business performance measures.

Consequently, our empirical results show that by using the importance-performance matrix in the strategic decision making process in operations management the industrial firm can improve its financial performance indicators, and – implicitly – its competitiveness.

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