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Doctoral Dissertation

Linking Manufacturing Strategy Process and Manufacturing Performance: The role of formalized strategic planning, internal communication and leadership practices

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A mi hermana, sin ti este trabajo no habría sido posible.

"Y nuestros recuerdos se atan
prisioneros a la 'Mujer Muerta',
al Hacho, a la Virgen de África,
a los crepúsculos del Estrecho,
a la nostalgia de unos besos"

Elma

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ABSTRACT

It is generally accepted that manufacturing strategy is a competitive weapon, as it acts in support of the overall strategy direction of the global business. However, there is a dearth of researching on manufacturing strategy process, in particular, the linkage between manufacturing strategy formulation and manufacturing strategy implementation, in spite of being identified as the second pillar stone of manufacturing strategy. Therefore, this thesis aims to expand knowledge on manufacturing strategy process, exploring its implication on operational performance. A comprehensive approach was developed through three empirical studies addressing factors that may reinforce manufacturing strategy process and how it may influence several activities related to exploration and exploitation orientations.

The first study examines manufacturing strategy process as a single activity. In particular, it focuses on the linkage between manufacturing strategy formalization and manufacturing strategy implementation, considering the potential moderating role of shop-floor communication. On the one hand, findings reveal that the existence of a formal strategic planning ensures manufacturing strategy implementation, as it offers support for strategic business objectives and the basis for trading off and selecting options. On the other hand, our finding shows the relevant role of feedback and instructive communication practices on manufacturing strategy process. They both help to convey strategy planning and goals to shop-floor operators, as well as to pass on information on the shop floor, leading to strategic embeddedness to adopt manufacturing strategy successfully and prompt adaptation to changes. The second study analyzes how several leadership practices used at the shop-floor level may exhibit or inhibit manufacturing strategy implementation, leading to higher or lower operational performance. The findings enhance the idea that the lack of managers' skills (e.g., leadership) is one of the main failures in manufacturing strategy implementation. Our findings show that the use of non-coercive leadership practices mitigate the negative impact of centralized structure in manufacturing firms and improve operational performance. This limits the negatively effects on manufacturing strategy implementation due to problems in communication, employees' participation and motivation.

Nevertheless, the negative effects of coercive leadership practices on manufacturing strategy implementation results in negative influence on operational performance, as they foster organizational rigidity and contribute to expand a hostile work environment, which results in inhibiting internal communication and boosting employees' turnover. The third study presents how manufacturing strategy formalization fosters exploitation orientation within manufacturing firms, identifying it as an antecedent of new technology anticipation. This research study also examines the implications of new technology anticipation on effective process implementation, which is stronger if manufacturing strategy formalization comes into play. New technology anticipation mitigates risks related to the adoption of new processes and manufacturing strategy formalization supports to exploit the existing resources and competences and, explore new ones in parallel. Additionally, it shows the importance of instructive communication as one of drivers to assimilate and exploit new technology anticipation.

This thesis contributes to strategic and operations management fields thought providing valuable insights for academics, employers, practitioners and, even employees. Our findings highlight the positive link of manufacturing strategy formalization to manufacturing strategy implementation, and the added value of human resources, in particular, internal communication and leadership practices on manufacturing strategy process. This research enhances the understanding of how manufacturing strategy process is strengthened, and in what way it fosters organizational ambidexterity, conferring a competitive position upon manufacturing firms.

RESUMEN

La estrategia manufacturera ha sido identificada como un arma competitiva, ya que ofrece dirección y apoyo en la toma de decisiones empresarial. Sin embargo, existe un abandono de investigación sobre el proceso estratégico manufacturero, a pesar de ser identificado como el segundo pilar de la estrategia manufacturera. Por ello, esta tesis trata de profundizar en la comprensión de dicho proceso, explorando sus implicaciones en el desempeño operativo. A través de tres estudios empíricos se analiza en profundidad los factores que pueden reforzar la relación entre las dos actividades principales que conforman el proceso estratégico: la formulación y la adopción de la estrategia manufacturera, remarcando la importancia de la formalización del plan estratégico. Asimismo, se analiza la influencia del proceso manufacturero en las actividades de explotación y de exploración dentro de la empresa manufacturera.

Más concretamente, el primer estudio se centra en analizar el proceso estratégico manufacturero como una sola actividad, destacando los beneficios de la formalización del plan estratégico sobre la adopción de la estrategia manufacturera, y la necesidad de la comunicación a nivel de planta en dicho proceso. Los resultados revelan que el plan estratégico es un factor clave para la adopción de la estrategia manufacturera, dado que su formalización, además de ser el principal apoyo para la toma de decisiones, ayuda a la coordinación de los diferentes procesos y áreas funcionales dentro de la planta. Asimismo, los resultados muestran que prácticas de comunicación como la retroalimentación y la instrucción a los empleados permiten transmitir los objetivos y planes estratégicos a los operadores y entre ellos mismos, conduciendo a la integración estratégica necesaria para adoptar la estrategia de fabricación con éxito.

El segundo estudio analiza cómo varias prácticas de liderazgo utilizadas diariamente en la planta pueden asegurar o limitar la implementación de la estrategia manufacturera, afectando al rendimiento operativo. Los resultados realzan la idea de que la ausencia de habilidades de dirección, como el liderazgo, es uno de los principales obstáculos para la adopción de la estrategia de manufacturera. Además, revelan que el uso de prácticas de liderazgo no

coercitivas mitiga el impacto negativo de la estructura centralizada en las empresas manufactureras, mejorando el rendimiento operativo. Asimismo, dichas prácticas limitan los efectos negativos en la adopción de la estrategia manufacturera debido a los problemas de comunicación, participación y motivación de los empleados. Por el contrario, los efectos negativos de las prácticas de liderazgo coercitivas en la implementación de la estrategia de fabricación tienen una influencia negativa en el rendimiento operativo, ya que fomentan la rigidez organizativa y contribuyen a expandir un entorno de trabajo hostil, provocando una inhibición de la comunicación interna y un aumento en la rotación de los empleados.

El tercer estudio se centra en el análisis de la formalización de la estrategia manufacturera sobre las actividades de explotación y de exploración de las empresas manufactureras. Por un lado, los resultados revelan que la formalización de la estrategia manufacturera establece las bases para el desarrollo de las capacidades relacionadas sobre la anticipación de las nuevas tecnologías. Por otro lado, muestran que la anticipación de nuevas tecnologías mitiga los riesgos relacionados con la adopción de nuevos procesos, y que la formalización de la estrategia de fabricación permite tanto explotar los recursos y competencias existentes como explorar nuevos recursos y competencias. Finalmente, se comprueba la importancia de la instrucción a los empleados como una práctica de comunicación que ayuda a la asimilación del conocimiento relacionado a la anticipación de la nueva tecnología y su posterior explotación.

Esta tesis contribuye al campo de la gestión empresarial, proporcionando información valiosa para académicos, empresarios y empleados. Los hallazgos obtenidos resaltan el vínculo positivo que existe entre la formalización y la adopción de la estrategia manufacturera. Además, se pone en relieve el papel significativo que juega el capital humano en el proceso estratégico manufacturero.

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Chapter 1

INTRODUCTION

Manufacturing industries worldwide are dealing with a new era of intense global competition. This increased competition has led to a search for a greater understanding of how to develop competitive capabilities and distinctive competences within manufacturing firms in order to secure their long-term survival and compete effectively in global markets (Chatha and Butt, 2015).

To achieve a competitive advantage, manufacturing firms put their efforts into linking manufacturing strategy to corporate strategy (Skinner, 1969). When this does not occur, firms' production systems may become non-competitive, costly and highly time consuming (Dangayach and Deshmukh, 2001). In this dynamic and competitive environment, it is increasingly important for companies to draft clear and coherent manufacturing strategies and achieve a greater understanding of what factors determine the adoption of successful manufacturing strategies, which support long-term business goals (Chatha and Butt, 2015; Manyika et al., 2012). Hence, manufacturing strategy is worthy of research and needs special attention.

It is generally accepted that manufacturing strategy is a competitive weapon, as it is the exploitation of certain properties of the manufacturing function (Skinner, 1969). It is also seen as a coordinated approach which ensures consistency between functional capabilities and policies for success in the marketplace (Hill, 1987). Manufacturing strategy must act in support of the overall strategic direction of the business, conferring a competitive advantage upon manufacturing firms (Cox and Blackstone, 1998). It is clear that manufacturing strategy plays a significant role within firms, especially in operations management (Dangayach and Deshmukh, 2001). Nevertheless, manufacturing strategy is an arduous undertaking, both in terms of what composes manufacturing strategy and how it should be developed and formulated (Adamides and Pomonis, 2009;

Da Silveira and Sousa, 2010). Therefore, this thesis focuses on expanding knowledge on manufacturing strategy.

Manufacturing strategy has been categorized into content and process. The former refers to the strategic choices in process and infrastructures, particularly manufacturing capabilities, strategic choices, best practices and performance, which differ from firm to firm. The latter refers to the design, development and implementation of the manufacturing strategy (Minor et al., 1994). Far more research has been carried out on manufacturing strategy content than manufacturing strategy process (Chatha and Butt, 2015). The related literature highlights a lack of academic attention to understanding the manufacturing strategy process and the linkage between its two main activities (manufacturing strategy formulation and manufacturing strategy implementation) (Crittenden and Crittenden, 2008; Leonardi, 2015). In spite of being identified as the second pillar of manufacturing strategy, manufacturing strategy process only represents 15 per cent of the publications in the manufacturing strategy literature (Chatha and Butt, 2015). Thus, there would appear to be a significant gap in the knowledge base at a time when the emergence of China, India, Southeast Asia and Brazil as manufacturing powers has dramatically reshaped competition in the manufacturing industry, challenging manufacturing industry leaders in North America and Europe (Chatha and Butt, 2015).

Manufacturing strategy process comprises two activities: manufacturing strategy formulation and manufacturing strategy implementation. Manufacturing strategy formulation is seen as a planning mechanism to provide support for strategic business objectives and to achieve a competitive advantage (Kohtamäki et al., 2012). Several researchers emphasize that formulation is a key success factor in implementation and advocate linking the strategy formulation to implementation in order to improve operational performance and, in turn, achieve a competitive position (Gimbert et al., 2010; Leonardi, 2015).

At present, there is significant controversy as to the extent to which the manufacturing strategy process should be formalized (Elbanna et al., 2016). Some researchers suggest that formalized strategic planning can result in a failing strategy implementation, because it makes the strategy process and decision-making inflexible (Giraudeau, 2008; Mintzberg, 1994). However, others

claim that firms with formalized strategy planning are more efficient, given that it provides a roadmap for effective manufacturing strategy implementation (Elbanna et al., 2016). These mixed results underline the need to analyse and offer empirical evidence in this respect.

Manufacturing strategy implementation refers to the adoption of a manufacturing strategy and is seen as a significant determinant of operational performance. Both researchers and practitioners agree that the real benefit of a strategy comes from its implementation (Kazmi, 2008). However, it is nowadays a source of frustration in most firms as, despite having a great strategy, the execution fails (Jagoda and Kiridena, 2015). This underlines the need to identify and examine what factors influence and ensure manufacturing strategy implementation.

Kay (1993) claimed that the adoption of a generic strategy does not confer competitive advantage upon firms, as it is imitable by competitors. According to the resource-based view (RBV) (Barney, 1991), competitive advantage stems from the presence of a unique combination of valuable, rare, inimitable and non-substitutable resources. Firms must be able to transform and combine their resources in such a way that they are inimitable by competitors. In doing so, firms comprise three kinds of resource: physical, human and organizational, whose combination is determinant in the achievement of a competitive position in the marketplace (Chowdhury et al., 2014; Grant, 1999). This thesis considers the manufacturing strategy process as an organizational resource that allows firms to organize resources (physical, human, etc.) in order to achieve and retain competitive advantage. In particular, this thesis recognizes the importance of human resources at the shop-floor level in the manufacturing strategy process, as innovative manufacturing practices and sophisticated technologies developed in manufacturing firms have little or no influence on operational performance unless human resources form a consistent socio-technical system (Davis et al., 2014).

Following the dynamic capability approach proposed by Teece et al. (1997), this study highlights the importance of manufacturing strategy formalization as a coordination mechanism helping firms not only to integrate, build and reconfigure internal and external competences to address rapidly changing environments, but

also to coordinate people and other resources, a typical feature of organizational routines (Nelson and Winter, 1982).

Finally, this thesis emphasizes the remarkable role of the manufacturing strategy process to reach a competitive position in the marketplace as a consequence of the development of exploration and exploitation orientations (organizational ambidexterity). The related literature mostly focuses on analysing the effects of the manufacturing strategy process on exploitation orientation, such as operational functions and competitive performance priorities (Acur et al., 2003; Jagoda and Kiridena, 2015; Machuca et al., 2011). Nevertheless, this thesis shows that the manufacturing strategy process influences not only exploitation orientation, but also exploration orientation within firms. It provides the external and internal knowledge, organizational structures, strategy and contexts required by organizational ambidexterity, which allows firms to exploit the existing resources and competences, and explore new ones in parallel.

1.1. Research Objectives and Questions

This thesis aims at achieving greater knowledge on the manufacturing strategy process and exploring its implications for competitive operational performance. In this regard, we identify a lack of academic attention to the manufacturing strategy process, in particular the linkage between manufacturing strategy formulation and manufacturing strategy implementation (Elbanna et al., 2016; Gimbert et al., 2010). During this thesis, we pay special attention to the role of human resources as a driver for the manufacturing strategy process. Specifically, we examine how leadership and communication practices at shop-floor level are crucial in formulating and adopting the manufacturing strategy, in addition to their effects on operational performance. Leadership has been recognized as a key lever for manufacturing strategy implementation (Beer and Eisenstat, 2000) and for operational performance (Jing and Avery, 2008), however the effect of leadership on manufacturing strategy implementation and operational performance has not deeply explored yet (Yukl, 2012). Most leadership theories only describe leadership styles or identify traits of effective leadership, analysing theirs effects on people, policies and the implementation of

practices (Avolio, 2007), but little is known about leadership in action. This knowledge gap is highly relevant for managers adopting a manufacturing strategy, given that at present they feel frustrated because they are ignorant of why the manufacturing strategy implementation fails (Jagoda and Kiridena, 2015).

In brief, the overall objective of this thesis is to achieve a greater understanding of the manufacturing strategy process, identifying what factors may reinforce it and how it may influence several activities related to exploration and exploitation orientations. This general goal is met by addressing the following research questions that cover different aspects within the manufacturing firm.

RQ1: Does manufacturing strategy formalization enhance manufacturing strategy implementation?

To date, few research studies have analysed the whole manufacturing process as a single activity (Leonardi, 2015), linking manufacturing strategy formulation to implementation (Crittenden and Crittenden, 2008), when it is clear that manufacturing strategy formulation and manufacturing strategy implementation are really not two separate activities (Dangayach and Deshmukh, 2001).

Moreover, as noted above, there is no consensus on the extent to which strategic planning should be formalized or on the real benefits of formal strategic planning. On the one hand, formalization in strategy planning is seen as a source of competitive advantage, given that it provides a roadmap for effective manufacturing strategy implementation (Elbanna et al., 2016). On the other hand, formalization makes the strategy process and decision-making inflexible, resulting in failing manufacturing strategy implementation (Giraudeau, 2008; Mintzberg, 1994).

Therefore, Chapter 2 sheds new light on the relationship between manufacturing planning/formalization and manufacturing strategy implementation, considering the whole process as a single activity and not as individual separate phases, given that strategy formulation is seen as a planning mechanism to provide support for strategic business objectives and it helps firms achieve a competitive position, guiding the decision-making process and

providing the basis for trading off and selecting options (Acur et al., 2003). In fact, manufacturing strategy formulation is seen as key to success in manufacturing strategy implementation, and the linkages between these two activities confers a competitive advantage upon firms (Gimbert et al., 2010). Among the reasons for this is that manufacturing strategy formalization is defined as a formal guideline and coordination mechanism to integrate, control, update and respond to the changing dynamic environment and focus on directing the firm towards effective implementation (Kohtamäki et al., 2012; Rudd et al., 2008).

RQ2: Do shop-floor communication practices strengthen manufacturing strategy process?

Montgomery (2008) emphasizes the need for a fluid and open process of planning to ensure that firms respond adequately to changes and implement strategies efficiently, given that an excessive formal strategic plan may introduce rigidity and encourage excessive bureaucracy, resulting in a dysfunctional process (Mintzberg, 1994; Olson et al., 2005). Although manufacturing strategy formalization (formal strategic planning) is seen as a source of knowledge that ensures coherence between operational decisions in order to ensure successful strategy implementation (Vänttinen and Pyhältö, 2009), such knowledge is not useful if it is not conveyed and updated (Rudd et al., 2008). In fact, the related literature has highlighted the lack of participation and involvement of all employees, particularly middle managers and shop-floor workers, as the main failure of manufacturing strategy implementation (Chaffey et al., 2009). Thus, this complex process needs effective communication.

Some research studies have emphasized the importance of communication and organizational learning in projects and strategy formulation, based on the communication flow between managers and supervisors, regardless of the shop-floor organizational level (Kim et al., 2012; Wei et al., 2011). However, little attention has been paid to the communication flow among employees themselves and plant supervisors and employees, despite such communication helping to identify problems and concentrate managers' attention on problems requiring their attention (Forza and Salvador, 2001). Shop-floor employees are familiar with the misalignment between existing products, services and technologies: hence they hold information about the problems in current operations (Wei et al., 2011).

Therefore, shop-floor communication practices facilitating work and knowledge transfer may be relevant in the manufacturing strategy process.

Chapter 2 reinforces the linkage between the two activities in the manufacturing strategy process. In particular, it emphasizes the role of manufacturing strategy formalization as a guideline and coordination mechanism which helps to integrate, control, update and respond to the changing dynamic environment and to focus on directing the firm towards effective manufacturing strategy implementation (Rudd et al., 2008).

On the other hand, Chapter 2 takes into consideration the mediating role of shop-floor communication in the manufacturing strategy process. This chapter focuses on four shop-floor communication practices: feedback, supervisor interaction facilitation, instructive communication and small-group problem solving. Among the reasons for analysing shop-floor communication are that middle managers have a better understanding of strategies (Mintzberg, 1994), their view is realistic, and they are responsible for creating meaning from messages provided by top managers (Wooldridge et al., 2008). In fact, some research studies have highlighted the need for their participation in the strategy process, since they are fully aware of strategic goals and plans (Chaffey et al., 2009). Therefore, they are the best organizational members to convey strategic planning to shop-floor operators, and to pass on information about what happens on the shop floor, encouraging them to work as a team and express their constructive opinions. Table 1.1 displays the hypotheses proposed in Chapter 2.

Table 1.1. Hypotheses proposed in Chapter 2

	Hypotheses
CHAPTER 2	H_1: There is a positive association between formal manufacturing strategic planning and manufacturing strategy implementation.
	H_2: Small-group problem solving will strengthen the relationship between manufacturing strategy formalization and manufacturing strategy implementation success.
	H_3: Supervisor interaction facilitation will strengthen the relationship between manufacturing strategy formalization and manufacturing strategy implementation success.
	H_4: Instructive communication will strengthen the relationship between manufacturing strategy formalization and manufacturing strategy implementation success.
	H_5: Feedback will strengthen the relationship between manufacturing strategy formalization and manufacturing strategy implementation success.

RQ3: How do leadership practices influence the relationship between manufacturing strategy implementation and operational performance?

It is generally accepted that manufacturing strategy implementation is crucial to achieve and sustain competitive advantage (Birasnav, 2014) and that the real benefit of strategy come from its implementation (Kazmi, 2008; Okumus, 2003). Nevertheless, it is an enigma nowadays, and a source of frustration in many firms (Jagoda and Kiridena, 2015). In this regard, both practitioners and researchers have emphasized that human capital, especially leadership, is a key factor for both manufacturing strategy implementation (Beer and Eisenstat, 2000; Youndt, Snell, Dean, and Lepak, 1996) and competitive operational performance (Jing and Avery, 2008; Kotter, 2001).

Over the years, several leadership models have been developed which describe different leadership styles and identify traits of effective leadership; however, none of them explains how to do it, proposing techniques or practices. According to Yukl (2012, p. 75), “to improve leadership theory and practice we need to know more about how much leadership behaviors are used, when they are used, how well they are used, why they are used, who uses them, the context for their use, and joint effects on different outcomes”. To fill this gap, Clawson (2009) developed a theoretical framework facilitating leadership practices, in

which managers and supervisors may enhance their leader presence within firms. No one has so far provided empirical evidence on the matter.

Most research efforts have been directed towards identifying effective leadership, as it is known that leadership styles or specific leadership traits influence people, policies and the implementation of practices (Avolio, 2007). However, little is known about leadership in action and, empirically, both leadership in practice and the extent to which leaders implement manufacturing strategies to improve operational performance have not yet been addressed (Speculand, 2014).

Chapter 3 addresses this research topic. Firstly, it brings a greater understanding of the theoretical framework provided by Clawson's leadership model in which he established that specific coercive and non-coercive practices can be executed by managers to obtain a specific response from employees. This chapter highlights the importance of leaders' influence on subordinates implicated in the daily implementation of policies and practices, such as plant supervisors and shop-floor operators (Gopal et al., 2014; Huy, 2011). Additionally, it offers empirical evidence on how specific coercive and non-coercive practices inhibit or promote manufacturing strategy implementation and operational performance. In this regard, the chapter shows that the use of such leadership practices may mitigate or not the negative impact of a centralized structure in manufacturing firms and improve operational performance (Sarros et al., 2002), limiting or promoting negative effects on the strategy process implementation due to problems in communication, and less employee participation and motivation (Kim and Shin, 2017). Table 1.2 shows the hypotheses proposed in Chapter 3.

Table 1.2. Hypotheses proposed in Chapter 3

	Hypotheses
CHAPTER 3	H_{1a}: Clear commands have a positive influence on operational performance.
	H_{1b}: The relationship between clear commands and operational performance is positively mediated by manufacturing strategy implementation.
	H_{2a}: Visible aggressive leadership behaviour practices have a negative influence on operational performance.
	H_{2b}: The relationship between visible aggressive leadership behaviour practices and operational performance is negatively mediated by manufacturing strategy implementation.
	H_{3a}: Conscious thought leadership practices have a positive influence on operational performance.
	H_{3b}: The relationship between conscious thought leadership practices and operational performance is positively mediated by manufacturing strategy implementation.
	H_{4a}: Unconscious thought leadership practices have a positive influence on operational performance.
	H_{4b}: The relationship between unconscious thought leadership practices and operational performance is positively mediated by manufacturing strategy implementation.

RQ4: Does manufacturing strategy formalization influence the anticipation of new technology and new process implementation?

Manufacturing firms continually improve and introduce new processes, methods, tools and technologies, because they believe that the development of new technologies is a factor in achieving reduced costs, improved flexibility, faster customer deliveries and improved quality (Tao et al., 2017). However, there is an emerging discussion about this association, as there are mixed results (Chung and Swink, 2009; Cordero et al., 2009).

Among the main reasons given for this is that technology alone does not offer a competitive advantage to manufacturing firms, because it is easily imitable by competitors who can acquire or develop it in the short run (Porter, 1985). Thus, manufacturing organizations have to be capable of transforming technology into a unique, rare and inimitable resource, fitting it with the product-process strategy (Barney, 1991). In other words, firms must be able to align the exploitation of existing competences and the exploration of new ones (organizational ambidexterity) (Salvador et al., 2014). This is a complex

competence to develop, given that it demands specific organizational structures, strategies and contexts (Alcaide-Muñoz and Gutiérrez-Guitérrez, 2017).

Chapter 4 sheds light on this research stream, identifying organizational structures as antecedents of new technology anticipation. At the same time, it shows that the association between organizational structures, such as manufacturing strategy formalization and new technology anticipation, is crucial to exploit knowledge related to new technology, resulting in effective process implementation. In fact, this chapter shows that the effect of new technology anticipation on effective process implementation is weak when manufacturing strategy formalization is neglected. Manufacturing strategy formalization as an information and coordination mechanism provides the organizational structures, strategies and contexts required in the development of organizational ambidexterity (Alcaide-Muñoz and Gutiérrez-Guitérrez, 2017). Therefore, it allows firms not only to develop both exploration and exploitation orientations (organizational ambidexterity), but also to align them.

Furthermore, this chapter takes into account human resources to exploit new technologies and so obtain effective process implementation. Firms must have the ability to acquire, assimilate and exploit both explicit and tacit knowledge (absorptive capacity) in order to achieve competitive advantage (Cohen and Levinthal, 2000). In this sense, on the one hand, manufacturing strategy formalization is clearly explicit knowledge, as it refers to formal strategic planning where the manufacturing strategies, mission and goals must be in writing. (Skinner, 1978). On the other hand, new technology anticipation involves the development of tacit knowledge (Finger et al., 2014). This chapter show that the shop-floor communication practice (instructive communication) is a good means of assimilating and exploiting knowledge, given that, in the related literature, it has been identified as one of the drivers for facilitating knowledge transfer (Kim et al., 2012). It allows adopters to acquire knowledge held by others (Kostava, 1999). The hypotheses proposed in Chapter 4 are in Table 1.3.

Table 1.3. Hypotheses proposed in Chapter 4

	Hypotheses
CHAPTER 4	H_1: Manufacturing strategy formalization positively influences the anticipation of new technology.
	H_2: Anticipation of new technology has positive effects on effective process implementation.
	H_3: The relationship between anticipation of new technology and effective process implementation is mediated by instructive communication.

1.2. Empirical approach

1.2.1. Data collection and sample

This thesis applies different analytical theoretical frameworks and methodologies to address the research questions posed. Our database comes from an international research project, the High Performance Manufacturing (HPM) project. The HPM project is a systematic international study of manufacturing plants initiated by Prof. Roger G. Schroeder and Prof. Barbara B. Flynn under the name World Class Manufacturing in 1989. The main purpose of the project is to evaluate critical success factors in operations management (Flynn et al., 1997). Hitherto there have been four rounds of the study. The first round focused on plant operation within the USA. The second round began in 1996 and covered a larger portion of the industrialized parts of the world, including countries such as the United Kingdom, Germany, Japan and Italy. The third round commenced in 2004 and encompassed ten countries. Finally, the most recent round commenced in 2012 and set out to cover 13 countries.

In our research study, we use the fourth round of this database. The database examines the relationship between firms' practices and performance, including manufacturing plants operating in the mechanical, electronics and automotive sectors around the world. In each country, a local HPM research team was charged with collecting data, selecting the plants, contacting them, distributing the questionnaires and assisting the respondents to ensure the reliability of the information gathered.

The plants were selected from a master list of manufacturing (i.e. Dun's Industrial Guide, JETRO database, etc.). Each local HPM research team had to

include an approximately equal number of plants that use advanced practices in their industries (i.e. world-class manufacturing plants) and traditional manufacturing units (i.e. not world-class manufacturing plants). Plants represent several parent corporations with at least 100 employees, ensuring that a sufficient number of managers and employees is available to complete the survey (Naor et al., 2010). At each plant, a pack of 23 questionnaires was distributed by individual visits or by mail to different respondents considered the best informed about the topic of each questionnaire, so the problem of common method bias is reduced.

Each questionnaire consists of perceptual scales and objective items. It includes a mix of item types and reversed scales to further reduce the possibility of common method variance. Although the official language used in the questionnaires is English, each local HPM research team translated them into the language of the participating country. After that, the questionnaire was back-translated into English by a different local HPM researcher to ensure accurate translation.

1.2.2. Measures and statistical treatment

In general, our study focuses on both world-class and not world-class manufacturing plants operating in the sectors mentioned above and located in Austria, Germany, China, Taiwan, Brazil, Finland, Italy, Israel, South Korea, Spain, Sweden, Vietnam and the United Kingdom.

The scales used in each project are based on the literature and have been previously used as measurement scales, in addition to being checked by experts and managers to validate their content. Therefore, our study employs scales used extensively and validated in past works as well as in the Operations Management (OM) literature.

This thesis draws from the following scales (see Table 1.4):

a) Manufacturing strategy formalization. The questionnaire included four items related to the strategy formalization concerning manufacturing strategy. These items are based on Skinner's (1978) scale, which describes formal strategic planning, where manufacturing strategies, mission and goals must be in writing. Furthermore, this must be routinely reviewed and updated. All the items have been used in all rounds (1, 2, 3 and 4) and answered by plant managers.

b) Manufacturing strategy implementation. The success of implementing the strategic plan involves plant management commitment engaged in the strategy implementation, a continuous improvement processes and the performance measures match clearly the goals of the plants (Acur et al., 2003; Elbanna et al., 2014). In this sense, the questionnaire included seven items related to the manufacturing strategy implementation, answered by plant management and plant supervisors. Both views give a real image of the plant, avoiding key informant bias (Flynn et al., 1994). In order to consider both views of the plant, we use an average index from plant supervisors and managers. Only the fourth questionnaire offers the plant supervisors' perspective; hence, this scale is relatively new.

c) Shop-floor communication. This is based on four communication practices: small group problem solving, supervisory interaction facilitation, employees' suggestions (implementation and feedback) and task-related training for employees, which have been analysed individually by several research studies (Abrahamsen and Häkansson, 2015; Kaye et al., 2014; Zeng et al., 2013). Zeng et al. (2013) identify these practices as shop-floor communication practices. Our studies use the same scales, except for feedback, given that Zeng et al. (2013) examine the impact of these practices on quality management. We therefore use another scale concerning feedback most linked to manufacturing strategy.

Small-group problem solving refers to a group of experts who are highly qualified and whose main task is to solve problems where they occur rather than being referred upwards in the hierarchy. This has been identified as a knowledge coordination and integrating mechanism (Zeng et al., 2013). This scale is answered by plant managers and is included in all questionnaires.

Supervisory interaction facilitation, called supervisor interaction facilitation in our study, relies on those activities which are promoted by the supervisor to make work flow easily, support workers in their tasks, help them understand the organizational common goals and mission and, in turn, create a positive work atmosphere. Plant supervisors answered this scale, and it appears in all rounds.

Task-related training for employees, labelled instructive communication in our study and the related literature, refers to any learning activity or training given to workers to improve their skills and thus improve work performance within

organizations (Chukwu, 2016). This scale is answered by plant supervisors and it is in all questionnaires except the first round.

Employees' suggestions—implementation and feedback, named feedback in our study, represents suggestions regarding problems and barriers in the implementation at the shop-floor organizational level (Zheng et al., 2013). This scale is answered by human resources managers and is included in all four rounds.

d) HPM leadership: This scale is based on Clawson's leadership model and comprises several leadership tools used at the plant level. Plant supervisors answered this scale and it is entirely novel; in fact, no empirical study has yet analysed this theoretical framework proposed by Clawson (2009).

e) Anticipation of new technology: This scale is based on Hayes and Wheelwright's (1984) definition as the extent to which a firm anticipates the new technologies that will be important to it in the future, acquires them and develops capabilities for implementing them, in advance of actual need. Recently, one research study conducted by Finger et al. (2014) has used and validated this scale. These questions are administered to process engineers, plant superintendents and plant managers, and have been used in all questionnaires.

f) Effective process implementation: This represents whether firms develop and implement new processes in an effective way. Some studies have shown that when firms adopt processes effectively, it results in process improvement and, in turn, operational performance improvement (Huang et al., 2008; Schroeder and Flynn, 2001). As in the preceding scale, this scale is answered by process engineers, plant superintendents and plant managers and has been previously used by Huang et al., (2008). All rounds include this scale.

g) Competitive performance (operational performance): The questionnaires provide several competitive performance priorities, but our study only focuses on the four commonly accepted competitive performance priorities—cost, quality, delivery and flexibility—which have been used in different research studies (Chen et al., 2004; Peng et al., 2008). Questions are answered by plant managers and are included in all rounds.

Table 1.4. Descriptive statistics of scales included in the HPM project questionnaire used in the thesis.

	Mean	Std. Dev.
Formulation of Manufacturing Strategy (Manufacturing Strategy Formalization)*		
Our plant has a formal manufacturing strategy process which results in a written mission, goals and strategies.	4.047	0.889
This plant has a manufacturing strategy which is put into writing.	3.997	0.897
Plant management routinely reviews and updates a long-range manufacturing strategy.	4.025	0.772
The plant follows an informal manufacturing strategy with no written strategy document	3.700	1.183
Implementation of Manufacturing Strategy: Plant Supervisors (Manufacturing Strategy Implementation)		
Plant management is engaged in the implementation of the manufacturing strategy.	4.045	0.673
The improvement programmes that we pursue to improve operations are based on our manufacturing strategy.	3.892	0.767
Improvement programmes are an essential element of our manufacturing strategy.	4.069	0.778
Changes to the manufacturing strategy are deployed to the entire manufacturing area.	3.812	0.797
The performance measures of the plant clearly reflect the goals of the plant.	3.856	0.884
What the strategy says and what we pursue on the shop floor are two different things.	3.707	1.228
We have a manufacturing strategy that is actively pursued.	3.909	0.782
Implementation of Manufacturing Strategy: Plant Managers (Manufacturing Strategy Implementation)		
Plant management is engaged in the implementation of the manufacturing strategy.	4.319	0.651
The improvement programmes that we pursue to improve operations are based on our manufacturing strategy.	4.046	0.731
Improvement programmes are an essential element of our manufacturing strategy.	4.312	0.712
Changes to the manufacturing strategy are deployed to the entire manufacturing area.	3.989	0.816
The performance measures of the plant clearly reflect the goals of the plant.	4.049	0.786
What the strategy says and what we pursue on the shop floor are two different things.	3.811	1.189
We have a manufacturing strategy that is actively pursued.	4.157	0.691
Small-Group Problem Solving		
During problem solving sessions, we make an effort to get all team members' opinions and ideas before making a decision.	4.038	0.730

Our plant forms teams to solve problems.	3.857	0.861
In the past three years, many problems have been solved through small group sessions.	3.732	0.918
Problem solving teams have helped improve manufacturing processes at the plant.	3.886	0.801
Employee teams are encouraged to try to solve their own problems as much as possible.	3.766	0.848
We don't use problem solving teams much in this plant.	3.804	1.241
Supervisory Interaction Facilitation		
Our supervisors encourage the people who work for them to work as a team.	4.185	0.785
Our supervisors encourage the people who work for them to exchange opinions and ideas.	4.120	0.748
Our supervisors frequently hold group meetings where the people who work for them can really discuss issues and share ideas.	3.894	0.910
Our supervisors rarely encourage us to get together to solve problems.	3.783	1.241
Employees' Suggestions—Implementation and Feedback (Feedback)		
Management takes all product and process improvement suggestions seriously.	3.971	0.781
We are encouraged to make suggestions to improve performance at this plant.	4.161	0.750
Management tells us why our suggestions are implemented or not used.	3.642	0.929
Many useful suggestions are implemented at this plant.	3.788	0.875
My suggestions are never taken seriously around here	4.045	1.065
Task-Related Training for Employees (Instructive Communication)		
Our plant workers receive training and development in workplace skills on a regular basis.	3.895	0.798
Management at this plant believes that continual training and upgrading of workers skills is important.	4.225	0.741
Employees at this plant believes that continual training and upgrading of employee skills is important.	3.692	0.795
Our workers regularly receive training to improve their skills.	3.850	0.787
Our employees are highly skilled in this plant.	3.974	0.721
HPM Leadership		
Clear commands	3.989	0.621
Threats (implied and explicit)	2.202	1,121
Manipulating	2.202	1.030
Coercion	2.064	1.045
Yelling	2.213	1.113

Data	3.983	0.674
Evidence	3.705	0.909
Careful listening	3.681	0.825
Debate	3.499	0.846
Analysis	3.809	0.731
Telling stories	2.734	1.107
Candour	3.826	0.744
Clarifying vision	3.648	0.790
Self-disclosing	2.903	0.997
Anticipation of New Technology		
We pursue long-range programmes in order to acquire manufacturing capabilities in advance of our needs.	3.623	0.981
We make an effort to anticipate the potential of new manufacturing practices and technologies.	3.976	0.767
Our plant stays on the leading edge of new technology in our industry.	3.627	0.966
We are constantly thinking of the next generation of manufacturing technology.	3.722	0.936
Effective Process Implementation		
We often fail to achieve the potential of new process technology.	3.285	1.077
Once a new process is working, we leave it alone.	3.412	1.178
We pay close attention to the organizational and skill changes needed for new processes.	3.841	0.869
We search for continued learning and improvement after the installation of new equipment.	4.189	0.677
Our processes are effectively developed and implemented.	3.872	0.752
Competitive Performance (Operational Performance) *"Please circle the number that indicates your opinion about how your plant compares to its competitors in its industry on a global basis."*		
Unit cost of manufacturing	3.327	0.934
Conformance to product specifications	3.995	0.718
On time delivery performance	3.894	0.801
Fast delivery	3.764	0.816
Flexibility to change product mix	3.876	0.788
Flexibility to change volume	3.767	0.819
Speed of new product introduction into the plant (development lead time)	3.533	0.875

*****Names used in our study

The statistical treatment and tools applied in each chapter of the thesis vary, hinging on the variables and topics that are examined. In general, the scales incorporated into the questionnaire suggest that our variables can be reflective indicators or formative indicators. In the related literature, a variable has to be treated as a reflective indicator when co-variation among measures is explained by variation in an underlying common latent factor (Bollen and Lennox, 1991). In contrast, when "the measures jointly influence the composite latent construct, and meaning emanates from the measures of the construct, in the sense that the full meaning of the composite latent construct is derived from its measures" (MacKenzie et al., 2005, p. 712), it has to be treated as a formative indicator.

In the case of latent construct models with reflective indicators, explanatory factor analysis (EFA) and confirmatory factor analysis (CFA) were performed to prove the constructs' reliability and to verify the validity of the measures (Nunnally, 1978). With regard to latent construct models with formative indicators, discriminant validity is assessed by testing the absence of collinearity among the items that make up the construct (Podsakoff et al., 2006). In this sense, a variance inflation factor (VIF) lower than five is a good indication of no multicollinearity problems (Judge et al., 1988).

1.3. Structure of the thesis

This thesis is structured in five chapters. The first chapter offers a general introduction and outlines the background of the manufacturing strategy process based on RBV, taking into account related frameworks such as organizational routines theory, dynamic capabilities and the organizational ambidexterity approach. Additionally, the main research questions of this thesis, the theoretical frameworks and the methodologies used throughout this research are presented. Chapter 2 addresses the emerging discussion on whether formal strategy planning helps to implement a strategy or makes decision-making inflexible, and how the strategy process can be strengthened by shop-floor communication. Chapter 3 recognizes the importance of leaders' influence over subordinates in the daily implementation of policies and practices. In doing so, it analyses how coercive and non-coercive practices may influence operational performance by

means of manufacturing strategy implementation. Chapter 4 emphasizes that technology does not by itself confer a competitive advantage upon manufacturing firms. Such an advantage concerning technology lies in the ability to anticipate competitors, to be the first to find or develop a new technology and implement it effectively. This chapter sheds light on the current paucity of literature on new technology anticipation, identifying manufacturing strategy formalization as an antecedent of new technology anticipation. Finally, Chapter 5 presents the overall conclusions, implications and future lines of research.

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Chapter 2

MANUFACTURING STRATEGY PROCESS: THE ROLE OF SHOP-FLOOR COMMUNICATION PRACTICES[1]

2.1. Introduction

It is well known that to remain competitive, firms must continually improve and introduce new processes, methods, tools and technologies; however, there is no unique successful strategy for this aim (Hill and Hill, 2009). For years, scholars have been trying to explain what environmental and organizational factors are behind the development of competitive manufacturing capabilities that allow firms to achieve a competitive position in the marketplace (Leonardi, 2015). However, less attention has been paid to the role that the strategic process plays in this and therefore, many questions remain open and unresolved.

In this paper, we focus on the manufacturing strategy process and analyze the relationship between planning/formulation and implementation of manufacturing strategy (Dangayach and Deshmukh, 2001). Strategy formulation is seen as a planning mechanism to provide support for strategic business objectives and it also helps firms achieve a competitive position, guiding the decision-making process and providing the basis for trading off and selecting options (Acur et al., 2003). Some scholars have found that formulation is key for success in strategy implementation and advocate linking strategy formulation to implementation in order to achieve a superior competitive position (Gimbert et al., 2010). This paper takes into consideration the degree of formalization of the planning process. Formalization in strategic planning is defined as a formal guideline and coordination mechanism to integrate, control, update and respond to the changing dynamic environment and to focus on directing the firm toward

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effective implementation (Rudd et al., 2008). Firms can develop formal or informal strategic plans to implement a strategy.

In this regard, there is no consensus on the extent to which strategic planning should be formalized or on the real benefits of formal strategic planning. On the one hand, formalization can improve business performance by providing a roadmap for effective implementation (Elbanna et al., 2016). On the other hand, some researchers suggest that formalized strategic planning can result in failing strategy implementation, because it makes the strategy process and decision-making inflexible (Mintzberg, 1994; Giraudeau, 2008).

The related literature on strategic planning and strategy implementation has analyzed these processes separately (Dangayach and Deshmukh 2001). However, strategy formulation and strategy implementation are not two separate activities. Only a few studies have examined the whole process as a single activity (Leonardi, 2015), linking manufacturing strategy formulation to implementation (Crittenden and Crittenden, 2008). In fact, the statement "… great strategy, shame about the implementation …" (Okumus and Roper, 1998, p. 218) emphasizes the lack of academic attention to the link between strategy formulation and strategy implementation (Crittenden and Crittenden, 2008; Leonardi, 2015). Among the reasons given for this apparent dearth of research effort is that the field of manufacturing strategy process is considered to be hardly "glamorous" as a subject area (Atkinson, 2006; Kazmi, 2008). Our study aims to contribute to the current literature on this topic shedding new light on the relationship between planning/formalization and strategy implementation, considering the whole process as a single activity and not as individual separate phases. In doing so, we use data from the fourth round of the HPM Project, which is a multiple-respondent survey from 189 manufacturing plants located in 10 different countries.

We focus on the relationship between planning/formalization and strategy implementation analyzing the role of communication as moderator of that relationship. Firms, through formal strategic planning, might convey their strategy, since the planning is itself an information and coordinator mechanism, but it is worth nothing if not all members of the firm know and participate in the strategy process. In our view, communication is an important factor which

facilitates information flow between different organizational members and, in turn, strengthens the relationship between the two phases of the strategy process. Andersen (2004) argues that organizational members may have a better understanding of the firm through communication, but there is a paucity of research into ways in which the relationship between manufacturing strategy formalization and manufacturing strategy implementation may be strengthened. Our study focuses on shop-floor communication considering small-group problem solving (GPS), supervisory interaction facilitation (SIF), feedback (FBCK) and instructive communication (ICM), since communication flow among workers themselves, and between plant supervisor and workers, can help managers focus on problems really needing their attention (Forza and Salvador, 2001). These practices help firms embrace the strategy, improve and control operational practices and solve problems (Zeng et al., 2013).

The paper is organized as follows. The next section presents the literature review in two ways: first, defining the strategy process in terms of planning and formalization and its relationship with strategy implementation; second, setting out the role that shop-floor communication plays as moderator in the relationship planning/formalization/implementation. Five hypotheses are proposed. Section 3 describes the characteristics of the database, the statistical treatment and econometric modeling. The paper closes with discussion and final remarks.

2.2. Literature review and hypotheses

2.2.1. Manufacturing strategy process: Formulation/formalization and implementation

Strategic planning is defined as a guideline and coordination mechanism to integrate and control different procedures within the firm. It helps the firm anticipate and respond to the changing dynamic environment as well as to identify weakness, resources and opportunities (Kohtamäki et al., 2012). Further, strategic planning can be seen as a source of knowledge that ensures coherence between operational decisions in order to successfully adopt different strategies (Vänttinen and Pyhältö, 2009; Kohtamäki et al., 2012). In this regard, Acur et al. (2003) and Gimbert et al. (2010) claim that this process is extremely complex and

the key factor in achieving successful strategy implementation and competitive advantage. Hence, it may be seen as an important information mechanism and important for the strategic management of any organization.

Many studies analyze different aspects of strategic planning to assess whether and how it works, and in which ways, for whom, and when (Kohtamäki et al., 2012; Dibrell et al., 2014). Particular attention has been paid to the link to business performance in both the public and private sectors (Acur et al, 2003; Elbanna et al., 2016). However, the benefits of strategic planning are not clear. Advocates emphasize that formal strategic planning is a key factor for strategy implementation. It may lead to a competitive advantage because plans help to translate strategy into shorter-term goals (Pinto and Prescott, 1990). Explicit knowledge is expressed in words, numbers or symbols (Linderman et al., 2004), so it may be transferred to workers with the help of the formal strategic plan leading to a greater understanding of goals, mission, and strategy. In contrast, some scholars argue that an excessive formal strategic plan may introduce rigidity and encourage excessive bureaucracy, resulting in a dysfunctional process (Mintzberg, 1994; Olson et al., 2005). Montgomery (2008) highlights the need for a fluid and open process of planning to ensure that firms respond adequately to changes and implement strategies efficiently.

Strategy implementation is defined as the sum total of the activities and choices required for the execution of a strategic plan (Hunger and Wheelen, 2004, p.192). Marucheck et al. (1990) defined it as “getting the workers to buy into the strategy” or “building a consensus among workers for the strategy”. Further, they stress that the real benefits of strategy come from its implementation, but it involves extremely complex tasks and decisions (Okumus, 2003; Kazmi, 2008). Evidence suggests that a successful manufacturing strategy implementation positively affects manufacturing performance (Jagoda and Kiridena, 2015). However, at present strategy implementation remains an enigma and source of frustration in many firms.

Very few studies shed light on the relationship between strategy formalization and strategy implementation in the manufacturing environment (Anderson et al., 1991). Some scholars have demonstrated that the development of formal strategic plans is useful for top managers, especially in terms of information flow

and communication issues (Dibrell et al., 2014). Lyles et al. (1993) found that several elements related to strategy implementation, such as developing distinctive competences, determining authority relationships, deploying resources, and monitoring, are more effective in the presence of formal planning.

In sum, the foregoing arguments allow us to argue that formal strategic planning, as a mechanism for coordination and information, will result in a successful strategy implementation. We propose the following hypothesis:

H_1: There is a positive association between formal manufacturing strategic planning and manufacturing strategy implementation.

2.2.1. The strategy formulation and implementation process: The role of shop-floor communication

Communication can be defined as the process by which organizational members generate and share information in order to reach a common understanding. It is a complex and continuous process through which organizational members create, maintain and change the firm (Jacobs et al., 2016). Communication is important in any firm, but particularly in a manufacturing environment where multiple shifts are employed. When communication does not occur, production and quality must suffer and resentment among workers may occur (Hancock and Zayko, 1998).

In recent years, communication has received increasing attention in many fields, such as organizational studies (Wirth et al., 2016), human resources management (Myers and Sadaghiani, 2010) and marketing management (De Vries et al., 2012). They have examined how both communication works, what communication systems must be adopted to handle external and internal organizational relationships, the link between communication and business performance, and how communication influences best practices adoption. While some scholars claim that successful best practices implementation depends on proper organizational communication and information management (Forza and Salvador, 2001), no studies have analyzed their effect on the association between planning and implementation of strategy.

Failures in strategy implementation generally indicate ignorance, lack of participation and involvement of all employees and particularly, shop-floor

workers. Strategic planning and formulation are mechanisms for coordination and information, which generate shared meanings and a common language for understanding strategic activities, goals and mission of the firm (Beer and Eisenstat, 2000). However, implementation requires effective communication, as it must be conveyed and updated properly (Rudd et al., 2008). Further, effective communication reduces agency costs, creating a common strategic understanding and organizational culture in such a way that organizational members, especially supervisors and blue-collar workers, pursue the same strategic goals.

In this paper, we analyze how the adoption of shop-floor communication practices may strengthen the relationship between strategy formalization and strategy implementation, examining its role as moderator. Shop-floor communication comprises those communication practices which take place at the shop-floor organizational level aimed at facilitating the achievement of manufacturing strategy implementation (Zeng et al., 2013). The related literature has established the importance of communication and organizational learning practices in the strategy process by focusing on the communication between managers and supervisors, regardless of shop-floor organizational level (Kim et al., 2012). Little attention has been paid to the effects of the communication flow among shop-floor operators and plant supervisor over the strategy process. These practices help to identify problems and to focus managers' attention where it is needed (Forza and Salvador, 2001), and to encourage knowledge transfer which stimulates learning and the continuous improvement of individuals, resulting in enhanced performance (Letmathe et al., 2012). Shop-floor operators are familiar with the misalignment among existing products, services and technologies, hence they hold information about the problems in current operations, which may contribute to the effective implementation of new practices, tools and process (Wei et al., 2011). In sum, shop-floor communication between blue-collar workers and supervisors is a determinant for top-down and bottom-up information that fuels the strategy process.

Our study analyzes shop-floor communication practices such as small-group problem solving (GPS), supervisory interaction facilitation (SIF), feedback (FBCK) and instructive communication (ICM) about the strategy process. Some

studies have shown that GPS, SIF and FBCK are critical factors in embracing and improving operational practices and procedures (Zeng et al., 2013; Abrahamsen and Häkansson, 2015). Additionally, ICM is seen as an important factor in facilitating knowledge creation and sharing information (Kim et al., 2012).

Small-group problem solving

Knowledge is created, stored and shared by all organizational members, but its coordination and integration is a difficult task for top management (knowledge-based theory). One mechanism used for knowledge coordination and integration is the creation of GPS. It involves a group of qualified experts whose main task is to solve problems where they occur, rather than being referred upwards in the hierarchy (Zeng et al., 2013). This results in a prompt response, agile operations and greater organizational adaptability to internal and external changes.

Zeng et al. (2013) show that these groups generate useful and reliable information for controlling and improving quality management practices. Therefore, we believe that information obtained by these groups may also be useful to update strategic plans and, thus, enhance manufacturing strategy, as they identify and solve problems that occur at the shop-floor organizational level. So, we hypothesize:

H_2: Small-group problem solving will strengthen the relationship between manufacturing strategy formalization and manufacturing strategy implementation success.

Supervisor interaction facilitation

We define SIF as those activities promoted by supervisor in order to make work flow easily, support workers in their tasks, help them understand organizational common goals and mission and, in turn, create a positive work atmosphere.

Because of their position within the firm, middle managers have a better understanding of strategies (Mintzberg, 1994), their view is realistic and, they are responsible for creating meaning from messages provided by top managers (Wooldridge, et al., 2008). At the same time, they are the recipients of all the information generated at the shop-floor organizational level, which must be conveyed to top managers in order to improve organizational strategy. Some

studies have highlighted the need of their participation in the strategy process, since they are fully aware of strategic goals and plans (Chaffey et al., 2009). Therefore, they are the best organizational members to convey strategic planning to shop-floor operators, as well as to pass on information about what happens on the shop floor, encouraging them to work as a team and express their constructive opinions.

Taking into account the preceding ideas, we believe that SIF is important not only to convey strategic and organizational goals as well as strategic planning, but also to update and enhance strategic planning using information obtained by the shop-floor operators. So, we hypothesize:

H_3: Supervisor interaction facilitation will strengthen the relationship between manufacturing strategy formalization and manufacturing strategy implementation success.

Instructive communication

Instructive communication comprises any learning activity or training given to workers to improve their skills and thus improve work performance within organizations (Chukwu, 2016)

Shop-floor operators have to carry out many different tasks such as operations, prevention, monitoring, transformation process evaluation, and feedback. A number of studies show that training is a key factor to perform any operational activity successfully, so plant management and supervisor can delegate tasks, leading to a prompt response to any problem (Kim et al., 2012). Additionally, in combination with SIF, plant supervisors can generate an environment where workers are encouraged to exchange ideas to improve production, fostering greater worker involvement in solving problems and improving processes (Zu et al., 2010). Therefore, training helps firms face a changing environment and facilitates strategy implementation

Moreover, training is a good means for facilitating knowledge transfer in the whole firm (Cormier and Hagman, 2014), apart from making it easier to convey strategic information to qualified workers who understand organizational goals and mission and how to achieve them. Therefore, training facilitates not only learning and knowledge, but also the understanding of strategic and

organizational goals and mission, resulting in successful strategy embeddedness and strategy implementation. Taking into account these ideas, we hypothesize:

H_4: Instructive communication will strengthen the relationship between manufacturing strategy formalization and manufacturing strategy implementation success.

Feedback

In our study, we take into account feedback from plant supervisor to plant management. We focus not only on performance feedback, but also on those suggestions regarding problems and barriers in the implementation at the shop-floor organizational level (Zeng et al., 2013).

FBCK is very important for the whole firm, but it has even greater significance for operational activities. No operational practices or strategy can be developed without receiving FBCK to fit and improve it (DeNisi and Kluger, 2000). FBCK makes it more likely that job performance will be improved, because it is seen as an important source of motivation leading to increased satisfaction and motivation (Hackman and Oldham, 1980). Both scholars and practitioners advocate the positive effects of FBCK in decision-making, claiming that the effectiveness of FBCK for improving job and business performance is essential (Ayres et al., 2012). Additionally, the FBCK literature shows that it is a necessary element in learning how to improve and control operational practices effectively, such as quality management practices and just-in-time, because problems can be identified, analyzed and dealt with through appropriate FBCK (Aladwani, 2001). It also enhances the effectiveness of organizational information, achieves better understanding of organizational practices and enables better integration between production and transportation (Lee and Prabhu, 2016). Therefore, FBCK helps firm adopt and improve strategies and practices effectively and perform agile operations.

On the other hand, as discussed in the previous sections, strategic planning makes more sense when it is continually reviewed and updated (Rudd et al., 2008). The view of plant supervisors is really important in the development of a manufacturing strategy, since they are the first to know and examine problems in the plant, through their interaction with shop-floor operators. In this regard, we

believe that FBCK gains greater weight, as it may help to update strategic planning resulting in better adaptation of strategy to internal and external changes and, in turn, help to convey strategic planning and goals from plant management and plant supervisor to shop-floor operators as well as ideas, solutions and improvement from shop-floor operators to plant supervisor and plant management, enhancing strategic embeddedness in order to implement strategy successfully. So, we hypothesize:

H_5: Feedback will strengthen the relationship between manufacturing strategy formalization and manufacturing strategy implementation success.

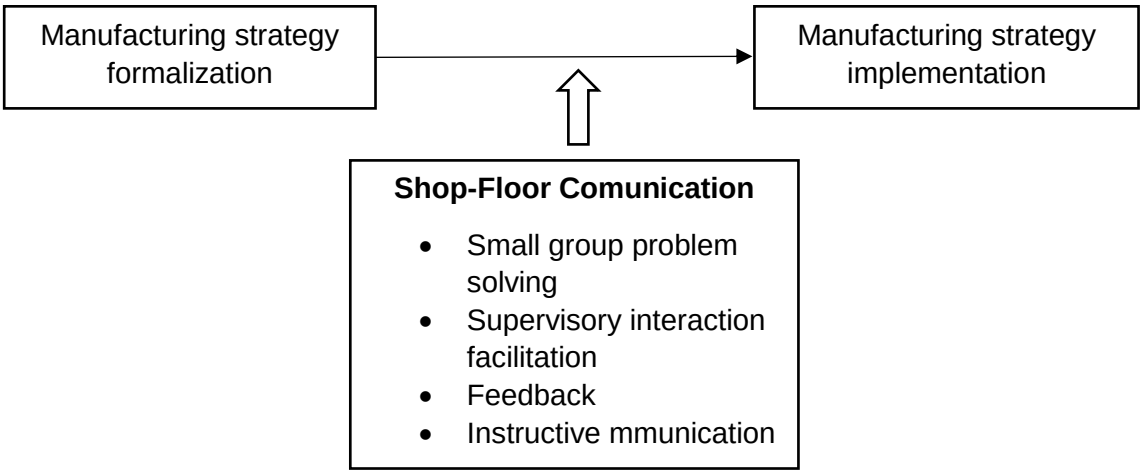

Figure 2.1. Research framework

2.3. Methodology

2.3.1. Data collection and sample

The database includes 189 plants integrating the fourth round of the international HPM project (2012), which operate in automotive, machinery and electronics industries. The items are based on one-to five Likert scales ranging from 1 “strongly disagree” to 5 “strongly agree”, and are used to create factors representing three constructs. The questions are intermixed in order to prevent the scale membership being obvious, and the interviewees were plant

management and plant supervisor, avoiding key informant bias (Sakakibara et al., 1997).

Table 2.1 shows relevant information about the sample of plants distributed in three different sectors. We can observe that plants have a similar age in each sector, since their mean is around 9.5 and 11 years old, considering the year of foundation or the last major modernization. With regard to the size, plants are medium and large sized. In the electronics and machinery sectors, the number of medium-sized plants is similar, around 50 percent, while in the automotive sector, 50 percent of plants are large sized. Concerning the type of production process used in each sector, it can be observed that plants adopt different strategies simultaneously. A small batch strategy is the most used in the electronics sector, while the processes "one of a kind" and "repetitive/line flow" are the most used in the machinery and automotive sectors, respectively.

Table 2.1. Characteristics about the three sectors

	Electronics	**Machinery**	**Automotive**
Age (mean)	10.618	9.574	11.000
Size			
Small	10	10	6
Medium	32	39	18
Large	25	25	24
Total	**67**	**74**	**48**
Types of process	**Total num. plants**	**Total num. plants**	**Total num. plants**
One of a kind	22 (0)	42 (15)	11 (1)
Small batch	36 (11)	44 (11)	29 (6)
Large batch	20 (4)	19 (3)	17 (3)
Repetitive/line flow	23 (3)	29 (4)	26 (8)
Continuous	27 (12)	28 (6)	16 (1)

Note: Number of plants that use each production process above 75% ( ).

3.2.2. Measures

The scales related to the topic under study incorporated into the questionnaire suggest that they should be treated as reflective indicators (MacKenzie et al., 2005). Latent construct models with reflective indicators assume that co-variation among measures is explained by variation in an

underlying common latent factor (Bollen and Lennox, 1991). Thus, explanatory factor analysis (EFA) and confirmatory factor analysis (CFA) were performed to prove the constructs' reliability and to verify the validity and unidimensionality of the measures for latent constructs (Nunnally, 1978). Further, discriminant validity was verified by comparing the root square of the average variance extracted (AVE) shared between the constructs and its measures and the correlation with the rest of constructs. In this case, discriminant validity is confirmed if the root square of AVE for each construct is larger than the correlation with the other constructs.

Strategy formalization

The questionnaire included four items related to strategy formalization concerning manufacturing strategy. These items are based on the Skinner scale (1978), which describes formal strategic planning where manufacturing strategies, mission and goals must be in writing, and also routinely updated.

To measure strategy formalization, a principal components factor analysis revealed one dimension that represents 73% of the variance of these variables. The Cronbach's Alpha coefficient shows the degree of internal consistency of dimension that explains the same structure (Cronbach's > 0.6) (Table 2.2).

As mentioned above, discriminant validity was verified, since the root square of AVE for the construct is larger than the correlation with the other constructs (Table 2.3) and, thus, the measurement model has a good global, parsimonious and incremental fit (NNFI= 0.999; CFI= 0.999; SRMR= 0.000; RMSEA=0.000).

Strategy implementation – plant management and plant supervisor

The questionnaire included seven items relating to manufacturing strategy implementation to be answered by plant management and plant supervisor. Together, the two views give a real image of the plant avoiding key informant bias. The success in implementing the strategic plan entails "plant management commitment engaged in the strategy implementation", "continuous improvement processes" and that "the performance measures match clearly the goals of the plants" (Elbanna et al., 2016). Each perception consists of one dimension comprising five items; then, we use an average index for plant supervisor and

plant management in order to obtain the variable called “Strategy implementation”.

Principal components factor analysis detected one dimension that explains 53% of the variance for plant supervisor and 60% for plant management. The dimensions offer good consistency and explain the construct (Cronbach's > 0.6). As Table 2.2 shows, plant management is engaged in the implementation of manufacturing strategy and organizational members consider improvement programs to be an essential element of manufacturing strategy.

Discriminant validity was confirmed for plant supervisor and plant management (Table 2.3). Additionally, the measurement models have a good global, parsimonious and incremental fit (NNFI= 0.982; CFI= 0.991; SRMR= 0.025; RMSEA=0.046 for P.S. and NNFI= 0.94.; CFI= 0.97; SRMR= 0.033; RMSEA=0.106 for P.M.).

Shop-floor communication

Items integrating each scale of shop-floor communication practices suggest that each one must be treated as a reflective construct. The degree of internal consistency and discriminant validity of each variable were verified (Tables 1.2 and 1.3). Further, indices of NNFI, CFI, SRMR and RMSEA indicate a good global, parsimonious and incremental fit for each dimension.

Table 2.2. Validity and reliability of factors

	Mean (St. Dev.)	**Loading**	**α Cronbach**
Strategy formalization	**3.986 (0.774)**	**2.215**	**0.823**
Our plant has a formal manufacturing strategy process, which results in a written mission, goals and strategies.	4.015 (0.94)	0.893	
This plant has a manufacturing strategy, which is put into writing.	4.002 (0.92)	0.884	
Plant management routinely reviews and updates a long-range manufacturing strategy.	3.984 (0.8)	0.808	
Strategy Implementation	**4.009 (0.491)**	**3.023**	**0.832**

Plant management is engaged in the implementation of manufacturing strategy.	4.194 (0.499)	0.7754	
Improvement programs are an essential element of our manufacturing strategy.	4.216 (0.607)	0.7919	
Changes to the manufacturing strategy are deployed to the entire manufacturing area.	3.82 (0.594)	0.7342	
The performance measures of the plant clearly reflect the goals of the plant.	3.895 (0.69)	0.7394	
We have a manufacturing strategy that is actively pursued.	3.954 (0.622)	0.8404	
Group problems solving	**3.775 (0.636)**	**2.169**	**0.703**
Our plant forms team to solve problems.	3.855 (0.893)	0.808	
In the plant three years, many problems have been solved through small group sessions.	3.689 (0.924)	0.743	
Problem solving teams have helped improve manufacturing processes at the plant.	3.870 (0.809)	0.844	
Employee teams are encouraged to try to solve their own problems, as much as possible.	3.690 (0.866)	0.51	
Supervisory interaction facilitation	**4.029 (0.707)**	**2.174**	**0.807**
Our supervisors encourage the people who work for them to work as a team.	4.113 (0.814)	0.850	
Our supervisors encourage the people who work for them to exchange opinions and ideas.	4.106 (0.764)	0.857	
Our supervisor frequently hold group meeting where the people who work for them can really discuss issues and share ideas.	3.866 (0.913)	0.846	
Feedback	**3.938 (0.654)**	**1.796**	**0.662**
Management takes all product and process improvement suggestions seriously.	3.965 (0.815)	0.721	
We are encouraged to make suggestions for improving performance at this plant.	4.167 (0.79)	0.829	
Many useful suggestions are implemented at this plant.	3.699 (0.887)	0.767	
Instructive communication	**3.949 (0.679)**	**2.143**	**0.802**

Our plant workers receive training and development in workplace skills, on a regular basis.	3.864 (0.826)	0.872	
Management at this plant believes that continual training and upgrading of workers skills.	4.158 (0.772)	0.804	
Our workers regularly receive training to improve their skills.	3.825 (0.811)	0.857	

Table 2.3. Discriminant validity analysis

	FM	IMPPSPM	GPS	SIF	FBCK	ICM
FM	**0.860**					
IMPPSPM	0.590***	**0.777**				
GPS	0.302***	0.609***	**0.740**			
SIF	0.622***	0.582***	0.377***	**0.851**		
FBCK	0.261***	0.574***	0.738***	0.349***	**0.774**	
ICM	0.370***	0.326***	0.156**	0.339***	0.238**	**0.845**

Note: The diagonal elements indicate the root square of the average variance explained shared between the constructs and its measures. The outside diagonal elements indicate the correlation between the constructs

Abbreviation: FM (Formalization); **IMPSPM** (Implementation - Plant supervisor and Plant manager); **GPS** (Group problem solving); **SIF** (Supervisor interaction facilitation); **FBCK** (Feedback) and **ICM** (Instructive communication)

Control variables

The size of the plant, the industry and the country where the plant is operating were included as control variables. It has been demonstrated that all these variables can influence the strategy process (Titus et al., 2011).

The size of the plant was measured by the logarithm of the number of workers, which is frequently log-transformed to linearize the relationship (Cohen et al., 2003). The industry variables represent the three industry sectors − automotive, machinery and electronics − and are represented by dummy variables.

2.3.3. Method

To test the hypotheses discussed in the theoretical section of the paper, we used the ordinary least squares multiple regression (OLSMR) model. This methodology is suitable for analyzing the main effects and the indirect effects

(interactions) between continuous variables (Aiken and West, 1991). Once the model has been checked for linearity, homoscedasticity and normality, the statistical significance of the regression coefficients allows the proposed hypotheses to be accepted or rejected.

Firstly, we developed a model with strategy implementation as the dependent variable and, then, we tested one model with moderating variables, and five interaction models. The seven estimating equations are as follows:

$$IMP_i = \alpha_0 + \beta_1 FM_i + \beta_2 X_i + \varepsilon_i \quad (1)$$

$$IMP_i = \alpha_0 + \beta_1 FM_i + \beta_2 GPS_i + \beta_3 SIF_i + \beta_4 FBCK_i + \beta_5 ICM_i + \beta_6 X_i + \varepsilon_i \quad (2)$$

$$IMP_i = \alpha_0 + \beta_1 FM_i + \beta_2 GPS_i + \beta_3 SIF_i + \beta_4 FBCK_i + \beta_5 ICM_i + \beta_6 FM_i{*}GPS_i + \beta_7 X_i + \varepsilon_i \quad (3)$$

$$IMP_i = \alpha_0 + \beta_1 FM_i + \beta_2 GPS_i + \beta_3 SIF_i + \beta_4 FBCK_i + \beta_5 ICM_i + \beta_6 FM_i{*}SIF_i + \beta_7 X_i + \varepsilon_i \quad (4)$$

$$IMP_i = \alpha_0 + \beta_1 FM_i + \beta_2 GPS_i + \beta_3 SIF_i + \beta_4 FBCK_i + \beta_5 ICM_i + \beta_6 FM_i{*}FBCK_i + \beta_7 X_i + \varepsilon_i \quad (5)$$

$$IMP_i = \alpha_0 + \beta_1 FM_i + \beta_2 GPS_i + \beta_3 SIF_i + \beta_4 FBCK_i + \beta_5 ICM_i + \beta_6 FM_i{*}ICM_i + \beta_7 X_i + \varepsilon_i \quad (6)$$

$$IMP_i = \alpha_0 + \beta_1 FM_i + \beta_2 GPS_i + \beta_3 SIF_i + \beta_4 FBCK_i + \alpha_5 ICM_i + \alpha_6 FM_i{*}GPS_i + \alpha_7 FM_i{*}SIF_i + \beta_8 FM_i{*}FBCK_i + \beta_9 FM_i{*}ICM_i + \beta_{10} FM_i{*}SIF_i + \beta_{11} X_i + \varepsilon_i \quad (7)$$

where i is the company index, IMP is an averaged index for the manufacturing strategy implementation from Plant Managers' and Plant Supervisors' perspective and FM is the manufacturing strategy formalization. GPS, SIF, FBCK and ICM are the four types of communication practices previously discussed. X is a control variable vector and ε is unobservable information.

2.4. Results

Table 2.4 presents the estimation models that summarize the relationships between strategy formulation and shop-floor communication as moderator to explain the implementation of manufacturing strategy. Model 1 shows that manufacturing strategy formalization is positively associated with manufacturing strategy implementation. This result highlights the development of formal strategic planning as a determinant to achieve successful strategy implementation at the manufacturing level, confirming hypothesis 1.

Model 2 incorporates the main effect of moderating variables related with shop-floor communication. Three out of four moderating variables (GPS, SIF and

FBCK) have a positive and statistically significant effect on success in manufacturing strategy implementation.

Regarding moderating effects, Models 3, 4, 5, 6 and 7 test the interaction effects of shop-floor communication on manufacturing strategy implementation. These models show that two shop-floor communication practices (FBCK and ICM) have significant and positive effects on strategy implementation. This supports hypotheses 4 and 5, since FBCK and ICM strengthen the relationship between manufacturing strategy formalization and manufacturing strategy implementation. The graphical representation of the two-way interaction illustrates the interaction effects on strategy implementation of FBCK and ICM (Figures 2.2 and 2.3).

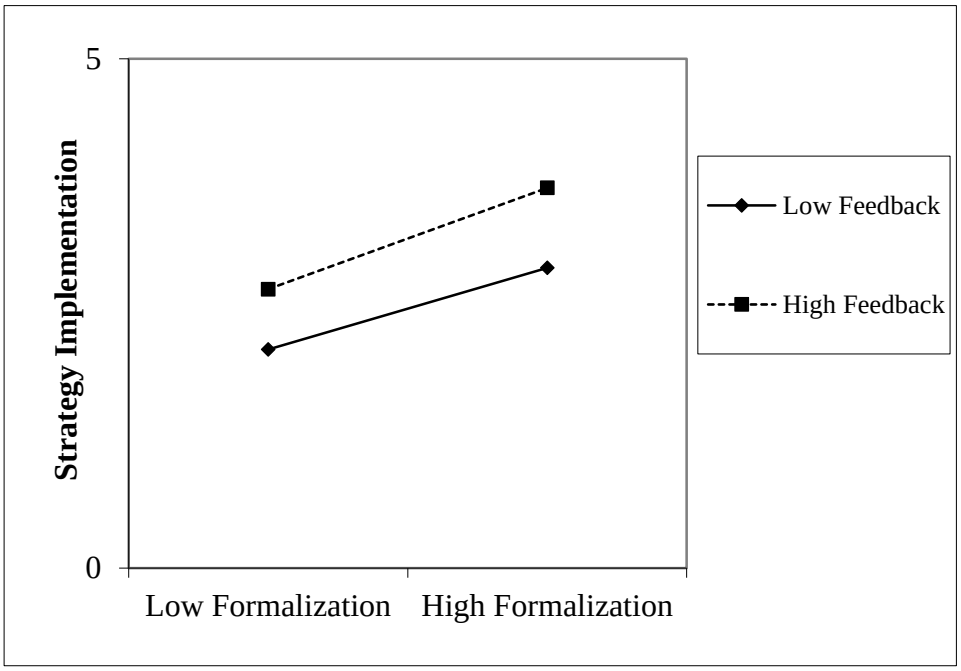

Figure 2.2. Interaction models - Feedback

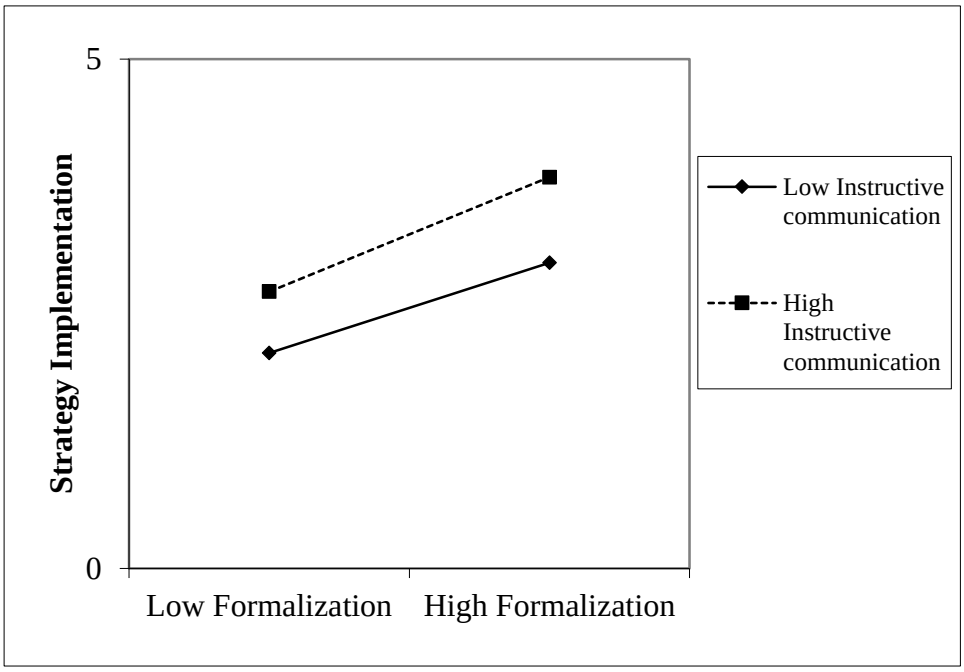

Figure 2.3. Interaction models - Instructive communication

Table 2.4. MOLS regression models: Dependent Variable: Strategy Implementation

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Manufacturing strategy formalization							
Formalization	**0.364*** (0.052)**	**0.205*** (0.041)**	**0.204*** (0.043)**	**0.203*** (0.041)**	**0.205*** (0.044)**	**0.209*** (0.042)**	**0.205*** (0.045)**
Moderating variables							
Group problem solving		**0.215*** (0.057)**	**0.211*** (0.058)**	**0.215*** (0.057)**	**0.195** (0.056)**	**0.205*** (0.054)**	**0.187*** (0.052)**
Supervisory interaction facilitation		**0.172** (0.067)**	**0.176** (0.066)**	**0.162** (0.062)**	**0.176** (0.067)**	**0.153** (0.061)**	**0.132** (0.054)**
Feedback		**0.128* (0.072)**	**0.131* (0.071)**	**0.131* (0.071)**	**0.152** (0.065)**	**0.138** (0.065)**	**0.169** (0.058)**
Instructive communication		0.054 (0.057)	0.054 (0.057)	0.059 (0.055)	0.058 (0.053)	**0.088* (0.045)**	**0.099** (0.041)**
Moderating effects							
Strategy formalizationn x group problem solving			0.025 (0.056)				-0.054 (0.075)
Strategy formalization x supervisory interaction facilitation				-0.039 (0.048)			-0.082 (0.051)
Strategy formalization x feedback					**0.094* (0.049)**		**0.129* (0.076)**
Strategy formalization x instructive communication						**0.111* (0.061)**	**0.097* (0.053)**
_Cons	**1.981*** (0.293)**	**3.496*** (0.185)**	**3.495*** (0.185)**	**3.511*** (0.175)**	**3.492*** (0.18)**	**3.468*** (0.179)**	**3.498*** (0.162)**
R^2	0.442	0.661	0.661	0.662	0.672	0.674	0.691

*p < 0.1, **p < 0.05, ***p < 0.01.

Note: Standard error between ( ). All estimations include the control variable described in the section 3.2.

Finally, Model 7 includes all variables, and both main and interaction effects. The results maintain the significance of the previous estimations and therefore support H1, H4 and H5. These findings corroborate our premise that formal

strategic planning positively affects strategy implementation at the manufacturing level; moreover, they prove that shop-floor communication − particularly, FBCK and ICM − moderate between manufacturing strategy formalization and manufacturing strategy implementation.

2.5. Conclusions

The increased competitiveness in manufacturing industry due to the new manufacturing powers such as China, India, Southeast Asia and Brazil, has led to a search for a greater understanding on how to develop competitive capabilities and distinctive competences within firms in order to secure their long-term survival. To this end, our study explores the influence of a formal strategic planning on strategy implementation at the manufacturing level among international firms in the automotive, machinery and electronics industries. Further, we analyze the moderating effects of shop-floor communication on the relationship between manufacturing strategy formalization and manufacturing strategy implementation. It may help firms reduce transaction costs and internal conflicts, create a common strategic understanding and organizational culture, and enhance decision-making and strategic planning resulting in improved performance.

In addition, we have analyzed the moderating effects of shop-floor communication practices on the relationship between manufacturing strategy formalization and manufacturing strategy implementation. Strategic planning is an information and coordination mechanism, but it must be known by all the organizational members in order to meet strategic goals and mission (Andersen,2004). Additionally, it must be updated continually in order to respond quickly to the changing environment (Rudd et al., 2008), which might be achieved through the use of shop-floor communication practices, since communication between shop-floor operators and plant supervisor helps managers focus on problems really requiring their attention (Forza and Salvador, 2001). These practices can interact with a formal strategic planning, reducing agency costs and internal conflicts, create a common strategic understanding and organizational

culture, and enhance the decision-making process, resulting in improved performance.

Our findings show that three shop-floor communication practices directly affect manufacturing strategy implementation (GPS, SIF and FBCK), but only two of them – FBCK and ICM – strengthen the link between manufacturing strategy formalization and manufacturing strategy implementation, promoting knowledge creation and strategy embeddedness. These practices are more associated with the day to day work, especially with the contact and interaction between supervisors and plant workers which, in turn, may facilitate information transfer from top to bottom and bottom to top.

This study has important practical implications. One the one hand, empirical evidence brings a greater understanding of the strategic process, emphasizing the importance of formalization. Formal processes tend to be more complex and at the same time more precise in definition. Perhaps for this reason, many organizations highlight the high costs they face due to the formalization of processes (Elbannaetal.,2016). However, this study shows that a more effective implementation of the strategic plans, which are associated with the improvement of both organizational and financial performance, can be achieved through formalization. Thus, identifying the elements that favor formalization and the promotion of them is a fundamental task for decision makers.

With this regard, this paper demonstrates that shop-floor communication practices positively interact with formalization to strengthen the implementation of manufacturing strategies. In particular, two shop-floor communication practices, feedback and instructive communication, were the most significant. These practices are associated with supervisors, whose roles increasingly involve training functions and communication skills, not only with their subordinates but also with top managers (Gilbert et al., 2015). In sum, this paper highlights the important role of line managers in the strategy process through the communication of manufacturing strategy, organizational goals and mission from one side and, from the other side, through updating and improving manufacturing strategy through reliable and useful information obtained by shop-floor workers, leading to prompt adaptation to internal and external changes. Thus, practitioners should take into consideration these evidences to implement soft criteria in both

the external selection process and the internal promotion of line managers and supervisors, considering their skills in communication, especially training and feedback.

For the academy, this paper adds new insights to the scarce literature on manufacturing strategy process and also provides evidence for the emerging discussion on whether formal strategic planning may help to adopt a strategy or make decision making inflexible. Our results are aligned with the idea of how important it is to formalize the processes in operations management, in this case associated with the strategic process. For that reason, it is important to highlight the benefits of strategic formalization in the course of operations management. In addition, our work reinforces the idea that relationships between variables are not direct, but complex and interaction effects with other factors should be considered. The moderating role of shop-floor communication on manufacturing strategy process sheds new light on the factors affecting the relationship between formulation/formalization and implementation of strategy. These moderating effects have not been tested previously, despite being an important factor in strategy formalization and implementation. Moreover, our study highlights the importance of developing strategy process as a single activity rather than as individual separated phases, and takes into account different respondents affording more reliable results.

Finally, our study, as always, has some limitations: first, it includes plants from three industries where shop-floor communication may differ significantly, making comparison difficult; and second, it only analyzes the industry sector, therefore future studies might compare these results to those from the service sector. Although our study is cross-sectional, our database is large and comprises three representative industries in the manufacturing sector, as well as manufacturers from different countries.

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Chapter 3

LEVEL THREE LEADERSHIP ON MANUFACTURING STRATEGY IMPLEMENTATION AND MANUFACTURING PEROFRMANCE

3.1. Introduction

In today's competitive and uncertain environments is key for companies to understand what factors are determinant to adopt successful strategies and especially how these strategies are effectively implemented, which is determinant for operational performance (Manyika et al., 2012; Chatha and Butt, 2013). Multiple causalities and interdependencies are behind the development of competitive manufacturing priorities that lead firms to remain a competitive position in the marketplace (Leonardi, 2015).

This study explores how human resources, in particular, leadership may confer a competitive advantage upon manufacturing firms, given that talents of an organization's workforce constitutes an intangible asset that is hard to copy, that is, inimitable (Barney, 1991; Cravens and Oliver, 2006; Chowdhury et al., 2014). According to Yukl (2012: pp 75).. "to improve leadership theory and practice we need to know more about how much the behaviors are used, when they are used, how well they are used, why they are used, who uses them, the context for their use, and joint effects on different outcomes". Nevertheless, most leadership theories only describe leadership styles or identify traits of effective leadership analyzing theirs effects on people, policies and practices implementation (Avolio, 2007), but they do not provide techniques or practices developing these types of leadership. To the best of our knowledge, only one of leadership theory proposed by Clawson (2009) addresses this issue theoretically. He established several leadership practices related to human behavior can be executed by managers to obtain a specific response from employees.

Furthermore, in our view, the greater understanding of leadership in practices is particularly relevant in medium-large manufacturing plants, which typically have vertical and centralized structures. The use of Leadership Practices

can mitigate the negative impact of centralized structure in manufacturing firms and improve operational performance (Sarros et. al., 2002), limiting the negatively effects on the strategy process implementation due to problems in communication, less employee participation and motivation (Kim and Shin, 2017). In addition, empirically, both leadership in practice and the extent to which leaders implement manufacturing strategy in order to improve operational performance have not been addressed yet (Speculand, 2014).

In order to achieve a greater understanding on leadership in practice, we explore theoretical framework proposed by Clawson (2009), analyzing the effects of leadership practices on operational performance in order to achieve a competitive advantage. In addition, we identify what leadership practices applied by plant supervisors can be useful to implement manufacturing strategy, leading to operational performance improvement. According to Clawson (2009), these practices may trigger negative and positive behaviors from employees, therefore, it is needed to identify what leadership practices lead to them and, may inhibit or exhibit manufacturing strategy implementation, enhancing or hindering operational performance.

In brief, this study attempts to ask the following research questions:

- *RQ1: Does Leadership practices improve operational performance?.*
- *RQ2: Does the effect of leadership practices on operational performance vary, hinging on their impact on manufacturing strategy implementation?.*

In order to answer the preceding research questions, we use 287 medium-large manufacturing firms, from thirteen countries around the world and three industries (electronics, automatic and machinery), participating in the fourth round of the international High Performance Manufacturing Project (HPMP).

This study contributes to the current literature on leadership and manufacturing strategy doubly. On the one hand, it comes to recognize the importance of leaders' influence to subordinates implicated in the daily implementation of policies and practices such as plant supervisors and shop-floor operators (Huy, 2011; Gopal and Chowdhury, 2014). On the other hand, it sheds light on the current paucity of literature on leadership practices delving into Clawson's theory. To fill this gap, we first attempt to understand the theoretical

model proposed by Clawson (2009) identifying helpful leadership practices for the daily work. After that, we analyze how their adoption at the plant level improves operational performance directly as well as by means of manufacturing strategy implementation, given that the degree of interplay between leadership, manufacturing strategy implementation and operational performance is complex and dynamic (O´Regan, Ghobadian and Sim, 2005). The theoretical argumentation and the empirical approach of this study considers not only the main effect of leadership practices over operational performance, but also the existence of mediation effect of manufacturing strategy implementation to explain the relationship between leadership practices and operational performance.

The study is organized as follows. Next, we analyze different leadership theories to finally focus on Clawson's leadership model (section 2). We specifically assess both the total effect of LP on operational performance and the indirect through manufacturing strategy implementation. As a result, eight hypotheses are proposed. Section 4 describes the empirical strategy: the characteristics of the database, the statistical treatment and econometric modeling. After that, the estimation results are presented. The discussion, final remarks and future research close the paper.

3.2. Literature review

3.2.1. Leadership in manufacturing

Despite not being a recent field of study, recently the interest on leadership has grown exponentially, particularly, in business management. There is an ongoing debate on identifying an effective leadership style enabling people and firms to achieve goals and perform efficiently. Several research studies have provided both theoretical and empirical evidence on which leadership style is determinant to foster different functions within firms. For instance, Rahim et al., (2016) and, Cheung and Wong (2011) address the impact of transformational leadership on organizational innovation, given that it promotes creativity within firm. In addition, Menguc and Auh (2008) and Bai et al. (2016) consider leadership as driver for daily issues within firm, given that it facilitates the

interaction among employees, promoting communication, knowledge sharing and solving operational problems and conflicts.

Leadership has great notoriety on project management, where leadership play a crucial role in obtaining successful projects, as it encourages employees to perform beyond their expectations and, in turn, enhances team cohesion and exchange of ideas and analytical perspectives (Sohmen, 2013, Aga et al., 2016).

On the other hand, it has been made a lot of research effort into finding proper measurement for leadership (Fleishman, 1992; Bass and Avolio, 1995), However, there is a lack of integration between different theories and perspectives that don´t contribute to clarify leader effectiveness (Avolio, 2007).

Close to our field of study, even though the topic of leadership has been under academic study for years on quality management, viewed as a key factor for the success of quality improvement programmes (e.g. Samson and Terziovski, 1999; Jamali et al., 2010); there is a dearth of empirical work in manufacturing strategy context (Birasnav 2014; Speculand 2014; Schaefer and Guenther, 2016).

Over the years, several leadership theories have been developed. They describe a diverse range of leadership styles and analyze human behavior or traits of effective leadership, leading to several leadership models. For instance, the contingency theory of leadership (Fieder, 1978) considers the environments where leadership is displayed, emphasizing the importance of both the leader's personality and the situation in which that leader operates, outlining two styles of leadership: task-motivated and relationship-motivated (fiedler leadership model).

During the 1990s, Bass and Avolio (1995) proposed the full range leadership model, which considers that exists a constellation of leadership styles or behaviors: Laisse-Fair, Transactional and Transformational leadership styles from the most passive to the most active leadership style. Laissez-faire leaders are hesitant and absent leaders. It is the extreme of completely absent leadership behavior, so they are regarded as the most ineffective leadership style.

Transactional leaders are those who focus on supervision, organization and performance, looking for compliance by followers establishing rewards or punishments (Bass, 2008). These leaders find the proper reward or punishment

in order to achieve desired goals. It is viewed as extrinsic and controlled motivation, since these rewards and punishments becomes the main reason for performing the tasks.

In contrast, transformational leaders are those who stimulate and inspire followers to both achieve extraordinary outcomes at the time they develop and reinforce own leadership capacities (Bass, 2008). Therefore, it is intrinsic and autonomous motivation, as leader exhibits charisma and shared vision with their followers, stimulating others to produce exceptional work (Shin and Zhou, 2003). Transformational leaders promote motivation by responding to individual followers' needs as well as aligning the objectives and goals of the individual followers, the leader, the group, and the larger firm (Cheung and Wong, 2011; Phaneuf et al., 2016).

In a similar train of Bass and Avolio's thought, the relational theory (Graen and Uhl-Bien, 1995) focuses on the relationship between leader and followers, known as leader-member exchange model (LMX). It suggests that leaders and followers build trustable and positive relationships, based on exchanges to promote desired outcomes (Graen and Uhl-bien, 1995). Relationships are based on trust and respect and are often emotional relationships that extend beyond the scope of employment (Bauer et al., 2015). Empirical evidences find a positive association between LMX approach and transformational leaders (Wang et al., 2005).

The trait-leadership theory (Kirkpatick, and Locke, 1991) focuses on analyzing heritable attributes that differentiate leaders from non-leaders. After three decades under academic studies, leadership motivation, achievement drive, honesty and integrity, self-confidence, cognitive ability, knowledge of business or emotional maturity have been identified as core traits of successful leaders (Colbert et al., 2012).

The preceding leadership theories only draw on leadership styles or traits of effective leadership, but they do not establish how to develop these leadership styles, called "knowhow". To address this issue, Clawson (2009) develops a complementary theory on how leaders have to behave through the

implementation of leadership practices, depending on how they affect behavior of subordinates. These levels are:

a) Visible behavior: It refers to what leaders say and do in a direct interaction with followers. Practices considered in this level are: clear commands, yelling, coercion or threats, which are aimed to achieve an entire obedience from followers.

Clear commands refer to giving clear instructions over tasks where employees have nothing to say. This practice may positively affect organizational performance. While practices such as yelling, coercion, threats and manipulating may generate negative consequences within firms (lack of involvement, anger, resentment, passive aggression or possible sabotage) (Park et al., 2016). As argued below, this dimension seems to be associated with transactional leadership, since most of these leadership look for compliance by followers establishing punishments.

b) Conscious thought: These leadership practices are aimed to know what people know and feel, identifying what people are really thinking. Clawson establishes conscious practices as data, evidence, careful listening, debate and analysis.

Data, evidence, debate and analysis on plant issues are seen as means of knowledge transfer and exchange (Tan et al., 2018), which enable leaders to obtain information directly from followers as well as to facilitate information to followers. All of them help to identify internal conflicts and problems and know what followers really think and vice versa. On the other hand, listening carefully to an employee worried and stressed provides not only support and encouragement, but also self-confidence to develop a difficult task (Yukl, 2012). In brief, these LPs help leaders to know what followers know and feel, so they may identify internal problems and conflicts, which need to be solved by them quickly.

These practices seem to be partially related to the contingency theory, given that they aim to promote communication and exchange of information, leading the achievement of task (task-motivated) and the interaction among employees (relationship-motivated).

c) Unconscious thought: It refers to values, assumptions, beliefs and expectations that control thinking and judgments about what people view to be right or wrong. Clawson includes practices such as candor, telling stories, clarifying vision and self-disclosing.

Clarifying vision involves explaining work responsibilities, assigning tasks, communicating objectives and priorities (Yukl, 2012). In combination with telling stories, candor and self-disclosing, these practices may promote the alignment of people toward the same goals and may favor social-exchange, resulting in an increase of followers' trust and commitment (Dhar, 2016). Therefore, we believe that these practices are associated with the relational theory, as they pursue the quality of leaders' exchange relationship, as suggested below.

3.2.2. Leadership Practices on the shop-floor, manufacturing strategy and operational performance.

In what follows, we develop a theoretical reasoning about Clawson's three leadership model on operational performance, considering both total and indirect effect through manufacturing strategy implementation.

Visible behavior

According to Clawson (2009), visible behavior leadership includes practices that lead to total obedience from employees. In this context, employees are considered like machines and their view is not appreciated, resulting in a centralized decision-making and control from leaders (Mihalache et al., 2014). The use of these practices fosters this type of power, given that they reinforce leaders' authority as the head of group. Leaders organize tasks in such way that subordinates have less job autonomy, just the opposite to Laissez-faire leadership approach. This type of leader is also known as "autocratic leader" characterized by very strict style, forcing the followers to comply with his instructions (Daft, 2005; Joguly and Wood, 2006).

Although all these practices lead to an entire obedience from employees, there are a clear difference among them; as one of these practices, clear commands, has effects less aggressive than manipulating, yelling, coercion and threats. In this sense, we analyze these two groups individually, labeling the

former as a non-aggressive leadership practice, and the later as aggressive leadership practices.

Clear commands are associated with centralized decision-making structure, stemmed from autocratic leaders (Jogulu and Wood, 2006). The related literature on centralized decision-making sets out that firm performance improves when strategy and activities is clearly defined, given that power and communication hierarchies is resolved (Jung and Avolio, 1999; Kirkman and Rosen, 1999). As a result, leaders make decision faster, since time-consuming negotiation and conflicts are minimized (Baum and Wally, 2003; Ghazali and Shamin, 2015).

Prior to the preceding research studies, Eisenhardt (1989) conducted a case study where he interviewed several executives, who linked centralized decision-making structure to adaptability to changing environment and, in turn, operational performance improvement. They stress the need of this structure in dynamic environments, where decisions have to be made quickly. As the Vice president of finance observed, because of slow decision-making, “the big players (customers and distributors) were already corralled by the competitor. We are late”. In addition, the delay on production process proved costly, leading to poor operational performance.

According to Harris and Raviv (2005), a centralized decision-making structure is more efficient, when firms have to invest in producing a new product or increasing output of an old product (flexibility), given that the responsibility falls into the shoulder of managers. Because of their position, they have a global vision of the firms and access both external and internal information; in addition to being the link with other parts of the firms. As a result, the introduction of a new product is speeded up, leading to a greater adaptability and new product flexibility.

Moreover, the absence of clear commands difficult the coordination among employees and functional areas (Halevy et al., 2012; Ronay et al., 2012). This lack of coordination generates conflicts, leading to drift and delay on execution of operational activities as well as production process (Nandi and Kumar, 2016). Additionally, unclear commands lead to the development of personal criteria on what approach or strategy must be adopted, which is not only at risk of being

incorrect, but can also drift over time, leading to variability in operational performance (Juran, 1988; Charles et al., 2015).

On the other hand, clear commands are associated with low role ambiguity, as it is defined as a lack of clear information needed to develop a specific function in the firm (Kahn et al., 1964). The related literature has showed that high role ambiguity is a driver for low employees' self-esteem, high stress and anxiety, generating conflicts and hostile work environment. It, thus, has negative effects over productivity, job satisfaction and performance (Tubre and Collins, 2000; Usman and Xiao, 2017; Bongga and Sussanty, 2018)

Taking into account the previous ideas, we hypothesize that this practice may have positive effects over operational performance, facilitating prompt adaptation to changes and, reducing reaction time and costs. Additionally, this leadership practices promoting centralized decision-making structures, may facilitate and accelerate the introduction of new products or the increase in old products. Given that, it accelerates decision-making process and, in turn, facilitates cooperation among employees and among functional areas.

H_{1a}: Clear commands have positively influence on operational performance.

The relationship between these leadership practices and operational performance may be mediated by manufacturing strategy implementation. Such leadership practices may exhibit or inhibit the adoption of manufacturing strategy; in this sense, the related literature is mixed. Autocratic leaders (vs. democratic leaders) have been linked to low (vs high) employees' empowerment, generating a sense of powerlessness and negative attitudes towards their work role and self-worth (Kim and Shin, 2017). It results in employees less passionate and committed to firms, determinant for failures in manufacturing strategy implementation (Kohtamäki et al., 2012). Additionally, significant information about strategic or operational problems can remain unrevealed, because employees are afraid of being punished by autocratic leaders (Cohen, 2008). Therefore, it leads to lack of communication and employees' involvement counterproductive to successfully adopt manufacturing strategy (Alcaide-Muñoz et al., 2018).

By contrast, managers admit that the best way to disseminate organizational targets is by means of clear commands downwards (Jääskeläinen and Luukkanen, 2017), so, employees know what is expected of them and uncertainty is reduced (low role ambiguity) (De Hoogh et al., 2015). In fact, as noted above, the existence of clear commands avoids taking unnecessary risks and facilitates coordination among employees and functional areas, given that it pulls people towards the common goals (Keltner et al., 2008; Halevy et al., 2011; Charles et al., 2015). Likewise, it facilitates manufacturing strategy implementation (Alcaide-Muñoz et al., 2018). As a result, time-consuming negotiation to achieve consensus and organizational conflicts are minimized (Mihalache et al., 2014). So, such leadership practice may be a double-edge sword.

Bearing the aforementioned ideas in mind, we expect that this practice positively affects operational performance by manufacturing strategy implementation, as evidence suggests a positive link between successful manufacturing strategy implementation and operational performance (Acur et al., 2003; Hill and Hill, 2009, Jagoda and Kiridena, 2015). Because of low employees' empowerment, such practice facilitates manufacturing strategy adopting, accelerating decision-making process and reducing role ambiguity, since responsibilities is clearly defined and decisions from leaders are undisputed. So, we hypothesize:

H_{1b}: The relationship between clear commands and operational performance is positively mediated by manufacturing strategy implementation.

According to Clawson (2009), other practices looking for absolute obedience from subordinates are manipulating, yelling, coercion and threats. These practices represent an abusive supervision, which negatively affects employees' outcomes and firms' performance, as victims of abusive supervision experience heightened psychological distress (that is, anxiety, fear, depression, stress and emotional exhaustion), generating hostile work environment (Martinko et al., 2013). It has also been associated with high employees' turnover and low job satisfaction (Park et al., 2016), which negatively influences operational performance owing to direct and indirect costs generated by the departure of

employees or the demoralization of employees (Dess and Shaw 2001; MacElroy et al., 2001; Tzabbar et al., 2017).

The demoralization is due to the loss of respected workmates or the additional work that employees have to undertake, because other employees leave firms, when their capacity is already stretched (Mowday et al, 1982). This feeling in combination with staff shortages has adverse consequences within firms, affecting productivity (MacElroy et al., 2001). In addition, new employees need time not only to learn new skills and procedures, but also to adapt to languages developed by employees working together (Mohr et al., 2012). As a result, it leads to negative effects on production process and, thus, operational performance, generating low quality, flexibility and delivery problems and, increasing cost.

Moreover, visible behavior has been associated with power tactics, because compliance is based on enforceable rules and is encouraged by negative and positive consequences contingent on compliance. There are two types of power tactics: harsh power tactics defined as the supervisor's ability to reinforce or reprimand its subordinates, using coercion or threats of punishment or promises of rewards based on compliance (coercive practices). Whereas soft power tactics refer to supervisors' interpersonal influence without coercion or threats (non-coercive practices) (Schwarzwald, Koslowsky and Brody-Shamir, 2006).

There is precedent in the industrial-organizational literature suggesting that harsh power tactics are positively associated with subordinates' stress at work, high employees' turnover, low job satisfaction and low decision acceptance (Erkutlu, Chafra, and Bumin, 2011). Accordingly, we expect that these practices lead to negative effects on production process and, thus, operational performance, increasing cost and inhibiting conformance of products, flexibility to introduce new products or more inputs on production process and delivery on time. Given that, employees are not willing to accept decision from supervisor and quit job due to ongoing stress feeling. So, we hypothesize:

H_{2a}: Visible behavior aggressive leadership practices have negative influence on operational performance.

Likewise, the relationship between these aggressive leadership practices and competitive operational performance is not only direct, but it may also be mediated by manufacturing strategy implementation. As generally known, the interaction among organizational members plays a key role in manufacturing strategy implementation, given that it facilitates knowledge transfer as well as strategy embeddedness, leading to prompt organizational adoption to internal and external changes (Alcaide-Muñoz et al., 2018). In this sense, subordinates under abusive supervision often engage in aggressive, retaliation and revenge behavior, performing acts of deviance against the interests of firm (Inness et al., 2005). In fact, Clawson claims that the use of this type of power from leaders creates resentment and underground opposition and, even fear, resulting in unwilling to exchange and share information and opinions from employees. In order words, subordinates may act against firm's interests, being able to sabotage manufacturing strategy implementation.

On the other hand, the behavior promoted by the use of these aggressive practices, increases organizational rigidity and inefficiency, given that employees learn not to ask questions and answer back and question management authority (Sarros et al., 2002). Accordingly, employees are less passionate and committed with firm (Kim and Shin, 2017). This, in turn, may promote failures in manufacturing strategy implementation usually associated with lack of participation, involvement and commitment of all employees (Speculand 2014; Schaefer and Guenther, 2016).

Taking into account the previous ideas, we expect that these practices affect performance through the effects on the implementation of manufacturing strategy, as such practices generate hostile work environment that inhibits communication flow and trust and quality relationship between employees and leader. As a result, employees' commitment and strategy embeddedness are not developed, that are determinant to adopt manufacturing strategy successfully (Alcaide-Muñoz et al., 2018). So, we propose the following:

H_{2b}: The relationship between visible behavior aggressive leadership practices and operational performance is negatively mediated by manufacturing strategy implementation.

Conscious thought

The second leadership dimension developed by Clawson (2009) focuses on catching conscious thought and knowing what employees really think. Conscious thought practices are related to fiedler leadership model proposed by Fiedler (1978), given that they seem to be geared towards the development and achievement of task (task-motivated) and the interaction among organizational members (relationship-motivated). In addition, these practices (data, evidence, careful listening, debate and analysis) may be seen as source of information, since they aim to know what people think and want to show.

Empirical evidence shows the negative consequences of the lack of communication within firm, it involves quality, productivity, adaptability and production issues as well as coordination problems and internal conflicts, increasing costs (Myers and Sadaghiani, 2010). Conscious thought practices are usually used in the day to day of operation. Data analysis, debate or evidence generate feedback and, in turn, enable firms to monitor processes in order to improve procedures and products (e.g. reducing variance in the processes leading to zero defects); in addition to reaching desired operative targets (Randolph et al., 2009; Murat Kristal et al. 2010; Alcaide-Muñoz and Gutierrez-Gutierrez, 2017). Murat Kristal et al. (2010) find out that the use of feedback and information obtained through debates, meetings or analysis, are associated with mass customization capability, cost reduction and greater flexibility.

Moreover, these practices are associated with low role ambiguity (explained and defined previously), since employees receive information about their responsibilities and tasks. They know what is expected of them, which reduces uncertain performance expectations or vague daily tasks and responsibilities (De Hoogh et al., 2015). As noted in the first dimension, low role ambiguity has positive effects over productivity, job satisfaction and operational performance.

In addition, leaders who listen carefully to their subordinates, willing to understand and appreciate their feelings and attitudes, are likely to improve wellbeing of employees (Yukl, 2012). From a social justice standpoint, these leadership practices also make it easier to detect any underlying feelings of

injustice and resentment about assignments, support or rewards (Mahsud et al., 2010). Ignoring any sigh of a serious problems or acting hastily before identifying the cause of the problem, can create more serious operative and organizational problem (Yukl, 2012).

Taking into account the preceding ideas, we hypothesize that such practices may have positive effects on operational performance, give that it promotes internal communication, facilitating the identification of operative and organizational problems and determining how to avoid or minimize their adverse effects. Additionally, these practices helps to reduce uncertain performance expectation (low role ambiguity), which positively affects productivity.

H_{3a}: Conscious thought leadership practices have positive influence on operational performance.

On the other hand, several research studies have shown as different tools related to performance measurement such as data, analysis, evidence, debate and meeting, influence manufacturing strategy implementation directly, given that they help to control and guide employees towards desired strategic goals, sharing vision and increasing employees' commitment (Jääskeläinen and Luukkanen, 2017). In this sense, evidences show how feedback (from leader to followers) makes it more likely that performance on the job is enhanced significantly, since employees may modify and improve their performance to reach the performance standards, facilitating learning and maintaining effort and persistence (Ayres et al., 2012). Therefore, it acts as a guide to their future goals setting and behavior, directing employees' attention towards the aspects of their tasks for which they have received feedback. As a result, this type of leadership practices generating information flow and feedback (from leader to followers and vice versa) facilitates manufacturing strategy implementation, helping to monitor processes, procedures and employees' behavior in order to reach desired goals.

Similar to visible behavior, the relationship between conscious thought and operational performance may be mediated by manufacturing strategy implementation, because such practices may help to lead employees to common goals. As communication tools, they have effects over organizational behavior, promoting knowledge transfer, learning and social interaction, which enhance to

convey and update strategy (Rudd et al., 2008) and reach common strategic understanding and organizational culture, resulting in enhanced operational performance (Letmathe et al., 2012; Alcaide-Muñoz et al., 2018). This, in turn, helps to identify problems and improve processes and procedures, given that novel ideas and improvement suggestions are exchanged (DeNisi and Kluger, 2000; Murat Kristal et al. 2010). On the other hand, feedback engaged from followers can be really useful, in particular, for both the strategy process and operations activities, since shop-floor operators and plant supervisors are familiar with the misalignment among existing products, services and technologies. They hold worthwhile and reliable information about the problems in current operations, which affects the effective implementation of new practices, tools and process as well as enhances decision-making process (Jääskeläinen and Luukkanen, 2017). It helps plant manager and plant supervisor convey strategic planning, mission and goals to shop-floor operators as well as ideas, solutions and improvement from shop-floor operators and plant supervisors to plant managers, enhancing strategic embeddedness in order to adopt strategy successfully (Alcaide-Muñoz et al., 2018).

Consequently, we expect that these practices positively influence operational performance by manufacturing strategy implementation, since they promote learning and knowledge transfer among employees. As mentioned above, communication flow is crucial for manufacturing strategy implementation (Alcaide-Muñoz et al., 2018), and the success on manufacturing strategy implementation leads to high operational performance (Acur et al., 2003; Hill and Hill, 2009, Jagoda and Kiridena, 2015). So, we hypothesize the following:

H_{3b}: The relationship between Conscious thought leadership practices and operational performance is positively mediated by manufacturing strategy implementation.

Unconscious thought

In the last dimension, Clawson (2009) claims that telling stories, candor, clarifying vision and self-disclosing help leaders influence followers in order to alter their beliefs, attitudes and behavior, by means of positive and non-coercive practice. So, this dimension is the opposite of visible behavior and is associated

to soft power tactics, given that soft power tactics refer to supervisors' interpersonal influence, charisma and mutual dependency (Schwarzwald, Koslowsky and Brody-Shamir, 2006).

Cohen (2008) and Clawson (2009) set out that leaders are not only a source of ideas, direction, motivation and knowledge, wisdom or action, but also have to identify and not to block the potential energy that everyone has, encouraging people to use their initiative and imagination. Hence, these leadership practices are associated with the inner development of followers and the quality of leaders' exchange relationship with subordinates as well as among subordinates.

Following this line of thought, this dimension is associated to ethical leaders. Ethical leaders are described as honest, candor, fair and trustworthy people that make fair choices and structure work environment justly (Brown et al., 2005). The related literature emphasizes greater impact of ethical leaders on subordinates in comparison to the others. Leaders are authority figures; however, ethical leaders are seen as role models and main source of guidance, as fairness and concern attract observer attention and enhance observer's desire to emulate modeled behavior (Treviño et al., 2003; Brown et al., 2005; Mahsud et al., 2010). It results in greater and favorable exchange relationship, which has important implications over job satisfaction, productivity and employees' commitment and low employees' turnover (Dhar, 2016). As noted above, the opposite has negative consequences within firm, leading to poor operational performance (Dess and Shaw 2001; MacElroy et al., 2001; Tzabbar et al., 2017).

Empirically, Kim and Brymer (2011) showed the association between this type of leaders and operational performance, as these leaders reduce ethical conflict and foster employees' organizational commitment or identification (DeConinck, 2011), which results in low employee's turnover and absence frequency (Brown and Trevino, 2006; Fukbua 2016; Liu and Lin, 2018). As noted above, employees' turnover has negative implications over operational performance (MacElroy et al., 2001; Mohr et al., 2012; Tzabbar et al., 2017). In addition, employees leaded by ethical leadership are encouraged to make extra efforts and help others although not required to do so, which leads to higher levels of operational and financial performance (Daily et al., 2009).

Taking into account the above-mentioned ideas, we expect that these practices developing quality exchange relationship at work, may positively affects operational performance, given that employees strive the best version of themselves to achieve goals individually and also as a team, exhibiting employee's organizational commitment or identification. So, we hypothesize:

H_{4a}: Unconscious thought leadership practices have positive influence on operational performance.

The relationship between these leadership practices and operational performance may be mediated by manufacturing strategy implementation. Ethical leaders are transparent and engage in open communication (Brown et al., 2005), promoting the interaction among organizational members. As said above, it is a significant vehicle for manufacturing strategy implementation, as communication generates learning and knowledge transfer, leading to organizational culture, prompt organizational adoption to internal and external changes, common understanding and strategic embeddedness (Alcaide-Muñoz et al., 2018).

Moreover, clarifying vision, personal humility as well as leading by example have been regarded as key leaders' behaviors in successful manufacturing strategy implementation (Collins, 2005; Crittenden and Crittenden, 2008). In other words, these practices may favor social-exchange and promote the alignment of people toward the same goals, resulting in an increase of subordinates' trust and commitment and, in turn, reducing organizational rigidity and inefficiency. This, thus, mitigates failures in manufacturing strategy implementation concerning lack of participation, involvement and commitment of all employees (Speculand 2014; Schaefer and Guenther, 2016). Additionally, behavior developing healthy relationship between managers and employees improves organizational embeddedness, increasing a sense of obligation to firm (Dechawatanapaisal, 2017) and fostering exchange tacit knowledge required to successful implement manufacturing strategy (Alcaide-Muñoz, et al., 2018). Accordingly, we expect that these practices affect operational performance through the effects on the implementation of manufacturing strategy, given that quality exchange and trust environment generated by such leadership practices fosters communication at work (knowledge transfer and learning), employees'

participation, involvement and commitment in order to reach strategic and operative goals. So, we propose the following:

H_{4b}: The relationship between unconscious thought leadership practices and operational performance is positively mediated by manufacturing strategy implementation.

3.3. Methodology

3.3.1. Data collection and sample

In our research study, we used the fourth round of High Performance Manufacturing (HPM) database. It is an international research project that examines the relationship between firms' practices and performance, which includes manufacturing plants operating in mechanical, electronics and automotive sectors. In each country, data were collected by local HPM research teams, responsible for selecting the plants, contacting them and distributing the questionnaires as well as providing assistance to the respondents in order to ensure the reliable information gathered.

To select the plants, a master list of manufacturing (i.e., Dun's Industrial Guide, JETRO database, etc.) was used. Each local HPM research team had to include an approximately equal number of plants that use advanced practices in their industries (i.e., world-class manufacturing plants) as well as traditional manufacturing units (i.e., not world-class manufacturing plants).

These plants represent different parent corporations and have at least 100 employees, this restriction ensures that a sufficient number of managers and employees would be available to complete the survey (Naor et al., 2010). In each plants, a batch of 23 questionnaires is distributed by individual visits or by mail to different respondents considered the best informed about the topic of each questionnaire, so the problem of common method bias is reduced.

Each questionnaire comprised perceptual scales and objective items, in fact, it included a mix of item types and reversed scales to further reduce the possibility of common method variance. The official language used in the questionnaires was the English, but then they were translated into the language

of the participating country by a local member of the HPM team. However, the questionnaire was then back-translated into English by a different local HPM researcher to ensure accurate translation.

3.3.2. Measures and statistical treatment

We analyze 287 world-class manufacturing plants and not world-class manufacturing plants, operating in the sectors mentioned above and located in Austria, Germany, China, Taiwan, Brazil, Finland, Italy, Israel, South Korea, Spain, Sweden, Vietnam and the United Kingdom. This HPM project includes scales based on the literature and previously used as measurement scales. Additionally, the content validity of each scale was checked through interviews with experts and managers. Therefore, our study consists of scales used extensively and validated in past works as well as in the OM literature.

The scales incorporated into the questionnaire related to our study, suggest that only one of them (manufacturing strategy implementation) should be treated as a reflective indicator, as co-variation among measures is explained by variation in an underlying common latent factor (Bollen and Lennox, 1991). In this case, explanatory factor analysis (EFA) and confirmatory factor analysis (CFA) were performed to prove the constructs' reliability and to verify the validity of the measures (Nunnally, 1978).

By contrast, the three levels of leadership should be treated as formative indicators, as "the measures jointly influence the composite latent construct, and meaning emanates from the measures of the construct, in the sense that the full meaning of the composite latent construct is derived from its measures" (MacKenzie et al., 2005, p. 712). Concerning operational performance, in the OM literature, operational performance is represented as reflective constructs in most studies; nevertheless, Forza (2016) suggests that it should be modeled as formative constructs, given that it meets the guidelines set by Jarvis et al. (2003) and Diamantopoulos and Winklhofer (2001). Following this line of though, we consider operational performance as formative construct.

With regard to latent construct models with formative indicators, discriminant validity is assessed by testing the absence of collinearity among the items that make up the construct (Podsakoff et al., 2006). In this sense, a

variance inflation factor (VIF) lower than five is a good indication of no multicollinearity problems (Judge et al., 1988).

Leadership practices

The questionnaire captured leadership practices suggested by Clawson (2009). The aims of this question is to catch Plant supervisor's perception on how they are being led and, in turn, how these practices are used with others. In other words, it captures which leadership practices related to human behavior are used within the plant in order to lead employees. Each leadership practice is based on one-to-five Likert scales ranging from 1 "strong disagree" to 5 "strongly agree" which are used to create four statistical constructs, following the indication of Clawson's theoretical framework.

First dimension -Visible behavior

As shown in table 3.1, the variance inflation factor (VIF) of both subdimensions never surpasses the threshold of higher than five, therefore, discriminant validity was verified. Although, it seems that clear command is the most used Leadership Practices (near 4) and, its variation is lower than the rest of leadership practices. We can observe that leadership practices such as manipulating threats, coercion and yelling have small value, therefore are less used, but there is a high variation.

Second dimension -Conscious thought

In this dimension, discriminant validity was also verified, as the variance inflation factor (VIF) is not above five. Although all leadership practices seem to be highly applied, the most LPs used within plants are data and analysis whose means are close to 4, and debate is less used (almost 3.5) Additionally, all of them have similar variations, except for data. (see Table 3.1).

Third dimension - Unconscious thought

Discriminant validity of this dimension was confirmed, since the variance inflation factor (VIF) are below five. In this case, both candor and clarifying vision are highly adopted in the plant (below 3.5), however self-disclosing and telling stories have a medium value. With regard to their variation, all of them seem to

have similar standard deviation value, except telling story, which have high variation (below 1) (see Table 3.1).

Table 3.1. Validity and reliability of factors

			Weight	Mean	SD	VIF
Leadership tools (formative indicators)						
Visible behavior	Non-aggressive behavior	Clear commands	0.996	3.989	0.621	1.000
	Aggressive behavior	Threats (implicit and explicit)	0.835	2.202	1.121	2.075
		Manipulating	0.878	2.223	1,030	2.773
		Coercion	0.929	2.064	1.045	4.065
		Yelling	0.884	2.213	1.113	2.802
Conscious thought	Data		0.664	3.983	0.674	1.376
	Evidence		0.689	3.705	0.909	1.341
	Careful listening		0.641	3.681	0.825	1.237
	Debate		0.566	3.499	0.846	1.217
	Analysis		0.761	3.809	0.731	1.484
Unconscious thought	Telling story		0.612	2.734	1.107	1.210
	Candor		0.574	3.826	0.744	1.217
	Clarifying vision		0.740	3.648	0.790	1.287
	Self-disclosing		0.678	2.903	0.997	1.209

Source: The authors
Abbreviation: S.D. (Standard Deviation) and **VIF** (Variance inflation factor)

Operational performance

Operational performance was assessed through the four commonly accepted competitive performance priorities of cost, quality, delivery and flexibility, which have been used in different research studies (Chen et al., 2004; Peng et al., 2008). Cost represents the unit costs of manufacturing and quality posits conformance of products specifications. With regard to delivery, it was assessed with two items that emphasize the fast delivery and delivery promise on time. Finally, three items are used to measure flexibility, pointing out the amount of emphasis that firms placed on handling changes in product mix and volume as well as the speed of new product introduction into the plant. All of them are based on one-to-five Likert scales ranging from 1 “Poor, much worse than global competitors” to 5 “Superior, much better than global competitors.

As a formative construct, its discriminant validity was verified by means of variance inflation factor (VIF), which is below five (see Table 3.2). As shown in table 3.2, the descriptive statistic shows that operational performance, in particular the conformance to products specification, is highly pursued, as its mean is near 4. Additionally, their standard deviations show a high variation in the set of data values, ranging between 0.71 and 0.93.

Table 3.2. Validity and reliability of factors

	Weight	Mean	S.D.	VIF
Operational performance (formative indicators) *"Please circle the number that indicates your opinion about how your plant compares to its competitors in its industry, on a global basis"*		**3.725**	**0.549**	
Unit cost of manufacturing	0.428	3.327	0.934	1.136
Conformance to products specifications	0.573	3.995	0.718	1.381
On time delivery performance	0.710	3.894	0.801	1.870
Fast delivery	0.802	3.764	0.816	2.155
Flexibility to change product mix	0.738	3.876	0.788	1.870
Flexibility to change volume	0.734	3.767	0.819	1.892
Speed of new product introduction into the plant (development lead time)	0.688	3.533	0.875	1.442

Source: The authors
Abbreviation: S.D. (Standard Deviation) and **VIF** (Variance inflation factor)

Manufacturing strategy implementation – Plant management and plant supervisor

The success in implementing strategy mainly entails plant management commitment engaged in the manufacturing strategy implementation, continuous improvement processes and that the performance measures match clearly the goals of the plants (Elbanna et al., 2016), which are represented in our variable labeled "Manufacturing strategy implementation". The questionnaire facilitates the same questions related to manufacturing strategy implementation to be

answered by plant management and plant supervisor. To give a real image of the plant avoiding key information bias, our study uses an additive index, taking into account both views.

Although, the questionnaire includes seven items for each perception, we have only taken into account five from seven items, because the loadings of the items captured in the latent construct have been considered, deleting those items with loadings smaller than 0.60 (Mathieson et al., 2001). In this regard, each item used to create variable, is based on one-to-five Likert scales ranging from 1 “strongly disagree” to 5 “strongly agree” (see Table 3.3).

Factor analysis reveals one dimension represented by 57.29%; in addition, all items exhibit a very good internal consistency to explain the construct, as Cronbach’s alpha, have a value above 0.6 as recommended Nunnally, (1978) (see Table 3.3). In turn, the value concerning the Kaiser-Meyer-Olkin criterion of sampling adequacy is satisfactory, since they exceed the minimum scores of 0.5 (KMO = 0.838). Discriminant validity was verified, since its square root is greater than the correlation of the other constructs (the root square of AVE is 0.757 – and inter-constructs correlation-see Table 3.4).

Furthermore, as we can observe in table 3.3, both plant management and plant supervisor are engaged in the implementation of manufacturing strategy and organizational members consider improvement programs to be an essential element of manufacturing strategy in particular. The success in manufacturing strategy implementation is medium-high, as its value is above 4.

Table 3.3. Validity and reliability of factors

	Mean	S.D.	Load.	α Cronbach	AVE
Manufacturing strategy implementation (reflective indicators)	**4.031**	**0.429**	**2.865**	**0.810**	**0.573**
Plant management is engaged in the implementation of manufacturing strategy.	4.169	0.491	0.735		
Improvement programs are an essential element of our manufacturing strategy.	4.167	0.571	0.786		
Changes to the manufacturing strategy are deployed to the entire manufacturing area.	3.877	0.590	0.738		
The performance measures of the plant clearly reflect the goals of the plant.	3.981	0.632	0.728		
We have a manufacturing strategy that is actively pursued.	4.019	0.554	0.795		

Source: The authors
Abbreviation: S.D. (Standard Deviation)

Finally, we obtained a correlation matrix to examine the impact of different variable, both independent and dependent variables. All independent variables showed significant positive correlation with the dependent variable, except for aggressive visible behavior. With regard to the relationship among independent variable, manufacturing strategy implementation has positive correlation with non-aggressive visible behavior, conscious and unconscious thought; however, its correlation with aggressive visible behavior is negative and slightly significant. Additionally, it seems that conscious and unconscious thought have a significant positive correlation to each other. The correlation matrix is depicted in Table 3.4.

Table 3. 4. Correlation matrix

	O.P.	V.B. (non-aggressive)	V.B. (aggressive)	C.T	U.T.	IMP
O.P.	1					
V.B. (non-aggressive)	0.268***	1				
V.B. (aggressive)	0.045	0.004	1			
C.T.	0.306***	**0.436*** **	-0.001	1		
U.T	0.281***	0.327***	0.099	**0.545*** **	1	
IMP	0.362***	0.229***	-0.184**	0.391***	0.369***	1

Source: The authors
Notes: *p<0.05; **p<0.01; ***p<0.001.
Abbreviation: O.P. – Operational Performance, **V.B.** – Visible Behavior, **C.T.** – Conscious Thought, **U.T.** – Unconscious Thought and **IMP** – Implementation.

3.3.3. Method

To test our hypotheses, given the nature of the dependent variables, ordinary least squares multiple regression (OLSMR) models were estimated to analyze both the direct effects and mediating effect. This methodology is suitable for analyzing the main effects and the mediating effects between continuous variables (Hayes, 2009). All models include the industry (automotive, machinery and electronics) and the size of the plant as control variables, which was measured by the logarithm of the number of employees. Additionally, the multicollinearity is not a problem in our models, since variance inflation factors show values below the usual thresholds of 5. Furthermore, we estimate the regressions with robust standard errors to avoid non-normality and heteroscedasticity problems in the residuals. We winsorize all variable at the 3% level to remove outliers.

To test the mediation mechanism implied by our hypotheses, we follow the bootstrapping method described by Preacher and Hayes (2004), as although one of the most popular mediation method used is Baron and Kenny's (1986) causal steps approach, it has been highly criticized. They establish that a significant total

effects of X and Y is necessary for mediation to occur, however some researchers have argued that it is no necessary (Shrout and Bolger, 2002; Hayes, 2009). In fact, these last ones recommend the use of others mediation test such as the product approach or boostrapping over Sobel test or casual steps approach, as the former does not impose the assumption of normality of the sampling distribution and, in turn, the significant total effects of X and Y is not necessary to be satisfied.

The first step is to analyze the effect of X on the mediating variable, so we firstly examine the effect of three leadership dimensions on our mediating variable (manufacturing strategy implementation). The second one is the analysis of the total effects between X and Y, regardless of the mediating effect, so we estimate the effects of three leadership dimensions (visible behavior, conscious and unconscious thought) on operational performance, so H_{1a}, H_{2a}, H_{3a} and H_{4a} are tested. The last one is the analysis of the direct and indirect effects (mediating effect); to this end, the effect of the mediation variable is added, which allows us to test H_{1b}, H_{2b}, H_{3b} and H_{4b}.

3.4. Results

3.4.1. Leadership practices and mediating variable

As noted above, we start estimating a model that analyzes the direct effects of three leadership dimension over manufacturing strategy implementation (mediating variable), including controls variables. Model I in table 3.5 summarizes the result of this estimation, showing standardized coefficient and where the amount of variance explained is near 30 percent. It shows that clear commands do not have effects over manufacturing strategy implementation; however, visible behavior dimension related to aggressive leadership practices is negatively associated with manufacturing strategy implementation. On the other hand, the other two dimensions have a positive and significant association. These results thus highlight the importance of these practices for manufacturing strategy implementation.

3.4.2. Leadership practices and operational performance

The second step is to test a model in which operational performance is regressed on the three leadership dimensions. As shown in model II of table 3.5, the total effect of leadership practices on operational performance varies. In the first dimension, just visible behavior related to non-aggressive leadership practices have positive and significant effects on operational performance. On the other hand, both conscious thought and unconscious thought positively and significantly influence operational performance. These results provide support for H_{1a}, H_{3a} and H_{4a}.

3.4.3. Leadership practices, mediating variable and operational performance

The final step is to analyze the direct and indirect effects, so we estimated a model in which operational performance is regressed on both leadership practices dimensions and manufacturing strategy implementation, with the control variable included. It is represented by Model II in table 3.5.

As shown in table 3.5, the exploratory power of the model increases with the introduction of the mediating variable (manufacturing strategy implementation), as the amount of variance explained varies from 13.3 percent in model II to 20.31 percent in the model III. Further, we can observe that the standardized coefficients of each leadership dimension decrease in almost all cases, except for visible behavior dimension related to aggressive leadership practices. In this case, the coefficient increases because of the fact that the main effect of this leadership dimension over manufacturing strategy implementation is negative. This variation on the coefficient means that when the mediating variable is not included in the model, the leadership dimensions absorb its effects on operational performance.

Even though the mediation has been supported, it is important to test whether the mediation is statistically significant. In doing so, we bootstrapped the indirect effects of leadership practices and operational performance, following Preacher and Hayes (2004) procedures. We can observe that the indirect effects are all significant, except for the first dimension of visible behavior; since the difference between the total and the direct effects of leadership practices and

operational performance are different from zero and their bias corrected with a 95 percent of confidence interval do not contain zero (see Table 3.6). Therefore, we conclude that manufacturing strategy implementation mediates the relationship between all leadership practices and operational performance, except for visible behavior related to non-aggressive leadership practices, which confirms H_{2b}, H_{3b} and H_{4b}.

Table 3.5. MOLS regression model for manufacturing strategy implementation (model I) and mediating effects (model II and III)

	Model I	Model II	Model III
Visible behavior (non-aggressive)	0.034	**0.155***	**0.144***
Visible behavior (aggressive)	**-0.234*****	0.037	0.109
Conscious thought	**0.266*****	**0.159***	0.076
Unconscious thought	**0.229****	**0.143***	0.071
Implementation			**0.313*****
R^2	0.277	0.134	0.204
F	**15.51*****	**5.69*****	**8.57*****

Source: The authors

Notes: *p<0.05; **p<0.01; ***p<0.001. Dependent variable of model I – Manufacturing strategy implementation. Dependent variable of model II and III – Operational performance.

Table 3.6. The indirect effects of each leadership practice on operational performance

	Operational performance		
	Effect	**BLLCI**	**BULCI**
Visible behavior (non-aggressive)	0.011 (0.021)	-0.031	0.053
Visible behavior (aggressive)	**-0.071** (0.024)**	-0.119	-0.024
Conscious Thought	**0.083** (0.028)**	0.031	0.137
Unconscious Thought	**0.071** (0.026)**	0.021	0.122

Source: The authors
Notes: 5,000 bootstrap samples. Standard error between ( ). 95% of confidence interval. *p<0.05; **p<0.01; ***p<0.001.
Abbreviation: BLLCI (Bias corrected confidence intervals Lower**)** and **BLLCI** (Bias corrected confidence intervals Upper)

3.5. Conclusions

In the last year, the competitiveness in manufacturing industry has led to a search for a greater understanding on how to develop competitive capabilities and distinctive competences within firms in order to secure their long-term survival. In particular, special attention has been paid to production process, as manufacturing firms allocate many resources on the production process in comparison with the other functions (Birasnav, 2014). Research studies have emphasized the added value of human resources within manufacturing firms, given that innovative manufacturing practices and sophisticated technologies alone have little or no influence on operational performance unless human resources form a consistent socio-technical system (Ahmad and Schroeder, 2003, Davis et al., 2014). Following this line of thought, our study explores the influence of leadership on operational performance, taking into account the mediating role of manufacturing strategy implementation.

For years, multiple leadership theories have been developed, which describe different leadership styles and identify traits of effective leadership; however, none of them explained how to do it, proposing techniques or practices.

To fill this gap, Clawson (2009) developed a theoretical framework, facilitating leadership practices in which managers and supervisors may lead to enhance their leader presence within firms. No one, so far, provides empirical evidence on the matter.

This study examines the relationship of leadership practices with manufacturing strategy implementation and operational performance, following Clawson's framework. It firstly explores the direct effects of leadership practices on operational performance and, then their total effects over operational performance, taking into account the mediating role of manufacturing strategy implementation. Our study focuses on analyzing international manufacturing firms in the automotive, machinery and electronics industries.

In general, our findings show that such leadership practices strengthen leader's presence and influence operational performance, but their effects do vary. For instance, visible behavior related to non-aggressive leadership practices (clear commands) has positive and direct effects over operational performance, but its effect over manufacturing strategy implementation is absent. Such leadership practice facilitates coordination among employees and functional areas, speeds up functional activities and decision-making process, and reduces uncertainty, given that the main responsibility lies on the shoulders of head of the group (in this case, the leader) and her decision is not undisputed. It results in faster decision-making and, in turn, prompt adaptation to changes, reducing costs and reaction time. Nevertheless, it inhibits manufacturing strategy implementation, because both manufacturing strategy and organizational culture are not conveyed and, thus, employees' commitment is not developed, hindering strategic embeddedness.

On the other hand, visible behavior related to aggressive leadership practices have a negative indirect effect on operational performance, given that its direct effect on manufacturing strategy implementation is negative. Such leadership practices generate organizational rigidity and a hostile work environment, inhibiting internal communication and promoting employees' turnover. In addition, this behavior triggers negative attitude from employees, who may act against firm's interests, being able to sabotage manufacturing strategy implementation.

Regarding conscious thought, it positively influences operational performance, and the relationship between these leadership practices and operational performance is positively mediated by manufacturing strategy implementation. Such leadership practices are determinant for both manufacturing strategy implementation and operational performance. They facilitate sharing information, internal communication, knowledge transfer and learning within firm, reducing uncertainty (low role ambiguity). In the related literature, all of them have been associated in multiple times with cost reduction, greater flexibility and delivery on time as well as the achievement of manufacturing strategy implementation (Murat Kristal et al., 2010; Letmathe et al., 2012). Employees develop a sense of commitment to firm, given that they are involved in decision-making process and can identify and solve problems at plant level. In addition, these practices help to lead employees towards both common strategic and operative goals and, facilitate strategic embeddedness.

The last dimension, unconscious thought, positively affects operational performance and its indirect effect is also positive. Such leadership practices leading employees to embrace manufacturing strategy successfully; given that they promote fair and positive environment, open communication and ethical behavior among employees, resulting in a quality leaders' exchange relationship with subordinates. It facilitates sharing information, transfer knowledge and, even the development of an own language among employees, increasing the feeling of belonging to a group or team (Mohr et al., 2012)

Our study has important implications for academics, as it adds new insights to absent literature on three level leadership model. It also provides evidence for the emerging discussion on the lack of managers' skills such as leadership is the main failure factor in manufacturing strategy implementation and, in turn their impact on operational performance. Moreover, it highlights the importance of human resources as part of a consistent socio-technical system and as a valuable and unique resource. As inimitable resource, it may help HPM firms develop distinctive competences, resulting in a competitive advantage (Chowdhury et al., 2014; Giffi et al., 2016).

The empirical evidence in this paper can also be useful for both practitioners and employers looking for ways of improving business value and

competitive position of firms. Unlike others leadership models, which only describe leadership styles or identify traits of effective leadership, we focus on leadership in action, also called “knowhow”. Our study analyzes how specific human behaviors called leadership practices affects operational performance and, at the same time, how this relationship is mediated by manufacturing strategy implementation in order to achieve a successful competitive position. The identification on what leadership practices improve operational performance, may be helpful to develop a specific leadership profile, facilitating recruitment process.

On the other hand, as noted above, the absence of literature and empirical evidence related to this type of leadership style suggests the need to extend this new leadership model to include antecedents and explain their effects. It is necessary to explore clearly which leadership practices influence the development of exchange relationship, job satisfaction, worker performance or work environment, and how it, in turn, affect the implementation of strategy and practices at manufacturing level. Additionally, according to Clawson (2009), although the third dimension has to be developed simultaneously, just the first two level is really achieved and the last one is neglected. Conversely, some theorists argue strongly that leaders must only deal with level one and that attempts to influence to level two or three are unethical and an invasion of privacy. For instance, Skinnerians claim that leadership should focus on behavior and not think about or worry about what goes on inside a person. Therefore, it would be interesting to find out whether these leadership dimension is really related each other as future research.

Of course, our study is not free of limitations. The main one is the differences in industries. The study includes plants from three industries where leadership practices may differ significantly, making comparison difficult. The second is that our data came from industrial firms, so future studies might analyze and compare these results to those from the service sector. It would be interesting to know if such leadership practices have a similar impact on service sector. Finally, although our study is cross-sectional, our database is large and comprises three different and representative industries in the manufacturing sector, as well as manufacturers from countries around the world.

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Chapter 4

LINKING MANUFACTURING STRATEGYFORMALIZATION AND NEW TECHNOLOGY ANTICIPATION TO EFFECTIVE PROCESS IMPLEMENTATION

4.1. Introduction

This chapter deals with the capacity of manufacturing firms to anticipate new technology and, how it affects the effective implementation of manufacturing processes. New technology implies a continuous challenge for manufacturing firms to be competitive. Investment in new technologies imply the assignment of both financial and organizational resources to access and introduce them into production process (Tao et al., 2017).

Manufacturing firms can achieve a better competitive position through technology if they are able to transform technology on a valuable, rare and inimitable resource (Barney, 1991). According with the literature there are two ways to do it. First, developing the ability to anticipate competitors to be the first to find or develop a new technology. Second, being efficient in implementing new technologies, exploiting to the maximum the potential of the machines and developing unique capabilities around them (Khanchanapong et al., 2014). In the background, accounting by new technology, by itself, does not provide a competitive advantage to manufacturing firms since technology is readily available to competitors (Porter, 1985).

In order to improve the understanding of the way firms anticipate new technologies, this chapter explore how the adoption of a formal manufacturing strategy process can be determinant to achieve anticipation of new technologies. In this sense, as stated in chapter 2, a formal strategic planning provides support for strategic business objectives, guiding the decision-making process and providing the basis for trading off and selecting options. Through this process, firms capture information and knowledge from internal and external

sources which are required to guide firms towards common goals and mission (Dombrowski et al., 2016), adopting new technologies in advance to customers' needs and develops of specific capabilities for its successful implementation (Finger et al., 2014).

In addition, following Cohen and Levinthal (2000) to achieve a competitive advantage, firms must develop the ability not only to acquire knowledge, but also to assimilate and use it. In this line, organizational learning practices may help to assimilate and exploit both explicit knowledge and tacit knowledge stemmed from manufacturing strategy formulation and new technology anticipation, respectively. With this regard, it has been stated that instructive communication is determinant to generate and transfer knowledge within firm (Cormier and Hagman, 2014). It also helps to embrace strategies and policies, facilitating the introduction of complex standards (Kim et al., 2012; Boscari et al., 2016). Thus, it may help firms set new technology to manufacturing process in order to improve its effectiveness. In this line, Johnson et al (2019) shows that training contributes of building both explicit and tacit knowledge as well as improving the development of new capabilities associated with the adoption of new systems or technologies.

This paper aims to build a theoretical reasoning and shed new lights to improve the knowledge about the relationship between formal strategic planning, new technology anticipation and effective process implementation. The research questions are the followings:

- *RQ1: Does the anticipation of new technologies improve the effectiveness of process implementations?*

- *RQ2: Does a formalization of manufacturing strategy promote new technology anticipation?*

- *RQ3: Does shop-floor training affects the association between new technology anticipation and effective process implementation?*

Answering these questions, this chapter contributes to the current literature on strategy and process implementation in manufacturing in several ways.

First, this paper shed light on the current paucity of literature on new technology anticipation, identifying organizational structures as antecedents of

new technology anticipation. To address this gap, we analyze the benefits of manufacturing strategy formalization and its linkage with new technology anticipation. The theoretical argumentations and the empirical evidence shows that formal strategy planning is a source to organize internal and external valuable information and knowledge and a coordination mechanism that helps firms to develop the capacity to anticipate knew technology within firm.

Second, it reinforces the idea of competitive advantage does not result from technology implementation, but from the combination of technology adoption and the development of tacit capacities related to new technology anticipation. These capacities are reinforced by the previous formal strategy planning and contribute learning during the process.

Third, the study focuses on the efficiency in the implementation of newprocesses. Many papers analyzed the impact of new technologies on productivity and manufacturing performance as a whole, however, there are very few references to the way to achieve these records. In this sense, in this work we understand that the effective implementation of new processes will be decisive for the performance of companies.

Fourth, the paper examines the influence of new technology anticipation on effective process implementation, which is stronger if manufacturing strategy formalization comes into play. Moreover, we suggest that instructive communication is one of drivers to assimilate and exploit new technology anticipation, facilitating the exchange of knowledge and the transmission of ideas, goals and strategy (Kim et al., 2012; Johnson et al., 2019). The theoretical argumentation and the empirical approach of this study considers not only the main effect of manufacturing strategy formalization on new technology anticipation, but also the existence of mediating role of instructive communication to explain the relationship between new technology anticipation and effective process implementation.

Finally, our database comes from the fourth round of the international High Performance Manufacturing Project (HPMP). In particular, this study examines 287 medium-large manufacturing firms, from thirteen countries around the world and three industries (electronics, automatic and machinery).

The study is organized as follows. Next section elaborates a theoretical argumentation on the relationship between manufacturing strategy formalization and new technology anticipation based on resource based view theory (RBVT) taking into consideration related framework such as organizational routines theory, dynamic capabilities approach and organizational ambidexterity approach. In addition, we analyze how the formalization of manufacturing strategy and anticipation of new technology influence effective process implementation, taking account the mediation role of a specific shop-floor communication practice (instructive communication) in order to assimilate knowledge related to new technology anticipation. As a result, three hypotheses are proposed. The third section, describes the data source, the statistical treatment and the econometric model used to test hypothesis. After that, the results are presented. Finally, it closes with the discussion, conclusions, and future research.

4.2. Literature review

According to the RBV theory (Barney, 1991), firms can achieve a competitive advantage derived from the presence of an unique combination of valuable, rare, inimitable and non-substitutable resources. Firms rely on three types of resources: physical, human and organizational, whose combination is determinant to achieve a competitive position in the marketplace (Grant, 1999). In this study, we explain and analyze how knowledge related to new technology anticipation and its implementation and exploitation as human and physical resources and manufacturing strategy formalization as an organizational resource, may confer a competitive advantage upon firms.

On the one hand, the RBV considers this knowledge as a competitive resource, given that tacit knowledge linked to technology is difficult and costly to transfer and to imitate (Grant, 1999; Nonaka, 1994). On the other hand, organizational resources capture the ability of firms to identify needs in advance and on how to anticipate new technology demands. These resources are more related to the strategic process and the company's capabilities to incorporate information and guidelines through strategic analysis and respond appropriately.

The inimitability that RBV theory predicts to achieve a sustainable competitive advantage may be achieved by the combination of new technologies and organizational elements (Zhang et al., 2016). This idea of complementarity refers to the nature of the resources required to capture the benefits associated with a particular strategy or technology.

Furthermore, firms increasingly promote the search of achieving a balance between exploration and exploitation orientations in order to reach and retain a competitive advantage (Alcaide-Muñoz and Gutiérrez-Guitérrez, 2017). It is knows as organizational ambidexterity and is one of most important organizational competences within firms (Zhang et al, 2016).

According to March (1991), exploitation orientation includes activities such as the improvement and control of stable and familiar processes (mechanistic orientations. It is associated with activities such as “refinement, efficiency, selection, and implementation” (p 102). By contrast, exploration orientation refers to innovation and creative activities in order to explore new alternatives (organic orientation). It refers to notions such as “search, variation, experimentation, and discovery” (p. 102). It is generally accepted that both orientations need to be promoted, given that one of them is not enough to tackle hypercompetitive and dynamic environments (Salvador et al, 2014). Exploitation and exploration orientations demands several organizational structures, strategies and contexts, given that there is a trade-off between aligning the organization to exploit existing competencies and exploring new ones (Alcaide-Muñoz and Gutiérrez-Guitérrez, 2017). Therefore, it is worthy of identifying organizational factors, which establish organizational structures and contexts as well as define strategies required by organizational ambidexterity.

4.2.1. Anticipation of new technology

New technology anticipation is described as “the extent to which an firm anticipates the new technologies that will be important to it in the future, acquires them and develops capabilities for implementing them, in advance of actual need” (Hayes and Wheelwright, 1984). It has been identified as a significant key to face dynamic competitive environments, because in such environments, customers’ preferences change quickly, so firms must respond by offering new

products or services, which meet the new needs of the markets (Tripsas, 2008). Additionally, firms that anticipate new technologies are better prepared to adopt them quickly when needed and, then, use them as a source of competitive advantage (Finger, et al., 2014).

New technology anticipation has been associated with a specific type of absorptive capacity, as it is based on the acquisition and assimilation of a specific knowledge about technology development and tacit capabilities for its effective adoption (Finger et al., 2014). So, it is not an easy competence, since it requires having the resources and foresight to acquire new technologies in advance to customers' needs as well as the development of specific capabilities for its successful implementation (Hayes et al., 1988; Maier and Schroeder, 2001).

Moreover, it may be a risky and costly strategy, given that manufacturing firms may invest in technologies that won't be profitable in the future, resulting in wasting time, money and resources (Finger et al., 2014). Therefore, it is important to underline out the need to identify what factors related to new technology anticipation may reduce such risks and costs, helping firms to identify the adequate technology and ensuring its implementation.

4.2.2. Manufacturing strategy formalization and anticipation of new technology

Resources of manufacturing firms are mostly allocated in the improvement of production process in comparison with the other functions, as it is seen as a potential source for obtaining competitive advantage and as a way of differentiating themselves from competitors (Machuca et al., 2011). So, many research efforts are put into understanding and improving manufacturing strategy (Bates et al., 2001; Acur et al., 2003; Jagoda and Kiridena, 2015). These studies show that manufacturing strategy enhances operational functions, competitive performance priorities and specific functional capabilities, amongst which the development of new technology and, even, its anticipation (Bates et al., 1995; Pretorius and Wet, 2000; Machuca et al., 2011).

Manufacturing strategy is described "a consistent pattern of decision making in the manufacturing function which is linked to the business strategy" (Hayes and Wheelwright, 1984). Such pattern is reflected in Strategic Planning, which is

defined as a guideline and coordination mechanism to monitor and integrate different procedures and functions within firms (Porter, 1990; Glaister et al., 2008; Kohtamäki et al., 2012). Lyles et al. (1993) highlight the role of strategic planning in manufacturing, given that developing distinctive competences, determining authority relationships, allocating resources, and monitoring, are more effective in the presence of formal strategic planning.

The organizational routines theory (Nelson and Winter, 1982) reinforces the view of the existence of organizational capabilities linked to strategic planning in dynamic context. Organizational routines involve complex patterns of coordination among people and between people and other resources (Grant, 1999). In this sense, the development of superior capabilities around strategic planning process involves a number of organizational routines that coordinate individuals of organizational functions to identify opportunities and treats and the resources to respond to these. Formalizing their strategic planning, also known as manufacturing strategy formalization, firms are able to improve the coherence between operational decisions of different functional areas and the efficient allocation of resources among them (Acur et al., 2003).

Manufacturing strategy formalization provides firms a sense of direction and outlines measurable goals, looking for efficiency, prioritizing investment, optimizing the resources allocation, guiding the decision-making process and providing the basis for trading off and selecting options (Bryson, 2012). It also ensures the link between manufacturing strategy and operations as well as its alignment with business and corporate strategy, determinant to mitigate risks related to technology, given that one of the main failures in their implementation is the misalignment between the selected technology and the business strategies of firm (Swamidass and Newell, 1987; Iakymenko et al., 2016). Thus, manufacturing strategy formalization may help manufacturers to effectively integrate and reinforce resources, especially technological resources to improve process and respond adequately to customers' and suppliers' demands.

On the other hand, the dynamic capability approach proposed by Teece et al. (1997 p. 516) considers "the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments". In this sense, manufacturing strategy formalization involves several stages,

including the assessment of both internal and external factors, which leads to the identification of own strengths and weakness as well as the potential opportunities and threats, concerning the industry and competitors (Dombrowski et al., 2016). Such internal and external analysis formalized in the strategic plan allows firms to compare their resources and associated capabilities with their competitors in order to anticipate the needs for successfully compete as well as to face internal deficiencies (Hoffman, 2001; Kohtamäki et al., 2012; Dombrowski et al., 2016). Thus, during this process, firms learn and expand their knowledge about new technologies, customers' and suppliers´ needs, firm's and stakeholders' requirements and, even, internal organizational needs. As a result, it may assist firms to build, integrate and fit both internal and external competences to face changing environment.

Moreover, as noted above, scholars advocate that firms must be capable not only to exploit their current resources and competences, but also tackle changing environment in order to achieve a competitive advantage (Salvador et al, 2014, Alcaide-Muñoz and Gutiérrez-Guitérrez, 2017). It is known as organizational ambidexterity, which is defined as "a firm's ability to be aligned and efficient in its management of today's business demands while simultaneously being adaptive to changes in the environment at the same time" (Raisch and Birkinshaw, 2008, p. 375). In this sense, the above-mentioned internal and external analysis in combination with the role of manufacturing strategy formalization as a coordination mechanism, offer external and internal knowledge as well as organizational structures, strategy and contexts required by organizational ambidexterity. As a result, it allows firm to exploit the existing resources and competences and, in turn, explore new ones.

The foregoing arguments allow us to argue that manufacturing strategy formalization, as a roadmap and coordination mechanism, provides a foundation for new technology anticipation, as it helps firms optimize the use of resources investment and focus efforts on developing distinctive competences such as new technology anticipation. At the same time, it helps to align new technology with internal and external environment and challenges, which makes for it to be non-substitutable. So, we hypothesize:

H_1: Manufacturing strategy formalization positively influences anticipation of new technology.

4.3.3. Anticipation of new technology and effective process implementation. The mediating role of shop-floor communication practice

Effective process implementation is described as "a manufacturer's effectiveness in the development and implementation of new processes and equipment" (Huang et al., 2008, p.718). Managers usually act with the goal of adapting their firms to changes in context to achieve fit and develop new processes (Ortega et al., 2012). In this line, because of its main characteristic as non-inimitable resource, the development of new technology is viewed as one of key factors to meet customers' demands or even make production process more efficient, leading to a competitive advantage (Heine et al., 2003; Machuca et al., 2011; Cozzarin, 2016).

The related literature shows that there is a high risk associated with the implementation of a new process, as the knowledge about the process does not results from an experience (Adamczak, Bochnia and Kaczmarska, 2015). Nevertheless, according to Finger et al. (2014), firms anticipating new technology have less substantial number of false starts down path to future technology. It results in less costs, higher quality, delivery and flexibility, as these firms use effectively their resources, gaining in efficiency. It, thus, ensures new process implementation and mitigates the related risks.

Furthermore, the development of new processes demands specialized internal and external knowledge as well as the design of interfaces and division of tasks between individual and department (Huang et al., 2008). On the one hand, new technology anticipation has been recognized as a type of absorptive capacity, which differentiates between current knowledge and future knowledge (both internal and external) (Finger et al., 2014). On the other hand, new technology anticipation in combination with manufacturing strategy implementation, may offer not only internal and external knowledge, but also the alignment of interfaces and division of tasks between individual and department required by effective process implementation. Thus, in line with this thought, we propose:

H_2: Anticipation of new technology has positive effects on effective process implementation.

As noted above, new technology anticipation involves the development of tacit knowledge, which needs to be transferred and assimilated by employees. Because of the intangibility of tacit knowledge and the difficulty of converting it into explicit knowledge, firms usually lose significant information when skilled employees leave (Smith, 2001). To address this issue, firms use organizational learning practice such as instructive communication, which is determinant for facilitating knowledge transfer (Kim et al., 2012).

Instructive communication refers to learning activities or training given to workers to improve their skills and thus improve work performance within firms (Chukwu, 2016). It allows adopters to acquired knowledge held by others (Kostava, 1999). Instructive communication has been viewed as enablers to embrace strategies or policies (Kim et al., 2012; Alcaide-Muñoz et al., 2018). The knowledge gained from the previous training effort favors the smooth introduction of complex standards, such as policy deployment (Boscari et al., 2016), given that this practice helps to identify problems and, in turn, to stimulates knowledge transfer, learning and the continuous improvement of individuals, leading to effective process implementation and development (Zu et al., 2010). Additionally, the lack of qualified employees has been identifying as main barriers to adopt new process, products or systems, given that it generates resistance to change (Madrid-Guijarro, Garcia and Van Auken, 2009; Hölzl and Janger, 2014; Abdullah et al., 2016).

Instructive communication has also been recognized as a shop-floor communication practice, linkedto the development of tacit knowledge as well as to successfully perform operational activities (Kim et al., 2012). Knowledge transferred by training enhances inspection performance (Drury and Watson, 2002; Cormier and Hagman, 2014) as well as the speed, accuracy and performance of visual inspectors, including the development of new capabilities to develop a new role (Letmathe et al., 2012; Johnson et al., 2019). In fact, a case study shown how, after introducing a training program, error rates, scrap, and rework were decreased significantly (Kleiner and Drury, 1993). Taking into account the previous ideas, we expect that instructive communication help to

assimilate and exploit tacit knowledge related to new technology, given that it is a good means for facilitating knowledge transfer in the whole firm (Cormier and Hagman, 2014). So we propose:

H_3: The relationship between anticipation of new technology and effective process implementation is mediated by instructive communication.

4.3. Methodology

4.3.1. Data collection and sample

Our database comes from an international research project, called High Performance Manufacturing (HPM) project. In our research study, we use the fourth round of this database, which analyze the relationship between firms' practices and performance in manufacturing plants. They operate in mechanical, electronics and automotive industries around the world. In each country, a local HPM research team were charged in collecting data, selecting the plants, contacting them, distributing the questionnaires and assisting the respondents in order to ensure the reliable information gathered.

The plants were selected by a master list of manufacturing (i.e., Dun's Industrial Guide, JETRO database, etc.). Each local HPM research team had to include an approximately equal number of plants that use advanced practices in their industries (i.e., world-class manufacturing plants) and traditional manufacturing units (i.e., not world-class manufacturing plants). Plants represent several parent corporations with at least 100 employees. It ensures that a sufficient number of managers and employees would be available to complete the survey (Naor et al., 2010). In each plants, a pack of 23 questionnaires is distributed by individual visits or by mail to different respondents considered the best informed about the topic of each questionnaire, so the problem of common method bias is reduced.

Each questionnaire consists of perceptual scales and objective items. It includes a mix of item types and reversed scales to further reduce the possibility of common method variance. Although the official language used in the questionnaires is the English, each local HPM research team translated them into the language of the participating country. Afterward, the questionnaire was back-

translated into English by a different local HPM researcher in order to ensure accurate translation.

4.3.2. Measures and statistical treatment

Our study focuses on 287 world-class manufacturing plants and not world-class manufacturing plants, operating in the sectors mentioned above and located in Austria, Germany, China, Taiwan, Brazil, Finland, Italy, Israel, South Korea, Spain, Sweden, Vietnam and the United Kingdom. In this project, each scale is based on the literature and previously used as measurement scales; in addition to being checked with experts and manager in order to validate its content. Thus, our study consists of scales used extensively and validated in past works as well as in the OM literature.

The scales incorporated into the questionnaire related to our study, suggest that all of our variables should be treated as a reflective indicator, as co-variation among measures is explained by variation in an underlying common latent factor (Bollen and Lennox, 1991). In this case, explanatory factor analysis (EFA) and confirmatory factor analysis (CFA) were performed to prove the constructs' reliability and to verify the validity of the measures (Nunnally, 1978).

Manufacturing strategy formalization

The questionnaire included four items related to manufacturing strategy formalization, answered by Plant managers and follow a one-to five Likert scale ranging from 1 "strongly disagree" to 5 "strongly agree". These items are based on the Skinner scale (1978), which describes formal strategic planning where manufacturing strategies, mission and goals must be in writing, and also routinely reviewed and updated. One item was rejected because its loading was smaller than 0.60 (Mathieson et al., 2001), therefore, the remaining three constitute the dimension called "Manufacturing Strategy formalization".

Factorial analysis reveals one dimension represented by 73.07%; in addition, all items exhibit a very good internal consistency to explain the construct, as Cronbach's alpha has a value above 0.6 as recommended Nunnally (1978) (see Table 4.1). Additionally, the value concerning the Kaiser-Meyer-Olkin criterion of sampling adequacy is satisfactory, since they exceed the minimum scores of 0.5 (KMO = 0.695). Discriminant validity was verified, since average

variance extracted (AVE) is above 0.5, and its square root for the construct is larger than the correlation of the other constructs.

Furthermore, we can observe that manufacturing plants has a high extend of formalized strategy, as its mean is above 4. There is a high variation in the set of data values, since standard deviations range from 0.8 to 0.89.

Anticipation of new technology

To measure anticipation of new technology, we use Finger et al. (2013) scale, based on Hayes and Wheelwright's (1984) definition. They describe new technology anticipation as "the extent to which a firm anticipates the new technologies that will be important to it in the future, acquires them and develops capabilities for implementing them, in advance of actual need" (Hayes and Wheelwright, 1084). These questions are administered to a process engineer, the plan superintendent and plant manager, and based on a one-to five Likert scales ranging from 1 "strongly disagree" to 5 "strongly agree".

Four items are used to create this latent construct, which represent the employees' efforts to anticipate new technology, acquiring them and developing capabilities to adopt them, in advance of their needs. All items have a loading higher than 0.6 (Mathieson et al., 2001), therefore, no one was rejected.

One dimension was revealed by factor analysis, which explains 60.33% of the variance of the latent construct. Cronbach's alpha has a value above 0.6, as the dimensions offer good consistency and explain the construct (Nunnally, 1978) (see Table X). In addition, the Kaiser-Meyer-Olkin criterion of sampling adequacy is satisfactory, since it exceeds the minimum scores of 0.5 (KMO = 0.777). Discriminant validity was confirmed, as average variance extracted (AVE) is 0.599 (AVE > 0.5) and, its square root is greater than the correlation of the other constructs (see Table 4.1).

As shown in Table 4.1, employees' in the plants, are engaged in pursuing the anticipation of new technology, acquiring manufacturing capabilities in advance of their needs. In particular, employees' make many efforts to anticipate the potential of new manufacturing practices and technologies (its mean is near 4). Additionally, the standard deviation of items shows a high variation in the set of data values, ranging between 0.76 and 0.98.

Instructive Communication

Instructive communication is one of shop-floor communication practices, used in some research studies (Zeng et al., 2013; Alcaide-Muñoz et al., 2018). This practice refers to task-oriented training for employees, offered by firms in order to improve their skills at work. Some studies have shown that this communication is really critical factors in manufacturing plants, as is seen as a driver of knowledge transfer (Kim et al., 2012) and, therefore, it helps to embrace and improve operational practices, procedures and strategy (Zeng et al., 2013; Abrahamsen and Häkansson, 2015; Alcaide-Muñoz et al., 2018).

The questionnaire included five items related to instructive communication, answered by human resources managers. Following the suggestions of previous research studies (Zeng et al., 2013; Alcaide-Muñoz et al., 2018), two items were rejected, since the loadings of the items were smaller than 0.60 (Mathieson et al., 2001) (see Table 4.1).

Factor analysis detected one dimension that explains 72.08% of the variance, which offers good consistency and explains the construct (Cronbach's > 0.6). Moreover, the Kaiser-Meyer-Olkin criterion of sampling adequacy is satisfactory, since it exceeds the minimum scores of 0.5 (KMO = 0.692). The construct has an AVE of 0.72 (AVE > 0.5) and its square root is greater than the correlation of the other constructs, so discriminant validity was verified (see Table 4.1).

Furthermore, the construct shows a high level of adoption of this shop-floor communication practices (around 4 on 1-5 Likert scale); as Table 1 shows, employees receive training to improve their skills and managers believes in continual training and upgrading of employees' skills. In addition, the standard deviation varies from 0.74 to 0.79, indicating variation in the dataset.

Effective Process Implementation.

Effective Process Implementation refers to whether firms develop and implement new processes in an effective way. Some studies have shown that when firms get to adopt processes effectively, it results in processes improvement, in turn, operational performance improvement (Schroeder and Flynn, 2001; Huang et. al., 2008). The questionnaire included one item that

literally measure that and, it is answered by process engineer (see Table 1). It follows a one-to-five Likert scales ranging from 1 “strongly disagree” to 5 “strongly agree”.

As shown in Table 4.1, manufacturing firms develop and adopt new processes effectively, as its means is near 4; although, its standard deviation shows a high variation in the set of data values.

Table 4.1. Validity and reliability of factors

	Mean	Loadings	α Cronbach	AVE
Manufacturing Strategy formalization	**4.023 (0.731)**		**0.815**	**0.73**
Our plant has a formal manufacturing strategy process, which results in a written mission, goals and strategies.	4.047 (0.889)	0.879		
This plant has a manufacturing strategy, which is put into writing.	3.997 (0.897)	0.879		
Plant management routinely reviews and updates a long-range manufacturing strategy.	4.025 (0.772)	0.803		
Anticipation of new technology	**3.737 (0.709)**		**0.777**	**0.599**
We pursue long-range programs, in order to acquire manufacturing capabilities in advance of our needs.	3.623 (0.981)	0.802		
We make an effort to anticipate the potential of new manufacturing practices and technologies.	3.976 (0.767)	0.765		
Our plant stays on the leading edge of new technology in our industry.	3.627 (0.966)	0.739		
We are constantly thinking of the next generation of manufacturing technology.	3.722 (0.936)	0.798		
Instructive Communication	**3.990 (0.658)**		**0.806**	**0.721**
Our plant workers receive training and development in workplace skills, on a regular basis.	3.895 (0.798)	0.882		
Management at this plant believes that continual training and upgrading of workers skills.	4.225 (0.741)	0.802		
Our workers regularly receive training to improve their skills.	3.850 (0.787)	0.861		

Effective Process Implementation	**3.872 (0.752)**			
Our processes are effectively developed and implemented.	3.872 (0.752)	1.000		

Source: The authors
Abbreviation: ( ) Standard deviation

In the table 4.2, we can observe the impact of both independent and dependent variables by correlation matrix. All independent variables have positive and significant correlation to each other; however, their relationships with independent variable (effective process implementation) varies. Both anticipation of new technology and instructive communication show a positive and signification correlations with effective process implementation, but their coefficients are below 0.32. Only manufacturing strategy formalization shows an insignificant correlation with effective process implementation. Additionally, the value of all correlations is lower than 0.137.

Table 4.2. Correlation matrix

	PI	**ICM**	**MSF**	**ANT**
PI	1			
ICM	0.131*	1		
MSF	0.102	0.369***	1	
ANT	0.311***	0.256***	0.357***	1

Source: The authors
Notes: *p<0.05; **p<0.01; ***p<0.001.
Abbreviation: ANT (Anticipation of new technology)**, MSF** (Manufacturing Strategy Formalization)**, ICM** (Instructive Communication) and **PI** (Effective Process Implementation).

4.3.3. Method

According to the theoretical model proposed in this research study (figure 4.1), the non-existence of latent variable with formative indicators, the sample size and absence of multivariate normality, a Structural Equation Model is considered the most suitable tool for the aims of this work (López-Arceiz, et al., 2016).

We test and estimate measurement and/or structural models based on robust statistics with multivariate non-normality of observations. The general estimation method used is MLR (maximum likelihood robust to non-normality of observations). The adequacy and adjustment of both measurement and structural models were assessed, using adjusted X^2, Standardized Root, Root Mean Squared Error Approximation (RMSEA), Non-normed Fit Index (NNFI), Incremental Fit Index (IFI) and Comparative Fit Index (CFI).

With regard to the structural model, we estimate one model, where we offer information about the impact of three dependent variables (manufacturing strategy formalization, new technology anticipation and instructive communication) on the independent variable (effective process implementation). This model allows us examine the direct, indirect and total relationship of the different constructs.

4.4. Results

The indices of the measurement model suggest that the model has reasonable fit, as all of them are above 0.90 and the RMSEA is lower than 0.08. (X^2=63.0625 df =33; RMSEA= 0.056; CFI= 0.959; NNFI= 0.944; IFI= 0.959).

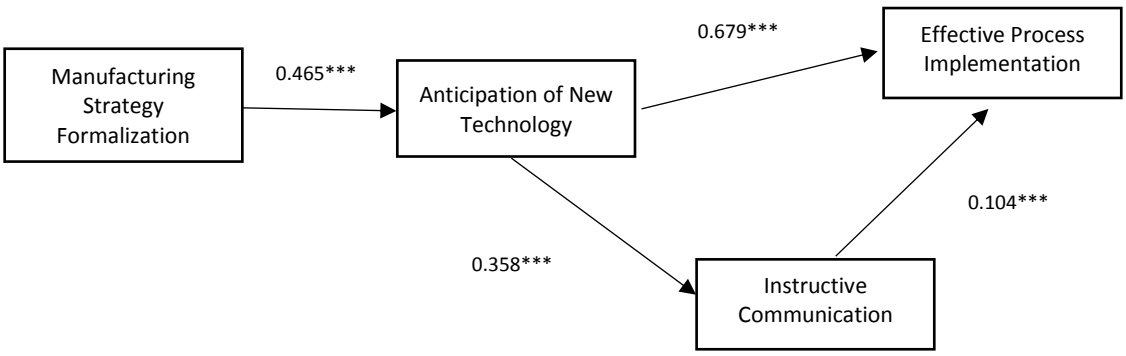

Figure 4.1. The structural model

With regard to the structural models, Table 4 contains the results of the SEM analysis. The first step is to analyze the direct effects between variables. In this sense, we can observe that the direct relationship between manufacturing strategy formalization and new technology anticipation is positive and statistically

significant, which support H_1, therefore manufacturing strategy formalization is an antecedent of new technology anticipation.

Model shows that there is also positive and direct relationship between new technology anticipation and effective process implementation, highly significant, which confirms H_2. Given that, firms exploring and anticipating markets demands are more capable to implement new technologies and processes when needed. Additionally, both the direct relationships between instructive communication and instructive communication and, effective process implementation are positive and significant, supporting H_3. It is due to instructive communication as communication practices facilitates knowledge assimilation, engaged from anticipation of new technology,

The second one is to examine the indirect and total effects between independent variables (manufacturing strategy formalization, new technology anticipation and instructive communication) and depend variables (effective process implementation). Because of the structure of our model, we can observe that the total and indirect effects between manufacturing strategy formalization and effective process implementation are the same. They are positive, significant and strong (see Table 4.3). Additionally, the indirect effect between these variables is also strong, but the variation of both path coefficients is not high, if instructive communication is included or not in the model (0.333 and 0.324, respectively) (see Table 4.3). It suggests that instructive communication is a driver for the assimilation of knowledge within manufacturing firms.

Moreover, the indirect effect of new technology anticipation on effective process implementation is significant, but not high, as its path coefficient is 0.042. It notes the crucial role of manufacturing strategy implementation as antecedent of new technology anticipation in order to develop and adopt new processes effectively.

Finally, at the bottom of table 4.3, we can observe that all structural models have a reasonable fit, given that fit indices are above 0.90 and the RMSEA is lower than 0.08.

Table 4.3. The structural model

	Estimate[a]	R^2
Structural model		
Direct effects		
MSF on ANT	 0.465***	 0.216
ANT on ICM EPI	 0.358*** 0.679***	 0.128
ICM on EPI	 0.104*	
Indirect effects		
MSF → ANT → ICM → EPI	0.333***	
MSF → ANT → EPI	0.324***	
ANT → ICM → EPI	0.042*	
Total effects		
MSF → EPI	0.333***	

Abbreviation: ANT (Anticipation of new technology)**, MSF** (Manufacturing Strategy Formalization)**, ICM** (Instructive Communication) and **PI** (Effective Process Implementation)

Notes: *p<0.05; **p<0.01; ***p<0.001. °Standardized coefficients are reported. RMSEA, root mean square error of approximation; CFI, comparative fit index; NNFI, non-normed fit index; IFI, incremental fix index. X^2=76.139; df=41; RMSEA=0.055; CFI=0.959; NNFI= 0.944; IFI= 0.960.

4.5. Conclusions

Because of new manufacturing powers, such as China, India, Southeast Asia and Brazil, manufacturing firms put their efforts into develop competitive capabilities and distinctive competences within firms in order to secure their long-term survival. They increasingly focus on the development of intangible resources, which are inimitable by competitors, and thus, lead them to reach a competitive position in the marketplace (Barney, 1991). In doing so, manufacturing firms has paid attention to improve production process by means of new technology implementation (Heine et al., 2003; Birasnav, 2014; Cozzarin, 2016). However, there is an ongoing discussion on whether technology adoption really provides a competitive advantage to manufacturing strategy (Das and Narasimhan, 2002; Machuca et al., 2011).

As noted previously, several researchers advocate that technology is easy to imitate, so it does not confer a competitive advantage upon manufacturing

firms (Porter, 1985; Hayes et al., 1988). In this sense, the characteristics related to new technology anticipation make for it to be a real competitive weapon for manufacturing firms (Finger et al. 2014). So, our study attempts to explore what organizational factors may reinforce new technology anticipation, leading to effective process implementation and, therefore, a competitive advantage.

In particular, this study identifies manufacturing strategy formalization as one of the foundations for new technology anticipation as well as the influence of new technology anticipation on effective process implementation. Additionally, it takes into account the mediation role of a specific organizational communication practice such as instructive communication between anticipation of new technology and effective process implementation. Our study focuses on analyzing international manufacturing firms in the automotive, machinery and electronics industries.

Our findings show that manufacturing strategy formalization has positive effects on new technology anticipation, given that it helps firms to know what tangible and intangible resources firms have, where they headed and how to protect them. It, as planning mechanism, also provides guidelines to develop tacit capacities and knowledge required for the development of new technology anticipation. All of them allow firm to use effectively their resources, gaining in efficiency.

Moreover, the relationship between new technology anticipation and effective process improvement when manufacturing strategy formalization is in the model. Given that, it helps firms to fit production process in accordance with market demand (external) and internal resources and deficiencies (Kohtamäki et al., 2012; Dombrowski et al., 2016). It also allows them to anticipate new technology and, when firms explore, innovate and tinker with theirs process technology, they are more capable of adopting this technology when needed and exploiting them as a source of competitive advantage (Hayes and Wheelwright, 1994). Therefore, the exploration and anticipation of market demands confer a competitive advantage upon firms, given that it allows them to be ready in adopting new technologies and processes. In addition, it mitigates risks related to new process implementation, ensuring the adoption of new processes efficiently.

Finally, our findings reinforce the idea that instructive communication is significant to ensure the exploitation of new technology anticipation (effective process implementation). It is due to the fact that such organizational learning practice facilitates knowledge exchange within firms (Kim et al., 2012). It also promotes learning and the continuous improvement of individuals, reducing resistance to change and, thus, leading to effective process implementation and development (Zu et al., 2010; Abdullah et al., 2016). Therefore, it allows employees to assimilate and exploit both explicit and tacit knowledge engaged from manufacturing strategy formalization and new technology anticipation.

Our study has important implications for academics, as it adds new insights to the current paucity of literature on anticipation of new technology and its antecedents. It provides empirical evidence for the emerging discussion on whether manufacturing firms have to focus their effort not only on new technology implementation, but also on the anticipation of new technology. Additionally, it emphasizes the remarkable role of human resources as part of a consistent socio-technical system and as a valuable and unique resource, given that the assimilation of explicit and tacit knowledge from employees is crucial to exploit technology efficiently, resulting in effective process implementation and improvement. It, therefore, leads to a competitive advantage.

The empirical evidence in this paper can also be useful for both practitioners and employers looking for ways of improving business value and competitive position of firms. Unlike most research studies, which analyze the implementation of new technology, our study delves into this topic, focusing on the development of tacit capabilities and knowledge related to new technology. Additionally, it brings a greater understanding of manufacturing strategy formalization in order to achieve competitive position in the marketplace, whose influence is highly underestimate in comparison with others strategies (Atkinson, 2006; Kazmi, 2008).

Furthermore, the absence of literature and empirical evidence related to new technology anticipation suggests the need to extend knowledge to include antecedents and explain their effects. It is necessary to explore what organizational factors reinforce the adoption of technology and the development of tacit capacities related to new technology. In addition, it would be important to

find out what other organizational learning practices may facilitate knowledge transfer to be exploited efficiently for future research.

Of course, our study is not free of limitations. The main limitation is HPM database, which can be restrictive in term of the research topics that can be examined. Additionally, our study is cross-sectional, which limits the possibilities of analyzing dynamic changes in the same plants. However, our database is large and comprises three different and representative industries in the manufacturing sector, as well as manufacturers from countries around the world.

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Chapter 5

CONCLUSION

5.1. Introduction

This thesis studies the link between the manufacturing strategy process and operational performance, giving special attention to the role of internal communication practices and leadership on the shop floor. In particular, it analyses the association between two activities of the manufacturing strategy process: manufacturing strategy formulation and manufacturing strategy implementation. Special attention is paid to formalization of the manufacturing strategy, given that, as a guideline and coordination mechanism, it helps firms to respond to the changing dynamic environment and ensure manufacturing strategy implementation. In order to advance understanding of the manufacturing strategy process, this study also considers the moderating role of shop-floor communication in the linkage between formalization and implementation. Shop-floor communication is considered in depth, including a set of practices such as small-group problem solving, supervisor interaction facilitation, feedback and instructive communication. The related literature emphasizes the need for effective communication in the planning process to ensure that firms respond adequately to changes and implement strategies efficiently (Montgomery, 2008).

Researchers have advocated the importance of the manufacturing strategy, and particularly the need to extend our understanding of the manufacturing strategy process (Dangayach & Deshmukh, 2001; Thun, 2008). On the one hand, this implies examining the manufacturing strategy process as a single activity, offering a new view and empirical evidence on the linkage between manufacturing strategy formulation and manufacturing strategy implementation (Gimbert et al., 2010; Leonardi, 2015). This in-depth analysis may bring light to the current controversy on whether formalization in the manufacturing strategy provides real benefits for manufacturing strategy implementation or whether, instead, it leads to failed strategy implementation (Elbanna et al., 2016).

On the other hand, the need to achieve a greater understanding of each activity in the manufacturing strategy process has been emphasized by researchers and practitioners (Dangayach and Deshmukh, 2001; Kazmi, 2008). In this sense, the related literature focuses on analysing the effect of manufacturing strategy formalization on exploitation orientation, neglecting its potential impact on exploration orientation (Acur et al., 2003; Jagoda and Kiridena, 2015; Machuca et al., 2011). Furthermore, although manufacturing strategy implementation has received special attention, it is still a source of frustration in manufacturing firms. Both researchers and practitioners ignore the real factors that ensure successful manufacturing strategy implementation (Jagoda and Kiridena, 2015).

Furthermore, this thesis analyses the effects of each activity in the manufacturing strategy process (formalization in manufacturing planning and manufacturing strategy implementation) individually in relation to exploitation and exploration orientations. On the one hand, it examines how leadership in practice affects operational performance by means of manufacturing strategy implementation. In particular, this study focuses on a type of leadership model proposed by Clawson (2009) and not yet tested. Clawson (2009) develops a theoretical framework based on how the use of leadership practices related to human behaviour executed by managers leads to a specific response from employees. The thesis reveals that the effects of these leadership practices on operational performance vary due to their influence on manufacturing strategy implementation.

On the other hand, this thesis analyses the effects of manufacturing strategy formalization on new technology anticipation and, indirectly, on effective process implementation. It comes to recognize the importance of an exploration orientation in organizations, following the idea that technology does not by itself confer a competitive advantage upon manufacturing firms, because it is readily imitable (Porter, 1985). The competitive advantage results from a combination of technology adoption and the development of tacit capacities related to new technology anticipation, which are reinforced by the previous formal strategy planning. At the same time, this study assesses the influence of new technology

anticipation on effective process implementation, which is found to be relatively stronger when including manufacturing strategy formalization as a regressor.

This thesis addresses these research gaps by emphasizing the added value of human resources in the manufacturing strategy process. In particular, it assesses how several shop-floor communication practices may influence the manufacturing strategy process as a single activity. In addition, it explores how the leadership practices used at shop-floor level improve operational performance and inhibit or promote manufacturing strategy implementation. Both aspects are thoroughly analysed in Chapters 2 and 3, while Chapter 4 considers manufacturing strategy formalization as a driver of organizational ambidexterity (exploitation orientation and exploration orientation). It identifies manufacturing strategy formalization as an antecedent of new technology anticipation, and emphasizes that manufacturing strategy formalization is a determinant not only in exploring new resources and competences, but also in exploiting the existing ones. Additionally, this chapter shows how new technology anticipation mitigates risks related to the adoption of new processes, ensuring effective process implementation. It also takes into consideration the mediating role of instructive communication as an organizational learning practice. This practice allows firms to assimilate and exploit both explicit and tacit knowledge stemming from manufacturing strategy formalization and new technology anticipation.

Manufacturing strategy formalization provides firms with a sense of direction and outlines measurable goals, looking for efficiency, prioritizing investment, optimizing the resources allocation, guiding the decision-making process, and providing the basis for trading off and selecting options (Bryson, 2012). It also ensures the link between manufacturing strategy and operations, as well as its alignment with business and corporate strategy, a determinant in mitigating risks related to technology, given that one of the main failures in their implementation is the misalignment between the selected technology and the business strategies of firm (Iakymenko et al., 2016; Swamidass and Newell, 1987). Thus, manufacturing strategy formalization may help manufacturers to integrate and reinforce resources effectively, especially technological resources, to improve process and respond adequately to customer and supplier demands.

The next section summarizes the preceding chapters, showing the hypotheses tested and their findings. After that, implications for both practitioners and researchers are presented. Finally, this section discusses the scope and limitations of the thesis and provides avenues for further research.

5.2. Hypotheses

Chapter 2 analyses the manufacturing strategy process as a single activity. This chapter sheds new light on the relationship between formalization in manufacturing planning and manufacturing strategy implementation (see Figure 5.1). It reveals that this relationship is positive (H_1) (see Table 5.1), given that strategy formulation is a planning mechanism to provide support for strategic business objectives and it also helps firms achieve a competitive position, guiding the decision-making process and providing the basis for trading off and selecting options (Acur et al., 2003).

Furthermore, this chapter takes into consideration the moderating role of four shop-floor communication practices due to the need for a fluid and open process of planning to ensure that firms respond adequately to changes and implement strategies efficiently (Montgomery, 2008) (see Figure 5.1). The shop-floor communication practices analysed in this chapter are:

a) Group solving process. Groups consist of qualified experts whose main task is to solve problems when they occur. They are a mechanism for knowledge coordination and integration and, in turn, generate useful and reliable information to control and improve processes and best practices (Zeng, 2013). We believe that information obtained by these groups may also be useful to update strategic plans and thus enhance manufacturing strategy, given that they identify and solve problems that occur at the shop-floor organizational level (H_2).

b) Supervisory interaction facilitation. Because of their position within the firm, middle managers have a good understanding of strategies (Mintzberg, 1994), their view is realistic, and they are responsible for creating meaning from messages provided by top managers (Wooldridge et al., 2008). We believe that it is important not only to convey strategic and organizational goals along with

strategic planning, but also to update and enhance strategic planning using information obtained by the shop-floor operators (H_3).

c) Instructive communication. Instructive communication refers to any learning activity or training given to workers to improve their skills and improve work performance within organizations (Chukwu, 2016). Training is a good means of facilitating knowledge transfer in the whole firm (Cormier and Hagman, 2014), apart from making it easier to convey strategic information to qualified workers who understand the organizational goals and mission and how to achieve them. Thus, training not only facilitates learning and knowledge, but also understanding of the strategic and organizational goals and mission, resulting in successful strategy embeddedness and strategy implementation (H_4).

d) Feedback. This refers to suggestions regarding problems and barriers to the implementation at the shop-floor organizational level which are made by plant supervisors to plant managers. The related literature shows that feedback is crucial in operational practices, given that it helps to enhance and control them effectively through the identification of operational problems (Aladwani, 2001). Additionally, feedback improves the effectiveness of organizational information, achieves better understanding of organizational practices, and enables better integration between production and transportation (Lee and Prabhu, 2016). We believe that feedback may help firms to update their strategic planning, leading to better adaptation of strategy to internal and external changes and, in turn, helping to convey strategic planning and goals from the plant management and plant supervisor to shop-floor operators, as well as ideas, solutions and improvements from shop-floor operators to the plant supervisor and plant management, enhancing strategic embeddedness in order to implement strategy successfully (H_5)

Table 5.1 displays each hypothesis proposed in this chapter and whether or not they have been supported. The findings are presented in next section.

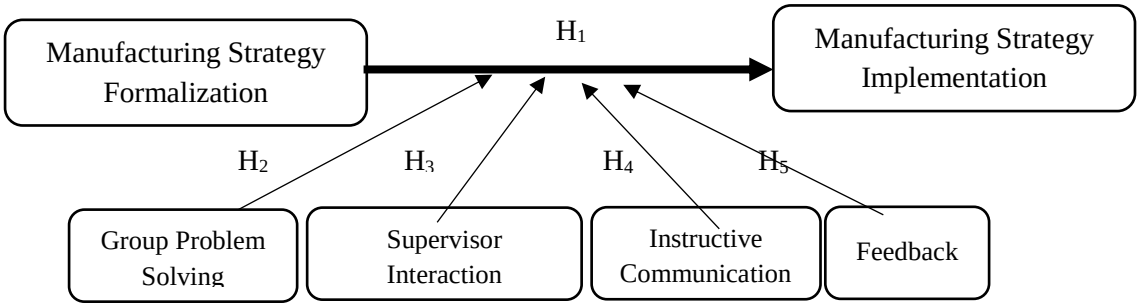

Figure 5.1. Research model of Chapter 2

Chapter 3 focuses on examining one activity of the manufacturing strategy process, manufacturing strategy implementation. Special attention is paid to manufacturing strategy implementation given that both scholars and practitioners assert that the real benefit of a strategy comes from its implementation (Kazmi, 2008; Okumus, 2003). At present, it is an enigma and sometimes a source of frustration in many firms (Jagoda and Kiridena, 2015). Hence, examining what factors influence manufacturing strategy implementation is worthy of research. In this sense, leadership has been recognized as a key lever for both manufacturing strategy implementation (Beer and Eisenstat 2000; Speculand, 2014) and competitive operational performance (Jing and Avery, 2008).

In the related literature, most leadership theories only describe leadership styles or identify traits of effective leadership, analysing their effects on people, policies and the implementation of practices (Avolio, 2007), but they do not provide techniques or practices to develop these types of leadership (leadership in practice). This chapter attempts to expand knowledge on leadership in practice, offering theoretical analysis and empirical evidence. It is based on the leadership theory proposed by Clawson (2009), which addresses this issue theoretically. He established several leadership practices related to human behaviour that can be executed by managers to obtain a specific response from employees. These leadership practices are included in three dimension or levels:

a) Visible behaviour. This refers to what leaders say and do in direct interactions with followers. Practices considered here are clear commands, yelling, coercion or threats, which aim to achieve total obedience from followers.

b) Conscious thought. This leadership practice aims to understand what people know and feel, identifying what people are really thinking. Clawson establishes conscious practices as data, evidence, careful listening, debate and analysis.

c) Unconscious thought. This refers to values, assumptions, beliefs and expectations that control thinking and judgements about what people view to be right or wrong. Clawson includes practices such as candour, telling stories, clarifying vision and self-disclosing.

This chapter individually analyses the effects of these three levels or dimensions on operational performance and manufacturing strategy implementation (see Figures 5.2a and 5.2b). Table 5.1 shows each hypothesis proposed in this chapter and whether or not it has been supported.

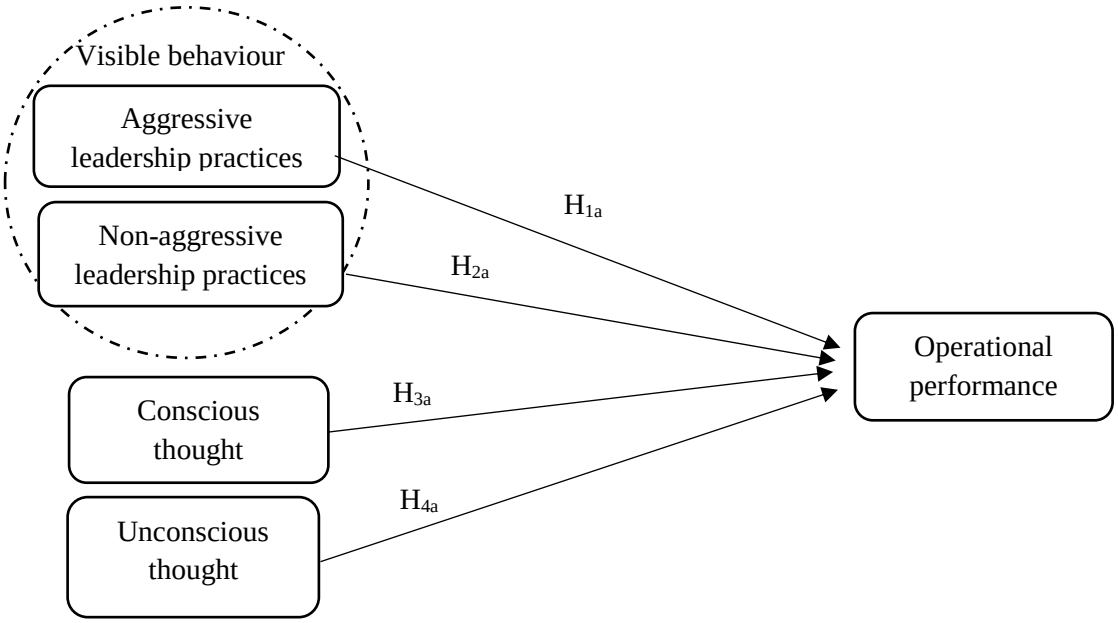

Figure 5.2a. Research model of Chapter 3. The direct relationship between leadership practices and operational performance

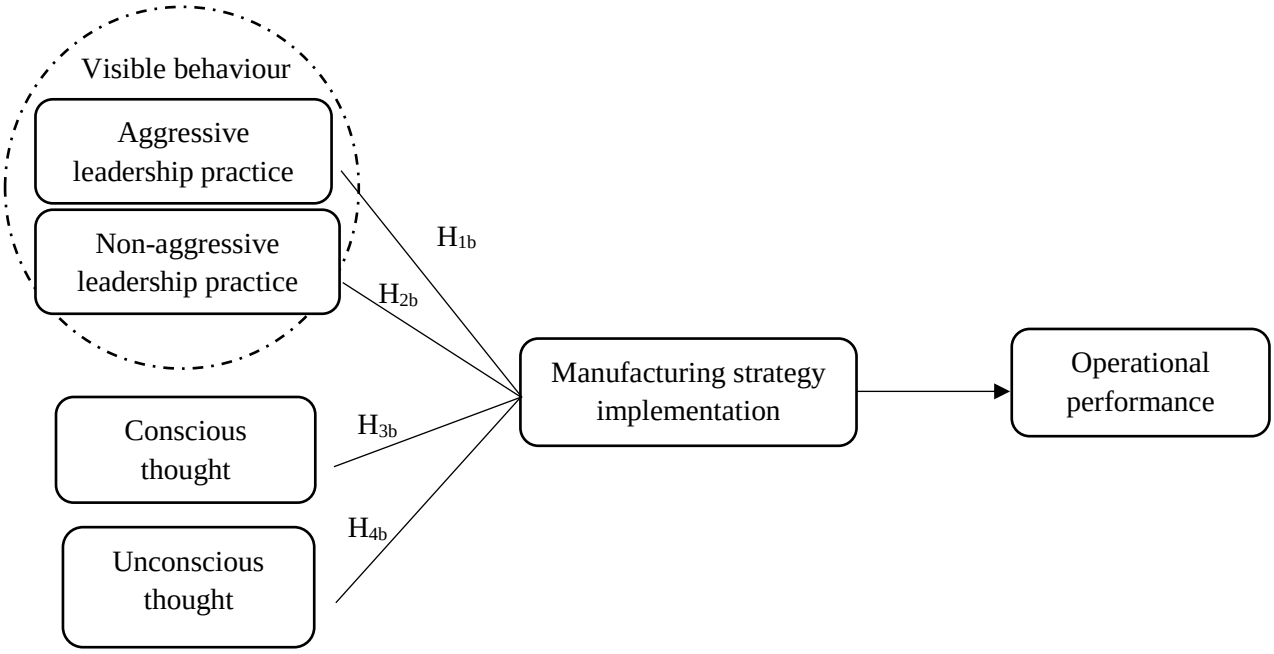

Figure 5.3b. Research model of Chapter 3. The mediating role of manufacturing strategy implementation

Chapter 4 examines the impact of manufacturing strategy formalization on exploration orientation. Manufacturing strategy formalization is identified as an

antecedent of new technology anticipation, in addition to being a factor ensuring the effects of new technology anticipation on effective process implementation (exploitation orientation). Formalization in manufacturing strategic planning offers firms a sense of direction and outlines measurable goals, looking for efficiency, prioritizing investment, optimizing the resources allocation, guiding the decision-making process and providing the basis for trading off and selecting options (Bryson, 2012). It therefore helps manufacturers to effectively integrate and reinforce resources, especially technological resources, to improve process and respond adequately to customer and supplier demands.

Furthermore, internal and external analysis formalized in the strategic plan allows firms to compare their resources and associated capabilities with their competitors in order to anticipate the requirements for successful competition and confront internal deficiencies (Dombrowski et al., 2016; Kohtamäki et al., 2012). During this process, firms learn and expand their knowledge about new technologies, customer and supplier needs, firm and stakeholder requirements, and even internal organizational needs. Thus, it allows firms to exploit the current resources and capabilities and, in turn, explore new ones, given that it helps firms to build, integrate and fit both internal and external competences to face the changing environment.

This chapter also reinforces the idea that the real competitive advantage comes from anticipation of new technology, and not from technology implementation by itself. The chapter analyses how new technology anticipation ensures effective process implementation, as it provides the current and future knowledge required for the development and effective implementation of new processes (Finger et al., 2014; Huang et al., 2008). Additionally, because of explicit and tacit knowledge stemming from manufacturing strategy formalization and new technology anticipation, identification of organizational learning practices that help to transfer knowledge is necessary. This chapter therefore highlights the role of instructive communication as a knowledge driver to exploit such knowledge efficiently, ensuring effective process implementation (see Figure 5.3).

Table 5.1 presents each hypothesis proposed in this chapter, all of which are supported.

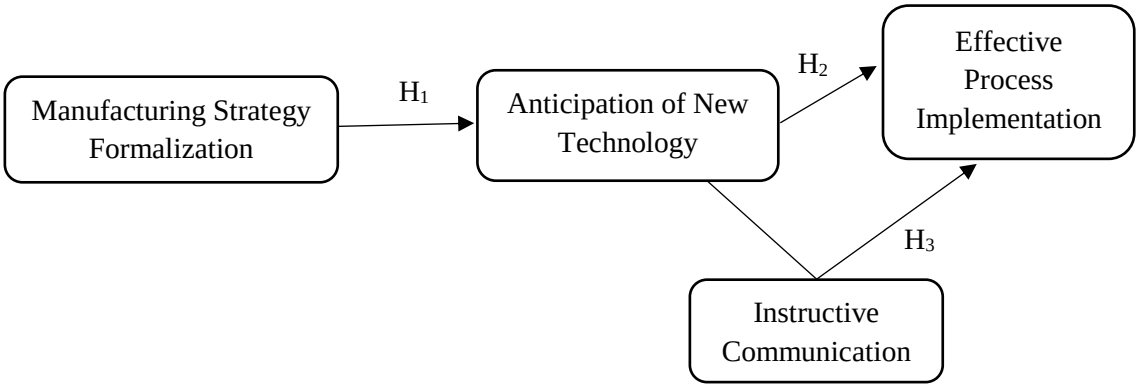

Figure 5.4. Research model of Chapter 4

5.3. Summary of findings

Chapter 2 analyses the relationship between manufacturing strategy formalization and manufacturing strategy implementation. It provides empirical evidence on the relevance of formalization in the manufacturing strategy to achieve a successful manufacturing strategy implementation. Formal strategy planning helps to integrate and control different procedures, as well as to identify weaknesses, resources and opportunities, pulling organizational members towards common goals. It therefore facilitates strategy embeddedness.

Furthermore, Chapter 2 takes into consideration the impact of shop-floor communication, given that an excessively formal strategic plan may introduce rigidity and encourage excessive bureaucracy, resulting in a dysfunctional process (Mintzberg, 1994; Olson et al., 2005). Thus, it must be an open process in order to ensure firms' adaptation to the changing environment. This chapter therefore focuses on examining the role of four shop-floor communication practices (group problem solving, supervisory interaction facilitation, feedback and instructive communication) in the manufacturing strategy process. The related literature has identified these practices as critical factors in embracing and improving operational practices and procedures, as well as drivers for the sharing of information and creation of knowledge (Abrahamsen and Häkansson, 2015; Kim et al., 2012; Zeng et al., 2013).

Consequently, prior to examining the moderating relationship, our findings show that three of the four shop-floor communication practices under study (group problem solving, supervisor interaction facilitation and feedback) have a positive and direct effect on manufacturing strategy implementation. However, only feedback and instructive communication strengthen the manufacturing strategy process. On the one hand, these practices help organizational members to adopt practices and procedures related to the manufacturing strategy. Shop-floor operations receive day-by-day support for operational practices by means of these communication practices. At the same time, these communication practices help to convey strategic planning to shop-floor operators and to pass on information about what happens on the shop floor, encouraging employees to work as a team and express their constructive opinions. On the other hand, feedback and instructive communication facilitate the information flow concerning the manufacturing strategy, organizational goals and mission, in turn helping to update and improve the manufacturing strategy through reliable and useful information stemming from shop-floor operators, leading to prompt adaptation to internal and external changes. Additionally, these practices lead to manufacturing strategy embeddedness, given that employees are involved in the manufacturing strategy process.

Chapter 3 focuses on the importance of leadership practices in relation to manufacturing strategy implementation and operational performance. In spite of having been recognized as a key lever for both manufacturing strategy implementation (Beer and Eisenstat 2000; Youndt et al., 1996) and operational performance (Jing and Avery, 2008; Kotter, 2001), there is a dearth of empirical work on the association between coercive and non-coercive leadership practices and manufacturing strategy implementation, and theirs impact on operational performance (Birasnav, 2014; Schaefer and Guenther, 2016; Speculand, 2014). Chapter 3 shows that the impact of leadership practices on operational performance does not differ. Nevertheless, their effects vary when manufacturing strategy implementation is included in the model.

On the one hand, only non-coercive leadership practices (non-aggressive visible behaviour, conscious thought and unconscious thought) have positive and significant effects on operational performance, regardless of the

manufacturing strategy implementation. Among these leadership practices, conscious thought and unconscious thought influence the manufacturing strategy implementation significantly, but not non-aggressive visible behaviour. A leadership practising clear command (non-aggressive visible behaviour) helps to coordinate employees and functional areas, to speed functional activities and decision-making processes, and to reduce uncertainty, given that the leader's decision is not undisputed. As a result, it boosts firms' adaptation to a dynamic environment and, in turn, reduces costs and reaction time.

Furthermore, conscious thought (data, evidence, careful listening, debate and analysis) aims to know what people know and feel, identifying what people are really thinking. Chapter 3 shows that these leadership practices are crucial to implement the manufacturing strategy successfully, given that they facilitate knowledge transfer and learning within firms, which results in reducing uncertainty (low role ambiguity). Additionally, they promote a sense of commitment to the firm on the part of employees, given that they are involved in decision-making processes, and pull employees towards both common strategic and operative goals, promoting strategy embeddedness.

Finally, unconscious thought (candour, telling stories, clarifying vision and self-disclosing) promotes a fair and positive environment, open communication and ethical behaviour among employees, facilitating the sharing of information and increasing the feeling of belonging to a group or team. Thus, it helps to embrace manufacturing strategy successfully and, in turn, increase productivity.

On the other hand, coercive leadership practices (aggressive visible behaviour) do not have a significant influence on operational performance; however, their effects on manufacturing strategy implementation are negative, which negatively affects operational performance. The main reason of this effect is that coercive leadership practices (yelling, coercion, threats and manipulating) generate organizational rigidity and a hostile work environment, which results in inhibiting internal communication and boosting employee turnover.

Therefore, Chapter 3 shows that non-coercive leadership practices are a determinant in manufacturing strategy implementation and operational performance. However, coercive leadership practices should not be used by

leaders if they want positive results in terms of manufacturing strategy and operational performance to achieve a competitive advantage.

Finally, Chapter 4 presents how manufacturing strategy formalization promotes exploration orientation within firms, identifying manufacturing strategy formalization as an antecedent of new technology anticipation. In addition, it highlights that a firm's ability to anticipate new technology is the real competitive weapon, and not technology implementation. Technology by itself does not provide a competitive advantage to manufacturing firms, since it is readily available to competitors (Porter, 1985); however, the ability to anticipate competitors and to be the first to find or develop a new technology and implement it effectively will confer a competitive advantage upon manufacturing firms (Finger et al., 2014). The findings show a positive and direct effect of manufacturing strategy implementation on new technology anticipation, as it helps firms to know what tangible and intangible resources firms have, where they are headed and how to protect them.

Regarding the relationship between new technology anticipation and effective process implementation, Chapter 4 shows that manufacturing strategy formalization is a determinant of the positive effects of new technology anticipation on effective process implementation, because the coefficient is lower when manufacturing strategy formalization is not in the model.

Furthermore, the findings reveal that new technology anticipation directly and positively affects effective process implementation, given that firms anticipating new technology have fewer false starts on the road to future technology. This results in lower costs and higher quality, delivery and flexibility, as these firms use their resources effectively, gaining in efficiency (Finger et al., 2014). Hence, new technology anticipation ensures new process implementation and mitigates risks concerning the implementation of new processes, such as a lack of knowledge and experience (Adamczak, Bochnia, and Kaczmarska, 2015).

Finally, Chapter 4 identifies shop-floor communication practices (as instructive communication) as a way to transfer tacit knowledge and learning within firms, leading to effective process implementation and development. They

allow employees to assimilate and exploit knowledge derived from manufacturing strategy formalization and new technology anticipation.

In brief, the findings of this thesis show that the manufacturing strategy process promotes organizational ambidexterity, given that it helps to exploit current resources and capabilities and explore new ones simultaneously. The manufacturing strategy process helps in the effective adoption of a process (exploitation orientation) and improves operational performance (exploitation orientation). It also helps firms to develop the ability to know and forecast market demands related to new technology (exploration orientation). Moreover, this thesis emphasizes the added value of human resources in the manufacturing strategy process, analysing leadership in practice and the moderating role of shop-floor communication practices. As noted above, Table 5.1 shows each hypothesis proposed in each chapter and whether or not they are supported.

Table 5.1. Hypotheses proposed in each chapter

	Hypotheses	Conclusion
CHAPTER 2	H_1: There is a positive association between formal manufacturing strategic planning and manufacturing strategy implementation.	SUPPORTED
	H_2: Small-group problem solving will strengthen the relationship between manufacturing strategy formalization and manufacturing strategy implementation success.	NOT SUPPORTED
	H_3: Supervisor interaction facilitation will strengthen the relationship between manufacturing strategy formalization and manufacturing strategy implementation success.	NOT SUPPORTED
	H_4: Instructive communication will strengthen the relationship between manufacturing strategy formalization and manufacturing strategy implementation success.	SUPPORTED
	H_5: Feedback will strengthen the relationship between manufacturing strategy formalization and manufacturing strategy implementation success.	SUPPORTED

CHAPTER 3	H_{1a}: Clear commands have a positive influence on operational performance.	SUPPORTED
	H_{1b}: The relationship between clear commands and operational performance is positively mediated by manufacturing strategy implementation.	NOT SUPPORTED
	H_{2a}: Visible aggressive behaviour leadership practices have a negative influence on operational performance.	NOT SUPPORTED
	H_{2b}: The relationship between visible aggressive behaviour leadership practices and operational performance is negatively mediated by manufacturing strategy implementation.	SUPPORTED
	H_{3a}: Conscious thought leadership practices have a positive influence on operational performance.	SUPPORTED
	H_{3b}: The relationship between conscious thought leadership practices and operational performance is positively mediated by manufacturing strategy implementation.	SUPPORTED
	H_{4a}: Unconscious thought leadership practices have a positive influence on operational performance.	SUPPORTED
	H_{4b}: The relationship between unconscious thought leadership practices and operational performance is positively mediated by manufacturing strategy implementation.	SUPPORTED
CHAPTER 4	H_1: Manufacturing strategy formalization positively influences the anticipation of new technology.	SUPPORTED
	H_2: Anticipation of new technology has a positive effect on effective process implementation.	SUPPORTED
	H_3: The relationship between the anticipation of new technology and effective process implementation is mediated by instructive communication.	SUPPORTED

5.4 Implications

These thesis has important implications for academics, as it adds new insights to the scarce literature on the manufacturing strategy process and provides evidence for the emerging discussion on whether formal strategic planning may help to implement a strategy or make decision-making inflexible. Moreover, it highlights the importance of human resources as part of a consistent socio-technical system and as a valuable and unique resource. As an inimitable resource, human resources may help HPM firms to develop distinctive

competences, resulting in a competitive advantage (Chowdhury et al., 2014; Giffi et al., 2016).

Chapter 2 emphasizes the importance of developing a strategy process as a single activity rather than as individual separate phases, and offers a greater understanding of manufacturing strategy formalization in order to achieve a competitive position in the marketplace. The influence of manufacturing strategy formalization has been highly underestimated in comparison with other strategies (Kazmi, 2008). Moreover, Chapter 2 considers the moderating role of shop-floor communication in the manufacturing strategy process, which sheds new light on the factors affecting the relationship between the formulation/formalization and implementation of a strategy, allowing a better understanding of that relationship. These moderating effects have not been tested previously, despite being an important factor in strategy formulization and implementation

Chapter 3 adds new insights to the literature on the three level leadership models. It also provides evidence for the emerging discussion on the lack of managers' skills, such as leadership, being the main failure factor in relation to implementation of the manufacturing strategy and, in turn, the impact of leadership on operational performance. In contrast to most leadership theories, Chapter 3 does not describe a leadership style, but focuses on identifying what leadership practices must be executed by a plant supervisor to improve operational performance and ensure successful manufacturing strategy implementation. This is a novel leadership model known as level three leadership (Clawson, 2009), which has not yet been empirically tested.

Chapter 4 sheds new light on the current paucity of literature on anticipation of new technology and its antecedents. It offers empirical evidence to the emerging discussion on whether manufacturing firms have to focus their efforts not only on new technology implementation, but also on the anticipation of new technology. This chapter expands knowledge on new technology anticipation, identifying formalization in manufacturing strategic planning as one of its antecedents.

Furthermore, each study developed in this thesis has relevant implications for practitioners and employers seeking ways to improve business value and

competitive position, as they offer a greater understanding of the strategy process and stress the crucial importance of human resources for the manufacturing strategy. Additionally, this thesis may be relevant for current and future employees, since it analyses the development of several skills concerning human resources within firms. Employees may take this into consideration in order to develop and improve their skills related to their work.

Chapter 2 reinforces the idea of the manufacturing strategy process as a single activity (Leonardi, 2015) and the linkage of manufacturing strategy formulation to implementation (Crittenden and Crittenden, 2008). It offers empirical evidence on the benefits of formalization in strategic planning in order to adopt manufacturing strategy implementation. Chapter 2 also identifies how several shop-floor communication practices are determinants for the manufacturing strategy process and, in turn, strengthen it, which may be of interest for practitioners and employers to achieve a successful competitive position and discover emerging business opportunities.

Chapter 3, as noted above, focuses on leadership in practice. It identifies how specific human behaviours, or leadership practices, affect operational performance and, in turn, how this relationship is mediated by manufacturing strategy implementation in order to achieve a successful competitive position. The study developed in Chapter 3 may be helpful for plant managers and plant supervisors, as it allows the determination of an effective leadership profile in manufacturing functions. Both plant managers and plant supervisors may change and adapt their leadership styles through the use of these leadership practices, depending on the responses or goals they want to achieve. Likewise, identification of how and in what way leadership practices improve operational performance and ensure successful manufacturing strategy implementation may facilitate the recruitment process.

Finally, Chapter 4 emphasizes new technology as a competitive advantage. It shows that competitive advantage does not lie in adopting a best practice or new technology, but in the combination of organizational, physical and human resources, which may be achieved by manufacturing strategy formalization. In addition, the chapter shows practitioners and employers that instructive

communication is an important organizational learning practice which facilitates both explicit and tacit knowledge related to new technology anticipation.

5.5. Limitations

Of course, our studies are not free of limitations. The main limitation is the HPM database, which can be restrictive in terms of the research topics that can be examined. Individual bias does not exist, because several employees from different departments and areas of firms are interviewed, but shop-floor operators' perspective is not included. In addition, the number of plants per country does not allow us to carry out a comparative analysis or to study each country individually.

Furthermore, we analysed the manufacturing strategy process using cross-sectional data: thus we were not able to fully capture the dynamic changes in the same plants because of the snapshot nature of data. Even though our database comprises plants from countries around the world, these plants are only large and medium in size. In addition, our study focuses on analysing only three different and representative industries in the manufacturing sector.

5.6. Further research

There are several avenues for further research related to the limitations. For instance, a longitudinal study in the future may allow us to examine dynamic changes in the same plants, as has been outlined in this study. There is also a need to expand this study by including small size plants, given that these plants have less centralized structures; hence, analysing if practices such as communication and leadership act the same way as in large and medium plants is an avenue for further research.

As noted above, our study takes into consideration several organizational members' perceptions, except shop-floor employees' perceptions. Another future research could expand the study to include the shop-floor operators' perspective. In addition, a cross-industry analysis or even the inclusion of other industries might be other avenues for future research.

Furthermore, the current thesis identifies the manufacturing strategy process as a competitive ability that influences operational performance, but this is not a unique capability, so future research might expand on the scope of the capabilities we have researched. Moreover, the significant role of the manufacturing strategy in coordinating functional activities and policies, and in supporting the strategy direction of the overall business (Cox and Blackstone, 1998; Swamidass and Newell, 1987). Atkinson (2006) highlights that little research attention has been given to manufacturing strategy process as a whole. Chapter 2 examines several practices related to shop-floor communication and associated with manufacturing functions. However, there may be other practices concerning effective communication which may strengthen the relationship between manufacturing strategy formalization and manufacturing strategy.

The absence of literature and empirical evidence related to Clawson's leadership model suggests the need to extend this new leadership model to include antecedents and explain their effects. Chapter 3 analyses several leadership practices, but there are other leadership practices which have not yet been tested. It is therefore necessary to explore how other leadership practices affect implementation of the manufacturing strategy and improve operational performance. Likewise, to the best of our knowledge, our study is the first to offer empirical evidences, but it only focuses on the influence of this leadership model on manufacturing strategy, and the leadership model may have a significant influence on daily practices at the manufacturing level. Therefore, a further avenue of research might be to explore the implications of these leadership practices for operational practices such as quality programmes, new product development processes, supply chain management and so on. There is a wide selection of further research linking these practices to the operational management field.

Moreover, our study only examines these three dimensions (visible behaviour, conscious though and unconscious thought) individually; however, according to Clawson (2009), they might be interconnected. Thus, an avenue of further research is not only to understand the impact of leadership practices on several operational practices, but also to achieve a greater understanding of this leadership model and the relationships among the three dimensions.

Furthermore, the current paucity of literature and empirical evidence related to new technology anticipation suggests the need to extend knowledge to include antecedents and explain their effects. It is necessary to explore what organizational factors reinforce the adoption of technology and the development of tacit capacities related to new technology. In addition, it is important for future research to find out what other organizational learning practices may facilitate efficient knowledge transfer.

Finally, research studies have stated the importance of matching managers with strategies at the corporate and business level, since top managers' strategic choices hinge on both the objective characteristics of the environment they deal with and their own personal traits and experiences (Boeker, 1997; Helfat and Martin, 2015). Kathuria and Porth (2003) assess the impact of several managerial characteristics, such as tenure, age and level of education of a manufacturing manager, on the alignment between the strategic and operational levels. There are a lot of managerial characteristics whose impact has not been analysed to date, such as control policies employed, education of workers, work organization or gender. Therefore, the impact of other managerial characteristics on alignment between the strategic and operational levels may also be worthy of research.

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