FUNDAÇÃO GETULIO VARGAS

ESCOLA DE ADMINISTRAÇÃO DE EMPRESAS DE SÃO PAULO

MARCIA REGINA SANTIAGO SCARPIN

Operational Capabilities' Typology: An Evolution from Operational Practices

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Orientador: Prof. Luiz Artur Ledur Brito, Dr.

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Para meus pais, Maria Aparecida Santiago and José Santiago Júnior, e meu amor Jorge Eduardo Scarpin❤

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Two roads diverged in
a wood, and I took
the one less traveled by, And that
has made all the difference.
- Robert Frost

RESUMO

Operational capabilities são caracterizadas como um recurso interno da firma e fonte de vantagem competitiva. Porém, a literatura de estratégia de operações fornece uma definição constitutiva inadequada para as *operational capabilities*, desconsiderando a relativização dos diferentes contextos, a limitação da base empírica, e não explorando adequadamente a extensa literatura sobre práticas operacionais. Quando as práticas operacionais são operacionalizadas no ambiente interno da firma, elas podem ser incorporadas as rotinas organizacionais, e através do conhecimento tácito da produção se transformar em *operational capabilities*, criando assim barreiras à imitação. Apesar disso, poucos são os pesquisadores que exploram as práticas operacionais como antecedentes das *operational capabilities*. Baseado na revisão da literatura, nós investigamos a natureza das *operational capabilities*; a relação entre práticas operacionais e *operational capabilities*; os tipos de *operational capabilities* que são caracterizadas no ambiente interno da firma; e o impacto das *operational capabilities* no desempenho operacional. Nós conduzimos uma pesquisa de método misto. Na etapa qualitativa, nós conduzimos estudos de casos múltiplos com quatro firmas, duas multinacionais americanas que operam no Brasil, e duas firmas brasileiras. Nós coletamos os dados através de entrevistas semi-estruturadas com questões semi-abertas. Elas foram baseadas na revisão da literatura sobre práticas operacionais e *operational capabilities*. As entrevistas foram conduzidas pessoalmente. No total 73 entrevistas foram realizadas (21 no primeiro caso, 18 no segundo caso, 18 no terceiro caso, e 16 no quarto caso). Todas as entrevistas foram gravadas e transcritas literalmente. Nós usamos o sotware NVivo. Na etapa quantitativa, nossa amostra foi composta por 206 firmas. O questionário foi criado a partir de uma extensa revisão da literatura e também a partir dos resultados da fase qualitativa. O método *Q-sort* foi realizado. Um pré-teste foi conduzido com gerentes de produção. Foram realizadas medidas para reduzir Variância de Método Comum. No total dez escalas foram utilizadas. 1) Melhoria Contínua; 2) Gerenciamento da Informação; 3) Aprendizagem; 4) Suporte ao Cliente; 5) Inovação; 6) Eficiência Operacional; 7) Flexibilidade; 8) Customização; 9) Gerenciamento dos Fornecedores; e 10) Desempenho Operacional. Nós usamos análise fatorial confirmatória para confirmar a validade de confiabilidade, conteúdo, convergente, e discriminante. Os dados foram analisados com o uso de regressões múltiplas. Nossos principais resultados foram: Primeiro, a relação das práticas operacionais como antecedentes das *operational capabilities*. Segundo, a criação de uma tipologia dividida em dois construtos. O primeiro construto foi chamado de *Standalone Capabilities*. O grupo consiste de *zero order capabilities* tais como Suporte ao Cliente, Inovação, Eficiência Operacional, Flexibilidade, e Gerenciamento dos Fornecedores. Estas *operational capabilities* têm por objetivo melhorar os processos da firma. Elas têm uma relação direta com desempenho operacional. O segundo construto foi chamado de *Across-the-Board Capabilities*. Ele é composto por *first order capabilities* tais como Aprendizagem Contínua e Gerenciamento da Informação. Estas *operational capabilities* são consideradas dinâmicas e possuem o papel de reconfigurar as *Standalone Capabilities*.

ABSTRACT

Operational capabilities are characterized as an internal resource of the firm and source of competitive advantage. However, the literature of operations management provides inadequate constitutive definitions of operational capabilities, does not cover the relativization to different contexts, has limited empirical grounding, and does not adequately explores the more extensive empirical literature on operational practices. When practices are operationalized in the internal environment of the firm, they can be incorporated as organizational routines, and through the pre-existing tacit knowledge of production, become operational capabilities, thus creating barriers to imitation. But, a few scholars have explored operational practices as an antecedent of operational capabilities. Based on this review, we investigated about nature of operational capability; the relationship between operational practices and operational capabilities; types of operational capabilities characterized in the firm's internal environment; and the impact of the operational capabilities on operational performance. Therefore, we conduct a mixed methods research. In qualitative stage, we conducted case studies in four firms, two multinational American firms operating in Brazil and two local Brazilian firms. We collected data through semi-structured interviews with open-ended questions, based on our theoretical review of operational practices and operational capabilities. The interviews were conducted face-to-face. In total, 73 interviews were performed in four different firms (21 - first case, 18 - second case, 18 - third case, 16 – fourth case). All interviews were recorded and transcribed literally in NVivo software. In quantitative stage, the sample was composed of 206 firms. The questionnaire creation involved an extensive review of the literature and also the use of the results of the analysis of the qualitative phase data. Q-sort was performed. Pre-test was administered to production managers. Measures were conducted to reduce Common Method Variance. A total of ten scales were used: 1) Continuous Improvement; 2) Information Management; 3) Learning; 4) Customer Support; 5) Innovation; 6) Operational Efficiency; 7) Flexibility; 8) Customization; 9) Supply Management; and 10) Operational Performance. We use Confirmatory Factor Analysis to conducted reliability, content, convergent, and discriminant validity. The data were analyzed using regressions. Our main results were: First, relate the operational practices as an antecedent of operational capabilities. Second, the creation of a typology divided into two constructs. The first construct is called Standalone Capabilities. This group consists of zero order capabilities such as Customer Support, Innovation, Operational Efficiency, Flexibility, Customization, and Supply Management. These capabilities aim to improve operational processes of the firm. They have a direct relationship with operational performance. Second construct is called Across-the-Board Capabilities. It is composed of first order capabilities such as Learning, Continuous Improvement, and Information Management. These capabilities are considered dynamic and they have the role to reconfigure Standalone Capabilities.

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INTRODUCTION

The concept of Operational Capabilities, understood as the capabilities related to the OM function, has been explored with different and problematic approaches in the OM literature(Wu, Melnyk, & Flynn, 2010). Some of the problems relate to the influence of framework of competitive priorities, others to the extensive literature on operational practices and the definitional conundrum involving practices, routines and capabilities.

The conceptual framework of competitive priorities has been predominantly used to define the concept of operational capabilities. The ability of a firm to compete with its direct competitors in quality, delivery, flexibility and cost, has been used to indicate the firm’s operational capabilities(*e.g.* Größler & Grübner, 2006; Rosenzweig & Easton, 2010; Wheelwright, 1984). However, the decision what prioritize precedes the development of an operational capability, but it is not the capability itself. Competitive priorities help the firm to do what it wants without wasting resources in lower-priority pursuits(Wheelwright, 1984). For example, a firm's acceptance of a low rate of growth can reflect a decision to retain a set of priorities in which diversification are more highly valued than growth. If diversification is the firm's strategy, operational capabilities such as flexibility, customization, and innovation should be developed to support this strategy.

We also find articles that conceptualize and measure operational capabilities by the result. This is a problematic situation as it creates confusion with the operational performance construct(*e.g.* Cua, McKone, & Schroeder, 2001; Flynn & Flynn, 2004; Schroeder, Bates, & Junttila, 2002). When operational capabilities are conceived and measured by performance, we get their effect, not the cause. We tend to ignore the path that leads to the result. Illustratively, it's like runners who want to reduce their time without considering the need to change their workout. We would be evaluating the result and not the ways in which time could be reduced. At the organizational level, it is like measuring the quality of the finished product, without evaluating the processes that caused this performance outcome.

Quality, delivery, flexibility and cost, for a long time have represented operational capabilities. Over the years, some scholars have added other dimensions, such as innovation, process technology, and environmental protection(Avella, Vazquez-bustelo, & Fernandez, 2011; Peng, Schroeder, & Shah, 2008; Rusjan, 2005).

A few scholars have explored individually different operational capabilities, such as customization, supply management, and others(Tu, Vonderembse, Ragu-Nathan, & Ragu-Nathan, 2004; Weigelt, 2013; Yeung, 2008; Zhang, Vonderembse, & Lim, 2003; and others) with approaches more focused on the causes rather than effects. We recognize the effort to highlight the importance of operational capabilities in the area of operations. However, we almost did not find studies that comprehensively investigated the development of operational capabilities from configuration of internal resources of the firm.

Operational capabilities can exhibit equifinality and can be developed through multiple paths. Operational practices can provide an appropriate basis for its beginning(Wu, Melnyk, & Swink, 2012). Since the 90s, operational practices have underpinned many studies in this area. Considered highly standardized and easily imitable procedures, theoretically, according to the Resource Based Theory (RBT) they cannot be sources of sustained competitive advantage. But, effective implementation of "best practices" (Laugen, Acur, Boer, & Frick, 2005, pp.131) such as total quality management, just-in-time, lean manufacturing, among others, tends to contribute to better performance.

When bundles of practices are operationalized in the internal environment of the firm, they can be incorporated as organizational routines, and through the pre-existing tacit knowledge of production, become operational capabilities, thus creating barriers to imitation. However, even with such a logical relationship, most of the operations literature refers to practices but does not mention the concept of operational capabilities(Ahmad & Schroeder, 2003; Dean & Bowen, 1994; Furlan, Vinelli, & Pont, 2011; Hackman & Wageman, 1995; Montabon, Sroufe, & Narasimhan, 2007; Swink, Narasimhan, & Kim, 2005).

One of the recent studies that brought a new approach to the field is Wu et al. (2012), in which the bundles of practices are addressed as background to operational capabilities. But despite the merit of promoting debate, and being the first to use a new taxonomy for operational capability, the theoretical argument used by Wu et al. (2012) for developing each capability is fragile and has limited empirical grounding. It uses as a basis the theoretical proposal of Swink and Hegarty (1998), in which one of the main limitations is precisely the lack of specificity of capabilities for the operations area.

In sum, the literature of operations management provides inadequate constitutive definitions of operational capabilities, does not cover the relativization to different contexts, has limited empirical grounding, and does not adequately explores the more extensive empirical literature on operational practices. This study contributes to the debate addressing the following gaps: the lack of a conceptual uniformity of operational capabilities(Flynn & Flynn, 2004; Wu et al., 2010), the lack of empirical studies about the development of operational capabilities in the firm's internal environment (Peng et al., 2008; Schoenherr, Power, Narasimhan, & Samson, 2012; Swink et al., 2005), and the relationship between bundles of operational practices and operational capabilities (Wu et al., 2012). We performed this study in Brazil, since according to Schoenherr et al. (2012) in industrialized countries operational capabilities could have already reached a level of maturity, and so they would have less importance as a valuable, rare and inimitable resource. Opposite of what occurs in lesser-developed countries, as Brazil, where they are still considered a powerful resource source of competitive advantage. Lower maturity level of operational capabilities these countries creates more opportunities to advance them.

Thus, the questions that we intend to investigate are:

1. What is the nature of operational capability?
2. What is the relationship between operational practices and operational capabilities?
3. What are types of operational capabilities characterized in the firm’s internal environment?
4. What is the impact of the operational capabilities on operational performance?

The specific objectives to answer these questions are:

1. Propose a constitutive definition and typology for operational capabilities.
2. Analyze the relationship between operational practices and operational capabilities.

3. Develop and test a measuring scale for operational capabilities.
4. Analyze the impact of operational capabilities on operational performance of the firm.

To investigate these questions we conducted a study of multiple cases and a survey. Case studies were conducted in four firms, two multinational American firms operating in Brazil and two local Brazilian firms. To reduce the variability between cases, and to account for context, all firms are in the packaging industry. Packaging industry was been chosen because it has relationships with almost all production industries in the manufacturing industry. It operates in the metal, carton, paper, cardboard, plastic and glass industries. Packaging industry has a high level of competition, a narrow margin for negotiation with its supply chain, and constantly receives pressure from government regulators. Therefore, firms in this industry are constantly developing operational capabilities to compete in this market.

The case studies addressed objectives 1 and 2 and encompassed 73 semi-structured interviews in four different firms (21 - first case, 18 - second case, 18 - third case, and 16 – fourth case). All interviews were recorded, transcribed, and analyzed in NVivo software.

The survey addressed objectives 3 and 4 and was based on 206 respondents - packaging industry firms. The case studies and literature were used to create the scales for operational capabilities. We used confirmatory factor analysis to validate the measuring scales. Using the firm as the unit of analysis, linear multiple regressions were used to explore the relationship between capabilities and operational performance.

The main theoretical contribution of the current study is a typology of operational capabilities based on the internal environment of firms. Typology was built from an extensive literature review and the results of qualitative data analysis. Figure 1 show operational capabilities identified at each stage. It is important to remember that some operational capabilities were removed or added from one phase to another. For example, we did not find Quality Management Capability in the analysis of qualitative data. But, we found two new capabilities, Operational Efficiency and Customer Support. In the quantitative phase, the capabilities Continuous Improvement and Learning, and Flexibility and Customization were grouped for not having discriminant validity between them.

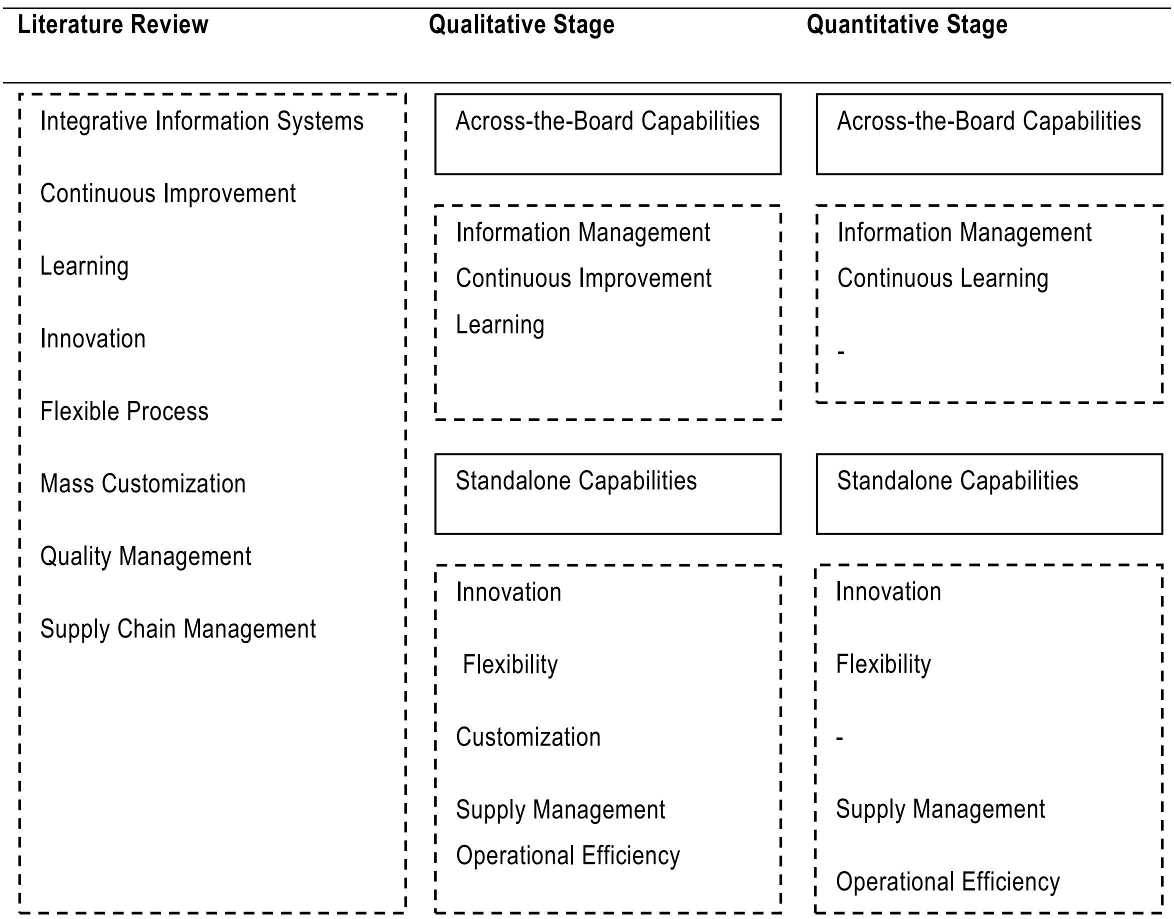


Figure 1 – Typology of Operational Capabilities

Our final typology presented two types of operational capabilities, Standalone Capabilities and Across-the-Board Capabilities. Each one has a specific function in the operational process. Standalone Capabilities improve operational performance, and Across-the-Board Capabilities can build or reconfigure Standalone Capabilities. We also identified bundles of operational practices as antecedent operational capabilities, and we have shown the path that leads to the development of operational capabilities. The quantitative part of the study added to the empirical support and provided nomological validity to the conceptualization of operational capabilities. As a practical contribution, these results can be used by managers to identify and improve the internal factors that contribute to the development of operational capabilities that generate superior performance.

This dissertation is divided in five main chapters. Chapter 1, which is this introduction, presents the research questions, goals, and motivation for this research. Chapter 2 presents the theoretical foundations. In Chapter 3, we describe the details of research design. In this chapter we present, industry and unit of analysis, qualitative stage, and quantitative stage. The results in Chapter 4 are presented in two steps. First, we present analysis of qualitative data, within-case, cross-case, and propositions. Second, we present an analogy based on running. Finally, we present analysis of quantitative data. Chapter 5 presents our conclusions, including the study´s contributions, limitations, and opportunities for future research. Appendices are presented at the end of this document, after the references.

2 LITERATURE REVIEW

The theoretical approach of this dissertation is focused on operational practices and operational capabilities. We also use Resource Based Theory as basis theory. It was introduced in the section of the operational capabilities.

2.1 Operational practices

While operational practices are "important concepts to strategy in general and to operations strategy specifically, the differences between these constructs are often unclear" (Wu et al., 2012, pp. 123).Operational practices can be a single element or interactions between different elements, since the adoption of one practice can be related to the adoption of other practices, for example, 5S as an individual element or Total Quality Management as a set elements. Sets or bundles of practices consistently appear together and work synergistically (Furlan et al. 2011). It is transferable, and step-by-step coding that distinguishes practices and capabilities.

Narasimhan, Swink, & Kim (2005) indicated that best known operations management practices in are related to six operations practices: Human Resource Management, Total Quality Management, Just-in-time, Supply Chain Management, Lean Manufacturing and Development of Products/Processes.

Human Resource Management (HRM) is composed of practices related to the development of employees, it is defined “as a set of distinct but interrelated activities, functions, and processes that are directed at attracting, developing, and maintaining (or disposing of) a firm's human resources" (Lado & Wilson, 1994, pp.701). Human resource management practices can have an impact on the organizational performance of the firm. They can intensify and complement other operational practices, such as just-in-time (JIT) and total quality management (TQM) (Ahmad & Schroeder, 2003; Furlan et al., 2011).For this reason, it is necessary to implement and monitor human resource management practices, such as selective hiring, decentralizing decisions, conducting multi-functional training programs and implementing profit sharing programs (Ahmad & Schroeder, 2003).

Total Quality Management (TQM) aims to maintain and improve the quality of products and processes involving the management, employees, suppliers and customers (Dean & Bowen, 1994; Hackman &Wageman, 1995; Powell, 1995). The effectiveness in the implementation of this practice is related to managerial leadership, intensive training and a good relationship between the staff, which can also be found in the practice of human resource management (Kaynak, 2003).Studies of total quality management practices indicate that its main goals are to continuously improve organizational processes. Their effective implementation has a relative effect on the firm's performance (Kaynak, 2003). However, Cole (1998) emphasizes that quality should be seen as a competitive factor, expanding its application beyond the internal processes of the firm. The author proposes that we need to approach it as a corporate language in the identification and solution of problems, with the involvement of all employees and customers.

Just-in-time (JIT)is a practice that aims to reduce and eliminate all forms of waste (Brown & Mitchell, 1991). There are nine frequently used practices to identify JIT: time reduction of set-up, pull production system, JIT delivery by suppliers, layout of equipment, adherence to the daily schedule, leadership commitment, strategic planning, cross training and employee involvement (Montabon et al., 2007).

Supply Chain Management (SCM)involves systemic and strategic coordination of the business processes of the supply chain, aiming to improve the firm's long-term results (Mentzer et al., 2001). The SCM construct is considered multidimensional and involves information sharing, risk and returns sharing, cooperation, similarity of goals, customer focus, integration of key processes, long-term relationships and cross-functional coordination (Mentzer et al., 2001).

Lean Manufacturing is based on the broad set of interrelated practices that work synergistically to create a high-quality system, with less waste and a production process that meets customer needs. Thus, it is formed by a multidimensional construct that includes practices such as just-in-time (JIT), total quality management (TQM), human resource management (HRM), total preventive maintenance (TPM), supplier management, etc. (Shah & Ward, 2003).The implementation of lean production promotes superior results in inventory management, process control, communication with the "shop floor", and improves delivery processes, flexibility and quality (Cua et al., 2001; Eroglu & Hofer, 2011).

The practice of development of products/processes facilitates collaboration among product and process designers, creating the development and integration of advanced technologies in the area of operations, ensuring that these technologies are considered during product design (Swink et al., 2005). The customer is also included in this process, with contributions at each stage of implementation, anticipating problems that could happen after project approval(Flynn, Schroeder, & Sakakibara, 1994).

2.1.1 Operational practices interlinked a Practice-Based View

Bromiley and Rau (2014) propose practice-based view (PBV). The PBV connects practices and capabilities. The process of adapting capabilities will depend on the explicit or implicit choices that firms make about practices. For them a practice is defined as a set of activities that different firms can perform. The use of common practices can significantly influence firm performance. Some studies show the relationship between the use of managerial practices and performance (see Kaynak, 2003; Mentzer et al., 2001; Furlan et al., 2011).

However, PBV can equally deal with practices that improve performance as with practices that reduce performance. In some cases, scholars might try to relate the practices directly to performance and in others they might operate through an intermediary construct. A good theoretical understanding of the impact of a practice on performance can apply to both beneficial and harmful practices. These variations may cause the same practice to have different effects on performance across firms (Bromiley & Rau, 2014).

Practices such as TQM, JIT, SCM, and others are not secret or technologically complex, nor do they require some hard-to-transfer resources. For example, in TQM the practices use are (1) management leadership; (2) training; (3) employee relations; (4) quality data and reporting; (5) supplier quality management; (6) product/service design; (7) process management; and (8) inventory management (Kaynak, 2003). JIT practices are (1) setup time reduction; (2) small lot sizes; (3) JIT deliveries from suppliers; (4) daily schedule adherence; (5) preventive maintenance; (6) equipment layout; (7) Kanban; (8) pull system; (9) JIT link with customers; and (10) repetitive nature of master schedule (Mackelprang & Nair, 2010). SMC are (1) customer focus; (2) management leadership; (3) human resource; (4) quality data and reporting; (5) supplier management; (6) design management; and (7) process management (Ou et al., 2010).

These studies show that firms differ in their use of rather simple and seemingly obvious practices, and these differences lead to performance differences across firms. Operations literature has studied the effective implementation of total quality management, just-in-time, and supply chain management and its benefits (Kaynak, 2003; Mackelprang & Nair, 2010; Ou et al., 2010).

As discussed, operational practices bundle are a set of interrelated and internally consistent practices. There is a complementarity between sets of management practices. Some studies introduce the concept of fit between individual practices arguing that a higher level of manufacturing performance can be expected when different common practices and basic techniques are jointly implemented. For example, JIT and TQM combination yields synergies leading to an overall performance that is higher than the sum of TQM and JIT contributions taken in isolation (Shah and Ward, 2003). The effects of integrating SCM and TQM practices can improve financial performance of the firm (Ou et al., 2010).

Interdependent nature of TQM practices and others, the interrelated use of operational practices helps explains why TQM has not produced maximum benefits for every company that has implemented it (Kaynak, 2003). Furthermore, the aggregation of various practices may provide different results. The use of several operational practices may also reinforce one another. A customer-oriented strategy can help a firm focus its management leadership on satisfying its customer needs (Ou et al., 2010).

World Class Manufacturing programs, such as JIT, TQM, and TPM, should not be evaluated in isolation. They are closely related and in combination can help foster better manufacturing performance. Operational practices help to improve the organization’s capabilities by enhancing the problem-solving skills of individuals and enabling learning across various functional areas. TQM and TPM are complementary; both can be a strong contributor to the strength of the organization and has the ability to improve manufacturing performance. TQM is an integrated management philosophy and set of practices that emphasizes among other things, continuous improvement, meeting customers' requirements, reducing rework, and others. TPM increase technical skills of production personnel, include maintenance in daily production tasks as well as long-term maintenance plans, and allow for information sharing among different functional areas (McKone, Schroeder, & Cua, 2001).

Contrary individual practices, aggregate practices are positively related to firm performance. To Mackelprang and Nair (2010) JIT practices are positively associated with aggregate performance. Each JIT practice results in improved aggregate performance even though the practice may not be positively associated with performance measures, when considered individually. For instance, Kanban is significantly associated with aggregate performance but at the individual performance level, it is associated with only three performance metrics (i.e. inventory, flexibility and delivery performance). JIT practices may interact with each other resulting in varying degrees of improved performance.

An unstated assumption of most research on routines or practices such as TQM, JTI or Lean is that the routines involved can in essence be described in an objective fashion and that those who engage with or perform the routine will describe the routine identically. This is evidenced by numerous studies that treat a single respondent's perceptions of the use of a routine not as a single perception, but rather as an objective indication of what the organization does. An organization that chooses to manage safety and operations in a coordinated fashion using a joint management system, safety and operational effectiveness are complementary (Pagell et al. 2015).

The relationship between JIT, TQM, and manufacturing performance has been supported in academic research (Flynn et al., 1995). Companies with higher implementation levels of JIT, TQM, and EI also had higher implementation levels of TPM (McKone, Schroeder, & Cua, 2001). We would like to consider the life cycle of the practices and evaluate the impact of the development time on manufacturing performance.

2.1.2 Operational practices as a source of superior performance

Several studies related operational practices such as TQM, JIT, and SCM with operational and/or financial performance. We have relationship between TQM practices and performance(Powell, 1995;Das, Handfield, Calantone, & Ghosh, 2000;Hendricks &Singhal, 2001;Wilson & Collier, 2000;Kaynak, 2003;Nair, 2006;Sila, 2007;Kaynak & Hartley, 2008;Jiménez-Jiménez & Martínez-Costa, 2009). JIT practices and performance (Callen, Fader, & Krinsky, 2000;Fullerton, McWatters, & Fawson, 2003). Finally, the relationship between SCM practices and performance (Tan, Kannan, Handfield, & Ghosh, 1999;Tan, Lyman, & Wisner, 2002; Droge, Jayaram, & Vickery, 2004). In general, these studies show positive effects among TQM, JIT, and SCM practices and operational and/or financial performance.

Operational practices have a strategic role in operational management, leading some authors to believe that they alone already provide a source of superior performance. Powell examines TQM as a potential source of sustainable competitive advantage, suggesting that when TQM practices are related with tacit features, such as an open culture, employee empowerment, and executive commitment, they can produce competitive advantage for the firm. The author emphasizes that TQM success depends their tacit aspects. Fullerton and McWatters (2001)demonstrated that practices embodied in the JIT philosophy can enhance firm competitiveness, and further, that JIT is a vital manufacturing strategy to build and sustain competitive advantage. Tan et al. (1999) says that supply chain practices implemented in an arbitrary and uncoordinated manner can affect its financial sustainability.

A direct relationship between bundles of operational practices and performance can lead firms to believe there is a competitive advantage. However, according to RBT, for a firm to generate competitive advantage, its resources must be valuable, rare, imperfectly, and non-substitutable. Practices are standardized rules and, therefore, do not meet this requirement, in contrast to operational capabilities that have unique and difficult to imitate characteristics. Nevertheless, the studies listed here ignore operational practices as antecedents of operational capabilities, with the exception of Tan et al. (1999), Das et al. (2000), Tan et al. (2002), and Droge et al. (2004). We do not ignore the fact that operational practices can lead the firm to have better performance, but we believe that bundles of inter-linked practices leads to the development of capabilities and that this will promote sustainable competitive advantage for the firm.

2.2 Operational capabilities

The Resource Based Theory (RBT)assumes that resources and capabilities are heterogeneously distributed between organizations and that many are not perfectly transferable between firms, even within the same industry (Barney, 1991; Crook, Jr, Combs, & Todd, 2008).The term “resources” is used by some researchers broadly, referring to the inputs of an organizational process. Although Barney (1991) classified capability as a resource type, some authors propose a distinction. Among these is Grant (1991), who defines resources as inputs in the production process (*e.g.* equipment, personal skills, patents, trademarks) and capabilities as the firm's ability to use these resources in operating activities.

Capabilities have certain characteristics that make them costly or even impossible to imitate or substitute, such as social complexity, causal ambiguity that involves their functioning and the history of how they have been accumulated, which is unique to each firm (Dierickx & Cool, 1989). In a production process, for example, idiosyncratic production processes occur when managers make decisions to prioritize certain production lines. Based on this decision, learning through a social construction of internal knowledge is developed and provides unique resources for the firm, which some authors call operational capabilities (Schroeder et al., 2002). It is important that the firm understands how its resources are used (Coates & McDermott, 2002). The firm's ability to manage them can lead it, in the long term, to develop certain capabilities involving their operational and managerial processes composed of their routines, practices and learning capacity.

2.2.1 Development of operational capabilities from organizational capabilities

The business strategy literature broadly deals with the theme 'organizational capabilities' and, despite being widely studied, its definition is still under construction(Lee & Kelley, 2008; Zahra, Sapienza, & Davidsson, 2006), with concepts such as:

1. "[…] information-based, tangible or intangible processes that are firm specific and are developed over time through complex interactions among the firm's *Resources*" (Amit & Schoemaker, 1993, pp.35).
2. "a high-level routine (or collection of routines) that, together with its implementing input flows, confers upon an organization's management a set of decision options for producing significant outputs of a particular type" (Winter, 2003, pp.991).
3. "the collective learning in the organization, especially how to coordinate diverse production skills and integrate multiple streams of technologies" (Prahalad & Hamel, 1990, pp.4).

Organizational capabilities are characterized as an internal resource of the firm that changes over time, influenced by management decisions. They are constituted from the individual skills of each employee, tacit forms of knowledge and social relations incorporated into the organizational routines, process management, forms of communication and organizational culture (Pandza, Horsburgh, Gorton, & Polajnar, 2003).

Over time, organizational capabilities can evolve to what the authors call dynamic capabilities, which are the firm's ability to learn by converting knowledge from the external environment in practices and routines (Eisenhardt & Martin, 2000; Teece, Pisano, & Shuen, 1997; Winter, 2003).

According to Teece et al. (1997, pp.515):

> The term 'dynamic' refers to the capacity to renew competences so as to achieve congruence with the changing business environment; certain innovative responses are required when time-to-market and timing are critical, the rate of technological change is rapid, and the nature of future competition and markets difficult to determine. The term 'capabilities' emphasizes the key role of strategic management in appropriately adapting, integrating, and reconfiguring internal and external organizational skills, resources, and functional competences to match the requirements of a changing environment.

According to Eisenhardt and Martin (2000, pp. 1106):

> Dynamic capabilities consist of specific strategic and organizational processes like product development, alliancing, and strategic decision making that create value for firms within dynamic markets by manipulating resources into new value-creating strategies.

Dynamic capabilities are considered a reconfiguration of organizational resources that will create a change in the market in which they operate. This dynamic creates value for the firm's business through the launch of new products, alliances, technology transfer, etc. Over time, the accumulated experience of the firm affects the evolution of its dynamic capabilities (Eisenhardt & Martin, 2000). Thus, the firm will be able to exploit its existing capabilities and, at the same time, develop new capabilities; this makes learning mechanisms one of the key formations of dynamic capabilities (Eisenhardt & Martin, 2000; Teece et al., 1997).

Although Teece et al. (1997) and Eisenhardt and Martin (2000) explore theme capabilities dynamics, the two seminal papers represent contradictory positions with respect to the framework's core elements. They differ with respect to the central issue of whether or not dynamic capabilities have the potential to explain sustainable competitive advantege in rapidly changing environments (Peteraf, Di Stefano,& Verona, 2013). Eisenhardt and Martin (2000) describe dynamic capabilities as best practices, able to sustain competitive advantage in moderately dynamic markets. Whereas Teece (2007) argues that dynamic capabilities are applicable in rapidlychanging environments, and thatbest practices cannot by themselves in a competitive market situation enable an enterprise to outperformance its competitors, because they are homogeneous.

We believe in theoretical progress of dynamic capabilities considering the idiosyncratic aspects of best practices (Peteraf, Di Stefano,& Verona, 2013).Some aspects can accelerate the formation of dynamic capabilities, such as administrative and operational practices, small errors, crises, and even the rhythm in which firms accumulate their experience. The application of best practice is associated with the firm's efficiency. Best practices help people understand how the processes work and also effectively develop organizational routines. The practices, in themselves, contribute to the development of dynamic capabilities, but develop into routines that encode the formal procedures and assist the transfer of technological knowledge that will facilitate the implementation of such practices. Routines are antecedents to dynamic capabilities and drive recombination, evolution and creation of resources that lead to competitive advantage sources. However, routines are necessary but not sufficient to achieve potential competitive advantages (Drnevich & Kriauciunas, 2011; Eisenhardt & Martin, 2000).

Dynamic capabilities are higher order capabilities. According to Zollo and Winter (2002, pp. 340), they develop "the learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness."Their function is to alter the existing operational capabilities of the firm. They are classified as first or second-order capability and can be used to develop operational capabilities (Collis, 1994; Zollo and Winter, 2002).

Operational capabilities are classified as substantives, ordinaries, or zero order capabilities (see Figure 2). These capabilities are a set of abilities and resources that will be used to solve problems, achieve results, or develop new products(Zahra et al., 2006).

The term operational capabilities is used by strategy scholars in a different meaning than the one used in this dissertation. In strategy, operational capabilities can be classified as zero or first order, and dynamic capabilities as first or second order. In this dissertation, as well as Hoopes and Madsen (2008), we will use zero order for operational capabilities and first order for dynamic capabilities (see Figure 2).

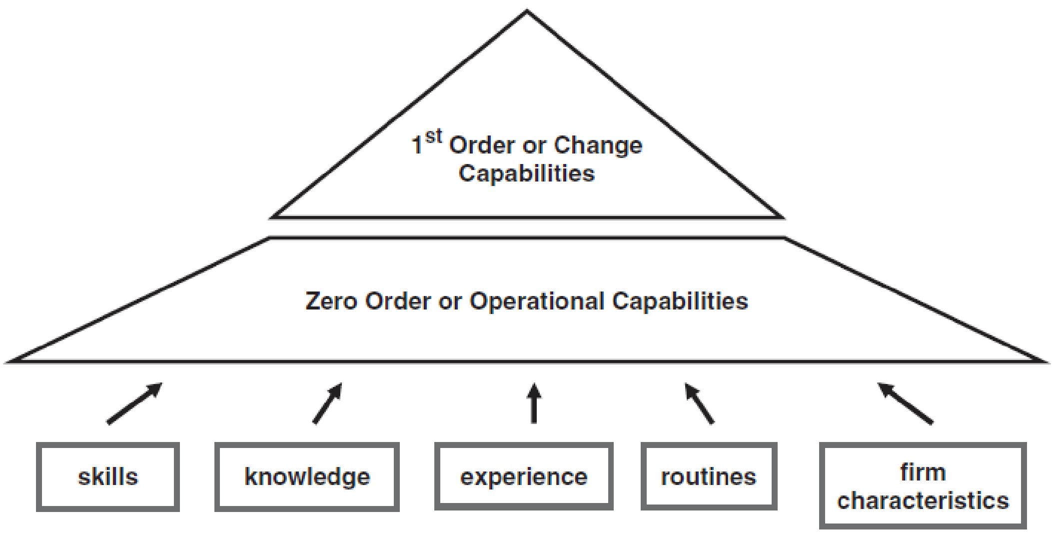


Figure 2– Winter’s capability hierarchy
Source: Hoopes and Madsen (2008)

A firm can have the operational ability to develop new products through its routines, or the dynamic capabilities to restructure its operating production process. New routines can be created from the existing knowledge of the firm, but its learning ability can also provide the creation of new operational capabilities, enabling significant changes in organizational routines (Zollo & Winter, 2002).

Dynamic capabilities induce a learning process, helping the creation and development of zero order capabilities(Collis, 1994; Zahra et al., 2006).In an operational area, operational capabilities are "firm-specific sets of skills, processes, and routines, developed within the operations management system that are regularly used in solving its problems through configuring its operational resources" (Wu et al., 2010, pp.726).However, even though the studies of Wu et al. (2010) are the first to conceptualize operational capabilities, its definition and implementation is under construction, since the variables commonly used to measure this construct - quality, delivery, flexibility and cost - are also used interchangeably to represent competitive priorities and operational performance.

2.2.2 Operationalization of operational capabilities as competitive priorities

Wheelwright (1984) was the first article to bring the variables, quality, delivery, flexibility, and cost as competitive priorities. For the author, as well as Skinner (1969), firms have to choose a competitive priority and invest in it (even at the expense of other priorities) front of their competitors. This is the principle of trade-off.

In contrast to the principle of trade-off, Ferdows and Meyer (1990) developed a model called the sand cone model. This model uses the same variables proposed by Wheelwright

(1984). Depending on the complexity of the operational capabilities, they can change or even reinforce each other, becoming cumulative. The sequence begins with quality, goes to delivery, flexibility and ends in cost.

In the sand cone model, quality is a precondition for all other operational capabilities, forming the foundation model. It is considered a foundation capability, because it affects different processes of production, and helps to develop the other capabilities. Once quality begins to show results, firm will continue expanding it, and at the same time, start efforts to obtain a reliable production process (delivery). When the firm has an established quality and reliable delivery, the next step is to add improvements related to flexibility, considering the volume of products and introduction of new products on the market. Finally, after all these efforts, the area of operations should invest in programs to improve the cost efficiencies. The operational cumulative continue to expand and simultaneously reach higher levels (Ferdows & Meyer, 1990). Table 1 shows some studies using quality, delivery, flexibility and cost as operational capabilities.

Table 1 – Operational Capabilities _Group 1

Variables	Classification	Authors	Year
Quality Delivery Flexibility Cost	Competitive Priorities	Wheelwright	1984
	Operational Capabilities	Ferdows & DeMeyer	1990
	Competitive Priorities	Kathuria	2000
	Cumulative Capabilities	Corbett & Whybark	2001
	Competitive Capabilities	Rosenzweig & Roth	2004
	Strategic Capabilities	Größler & Grübne	2006
	Cumulative Capabilities	Amoako-Gyampah & Meredith	2007
	Cumulative Capabilities	Schroeder, Shah & Peng	2010
	Competitive Capabilities	Rosenzweig & Easton	2010
	Competitive Capabilities	Hallgren, Olhager & Schroeder	2011
	Competitive Capabilities	Liu, Roth & Rabinovich	2011
	Competitive Capabilities	Schoenherr, Power, Narasimhan & Samson	2012

Evidence supporting or opposing the sand cone model is found in studies of Kathuria (2000), Corbett and Whybark (2001), Rosenzweig and Roth (2004), Größler and Grübner (2006), Amoako-Gyampah and Meredith (2007), Hallgren, Olhager, and Schroeder (2011), Liu, Roth, and Rabinovich (2011), and Schoenherr et al. (2012). Corbett and Whybark (2001) compared firms with high and low performance and concluded that both follow the same sequence described by the sand cone model. Similarly, Rosenzweig and Roth (2004) and Größler and Grübner (2006) presented empirical evidence that operational capabilities are cumulative, and they develop gradually. The authors also said they may indirectly affect each other, as in the case of quality that positively affects flexibility (Größler & Grübner, 2006).On the other hand, Kathuria (2000) presented three cumulative operational clusters. The first, Efficient Conformers, has a significant emphasis on cost and quality. The second, Speedy Conformers, equally focuses on the delivery and quality, and the last cluster, Do All, has four operational capabilities.

Differences in the sequence of the sand cone model were found in studies conducted by Hallgren et al. (2011). The authors developed a hybrid model where quality is the basis for delivery, but flexibility and cost are not sequential and can be developed at the same time. Amoako-Gyampah and Meredith (2007) tested the sand cone model in Ghana. The results supported the model; however, it contained a significant change in its sequence. The model has quality at its base, and it is followed by cost. Delivery and flexibility are at the top. According to the authors, the difference in sequence depends on the economic conditions of the country. In Ghana, for example, the cost is a strategy for enterprises throughout the country (Amoako-Gyampah & Meredith, 2007).

To compare the behavior of operational capabilities by groups of countries, Schoenherr et al. (2012) conducted a survey in industrialized, emerging and developing countries. The main results found that, in industrialized countries, operational capabilities have achieved a mature level. While operational capability is considered significant in among industrialized countries, it has less importance as a source of competitive advantage. This is contrary to what occurs in less developed countries, where operational capabilities are considered a valuable resource and can leverage social and economic development in those countries.

The analyzed studies demonstrate that the sand cone model is not a universal model. Schroeder et al. (2010) showed that 33% of the sample of their study did not follow the cumulative model, while 67% could eventually develop it. In addition, Liu et al. (2011) argue that the cumulative model and trade-off model are not mutually exclusive, and both can be evidenced in the same operating process at different times. Cumulative model is linked to effective operating practices, while the trade-off model is related to the performance frontier in the innovation cycle.

Group 1 in Table 1 consists basically of studies about the sand cone model (Ferdows & Meyer, 1990). Some authors empirically have evidenced its existence, while others disagree with the sand cone model as a cumulative process. But all of them use the same scale, quality, delivery, flexibility, and cost.

In addition to studies that tested the original scale of Wheelwright (1984) and sand cone model (Ferdows & Meyer, 1990), there are those that altered it, including or removing variables. The search results are shown in Table 2.

Table 2 – Scale with variations in operational capabilities_group 2

Variables	Classification	Authors	Year
Quality, confidence in the production system, delivery, cost, flexibility, innovation	Operational cumulative	Noble	1995
Product flexibility (customization),process flexibility, volume flexibility, low production costs, introduction of new products, speed of delivery, delivery reliability, quality specification, confidence in the product, quality design (innovation).	Competitive priorities	Vickery, Dröge & Markland	1997
Consistency of quality, high productivity, delivery speed, reliability of delivery.	Operational Performance	Mapes, Szwejczewski & New	2000
Quality-based process, quality based on the market, on-time delivery, fast delivery, product flexibility, volume flexibility, cost, cycle time, speed with new products.	Operational cumulative	Flynn & Flynn	2004
Quality, delivery speed, reliability of delivery, flexibility, cost, innovation in new products, conformity with product specifications, workforce, process technology, materials, planning, organization, control of production.	Competitive priorities	Rusjan	2005
Quality, delivery (fast delivery, on-time delivery and manufacturing cycle), flexibility (volume and mix change), cost, innovation.	Operational cumulative	Peng , Schroeder & Shah	2008
Quality, delivery, flexibility, cost, environmental protection	Operational cumulative	Avella, Vazquez-Bustelo & Fernandez	2011

Noble (1995) was one of the first authors to add new capabilities. The author included dependability and innovation. The result of her study showed that firms competing in multiple operational capabilities have better performance than those that focused only on one or two. The preferred strategy of firms located in different countries tends to influence the result of the cumulative model.

Similarly, Flynn and Flynn (2004) included cycle time and the rate of new product introduction to the original scale of the sand cone model. The database used was the World Class Manufacturing (WCM, round II), involving Germany, Italy, Japan, the UK and the United States firms. The authors demonstrated that the operational capabilities have a positive relationship with operational performance, suggesting that the accumulation of operational capabilities can indeed generate a sequence, but not a universal sequence, as recommended in some studies. Each country has its own unique operational capabilities and this fact impacts their composition; it is unlikely that the same sequence can serve all circumstances generated by the competitive environment. For example, in Japan the operational capabilities proved to be cumulative between them, however, in the case of England only operational capability delivery had a positive effect on quality(Flynn & Flynn, 2004).

Peng et al. (2008) tested the cumulative model, adding the variable innovation. The database used was the World Class Manufacturing (WCM, round III). The model was tested with 189 firms in the countries of Finland, Germany, Japan, Korea, Switzerland and the United States. The results, similar to the findings of Flynn and Flynn (2004), indicated that the sand cone model cannot be considered a unique phenomenon applied to all firms, because changes in operational strategic choices and contingency factors can influence its sequence. In addition, the authors argue that the trade-off theory is appropriate when the production is near the border of efficiency, particularly when it is static.

On the other hand, Avella, Vazquez-bustelo, and Fernandez (2011) tested the cumulative model, including variable environmental protection. The authors verified that operational capabilities can occur gradually, without incompatibilities or trade-offs. The relationship between quality, delivery, flexibility, environmental protection and costs has a positive and direct effect and operational capabilities that are not adjacent have an indirect effect on their subsequent operational capability, reinforcing the sequence of the sand cone model.

In addition to the cumulative model, other techniques were also employed for the analysis of operational capabilities. Vickery, Dröge, and Markland (1997) used factor analysis and multiple regressions, and tested the operational capabilities in a single industry (furniture) to avoid variability between different industries. The results identified four groups of operational capabilities: (1) innovation; (2) delivery; (3) flexibility; and (4) value (combination of quality and cost). All groups were positively related to operational performance. Rusjan (2005), through a simple regression, determined that the strategic decision of the manager has an influence on the choice of competitive priorities. For this author, the chosen strategies should meet the present situation of the firm, at the same time realizing possible changes that the firm hopes to achieve. Thus, formal periodic planning is necessary to determine which competitive priorities should be considered, allowing operational improvements and possible changes in the firm's competitive environment.

And finally, Mapes, Szwejczewski, and New (2000) compared plants with high and low performance. The authors concluded that for quality, productivity and delivery, plants with high performance used processes and procedures with less variability and uncertainty than the low-performance plants. Furthermore, the authors did not identify differences between size, complexity, volume of production and industry, but found that high-performance plants are prone to belong to foreign groups.

The group 2 studies are focused on the influence of contingency factors in the formation of operational capabilities. They show that more important than a possible ideal sequence is the firm's ability to articulate its main operational capabilities, promoting best performance.

We recognize that it is not always easy to distinguish competitive priority, operational capability, and operational performance. The same variable may be used in both cases. For example, flexibility has three meanings: (1) how a firm prioritizes a number of strategic initiatives that will lead it to be more flexible operationally; its scale can be compared with other competitive priorities; (2) how flexible a firm is, compared to its competitors; its scale is composed of performance in flexibility compared to its competitors; (3) how competent a firm is to operate with flexibility; its scale is used for operational capability.

In order to assist in the definition of competitive priorities and operational capabilities, Schroeder, Shah, and Peng (2011) conceptualized competitive priority as a strategy used to achieve a certain objective of production and operational performance as a result of these activities. Nevertheless, our review of the literature showed that there is a conceptual confusion between these two constructs. The same variables are used to represent both competitive priority and operational capability, without distinguishing the content of variables.

In the literature review we also found some studies that operationalize the operational capabilities individually. These studies address new operational capabilities, expanding their scope. We discussed better about them in section 2.2.3.

2.2.3 Operationalization of independent operational capabilities

Some researchers emphasize a unique operational capability, analyzing it deeply in order to understand its role in the value chain. To select these operational capabilities we did a literature review with the following journals: Journal of Operations Management (JOM), International Journal of Operations Production Management (IJOPM), Production and Operations Management (POM), Decision Sciences (DS). The selection was conducted using the following keywords: (1) operational performance; (2) competitive priority; (3) competitive capability; (4) operational capability; and (5) competence. First, we look for keywords in title, abstract, and keywords. In total we found 2101 articles. Second, we analyzed the abstracts looking for operational capabilities. We got approximately 200 articles. Third, we separate articles by type of operational capabilities.

Figure 3 (group 3) shows selected operational capabilities. In total were found eight operational capabilities: (1) information systems integration; (2) continuous improvement; (3) innovation; (4) flexibility of processes; (5) mass customization; (6) quality management; (7) supply chain management; and (8) learning. These are described below.

Figure 3–Operational capabilities_group3

2.2.3.1 Integrative information systems capability

Information System is the capacity to manage a set of tangible assets (*e.g.* information systems hardware, network infrastructure) and intangible (*e.g.*, software patents, strong vendor relationships) formed from the productive use of information technology. Information System resources rarely contribute a direct influence to sustained competitive advantage, they form part of a complex chain of assets and capabilities that may lead to sustained performance. Their influence on the firm is through complementary relationships with other firm assets and capabilities (Wade & Hulland, 2004).

For Flynn and Flynn (1999)information systems practices include (1) the use of multifunctional employees; (2) communication of operations strategy; (3) coordination of decision-making; (4) simplification of product design; (5) inventory reduction; (6) interaction with supervisors; (7) flexibility in the selection and recruitment of employees; (8) practices of JIT; (9) limited purchase orders; and (10) strong relationships with customers that promote moderation in the relationship between capabilities in information processing and operational performance. For the authors, simplifying practices in the operational environment by reducing the amount of information to be processed helps the firm achieve better results in communication, because although the firm may have sophisticated information systems, it needs a high level of communication so that it can transform data into usable information (Flynn & Flynn, 1999).

The information system integrates the complexity of the production process. Information needs to be shared, revealing the importance of processing, especially when new products/services are inserted into the production line (Swink & Hegarty, 1998; Wu et al., 2010).The management of a completely integrated information system involves internal and external cross-functional activities, including customers and suppliers. The use of advanced technology positively impacts the performance of the firm and its responsiveness to customers, leading it to better compete in competitive environments (Narasimhan & Jayaram, 1998; Wu et al., 2010, 2012).

Integration of the information system is necessary so that managers have access to relevant information without interruption, including in the supply chain. Suppliers can also contribute to applying technologies, operating systems and establishing a learning relationship, creating value for the relationship (Weigelt, 2013).Operations should be able to acquire knowledge through the coordination of data and communication networks that connect organizations. The ability to manage operational knowledge is an important predictor of organizational competitiveness and an antecedent operational of absorptive capacity (Setia & Patel, 2013). The firm must also develop best practices internally and effectively manage external information, which involves managing the supply chain information system (Zhao, Huo, Selen, & Yeung, 2011).

2.2.3.2 Continuous improvement capability

Continuous improvement is the firm's ability to gradually increase its operational performance (Swink & Hegarty, 1998). This capability is a different set of skills, processes and routines that increase, refine and reinforce the processes of existing operations (Wu et al., 2010, 2012). The cumulative effect of this capability can mean long-term, new products or improve existing ones. Benner and Tushman (2003) refer to continuous improvement as exploitation, because it indicates the firm's willingness to improve its existing technological and operational processes.

Operational improvement capability is in the dynamics of learning, renewal and motivation of those involved (Swink & Hegarty, 1998). The manager's ability to create and use a set of interrelated routines for incremental improvement of its processes/products favors the development of a specific continuous improvement capability (Narasimhan & Jayaram, 1998; Peng et al., 2008). Learning mechanisms can also enhance continuous improvement capability, such as: (1) training for problem resolution; (2) application of techniques for continuous improvement; (3) management of ideas; (4) monitoring and measurement of results; and (5) reward and recognition systems. Such mechanisms may have different levels within an organization's evolution (Bessant & Francis, 1999).

Continuous improvement can also mediate the relationship between learning and innovation (Y. Li, Li, Liu, & Yang, 2010). Firms that focus on process improvement strategies, such as TQM, tend to have more incremental innovations (Benner & Tushman, 2003). The incremental process of innovation is identified by continuous improvements made in products and/or services that aim to achieve low cost and high quality. The management of incremental innovations requires performance measurement and coordination of conflicts in critical processes. Pre-established routines can add value to products and services favoring incremental innovations. The accumulation of information and knowledge generated by the set of organizational routines creates a learning base through management processes facilitating activities related to innovation (Kim, Kumar, & Kumar, 2012).

2.2.3.3 Innovation capability

Opposed to incremental innovation, radical innovation creates, improves or implements unique processes that radically improve operational performance (Swink & Hegarty, 1998; Wu et al., 2010, 2012). Operational innovation seeks to change pre-established technological trajectories. Usually it is related to exploration capabilities that focus on processes and routines related to the research, testing and implementation of new technology (Benner & Tushman, 2003).

Radical innovation is associated with the implementation of new and significant process improvements in products and services to achieve low cost and high level of quality. Quality management practices are facilitators of innovation projects, as they involve important critical activities, such as rethinking the set of existing routines (Kim et al., 2012).

Flexible routines tend to favor the development of radical innovations, as well as provide learning opportunities to firms. In addition, they also increase the responsiveness to customer needs (Kim et al., 2012). Peng et al. (2008) found that the resource associated routines improvement and innovation benefit research for new technologies and help the development of new products. These routines also speed the results of R&D and can help in building an innovation capability.

Innovation capability prospers from a supportive work environment based on clear objectives, space for creativity, focus on R&D, and proximity to partners. Part of the success of the innovation capability is the absorptive capacity of the firm to apply external knowledge in internal learning activities. The firm also needs to have the ability to adapt to the market and customers, allowing radical innovations to emerge from this process (Biedenbach & Müller, 2012).

2.2.3.4 Flexible process capability

Flexibility is the operational response capacity of the firm to make changes in its inputs and outputs (Swink & Hegarty, 1998; Wu et al., 2010, 2012).Operational flexibility is the ability of the firm to manage its productive resources, in order to meet a growing variety of customer expectations. However, it should not generate excess cost, time, operational interruptions or performance loss (Swink & Hegarty, 1998; Wu et al., 2010, 2012; Zhang, Vonderembse, & Lim, 2003). Operational flexibility allows the firm to produce necessary amounts of products with high quality, speed and efficiency through the reduction of time to set-up, flexible cell layouts, preventive maintenance, improvement in quality and reliable suppliers (Zhang et al., 2003).

According to Zhang et al. (2003), flexibility can be assessed in a dichotomous manner, differentiating between competence and capability. Competence is an internal resource of the firm, composed of the flexibility of the machines, employees and raw materials and represented by flexible internal routines to which the customer has no access. Capability, on the other hand, is the perception of its customers, for example, the volume and mix of products that creates value for them. The firm achieves customer satisfaction by building its capabilities from its competencies. In this sense, it can be said that the competence is the path to the capability (performance).

The competence and capability terms used by Zhang et al. (2003) to represent capability and performance can confuse the reader. Capability, for most of the operations in the studies, is not considered performance. However, this is a semantic issue, since the meanings of the concepts are the same used in this study. Capability is the means to the end (performance).

Flexible capability is moderated by the absorptive capacity of the firm to explore and apply new knowledge. Firms developing a learning capability can improve the flexibility of their production system, leading to higher operating performance (Patel et al., 2012).

2.2.3.5 Customization capability

Customization and flexibility are indissociable variables, since flexibility is the means by which the firm can develop the customization of its products (Vickery et al., 1997; Zhang et al., 2003).

Customers are ever more sophisticated. There is a constant demand for a variety of products with good quality and low prices. Mass customization reflects the firm's ability to customize its products to meet the specific needs of its market, producing on a large-scale, for the short-term, and at a cost that is comparable to mass production of non-customized products (Zhang et al., 2003).

Customization is a set of skills, processes, and routines that generate knowledge through expansion and personalization of processes and operating systems (Wu et al., 2010, 2012). It can be managed by dividing it into smaller modules and examining each piece separately. Customization represents a paradigm of the production process, as it must combine product customization with the efficiency of the production cost. The firm may decide on full mass customization, in which manufacturing the products can be customized in part of the production cycle, or partial customization, in which customization is done in assembly steps or during delivery of the products (Huang, Kristal, & Schroeder, 2008, 2010).

Either way, the firm needs a structure (machines, processes, and layout) that allows it to achieve the customization of its product (Tu et al., 2004; Wu et al., 2010, 2012). One way is through the modular production system. Modularity is the level at which components of a system can be separated and recombined. Modularity of products, processes, and work teams is effective in the development of mass customization capability (Tu et al., 2004). Another way is by production practices based on modularity (MBMP), which are formed by the set of actions that allow the firms to achieve differentiated designs of products, processes, and industrial designs, enabling the customization of mass produced products.

The organizational structure has an impact on the capability of mass customization of the production system of a firm. Considering this aspect, Huang et al. (2010) conducted a study in 167 manufacturing plants. Database used was the high performance manufacturing study, Round III. Industries chosen were electronics industries, machinery, and suppliers of the automotive industry. The authors studied the relationship of an organic structure (level of decentralization, cross-functional teams, and hierarchical structure) with ability to conduct mass customization. Sample was composed of 93 firms using complete full mass customization (*e.g.* Adidas) and 74 firms using partial customization (*e.g.* Dell). The results showed that there is a positive relationship between organizational structure and full mass customization, but not with partial customization. This can be explained by the fact that the modular architecture is usually used by partial customization. Products are customized only at the end, using a traditional organizational structure.

2.2.3.6 Quality management capability

Improving operational quality is the learning capacity of the firm to operationalize the concepts of exploratory learning, exploitative learning, explicit knowledge, and tacit knowledge. Quality programs that include contextual elements associated with exploratory learning and tacit knowledge and methodological elements related to exploitative learning and explicit knowledge tend to sustain a competitive advantage (Choo, Linderman, & Schroeder, 2007).

Kim et al. (2012) conducted a survey of firms certified in ISO 9001. Study's findings showed that the management of quality practices directly and indirectly influences the innovation process, but this relationship only occurs if bundles of practices are interrelated. This means that the firm must use a set of complementary practices to achieve the desired results. Use of isolated quality practices does not provide the same performance. An example of this was found in the positive, but indirect, relationship between managerial leadership and innovation. This relationship only occurs through other quality management practices, such as training, developing relationships with employees and customers, managing the quality of suppliers, and managing the design of goods and services. Similarly, the management of suppliers has been linked indirectly to innovation through services designers.

2.2.3.7 Supply chain management capability

Supply chain management (SCM) is "defined as a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer" (Mentzer et al., 2001). It emphasizes the interdependence and integration of firms working collaboratively to improve the efficiency of the entire logistics channel. However, Yeung (2008) believes that the management of suppliers is more important than the own chain management. Strategic supply management (SSM) is a long-term planning which seeks to create a base of suppliers able to offer benefits in the relationship. Strategic management of suppliers focuses on the dyad between production and its main suppliers. Firms select a few suppliers with high quality and include them in their strategic planning. Yeung (2008) found that the strategic management of suppliers positively impacts the delivery time and reduces operating costs, generating customer satisfaction and improved business performance.

Kristal, Huang, and Roth (2010) argued that the supply chain strategy needs to work simultaneously with practices of exploitation and exploration. Firms can seize the knowledge generated through the supply chain to acquire and/or build their internal operational capabilities. Thus, managers should simultaneously implement efficient operational practices and research opportunities that give the firm a competitive advantage.

However, the concern in managing the supply chain goes beyond the direct performance gain. Firms are concerned about the indirect losses from lack of control of their suppliers. Firms in advanced economies outsource to firms that are in developing countries, and this leads to discussions of social, ethical, and sustainability issues in global supply chains (Jiang, 2009).

Some firms understand that sustainability is a critical factor for growth and financial performance. They look to develop an alignment between environmental and financial goals (Pagell & Wu, 2009). However, there are still a large number of firms, mainly in developing economies, which need to focus on sustainability issues. Therefore, the supplier code of conduct (supplier codes of conduct -SCC) is increasingly used as a way to control and preserve the reputation of multinational firms in the international market (Jiang, 2009).

Supplier code of conduct provides employees safe and healthy working conditions, compliance with child labor laws, and control of wages and the number of hours worked. However, for the compliance of the code by suppliers to be sustainable, it is necessary that the buyer of the governance process seeks greater integration and cooperation with the suppliers and reduce contractual threats. Practices that generate transparency, traceability, and certification also strengthen the sustainability of the supply chain (Pagell & Wu, 2009).

The firm's commitment to establish a good relationship with its suppliers and customers creates an integration of the supply chain. However, issues such as regionalization should also be considered. Individual characteristics of each country can interfere with the context, generating adjustments in its management of the supply chain. For example, Zhao et al. (2011) studied 587 Chinese firms and realized that, in firms established in China with foreign ownership, the commitment to integration of the supply chain is lower than in firms that had Chinese control. This result is due to the strong collectivist culture of China and "Guanxi" (relationships that are based on the exchange of reciprocal favors or connections that are beneficial for the parties involved) characteristics of Chinese firms. Thus, for foreign-controlled firms, internal learning and their ability to process information effectively, with a solid competent technology, make it possible to better understand the business of their partners. It also establishes greater external integration in supply chain management.

2.2.3.8 Learning capability

The process of developing capabilities should not be separated from the way that knowledge is acquired. Knowledge is connected to experience and managers' ability to learn. Over time, the accumulation of knowledge helps build operational capabilities that are used a basis for the management of organizational resources (Pandza et al., 2003). According to Paiva, Roth, and Fensterseifer (2008), organizational knowledge as a resource develops through cross-functional interaction between areas. The role of internal knowledge is to help the firm adapt to the changes in its environment. The role of external knowledge is to give the firm tools to better deal with the market changes, reduce risks, and reduce uncertainties.

The firm should be able to create and manage knowledge, and absorb and use it in its production system. This ability is called absorptive capacity. Adapted from macroeconomics, its concept is defined as the firm's ability to recognize the value of external information, assimilate it, and apply it to commercial ends (Cohen & Levinthal, 1990). Zahra and George (2002) proposed four dimensions that form absorptive capacity:

(1) acquisition; (2) assimilation; (3) processing; and (4) exploitation of knowledge (Patel et al., 2012; Setia & Patel, 2013).

Setia and Patel (2013) divides absorptive capacity into two groups: (1) potential operating absorption capacity, which the ability of operations to create, acquire, and assimilate knowledge, and (2) realized operating absorptive capacity, which is the effective processing, use, and exploitation of knowledge in operational processes. According to Setia & Patel (2013), realized absorptive capacity is the antecedent of organizational performance, indicating that firms only benefit from knowledge after implementing processes that exploit realized absorptive capacity. As a result, it transforms knowledge into products and services. Potential absorption capacity creates market value for the firm and is influenced by realized absorptive capacity.

The exploitation of knowledge also implies the firm's ability to operate its resources, embodying a combination of explicit processes (*e.g.* practices) and tacit elements (*e.g.* know-how). Therefore, the firm needs to develop its absorptive capacity, involving factors such as exploratory, exploitative, and transformative learning and the firm's adaptive capacity to identify and capture opportunities in emerging markets (Wang & Ahmed, 2007). Biedenbach and Müller (2012) conducted a study on R&D in the pharmaceutical industry, measuring absorptive and adaptive capacity. The study used the methodology of critical realism, which involves mixed methods (qualitative and quantitative). The qualitative results showed that a mix of different capabilities improved R&D, and that absorptive, adaptive, and innovative capacities are complementary and contribute to the performance of portfolios and R&D projects. In the quantitative phase, external information, knowledge, and learning were also positively related to the R&D process.

Absorptive capacity may impact the implementation of successful operational practices. For example, Tu, Vonderembse, Ragu-Nathan, and Sharkey (2006) found a positive relationship between absorptive capacity and operational practices and between operational practices and the creation of value for the customer. Tu et al. (2006) consider the learning process to be a capability; it can be developed through experience and operational knowledge. According to Huber (1996), in highly complex environments, the lack of organizational learning capacity may explain why some organizations are less effective in assimilating practices and technologies that generate competitive advantage.

Kogut and Zander (1992) argued that the knowledge is generated, transferred, and learned by individuals in the organization, consisting of information (*e.g.* who does what) and know-how (*e.g.* how teams work). The construction of knowledge occurs through the social relations existing in the firm accumulated over time. Internal learning is acquired by experience, errors, and so on; and external learning is associated with new hires, acquisitions, partnerships, and so on. The authors believe that, when internal and external learning are aligned, the firm develops a combinative capability. Its main function is to mediate the internal knowledge of the firm and the technological and organizational opportunities offered by the market

Miller (1996, pp. 486) described organizational learning as the "acquisition of new knowledge by actors who are capable and have willingness to apply it in their decision making or influencing others in the organization."Patel et al. (2012) warned that the managers of USA manufacturing firms are often pressured to cut costs and focus on short-term goals, neglecting investments and time in the learning process. Learning processes involve information systems, research and development, and production and management operational processes. They connect external knowledge to internal knowledge, providing the development of organizational learning (Y. Li et al., 2010).

Thus, learning capability is the basis for the firm to build or improve other capabilities present in its production process, such as quality, innovation, continuous improvement, among others. Combined, these operational capabilities affect the operational performance of a firm and can be a source of competitive advantage.

2.2.4 Operational practices as antecedents to operational capabilities

The benefits of adopting practices such as TQM, JIT, SCM, among others, applied individually are inconsistent, perhaps due to the fact that for the practices to be effective, they need to be associated with other practices over time, in an enabling environment (Benner & Tushman, 2003).Furthermore, the intensive use bundles of operational practices can be antecedents of operational capabilities, which in turn are more rare and difficult to imitate.

Cua et al. (2001) investigated the relationship among TQM, JIT, TPM and operational performance (cost, quality, delivery and flexibility). The main results were that leadership practices, consumer involvement and emphasis on technology had a positive effect on volume flexibility performance. Lee & Kelley (2008) also found that the practices with a high level of learning and improvisation were one of the aspects that helped to develop the dynamic innovation capability. The term “dynamic capability”, in this case, is merely semantic, since it is clear that the authors are referring to operational capability.

Benner & Tushman (2003) explained it is necessary for researchers to pay attention to the context in which operational practices are implemented. The industry in which the firm operates influences the type of practices used. For example, firms operating in technologically advanced environments need to develop practices related to radical innovation capability. For those that operate in static environments, the focus should be on the practices that lead to the continuous improvement capability. In general, the successful implementation of operational practices depends on individual characteristics of each firm. Firms need to assess which set of best practices fit with their production process and if they are able to implement them (Shah & Ward, 2003). Powell (1995) argued that tacit aspects linked to the environmental context create a culture where practices affect performance.

Operating practices developed over time can be transformed into an operational capability; this will depend on their level of complexity. Figure 4 of Rondeau, Vonderembse, & Ragu-Nathan (2000) identifies the path between a practice and a competitive capability.

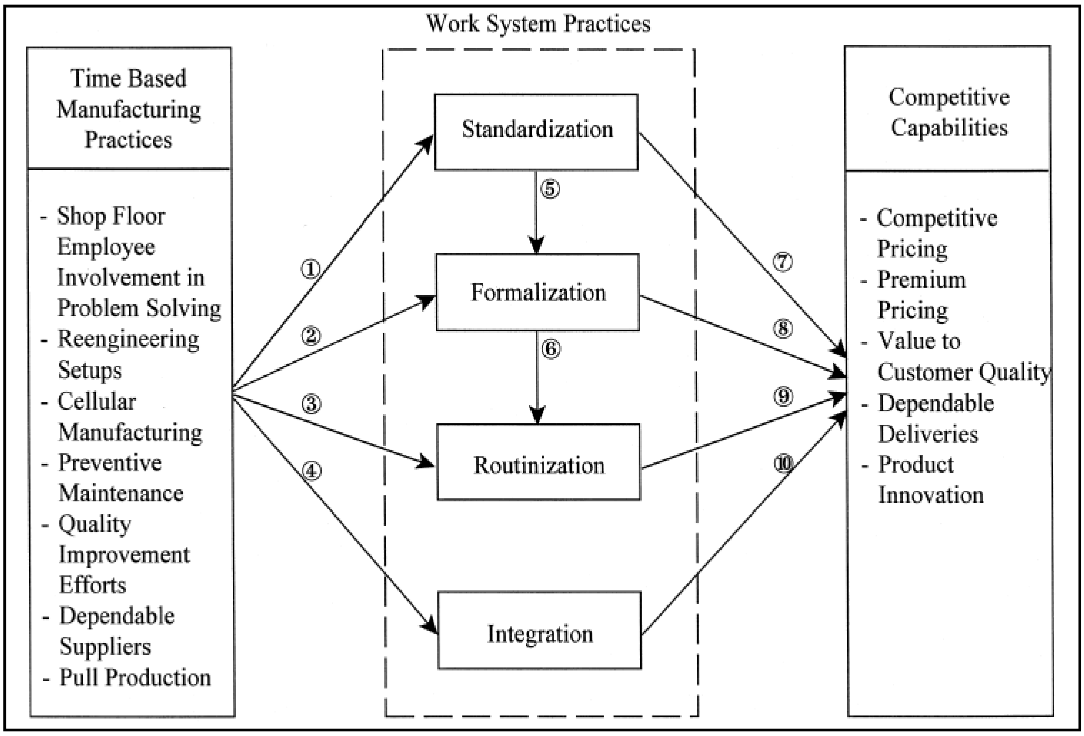


Figure 4– Work system practices
Source:Rondeau et al. (2000)

Rondeau et al. (2000) observed that firms with standardized routines and integrated operational practices tend to be able to develop competitive capabilities. The study was conducted with 265 firms in the industries of: (1) Furniture and Fixtures; (2) Metals; (3) Industrial; Machinery and Equipment; (4) Transportation and Equipment; and (5) Instruments and Related Products. Each number presented in Figure 4represents a hypothesis. With the exception of hypotheses three, eight, and nine, the others were confirmed in the study of Rondeau et al. (2000). The main contribution of their study was to show the mechanisms that connect practices and capabilities. Mechanisms pointed out by the authors as most important were standardization and integration. Standardization helps in the development of products and processes, and encourages employee participation in the creation, development and integration of norms that aim to increase customer satisfaction and improve production capacity. Integration, in turn, provides a way for employees to share knowledge, promote learning, and solve problems with cross-functional teams (Rondeau et al., 2000). Although the authors did not work with operational capabilities, this is one of the few studies that separates practices and capabilities, and at the same time shows their relationship.

The distinction between operational practices and operational capabilities is not clear in the literature. Wu et al. (2010) developed a metaphor related to the kitchen of a restaurant to aid in this understanding. For the authors, in a kitchen, resources are all assets, tangible and intangible, such as the stove, utensils and the ability of individuals, which together define the potential of what may or may not be executed in the kitchen, but that separately cannot achieve the ultimate goal. For example, the stove alone does not prepare a food; the chef needs instructions on how to use it along with other resources to complete the dish. The instructions in the kitchen represent operational practices, through standardized processes. Recipes and rules indicate how to combine the resources available for preparation of the dish. The problem with this, however, is that a recipe can be easily copied by competitors' restaurants. But differentiation is not the role of operational practices because they cannot capture less tangible aspects, such as the freshness and quality of ingredients or the chef's experience. The ability to develop dishes that reflect the restaurant's unique history, style and customer preference is the role of capabilities. It will be developed from the skill in food preparation and environment characteristics that are difficult to transfer from one environment to the other, since they involve interactions over time, which translates into a unique specificity of each kitchen. This set of interactions is called a capability (Wu et al., 2010). Sousa & Voss (2002) assert that it is these interaction effects that distinguish successful firms from others, creating inimitable capabilities.

2.2.5 “Shades of Gray” of operational capabilities

In the literature, there is no consensus on how the capabilities are developed over time. The capability development process is subject to a high level of complexity and associated causal ambiguity. Different paths can lead to its development. Their trajectories can be affected by learning, experience, research and development, imitation, or any other activity and resources of the firm. Whether multiple variables are controlled or not, the firm is unique history can lead to the development of capabilities (Rockart & Dutt, 2015).

On the one hand, it is difficult to determine which variables lead to the development of a capability; on the other hand, there is no question about its existence. A capability is a real phenomenon, operating in several empirical studies as an internal resource of the firm. It is a working process and can develop into different levels within the firm. Rockart & Dutt (2015) argue that capability development trajectories should consider what they call ratio and potential (see Figure 5). "Ratio is fraction of the gap between the firm's current and potential capability with each unit of activity. Potential is the maximum capability level the firm could achieve through repeating the set of activities over time" (Rockart & Dutt, 2005, pp. 53).

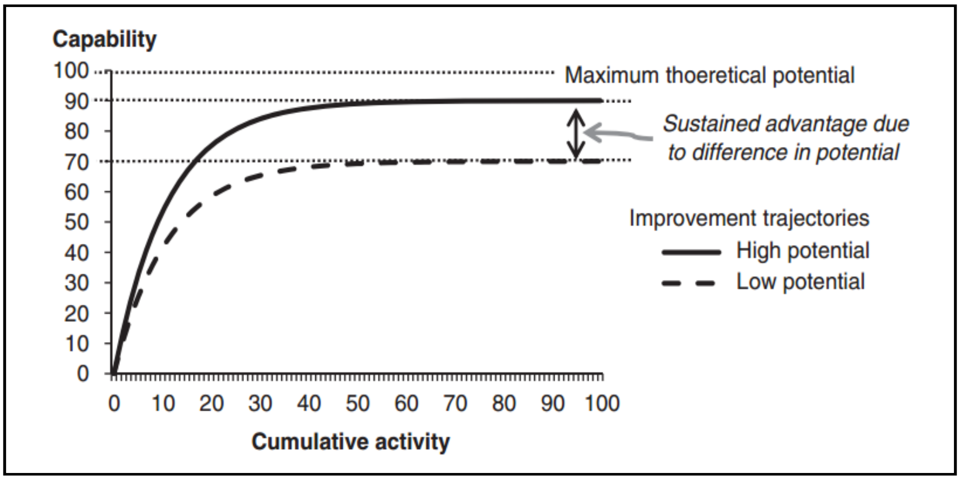


Figure 5 – Advantages based on differences in improvement potential.
Source: Rockart and Dutt, (2015, pp. 55)

As shown in Figure 5 each firm has a maximum development potential of its capabilities. When it reaches its maximum level while keeping some distance from its main competitor, it has a temporarily sustainable competitive advantage. The potential level which the capability can achieve will depend on its experience and the firm's learning process, depicted in Figure 5 by the cumulative activity. Experience is an important factor driving the capability development trajectory. It is based on a learning process that occurs through repetition as firms accumulate knowledge Rockart & Dutt (2015). However, even the firm’s having capabilities does not guarantee its sustainable competitive advantage, because for that competitive advantage to happen, the firm needs to have its capabilities developed at maximum potential and ahead of its competitors.

Capabilities may be at different levels of development. Each firm may differ in the efficiency or effectiveness of a particular type of capability. Thus, some capabilities may be better developed than others within the firm, or among firms. For example, Toyota may have an excellent operational efficiency capability, while Amazon may have the best supply chain management capability. Both firms can have both capabilities, but on different levels, the evolution level of a capability depends on the market in which the firm operates and the type of customer it serves. To help explain the process of evolving capabilities, Helfat & Peteraf (2003) introduced the concept of the capability lifecycle (CLC) (see Figure 6). The level of capability per unit of activity reflects the overall skillfulness of the team in executing the particular activity. The founding and development is the point where it begins and develops; it is difficult to define an exact transition point between them. Maturity is with a steady-state level of capability maintenance accompanying the level of task performance over time.

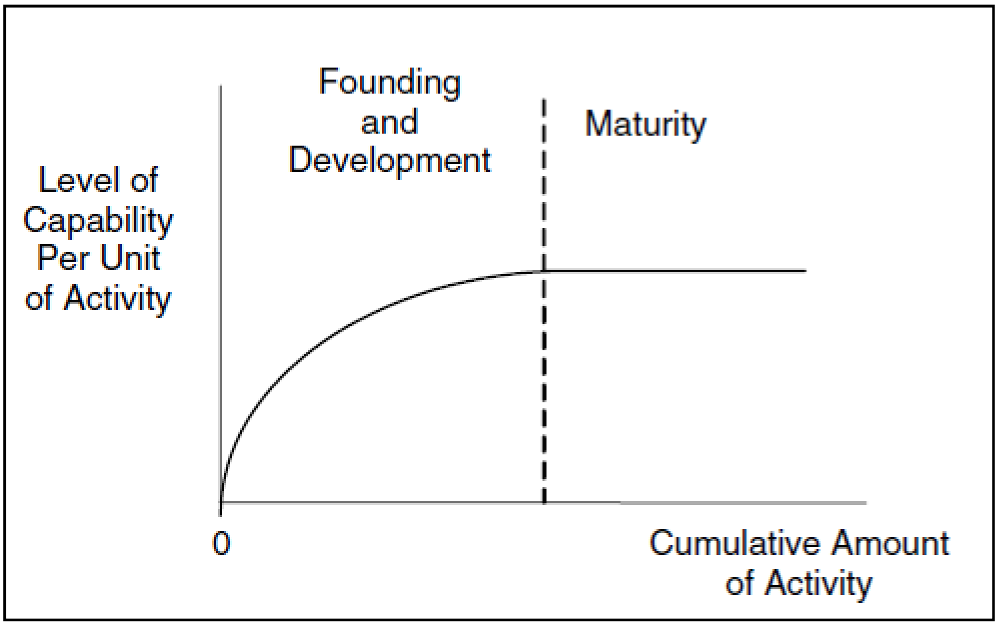


Figure 6– Stages of initial capability lifecycle
Source: Helfat and Peteraf (2003, pp. 1003)

When a capability is in its level of maturity, it may have the risk of retirement, as shown in Figure 6. However, in its process of development or maturity, if it is affected by one or more internal or external events, its trajectory can be changed. An internal event may be related to a management decision. On the other hand, an external event is one that cannot be controlled by the firm, as the fusion of two competitors. Intervening events may impact in six branches of the life-cycle capability (see Figure 7).

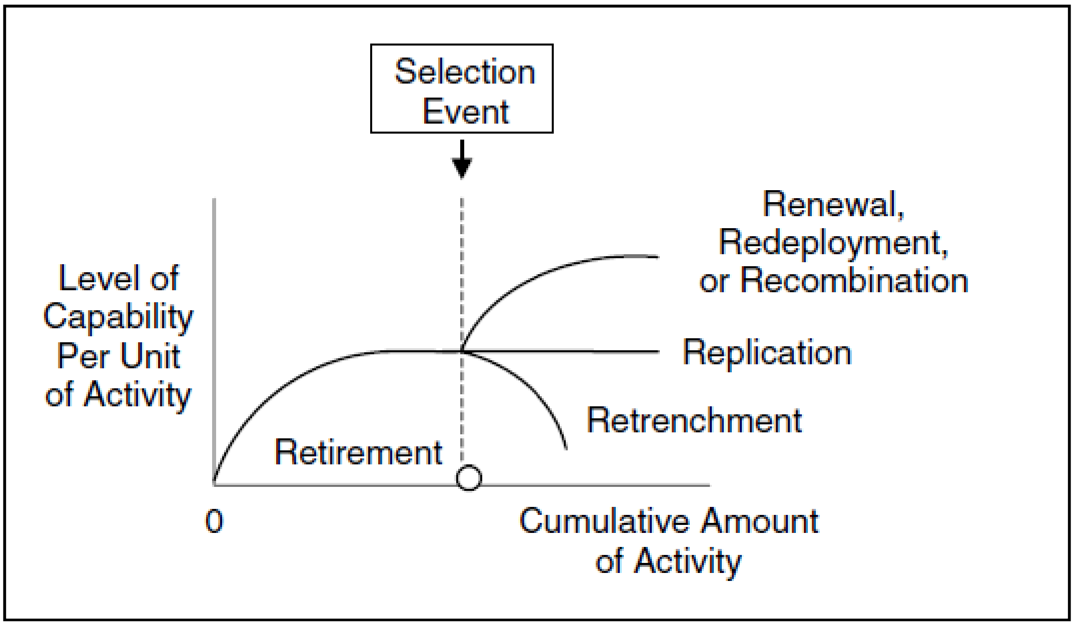


Figure 7–Branches of the capability
Source: Helfat and Peteraf (2003, pp. 1003)

Branches of the capability lifecycle are considered the six Rs: 1) Retirement (death); 2) Retrenchment; 3) Replication; 4) Recombination; 5) Redeployment; and 6) Renewal. Retirement and retrenchment finalize the cycle of a certain capability; in extreme cases, they can force the firm to discontinue a capability. Replication implements the same capability in another geographic market. Recombination, redeployment, and renewal are together because they have similar trajectories, but they use different development mechanisms to renew, redefine, or recombine new capabilities (Helfat & Peteraf, 2003).

Operational capabilities allow us to identify unique, proprietary, special abilities in manufacturing firms, and can improve the performance of the firm. However, its effects on performance can be decomposed into stable (fixed) effects and temporary (incremental effects) over time. This dynamic effect may be captured in the firm's ability to better experiment with, or adapt to, alternative industry conditions (Hoopes & Madsen, 2008)

2.2.6 Typology and operational capabilities

Theories in biology offer more than 200 years of experience in classification that can be applied in organizations. For example, one derived theory of biology that can be possibly applied in organizations is the general classification of groups. Attributes are observed together, allowing the investigation and classification of organizational behavior, design, policy, and management practices (McKelvey, 1978).

There are two main approaches to classification: taxonomies and typologies. Although different, the terms "taxonomy" and "typology" are sometimes used interchangeably. According to Doty and Glick (1994a), taxonomies are "classification systems that categorize phenomena into mutually exclusive and exhaustive sets with a series of discrete decision rules." and typology "refers to conceptually derived interrelated sets of ideal types. Unlike classification systems, typologies do not provide decision rules for classifying organizations" (Doty & Glick, 1994a, pp.232).

A well constructed typology can be very effective in bringing order out of chaos. It provides a parsimonious framework for describing complex organizational structures. It transforms the complexity of diverse cases in data well-ordered sets, providing elegant descriptions of their typologies. Typologies are useful in combining variables in such a way that interaction effects can be analyzed (Bailey, 1994; Doty & Glick, 1994).

Classical typology strategy uses a combination of conceptual and empirical data. A typology strategy can be either deductive or inductive. It is deductive when conceptual labels are tested in empirical cases. It is inductive when there is empirical data that is used to formulating conceptual labels (Bailey, 1994). Typologies are grounded in empirical experience, thus, they are not fully developed until they have been empirically validated (Bozarth & McDermott, 1998; Doty & Glick, 1994).

Typologies are a form of building theories for helping management researchers to understand a complex phenomenon. Good typologies have three main characteristics: (1) they provide a generalizable, grand or middle-range theory, applicable to individual types; (2) they are unidimensional constructs that are the building blocks of traditional theoretical statements; and (3) their hypotheses are empirically testable (Bozarth & McDermott, 1998). Good development of typologies should do the following: (1) make grand theoretical assertions explicit; (2) completely define the set of ideal types; (3) provide complete descriptions of each ideal type, using the same set of dimensions; (4) explicitly state the assumptions about the theoretical importance of each construct used to describe the ideal types; and (5) be tested with conceptual and analytical models that are consistent with the theory (Doty & Glick, 1994).

Studies of typologies are found in the literature of operations. Stock and Tatikonda (2000) developed a conceptual typology of inward technology transfer (ITT), which considers technology transfer at the project level of analysis, rather than at the firm level. The authors characterize the three dimensions of their typology: the technological uncertainty of the technology that is transferred, the organizational interaction between the source of the technology and the recipient, and its transfer effectiveness. Devaraj, Hollingworth, and Schroeder (2001) reported a conceptual and empirical comparison of the Hayes and Wheelwright Product–process matrix and the Kotha and Orne generic manufacturing strategy framework. They found that the product–process matrix has predictive capability with respect to manufacturing performance. The organizational scope of the two dimensions of the product–process matrix adds explanatory capability in predicting a broad array of types of manufacturing performance at the plant level. De Blok, Meijboom, Luijkx, Schols, and Schroeder (2014) developed the first typology on interfaces in modular services. Four interface categories are distinguished, offering a specification of the interfaces' function in creating variety and coherence, when linking content components, as well as service providers. Cook, Goh, and Chung (1999a) developed a service typology.

Although studies using typology are found in the literature, none has specifically addressed operational capabilities. We propose a typology about operational capabilities.

2.3 Operational performance

Researchers have proposed a variety of operational performance measures for manufacturing facilities(Ahmad & Schroeder, 2003; Jacobs & Swink, 2011; Wong et al., 2011). These include cost, quality, delivery, and flexibility. Rate of new product introduction has also been included in this list, as innovation(Vickery et al., 1997). We performed factor analysis to check if these five operational performance measures formed different groups. We did not find unidimensionality among dimensions, so we decided to operationalize operational performance as multidimensional constructs. We examine five dimensions of operational performance - unit cost, quality, delivery, flexibility, and innovation. All they have been addressed in the operations management literature(Jacobs & Swink, 2011; Wong et al., 2011). Cost was operationalized as unit cost of manufacturing, quality as conformance to product specifications, delivery as on time delivery performance, flexibility as flexibility to change volume, and innovation as on-time new product launch(Finger, Flynn, & Paiva, 2014).

2.4 Conceptual framework

Figure8 shows the conceptual model containing operational practices, operational capabilities, and operational performance.

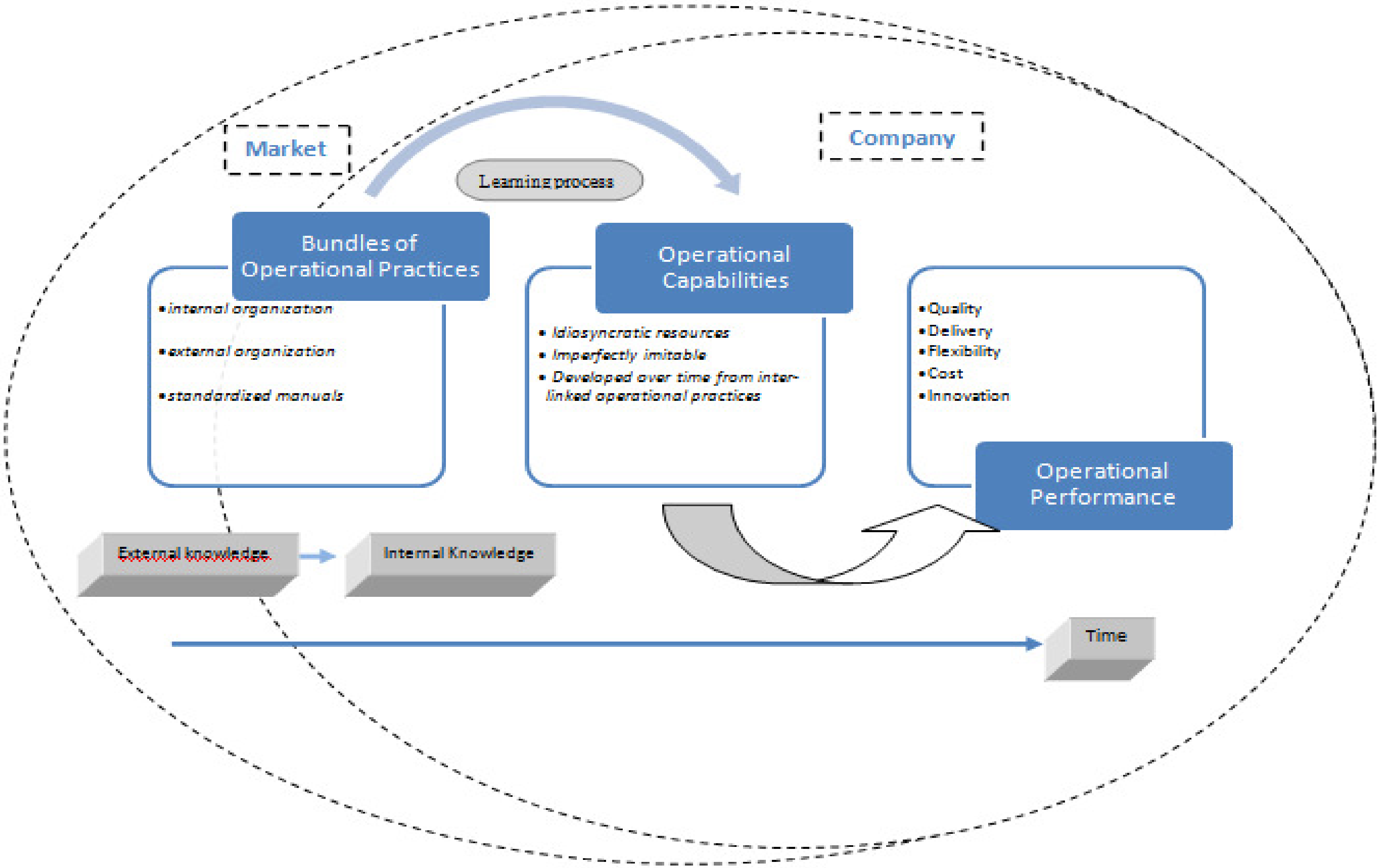


Figure 8–Conceptual Framework

Operational practices are standardized procedures. They can be purchased in the external environment of the firm or be developed in its internal environment. In the implementation bundles of operational practices, adaptations and adjustments are made so that they became integrated organizational routines. New knowledge is integrated into the knowledge already established by employees, generating organization routines.

Custom operational practices in the production process of an organization precede the development of an operational capability. Their internalization involves time and learning. Over time, employees learn how to operationalize practices to adjust daily activities. This learning process makes operational practices develop unique and untransferable aspects, favoring the emergence of operational capabilities. Operational capabilities have idiosyncratic aspects that hinder their transfer from one organization to another, leading firms to create competitive advantage.

3 RESEARCH DESIGN

This study is based on the paradigm of critical realism, which considers the existence of a unique reality and true, structured and independent people, but believes that their knowledge is relative and constructed socially and historically. For critical realism the word consist of mechanisms not events. A mixed methods approach was followed: (1) identify and test the interaction mechanisms and the factors that affect them; (2) test for the presence of these mechanisms in an empirical environment (qualitative research); and (3) to test them again, in an open system (survey research) (Miller & Tsang, 2010).

The use of both qualitative and quantitative procedures allows us to make a broader analysis of the research problem, analyzing different levels of analysis (Creswell, 2007). In this research, we intend to apply three approaches presented by Miller and Tsang (2010). The first approach is identifying the interaction mechanisms. The second is conducting qualitative research, and the third is applying survey research.

Initially, in the qualitative stage, case studies were conducted in four firms, two multinational American firms operating in Brazil and two local Brazilian firms. We decided to do the research in the same industry to reduce the variability between cases; therefore, all firms are in the packaging industry (details in section 3.1). We used polar opposites to observe different patterns of data, as shown in Figure 9 (Eisenhardt & Graebner, 2007; Eisenhardt, 1989).

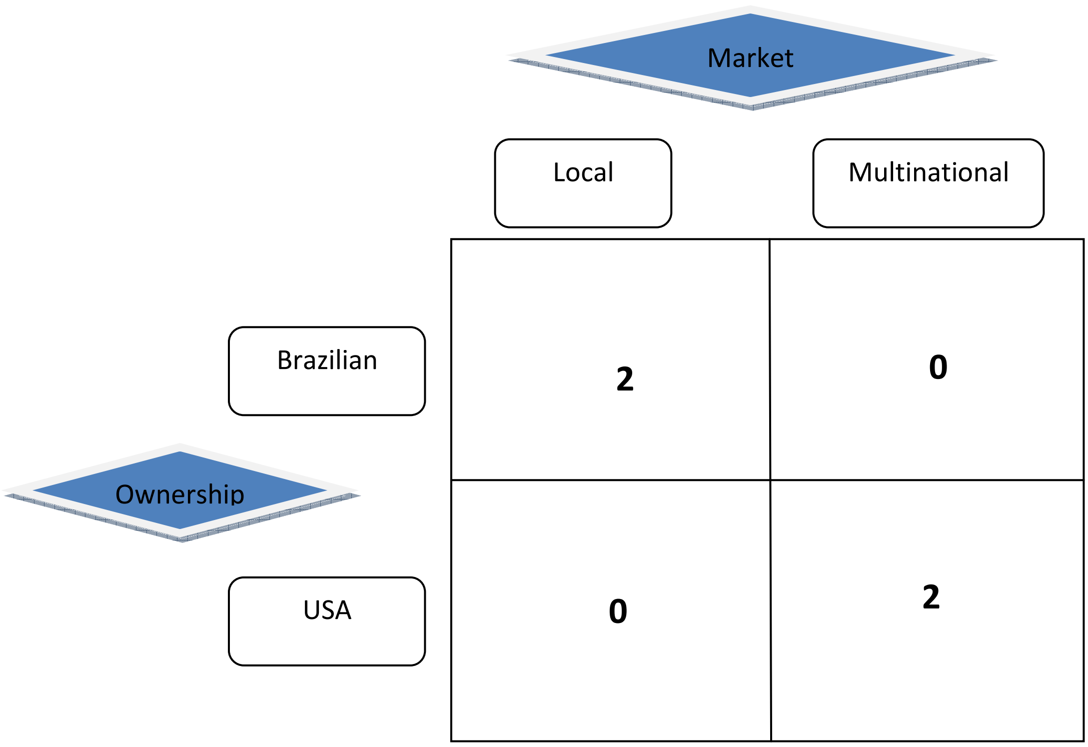


Figure 9– Cases Design

Based on the qualitative data, a quantitative instrument was prepared and applied in the packaging industry, in order to identify the relationship between operational capabilities and operational performance.

All the steps of this study are intended to support its objective: to analyze the relationship between bundles of operational practices, operational capabilities and operational performance. Therefore, we designed a conceptual model identifying key elements of this relationship and its connections, as shown in Figure 10.

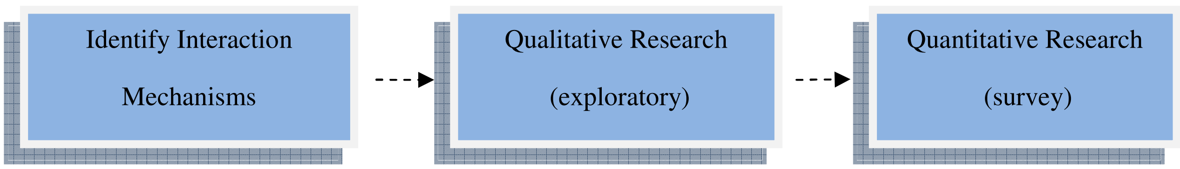


Figure 10–Research Design
Source: Miles et al. (2013, pp.44)

3.1 Industry and unit of analysis

The unit of analysis is a firm in the packaging industry. Packaging industry was been chosen because it has relationships with almost all production industries in the manufacturing industry. It operates in the metal, carton, paper, cardboard, plastic and glass industries. Packaging industry has a high level of competition, a narrow margin for negotiation with its supply chain, and constantly receives pressure from government regulators. Because of this, it has to constantly develop new capabilities to compete with its competitors and to meet the requirements of their customers.

In 2012, the Associação Brasileira de Embalagem (ABRE) reported that Brazilian packaging firms had 224,811 employees, net sales revenue of R $ 46.1 billion, physical production of R $ 46.9 billion, and exports amounting to US $ 498.3 million, which was an increase of 5.85% compared to 2011. However, even with these favorable indicators, packaging industry production retreated 1.19% in 2012.

Retraction of the packaging industry in recent years is due to its vulnerability in relation to its suppliers, competitors and government and its inefficiency in the use of internal resources. For example, in 2012, a law was published demanding that supermarkets abolish plastic bags. However, the lack of technological resources to replace plastic bags generated protests from packaging firms. They appealed to the employability factor, and after a long time of discussion with the government, the packaging firms were able to reverse the law. Even so, the lack of ability of packaging, firms to promote new technological and operational solutions continues.

There are few studies about the packaging industry, especially on the theme of operational capabilities. One of the few is by Klassen and Angell (1998), who argue that the main operational capability that needs to be developed by packaging firms is flexibility. They emphasize that it is necessary to develop new operational capabilities, for the packaging industry to be competitive.

Next, the two phases of research to be achieved in this dissertation are detailed. Figure 11illustratesthe integrated plan.

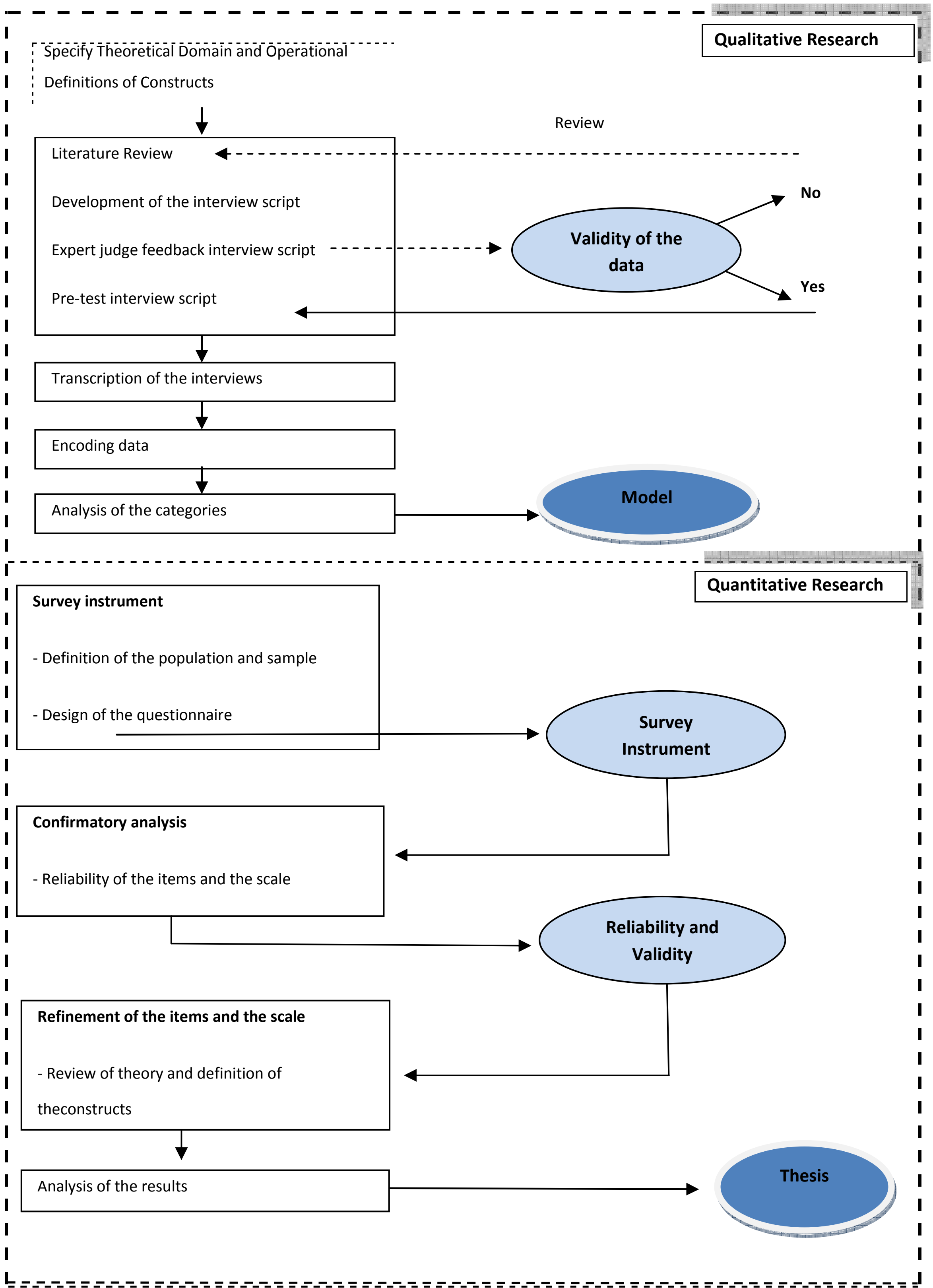


Figure 11–Framework
Source: Adapted Menor and Roth (2007, pp.831)

3.2 Qualitative stage

The qualitative phase meets the first two specific objectives of this research:

1. Propose a constitutive definition and typology for operational capabilities.
2. Analyze the relationship between operational practices and operational capabilities.

3.2.1 Case studies

This multiple case study consists of four cases (Eisenhardt & Graebner, 2007). The purpose of this method was to develop a deeper understanding of operational capabilities. There are many quantitative studies on operational capabilities; however, they lack the appropriate framework or typologies that offer insight into its dynamics from the bundles of operational practices in the internal environment of the firm. Our aim was to emphasize the rich and complex context of the real world in which they occur.

The use of multiple cases allowed us to understand the patterns that emerged from the data of each case. Cases were based on a variety of evidence, to make them theoretically robust. Each case followed the same research protocol (Appendix 2). The main method used was semi-structured interviews in different functions, but technical visits, report analyses, and observations were also conducted. These multiple sources of evidence facilitated the triangulation process (Eisenhardt, 1989). They allowed us to examine the relationship between bundles of operational practices and operational capabilities and identify the types of operational capabilities within each case and subsequently cross cases.

3.2.1.1 Sample selection

We used theoretical sampling of firms that were recognized by the packaging industry as a reference for bundles of best practices and which were known as market leaders. Firms were invited based on their individual characteristics and the strategic sampling plan. To ensure variability, their subsector, size, revenue, time of existence, export, and organizational structure were considered. Two of the cases were multinational and two were local. Table 3 presents model of the structure of the research design.

Table 3 – Characteristics

Characteristics	**HIGH OPERATING PRACTICES LEVEL**			
	Case 1	**Case 2**	**Case 3**	**Case 4**
1				
2				
3				
4				
5				

First, firms were contacted by telephone. After confirmation of interest, a letter of invitation was sent (Appendix 6) containing a description of the purpose of the research and data collection procedures. After the firm accepted, a first visit for the explanation of the research and an interview were scheduled. Each firm provided a room and a secretary to conduct the interviews.

3.2.1.2 *Cases*

Table 4 – Description of cases

Cases	Label_Case	Flexi_Case	Paper_Case	Metal_Case
Industry	Packaging	Packaging	Packaging	Packaging
Sector	Adhesives, paints, pigments, varnishes	Flexible Plastic	Paper	Steel
Firm's time	> 60 years	> 60 years	> 125 years	> 60 years
Number of employees	500	800	600	1.000
Number of interviewed	21	18	18	16
Headquarters location	São Paulo/Brazil	Paraná/Brazil	São Paulo/Brazil	São Paulo/Brazil
Exports	Yes	Yes	Yes	Yes
Type of Market	Multinational	Multinational	National	National
Size (revenue > R$300 million	Large	Large	Large	Large
Criteria for selection of firms	BMP (Best Manufacturing Practices)	BMP (Best Manufacturing Practices)	BMP (Best Manufacturing Practices)	BMP (Best Manufacturing Practices)
Criteria for selection of interviewees	Interface department production	Interface department production	Interface department production	Interface department production

The first case is a global leader in labeling and packaging materials and solutions. The firm uses a high level of technology in its products, which are distributed in major world markets. The firm operates in more than 50 countries and has more 25,000 employees worldwide. Innovation is one of the characteristics this firm. Since 1935, its products have helped to develop new concepts for the brand of its customers. The firm has been in the market for 80 years and manufactures and distributes display graphics, labeling, packaging materials, retail graphic embellishments, and RFID tags. It operates using the concepts of BMP (Best Manufacturing Practices). The unit analyzed is a plant in Brazil with 60 years of existence; it currently has about 500 employees.

The second case is a global leader in food packaging, consumer products, healthcare materials, and industrial applications. It was started in 1858, so it is currently 157 years old. It has more than 70 plants in 11 countries worldwide and 17,000 employees. The firm is known for designing and producing innovative packaging that serves the global market and adds value to the products of its customers. In Latin America, this firm produces several types of packaging: cartons, flexible, laminated, rigid, and labels. It also operates using the concepts of BMP. The unit analyzed was a plant in Brazil that has been inexistence for more than 60 years and has about 800 employees.

The third case is a Brazilian paper packaging industry that was started in 1890, and it has been producing decorative, industrial, duplex, and triplex papers to serve the industrial and graphic market with over 125 years of existence, it has two units in São Paulo, exports to more than 40 countries, and has over 600 employees. It is the market leader in Latin America in the manufacturing of decorative papers for high and low pressure laminates used by the furniture industry. It also operates uses the concepts of BMP. The firm has several awards in its category and has won many awards in its industry for excellence in quality, technology, design, functionality, and innovation, always seeking to invest in differentiated products to specific segments.

The fourth case is a Brazilian firm that has been operating for 60 years, and it is the leader in the metal packaging market it has close to 1,000 employees and is considered one of the most innovative firms in its industry. Over the past 10 years, the firm has won more than 170 awards for its innovation and quality and for being the best supplier. Its clients are basically multinational firms that demand high levels of quality and technology. The firm has operations in São Paulo, Rio Grande do Sul, Goiás, and Pernambuco. It also operates using the concepts of BMP and is part of the IPA -International Packaging Association.

3.2.2 Development of interview script

Data collection was conducted through semi-structured interviews with open-ended questions, based on our theoretical review (Miles, Huberman, & Saldaña, 2013). The interview script was developed in five phases. In the first phase, an extensive literature review on operational practices and operational capabilities was performed. This theme was researched in the following journals: Journal of Operations Management (JOM), International Journal of Production Operations Management (IJOPM), Production and Operations Management (POM), and Decision Sciences (DS). A first selection was made by searching the words "operational practices" and "operational capabilities" in the title, abstract, and keywords.

In the second stage, articles on operational practices were selected, in order to analyze how the authors operationalized them. We separated the articles about operational practices (Appendix 1). The operationalizations of the operational practices construct were compared using an Excel spreadsheet. Three operational practices were highlighted: total quality management (TQM), just-in-time (JIT), supply chain management (SCM). Each measurement of operational practices was transformed into open-ended interview questions.

In the third phase, we conducted a Q-Sort. The questions were intermingled and placed on a form in which respondents classified the questions as TQM, JIT, or SCM

(Appendix 3). The form was sent electronically to students of a doctoral program in operations management. The results showed that the majority of questions were correctly classified as TQM, JIT, and SCM operational practices. No questions were removed from the interview script, but some adjustments indicated by the respondents were performed. In addition, operational practices were divided into topics, which were used to create questions for the interview script. Each question had a set of inter-items that allowed us to relate operational practices and operational capabilities (see Appendix 4 and Table 5).

The focus of the interviews was to understand what operational capabilities were observed, based on the application of operational practices. Operational practices are standardized norms and easily identified in the operational process of the firm. However, once implemented they absorb tacit aspects of the firm as culture, philosophy, knowledge, and capacity to learn, which help integrate it into a management system. Over time the learning process of the firm and the interrelationship between bundles of operational practices can lead the firm to develop operational capabilities. Relationship between operational practice and operational capabilities is shown in Table 5.

Table 5 – Relationship between operational practice and operational capabilities.

Practices	Topics indicative questions	**Inter-item**	Possible Relations between Operational Practices and Operational Capabilities (based on the Inter-item)							
			Continuous Improvement	Flexibility	Integrative Information Systems	Innovation	Learning	Mass Customization	Quality Management	Supplier Management
TQM	Operational Management Quality	(see Appendix 8, 9, 10, 11, 12, 13, 14, 15)	✓			✓	✓		✓	✓
	People Management and Leadership		✓	✓	✓	✓	✓		✓	
	Measuring and Analysis		✓		✓		✓		✓	✓
	Design of products		✓	✓		✓	✓	✓		
	Customization			✓		✓	✓	✓		
	Client focus		✓	✓		✓	✓	✓	✓	
JIT	Adherence in daily program		✓	✓	✓		✓		✓	
	Small Lots			✓	✓			✓	✓	
	Reduction cycles and Setup		✓			✓	✓	✓	✓	
	Cell Arrangement		✓	✓	✓		✓			
	Layout equipment		✓	✓		✓	✓			
	Preventive Maintenance		✓		✓	✓	✓		✓	
	Client focus		✓	✓		✓	✓	✓	✓	
SCM	Selection						✓			✓
	Integration		✓		✓	✓	✓			✓
	Relationship		✓		✓	✓	✓		✓	✓
	Evaluated		✓				✓		✓	✓

The last phase was the completion of the interview script. The interview script (Appendix 5) consists of four sections. First section was directed toward the characterization of the respondents. Second section dealt with the functions related to production, such as Marketing, Sales, and Customer Service etc. The questions were intended to understand the influence of certain activities in the production process. Third section addressed the production process; the interviewees answered questions about their day-to-day activities, and the questions followed a script, which addressed TQM, JIT, and SCM operational practices. The fourth and last section focused on characterization of the firm.

3.2.3 Pre-test

For the pre-test, eleven exploratory interviews were done with production managers in the manufacturing industry. Then, to refine and validate the interview script, a total of eight interviews were conducted in four firms in the packaging industry; these firms are different from those used in the case study. Each visit consisted of two face-to-face interviews and an observation of the production process.

The selected firms were Brazilian and suppliers of multinational firms. Therefore, they follow rigorous quality standards. All are ISO 9000 certified and receive external audits. They have high control of the health and safety of their employees and of their production processes. They are also references for their respective industries. Interviews were made by appointment and confirmed by email and/or phone in April, 2014. The firms are described in Appendix 16.

Pre-test process was important for adapting the script. Interview questions were changed for each interview. Some questions were excluded and other reformulated. The interviews were transcribed, and some analytical categories were preliminarily identified, validating the script. From these results, we were able to consolidate an appropriate structure for the interview script.

For example, there was one of the firms belonging to the cardboard packaging industry that developed a capability in its relationship with suppliers, which gave it an advantage compared to its competitors' delivery requests. One bundle of practices that helped in the development of this capability was Just in Time. The industrial manager said, "We can always meet our customers when they need [...] we are the inventory of them [...] this is only possible because our suppliers are partners and serves us on time."

3.2.4 Interviewees

With the objective to identify the operational capabilities that lead to competitive advantage, respondents were employees of the production area and related functions.

The interviews were conducted face-to-face, at each of the firms researched. Each participant received the interview script in advance and a statement informing him or her about the necessary conditions for the research. The firms provided one office and a secretary to help in the process. Schedules were made by the secretary. Respondents received an email in advance with basic information about the research. The interviews were conducted as shown Table 6, Table 7, Table 8, and Table 9.

Table 6 – Interviews_Label_Case

Case 1					
Date	**Duration in minutes**	**Start time**	**Job Title**		**Equivalent departments**
10/13/2014	80:41	1:00 PM	1	Manager PTI Brazil	R&D and Continuous Improvement
10/13/2014	79:24	3:00 PM	2	Manager EHS / ELS AS.	R&D and Continuous Improvement
10/14/2014	82:29	8:30 AM	3	Brazil Operations Manager	Production
10/14/2014	51:28	2:00 PM	4	Operations Coordinator	Production
10/14/2014	48:49	1:00 PM	5	Operations Coordinator	Production
10/14/2014	50:19	3:00 AM	6	Project / Processes / Machines Manager	R&D and Continuous Improvement
10/15/2014	75:36	8:30 AM	7	SCM Manager	SCM
10/15/2014	47:50	10:30 PM	8	Finishing Manager	Production
10/15/2014	79:48	1:00 PM	9	HR Manager / Training and Development	Production
10/15/2014	73:38	3:00 PM	10	Quality Manager	Quality
10/29/2014	34:55	8:30 AM	11	Maintenance Coordinator	Maintenance
10/29/2014	50:56	9:30 AM	12	Health and Safety Coordinator	Health and Occupational Safety
10/29/2014	69:22	10:30 AM	13	Purchasing Manager	SCM
10/29/2014	51:17	1:00 PM	14	Sales Coordinator	Marketing and Sales
10/29/2014	34:07	2:00 PM	15	Process Engineer	R&D and Continuous Improvement
10/29/2014	55:44	3:00 PM	16	Logistics Coordinator	SCM
10/30/2014	35:14	8:00 AM	17	Maintenance Supervisor	Maintenance
10/30/2014	48:20	10:00 AM	18	President	Board of Directors
10/30/2014	30:12	11:00 AM	19	Maintenance Planner	Maintenance
10/30/2014	24:45	1:00 PM	20	Communications Coordinator	Marketing and Sales
10/30/2014	48:24	2:00 PM	21	Technical Support	Marketing and Sales
Totally	**19 hours, 37 minutes and 05 seconds, with 21 interviewees.**				

Table 7 – Interviews_Flexi_Case

Case 2					
Date	**Duration in minutes**	**Start time**	**Job Title**		**Equivalent departments**
11/25/2015	35:19	8:00 AM	1	Production Supervisor	Production
11/25/2015	35:00	9:45 AM	2	Production Supervisor	Production
11/25/2015	44:39	10:15 AM	3	Production Supervisor 2	Production
11/25/2015	28:14	11:15 AM	4	Production Supervisor	Production
11/25/2015	56:18	1:00 PM	5	Logistics Manager	SCM
11/25/2015	60:00	2:00 PM	6	Production Planning Control	Production
11/25/2015	46:27	3:00 PM	7	S &OP Manager - Logistics	SCM
11/25/2015	48:21	4:00 PM	8	Logistics Supervisor	SCM
11/26/2015	36:30	8:00 AM	9	Industrial Manager	Production
11/26/2015	56:40	9:00 AM	10	Continued Improvement Coordinator	R&D and Continuous Improvement
11/26/2015	55:14	10:00 AM	11	Latin American Coordinator WCOM	R&D and Continuous Improvement
11/26/2015	27:49	11:00 AM	12	Business Manager - Supplies	SCM
11/26/2015	28:04	12:00 AM	13	Paint Production Manager	Production
11/26/2015	57:15	1:00 PM	14	Quality Supervisor	Quality
11/26/2015	40:23	2:00 PM	15	Quality Assurance Manager	Quality
11/26/2015	49:26	3:00 PM	16	Engineering Manager - Maintenance	Maintenance
11/26/2015	45:56	4:00 PM	17	Work Safety Supervisor	Health and Occupational Safety
11/26/2015	35:12	17:35 PM	18	Corporative Director	Board of Directors
Totally	**13 hours 47 minutes 53 seconds, with 18 interviewees.**				

Table 8 – Interviews_Metal_Case

Case 3					
Date	**Duration in minutes**	**Start time**	**Job Title**		**Equivalent departments**
10/07/2015	75:22	2:30 PM	1	Production Planning Control I	Production
10/07/2015	76:26	4:00 PM	2	Production Planning Control II	Production
10/08/2015	42:23	8:10 AM	3	Production Coordinator	Production
10/08/2015	74:24	9:00 AM	4	Quality Coordinator	Quality
10/08/2015	84:39	10:30 AM	5	Production Engineer	Production
10/08/2015	54:08	12:10 PM	6	Maintenance Coordinator	Maintenance
10/08/2015	60:55	2:00 PM	7	Financial Coordinator	SCM
10/08/2015	61:06	3:20 PM	8	Purchasing Manager	SCM
10/08/2015	46:00	4:20 PM	9	Electrical Maintenance Engineer	Maintenance
10/08/2015	59:10	5:20 PM	10	Quality Assistant Manager	Quality
10/20/2015	52:25	10:00 AM	11	Corporative Director	Board of Directors
10/20/2015	66:09	11:15 AM	12	Lithography Manager	Production
10/20/2015	55:24	1:00 PM	13	Logistics Supply Manager	SCM
10/20/2015	61:59	2:00 PM	14	R & D Manager	R&D and Continuous Improvement
10/21/2015	49:54	08:30 AM	15	Assistant Administrative	R&D and Continuous Improvement
10/21/2015	89:25	10:00 AM	16	Coordinator Quality	Quality
10/21/2015	55:14	2:30 PM	17	Sales Manager	Marketing and Sales
10/21/2015	55:49	3:30 PM	18	Commercial Director	Board of Directors
Totally	**18 hours, 49 minutes and 54 seconds, with 18 interviewees.**				

Table 9 – Interviews_Paper_Case

Case 4					
Date	**Duration in minutes**	**Start time**	**Job Title**		**Equivalent departments**
11/03/2015	90:22	9:30 AM	1	Production Supervisor	Production
11/03/2015	52:33	2:00 PM	2	Maintenance Manager	Maintenance
11/03/2015	87:28	3:00 PM	3	Technology and Development Manager	R&D and Continuous Improvement
11/04/2015	54:01	9:00 AM	4	Purchasing Manager	SCM
11/04/2015	37:12	10:00 AM	5	Production Supervisor	Production
11/04/2015	33:01	11:00 AM	6	Industrial Director	Board of Directors
11/04/2015	59:47	2:00 PM	7	Production Manager	Production
11/04/2015	34:19	3:00 PM	8	Export Manager	Marketing and Sales
11/04/2015	30:00	3:30 PM	9	Marketing Analyst	Marketing and Sales
11/04/2015	22:45	4:00 PM	10	Work Safety Coordinator	Health and Occupational Safety
11/05/2015	34:28	4:30 PM	11	Production Planning Control	Production
11/05/2015	43:44	9:00 AM	12	Customer Service	Marketing and Sales
11/05/2015	58:47	10:00 AM	13	Quality Coordinator	Quality
11/05/2015	58:28	11:00 AM	14	Finishing Coordinator	Production
11/05/2015	58:46	2:00 PM	15	Quality Manager	Quality
11/05/2015	32:16	4:00 PM	16	Logistic Coordinator	SCM
Totally	**13 hours, 07 minutes and 57 seconds, with 16 interviewees.**				

In Brazil, a firm is responsible for providing the name of its function and following legal criteria. Each firm has different names for similar functions. To facilitate comparison between cases, we designated the functions by department, as shown in Table 10.

Table 10 – Equivalence of functions by department

Department:	Functions:
Board of Directors	President, corporative director, commercial director, director industrial.
Health and Occupational Safety	Health and safety coordinator, work safety supervisor, work safety coordinator.
Maintenance	Maintenance coordinator, supervisor maintenance, planner maintenance, engineering manager – maintenance, electrical maintenance engineer, maintenance manager.
Marketing and Sales	Sales coordinator, communications coordinator, technical support, sales manager, export manager, marketing analyst, customer service.
Production	Brazil operations manager, coordinated operations, finishing manager, HR manager / training and development, production supervisor, production planning control, industrial manager, paint production manager, production coordinator, production engineer, lithography manager, finishing coordinator.
Quality	Quality manager, quality supervisor, quality assurance manager, quality coordinator, quality assistant manager.
R&D and Continuous improvement	Manager PTI Brazil, manager EHS / ELS AS., project / processes / machines manager, processes engineer, continued improvement coordinator, Latin American coordinator WCOM, R&D manager, assistant administrative, technology and development manager.
SCM	SCM manager, purchasing manager, logistics coordinator, logistics manager, S&OP manager – logistics, logistics supervisor, business manager – supplies, financial coordinator, logistics supply manager.

Interviews were consolidated in the Table 11.

Table 11 – Consolidated interviews

Departments	Label_Case	Flexi_Case	Metal_Case	Paper_Case	Totally
Board of Directors	1	1	2	1	5
Health and Occupational Safety	1	1	0	1	3
Maintenance	3	1	2	1	7
Marketing and Sales	3	0	1	3	7
Production	5	7	5	5	22
Quality	1	2	3	2	8
R&D and Continuous Improvement	4	2	2	1	9
SCM	3	4	3	2	12
Total	**21**	**18**	**18**	**16**	**73**

In total, 73 interviews (65 hours and 22 minutes) were conducted in four different firms. For the first case, 21 interviews were held. For the second case, 18 interviews were held. For the third case, 18 interviews were conducted, and for the fourth case, 16 interviews were conducted.

The interviews were conducted in the manufacturing and related departments. Different hierarchical levels were investigated. We conducted interviews with directors, managers, supervisors, and foremen in the following departments: administrative, health and occupational safety, maintenance, marketing and sales, production, quality, R&D and continuous improvement, and SCM.

3.2.4.1 Transcription

All interviews were recorded and transcribed literally, without modifying or removing words. However, occasional errors of grammar and language were corrected. The interviews were conducted and transcribed in Portuguese. The terms in English remained in the original language. Parts of the interviews, when analyzed, were translated into English. The transcription process was outsourced to a specialized firm. To ensure the confidentiality of data, the firm signed a Non-Disclosure Agreement. To ensure reliability of the data, the interviews were reviewed before we started the encoding process. The interviews were read and listened to simultaneously. The interviews were analyzed using NVivo software.

We also guaranteed the confidentiality of the firms' data by signing a Non-Disclosure Agreement.

3.2.4.2 Translation

The interviews were recorded and transcribed in Portuguese, but their coding was in English. As a result, parts of the interviews were translated into English. The development of equivalent terms was discussed with American researchers.

3.2.5 Triangulation

In addition to the semi-structured interviews, triangulation of data was done through analysis of documents such as the production history of the firm, the monitoring of reports, quality control, production planning, information panels, etc. The aim is to monitor the day-to-day activities of the respondents. We also observed the production process, in order to give more validity to the results. In addition, physical artifacts (condition of the machines, safety equipment) were observed and evaluated. We also used news about the firm that was available in newspapers, magazines, and websites.

3.2.6 Data analysis

Data analysis was conducted using content analysis (Krippendorff, 2013). Content analysis was conducted by case through analysis of interviews seeking to answer the research question of this dissertation. First, interviews of each case were transferred into NVivo software. Each interview was analyzed individually. Parts of the interviews were coded and grouped by bundles of operational practices used in day-to-day of the firm. At certain times, we infer some operational practices based on literature review and in parts of the interviews. Later than, the practices that were linked by common aspects were regrouped and characterized as an operational capability.

3.2.6.1 Within and cross-cases

First, all cases were analyzed individually. All transcribed interviews were included in NVivo software. In each, we included information about the interviews and firms. For the interviews, information included length of service and industry, function, and the education level. For firms, information included number of employees, length of existence, revenues, and exports.

The first case we selected was the one of the American multinationals. We started the encoding process with the manufacturing department. First step was to read the full interview to get an overview, before beginning the encoding process. The first three interviews were analyzed using an inductive process. As reading was done, codes emerged from its context. At the end of the third interview, some codes had emerged, but they were fragmented. We then did debugging codes (cleaning of excess codes) and classified our first categories. Some of these categories had been raised in the literature review (see Figure 3); others emerged from the data analysis (see Figure 12).

Name	Sources	References
Absorptive Capacity	1	1
BUYER (Client) RELATIONSHIP CAPABILITY	1	1
Change Management	2	2
CONTINUOS IMPROVEMENT CAPABILITY	2	5
Health and Safety at Work	0	0
Human Resources	0	0
Information System	0	0
INNOVATION CAPABILITY	0	0
Knowledge	0	0
Learning	1	3
Maintenance	2	28
Multinational Structure	1	2
OPERATIONAL MANAGEMENT CAPABILITY	2	4
Efficiency	2	6
Monitoring of Indicators	1	9
Practices	1	1
Solving Problems Quickly	1	1
OUTSIDE THE COMPANY	0	0
Process Management	2	3
Product	0	0
Projects Management	2	4
Rework	1	1
Strategic Planning	2	6
SUPPLIER MANAGEMENT CAPABILITY	0	0
Sustainability	2	6

Figure 12– Codes

The encodings were followed, and for every cycle of five interviews, a new review of the data by depuration was done. New codes were created, grouped, and relocated. For example, in the second round was created a category for Integrative Information Systems Capability and the code Monitoring of Indicators was relocated to this capability. In this adjustment process, new categories emerged. Partial reports were generated for analyses and simulation results (Miles et al., 2013).

Name	Sources	Referer
Absorptive Capacity	1	1
Belief or Culture or Philosophy	14	57
BUYER RELATIONSHIP OR SEVICE LEVEL CAPABILITY	5	6
Change Management	2	2
Communication	2	7
CONTINUOS IMPROVEMENT CAPABILITY	2	4
Customization	1	2
Flexibility	0	0
Health and Safety at Work	4	8
Human Resources	2	3
INNOVATION CAPABILITY	0	0
INTEGRATIVE INFORMATION SYSTEMS CAPABILITY	0	0
Interviwees	1	1
Knowledge	0	0
Learning	2	4
Maintenance	6	105
Multinational Structure	7	10
OPERATIONAL MANAGEMENT CAPABILITY	3	5
OUTSIDE THE COMPANY	0	0
Process Management	2	3
Product	1	1
Profitability	1	2
Projects Management	2	4
Quality Management	1	1
Rework	1	1
Strategic Planning	3	7
SUPPLIER MANAGEMENT CAPABILITY	2	11
Sustainability	2	6

Figure 13– Codes

At the end of the first case, we had a meeting with the group of researchers from the area of operations to validate the codes and categories. There were a total of 444 codes, which were printed, cut, mixed, and grouped by similarity. In this next stage, we identified categories of operational capabilities and their respective bundles of operational practices. Then, we compared the categories raised in the literature, the categories of NVivo, and the group of researchers' categories. This work resulted in a set of operational capabilities. The remaining cases followed the same logic as the first case.

For the cross-case analysis, we also used NVivo. We analyzed the categories that were present in all cases, as well as those to be shown only in a specific case. Same category may be present in more than one case, but with different intensity, so we analyzed the intensity of each category per case. The intensity was measured in NVivo from the number of references presented in the categories within each case.

3.2.7 Validity

Validity of the qualitative research component was established in terms of its construct validity, internal validity and external validity. Construct validity shows the manner in which they were measured. Internal validity confirms that an event leads to a certain result, based on interviews and documentary evidence. External validity ensures that the research findings can be applied in other contexts (Eisenhardt & Graebner, 2007; Miles et al., 2013; Yin, 2010). We consider three types of validity in this study, detailed below.

3.2.7.1 Construct validity

The measured construct increases the testability of the theory and creates a bridge between the theory and qualitative evidence (Eisenhardt & Graebner, 2007; Eisenhardt, 1989). To validate the constructs, we followed steps suggested by Yin (2010). First, we carried out an extensive review of the literature about operational practices and operational capabilities (see section2.1). Second, we used multiple sources of evidence in the four cases studied, such as: 1) visit the production; 2) multiple interviews involving different departments (see Table 6,Table 7, Table 8,Table 9,Table 10, and Table 11);3) analysis of documents as reports, projects, and contracts; and 4) observation of some processes, such as programming of the day, setting up the machines, quality inspection, security mechanisms, internal logistics, and meeting with a supplier. Each observation considered the process, the employees and the physical artifacts. This step enabled us to do data triangulation. Third, key informants reviewed the draft case study report. Finally, in the fourth step, we established a chain of evidence between operational practices and operational capability (see Table 12).

Table 12 – Chain of evidence

CHAIN OF EVIDENCE

				Appendix 4 and Table 5	
Research Question	**Possible Conclusions**	**Evidence to support the conclusions**	**Specific study research question**	**Operational Practices' Question**	
How are operational capabilities identified in the internal environment of the firm?	Operational practices are antecedent of operational capabilities Operational practices inter-linked lead to operational capabilities There are different types and levels of operational capabilities	Interview quotations Meet production process Observation Processes Site visits	What are the operational practices implemented in the production process of the firm? How are operational practices used? What are the interaction mechanisms between operational practices and operational capabilities? Why are operational practices antecedent to operational capabilities? What are operational capabilities?	TQM	1. How is production planning? 2. How are training and development of production employees' policies made? 3. How do employees improve the production process? 4. How is communication conducted among cross-functional teams? 5. What is the role of management in the development of activities day to day? 6. What type of report do you have in this function? Who issues it? And, how does it help in the development of your activities? 7. How are new products created and inserted in the production line? 8. At what stage do you customize the product to a customer? 9. How do the new technologies influence production? 10. How do customers influence production?
				JIT	11. How are daily activities of production planned and implemented? 12. How is the production flow organized? (people and layout of machines) 13. How are the machines maintained?
				SCM	14. How are suppliers selected? 15. How are suppliers integrated into production planning? 16. How does the relationship with suppliers help improve the production process? 17. How do suppliers help in the acquisition of new technologies? 18. How are suppliers evaluated?

3.2.7.2 Internal validity

Internal validity explains how and why operational practices lead to operational capability. We used three techniques to ensure internal validity: logical model, pattern matching, and rival theories (Miles et al., 2013; Yin, 2010). First, from the literature review, we created a logic model (Figure 14), which shows bundles of operational practices as the antecedents of operational capabilities.

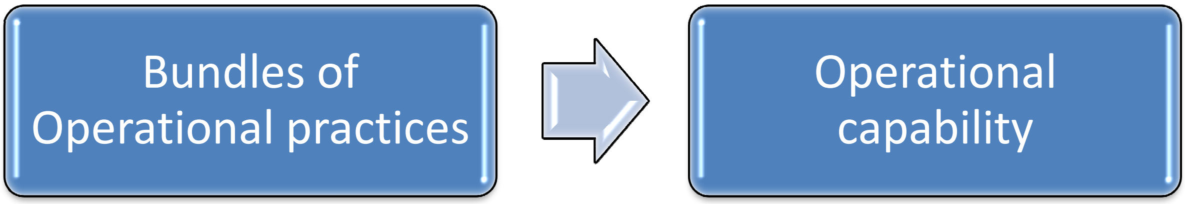


Figure 14– Operational practices as antecedents of the operational capabilities.

Second, we developed the pattern matching by comparing the findings from case studies with what the model predicted (Figure 8) before the data was collected. Our findings showed some operational capabilities, which emerged from the following procedures: 1) selection of key operational practices (Appendix 1); 2) selection of the inter-item of operational practices (Appendix 4);3) selection of operational capabilities(Figure 3); 4) selection of the inter-item of operational capabilities (Appendix 8, 9, 10, 11, 12, 13, 14, and 15);5) comparison of the inter-item of operational practices and operational capabilities; and 6) development of the interview script based on operational practices and operational capabilities (Appendix 5).

Finally, we investigated and used a rival theory. For this, we use exploration and exploitation to support our findings (March, 1991; Zollo & Winter, 2002). Exploration "includes things captured by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, and innovation. Exploitation includes such things as refinement, choice, production, efficiency, selection, implementation, and execution" (March, 1991, pp.71). Exploration is experimentation with new alternatives. Exploitation is the use of existing resources. The distance in time and space between the locus of learning and the locus for the realization of returns will direct exploration (unknown) or exploitation (known).

Exploration and exploitation mechanisms can be used to help the firm absorb knowledge and pursue ambidextrous capabilities to achieve superior performance (Patel, Terjesen, & Li, 2012; Salvador et al., 2014).Operational capabilities are developed in the internal environment of the firm, but they are created from the needs of customers and the market Thus, even operational capabilities characterized as an internal resource of the firm (RBT), external aspects influence in their creation (exploration and exploitation). This aspect was considered in the analysis of data.

3.2.7.3 External validity

External validity allows the study's findings to be transferred and generalized(Miles et al., 2013; Yin, 2010). Transferability leads to replication of the case study. Section**Erro! Fonte de referência não encontrada.** describes the step by step execution of this research. Generalization is the applicability of a study to other contexts. For this, we used multiple cases with different characteristics (see section 3.2.1.2). The diagram in Figure 15 shows the execution of the multiple-case study.

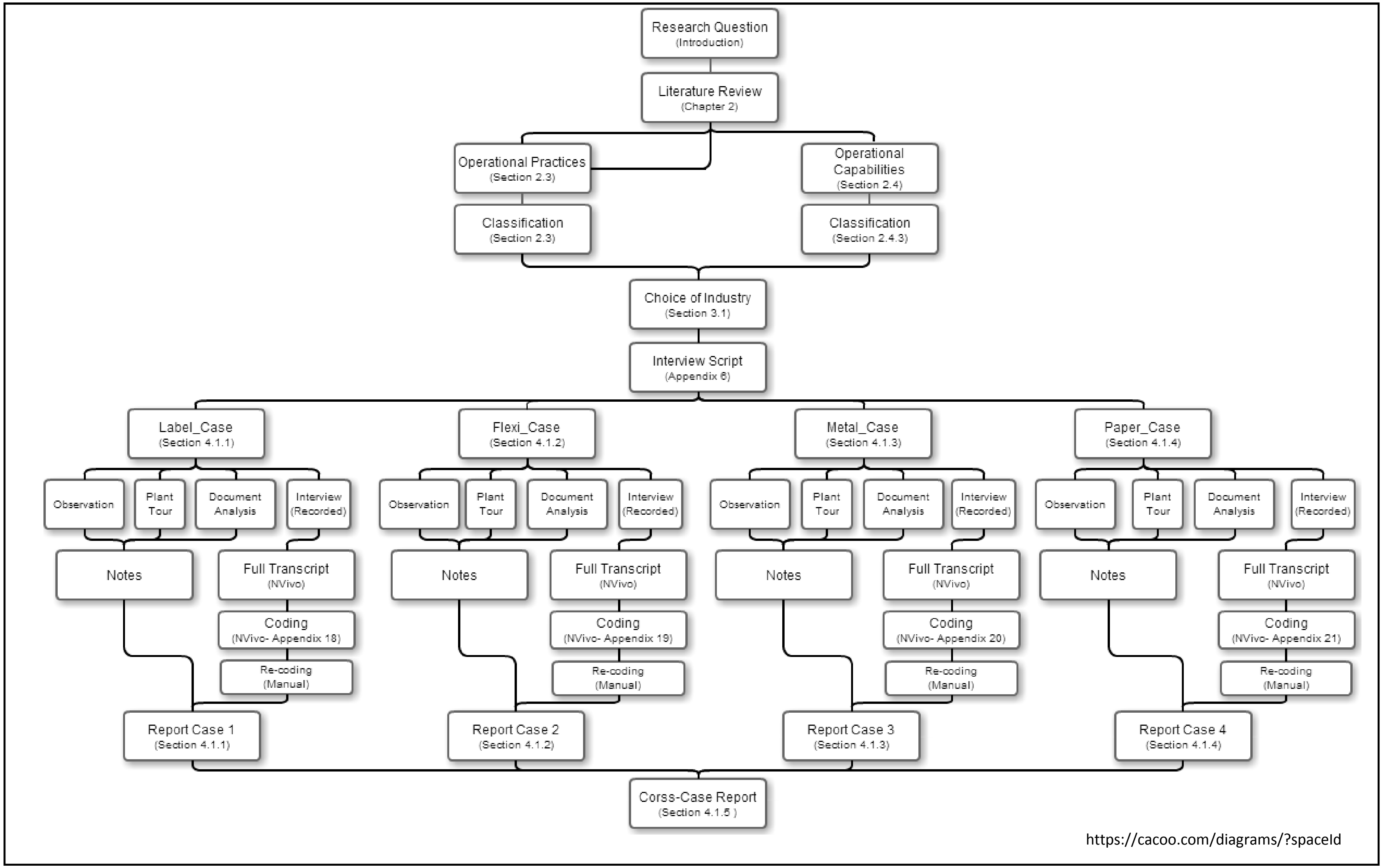


Figure 15– Evidence of multiple-case study



3.2.7.4 Reliability

To assure reliability, we took into account three steps, stability, replicability, and accuracy. To ensure stability we used the accounting log data. We prepared a spreadsheet with information about interviewees and firms. For each interviewee, we asked about his or her function, time in the firm, years of experience in the packaging industry, and academic education. For each firm, we asked about number of employees, exports, national market share, and earnings. The data was consolidated into NVivo software. We also created a report for each firm considering the basic information, first impressions, specific characteristics, and details of the production processes.

Replicability was established through the use of the case study protocol, a data base, and an evidence table. To study case protocol, we developed an interview protocol containing information about the interviewees, firms, and main points that should be addressed to interviewees (Appendix 2). The research protocol was made following the steps recommended by Miles et al. (2013, pp.299). In developing a case study database, the interviews were recorded, transcribed, and analyzed one by one. The observations and the analysis of documents were listed for future analysis. We used NVivo software to work with the data. An evidence table was also created from the theory, relating bundles of operational practices to the operational capabilities (Appendix 4 and Table 5).

To assure accuracy, we conducted a pre-test phase, triangulation of the data coding and, analysis of codes by different researchers. The pre-test phase was conducted with five firms, different from those researched firms in the actual data collection

(Appendix 7).The triangulation of the data coding was done through multiple researchers coding same data. The analysis of codes was also performed by different researchers.

3.3 Quantitative stage

The quantitative stage meets the last two specific objectives:

3. Develop and test a measuring scale for operational capabilities.
4. Analyze the impact of operational capabilities on operational performance of the firm.

3.3.1 Construction of questionnaire

The questionnaire creation involved an extensive review of the literature and also the use of the results of the analysis of the qualitative phase data. In the literature review we found eight operational capabilities: 1) Integrative Information Systems; 2) Continuous Improvement; 3) Innovation; 4) Flexible Process; 5) Mass Customization; 6) Quality Management; 7) Supply Chain Management; and 8) Learning. From operational capabilities found in the literature, we begin to analyze the interviews. In total four cases and 73 interviews were conducted. Case coding showed some operational capabilities from the literature well as some different capabilities. The new typology can be seen in Table 13.

Table 13– Operational Capabilities and concept

Operational Capabilities	Concept	Author
Continuous Improvement	It is the firm's ability to gradually increase its operational performance. This capability is a different set of skills, processes and routines that increase, refine and reinforce the processes of existing operations	Swink & Hegarty (1998), Wu et al. (2010, 2012)
Customer Support	It comprises the entire array of practices that are employed for the purpose of managing customer complaints, building long-term relationships with customers, and improving customer satisfaction and productivity	S. Li et al, (2005)
Customization	It reflects the firm's ability to customize its products to meet the specific needs of its market, producing on a large-scale, for the short-term and at a cost that is comparable to mass production of non-personalized products	Zhang et al. (2003)
Flexibility	It is the operational response capacity of the firm to make changes in its inputs and outputs	Swink & Hegarty (1998), Wu et al. (2010, 2012)
Information Management	It is the capacity to manage a set of tangible assets (*e.g.* information systems hardware, network infrastructure) and intangible (*e.g.*, software patents, strong vendor relationships) formed from the productive use of information technology	Wade & Hulland (2004)
Innovation	It seeks to change pre-established technological trajectories. Usually it is related to exploration capabilities that focus on processes and routines related to the research, testing and implementation of new technology	Benner & Tushman (2003)
Learning	It reflects acquisition of new knowledge by actors who are capable and have willingness to apply it in their decision making or influencing others in the organization	Miller (1996)
Operational Efficiency	It eliminates waste and inefficiencies on the shop floor	R. Fullerton et al. (2014)
Supplier Management	It is a long-term planning which seeks to create a base of suppliers able to offer benefits in the relationship. The strategic management of suppliers focuses on the dyad between production and its main suppliers	Yeung (2008)

For each operational capability (selected in the qualitative stage) we selected a scale. Choice of scales was based on the *Handbook of metrics for research in operations management* and some recent articles. In choosing the scales we considered the results of the qualitative phase of this study. A total of nine scales were found: 1) Continuous Improvement; 2) Information Management; 3) Learning; 4) Customer Support; 5) Innovation; 6) Operational Efficiency; 7) Flexibility; 8) Customization; and 9) Supply Management (see Figure 3).

Items of the scales were translated into Portuguese. To ensure the reliability of the translation, we reviewed the terms and validated the scale through the Q-sort method. At this stage, fourteen individuals were involved, nine teachers of operational management, and five managers of the manufacturing industry. In the first round some items were a low level of reliability. Nahm, Solis-Galvan, Rao, & Ragu-Nathan, (2002) argues that the scores are excellent (0.76 - 1.00), fair to moderate (0.40 - 0.75), and poor (0.39 or less). Complete table with the results of the Q-sort can be seen in Appendix 22.

After performing the first Q-Sort, some terms of translation were reassessed, some items were excluded, and some scales were replaced, including, Continuous Improvement, Customization, and Operational Efficiency. A new round of Q-sort was performed and, the results are presented in Appendix 23.

3.3.2 Common method variance

To reduce the threat of common method variance, we preserved the anonymity and confidentiality of respondents. Appropriate arrangements for the order of questionnaire items can reduce respondents' consistent motive to a certain extent so as to decrease the common method bias in self-reporting (Podsakoff et al., 2003; Podsakoff & Organ, 1986).In the questionnaire design questions were mixed, and different scales were used for the dependent and independent variables. Q-Sort method was applied to reduce potential ambiguity between the items of the questionnaires. Furthermore, respondents are familiar with the constructs, because they have been managerial positions in production. Finally, we included a scale

Environmental Dynamism to show that results vary according to the selected constructors (Podsakoff et al., 2003).

3.3.3 Pre-test

The questionnaire was composed of closed questions and multi-item scales. In the first section of the questionnaire we present the characterization of the firms. The second included characterization of respondents. The third section included questions representing the operational capabilities: 1) Continuous Improvement;2) Information Management;3) Learning;4) Customer Support;5) Innovation;6) Operational Efficiency;7) Flexibility;8) Customization;9) Supply Management; and 10) Operational Performance.

Pre-test was administered to production managers; in total there were 28 interviewed. After returning the questionnaires, correlations were analyzed. We checked the correlations between the items of each construct, and the following questions were removed (see Appendix 24).After removal of the questions, a new round was conducted and the descriptive statistics presented. Results are shown in Appendix 25, within acceptable standards. In sequence, correlations were conducted between the items of each construct, results showed significant level ($p < 0.05$). In addition, correlations were analyzed between constructs (see Appendix 26). Pre-test showed significant correlations in most constructs; however, to confirm multicollinearity we calculated the inflation factor of variance (VIF). VIF revealed an absence of multicollinearity (value <5.0). Results are in Appendix 27.For the final questionnaire (see Appendix 28) some terms were changed, and operational performance scale was introduced, with the following questions: 1) Unit cost of manufacturing; 2)

Conformance to product specifications; 3) On time delivery performance; 4) Flexibility to change product mix/volume; 5) Innovation – on time new product launch(Finger et al., 2014; Furlan et al., 2011).

3.3.4 Administered questionnaire

The questionnaire was composed of closed questions and multi-item scales. All measurement items, except for some of the control variables, were formulated as Likert-type statements anchored by a five-point scale, ranging from 1 ("strongly disagree") to 5 ("strongly agree") (see Appendix 28). Although the questionnaire structure has remained the same pre-test, some questions have been updated or remove, and new questions have been added. For example, we have added scale operational performance with five questions. Original scales are in English, but were translated into Portuguese, considering the meaning of the words as well as aspects of day-to-day of Brazilian industry. We use double and reverse translation procedures.

In the first section of the questionnaire we present the characterization of the firms, such as size, and sector. The second refer characterization of the interviewees, position job, department, time working in the firm, time job, and time experience in the packaging industry. The third section included questions representing the operational capabilities: Continuous Improvement, Information Management, Learning, Customer Support, Innovation, Operational Efficiency, Flexibility, Customization, Supply Management, and Operational Performance. See items in Table 14.

Table 14–Operational Capabilities Scales – (administered questionnaire)

			Operational Capabilities Scales		
Code		No	Translated scale	Translated scale	Reference
Continuous Improvement	CI1	1	People use appropriate tools and techniques to support CI sustained involvement in CI	Usamos programas e metodologias específicas para dar suporte ao nosso processo de melhoria contínua	Bessant et al. (2001)
	CI2	2	People (as individuals and/or groups) initiate and carry through CI activities - they participate in the process	Nossos funcionários (individualmente ou em grupos) participam e colaboram intensamente com atividades do nosso processo de melhoria contínua	
	CI3	5	Our firm has continuous quality improvement program	Possuímos um programa melhoramento contínuo da qualidade	S. Li et al. (2005)
	CI4	7	Our firm has continuous occupational health and safety improvement program	Melhoramos continuamente nossos programas de saúde e segurança do trabalho à frente da concorrência	Result, the analysis of the four cases
Learning	LE1	3	Any one person's knowledge is transmitted and made readily available to the employees	O conhecimento (de uma forma geral) é facilmente transmitido e disponibilizado a qualquer funcionário	Escrig-Tena & Bou-Llusar (2005)
	LE2	4	There is an important spirit of dialogue and acceptance of diverse opinions in all areas of the firm	Existe um importante espírito de diálogo entre as áreas e aceitamos diferentes opiniões	
	LE3	6	Work process have been designed in such a way that they are capable of developing standards of conduct at all levels of the firm	Nossos processos de trabalho são definidos em equipe visando estabelecer mecanismos de aprendizagem em todos os níveis da fábrica	
	LE4	8	Employees are capable of taking the initiative and assimilating better ways of doing their job	Nossos funcionários têm facilidade de apreender novas maneiras de fazer seu trabalho	
Customization	CT1	9	Our capability of customizing products while maintaining a large volume is high	É alta nossa capacidade de customizar produtos mantendo um grande volume de produção	Qiang Tu et al. (2004) Kortmann et al. (2014)
	CT2	11	Our product process is designed as adjustable modules	Todo o nosso processo produtivo está estruturado em processos modulares ajustáveis	
	CT3	13	Production process modules can be adjusted for changing production needs	Nosso processo produtivo é facilmente ajustado para atender as necessidades de alterações na produção	
	CT4	15	Production process modules can be rearranged so that customization sub processes occur last	Nossos processos podem ser facilmente reorganizados permitindo que os subprocessos de customização ocorram por último	
	FL1	10	Machine tools can be changed quickly	Conseguimos trocar rapidamente as ferramentas de nossas máquinas	Zhang et al. (2003)

Flexibility	FL2	12	We can quickly change the quantities for our products produced	Conseguimos mudar rapidamente a quantidade de produtos produzidos	
	FL3	14	We can produce a wide variety of products in our plants	Conseguimos produzir uma grande variedade de produtos	
	FL4	16	The ability to effectively respond to changes in planned delivery dates	Temos capacidade de responder rapidamente às mudanças de programação de datas de entrega	Pagell & Krause (2004)
Information Manag.	IM1	17	Information on quality performance is readily available to employees	Disponibilizamos informações atualizadas sobre o desempenho da qualidade para nossos funcionários do chão de fábrica	Cua et al. (2001)
	IM2	19	Information on productivity is readily available to employees	Disponibilizamos informações atualizadas sobre produtividade para nossos funcionários do chão de fábrica	
	IM3	21	Charts plotting the frequency of machine breakdowns are posted on the shop floor	Possuímos quadros atualizados no chão de fábrica com dados de paradas de máquinas	
	IM4	23	Charts showing defect rates are posted on the shop floor	Possuímos quadros atualizados no chão de fábrica mostrando quantidade de estragos	
Operational Efficiency	OE1	20	Our firm has very low unit costs of manufacturing	Nossa fábrica possui baixo custo unitário de produção comparado aos nossos concorrentes	Kortmann et al. (2014)
	OE2	22	Our firm has very short manufacturing lead time	Comparado aos nossos concorrentes, nossa fábrica regularmente trabalha com tempo reduzido de lead time na produção	
	OE3	24	Our firm has an excellent production cycle time	Comparado aos nossos concorrentes, nossa fábrica regularmente trabalha com tempo de ciclo de produção	
	OE4	18	Undertaking programs for the improvement of your equipment productivity (*e.g.* Total Productive Maintenance programs) (Equipment productivity/TPM)	Nosso programa de manutenção consegue manter as máquinas com alto índice de produtividade	Silveira & Sousa (2010)
	OE5	26	Our scrap rate has been reduced over the last 3 years	Regularmente reduzimos a quantidade de estragos da produção	Ahire & Dreyfus (2000)
Supply Management	SM1	25	Involve key suppliers in design stage of new products	Nossos principais fornecedores sempre são envolvidos no desenvolvimento de novos produtos	Stanley & Wisner (2001)
	SM2	28	Hold meetings with suppliers on regular basis to solve problem	Realizamos reuniões frequentes com nossos fornecedores visando à resolução de problemas	
	SM3	29	Formal, periodic written evaluation suppliers	Periodicamente fazemos avaliações formais com nossos fornecedores	

	SM4	27	We have a formal process for selecting suppliers	Seguimos um processo formal para seleção de fornecedores	Result, the analysis of the four cases
Innovation	IN1	30	Frequency of new product introduction	Frequentemente introduzimos novos produtos na produção	Schroeder et al. (2010)
	IN2	31	Our plant stays on the leading edge of new technology in our industry	Somos líderes em novas tecnologias em nossa indústria	
	IN3	32	We are constantly thinking of the next generation of manufacturing technology	Constantemente pensamos na próxima geração de tecnologias em manufatura (produção)	
	IN4	33	We make an effort to anticipate the potential of new manufacturing practices and technologies	Buscamos frequentemente implementar novas práticas/processos em nossa produção	
Customer Support	CS1	34	We frequently determine future customer expectations	Procuramos constantemente detectar futuras expectativas dos nossos clientes	S. Li et al. (2005)
	CS2	35	We facilitate customers' ability to seek assistance from us	Nossos clientes são rapidamente atendidos por nossa assistência técnica	
	CS3	36	We frequently evaluate the formal and informal complaints of our customers	Sempre avaliamos e respondemos as reclamações formais e informais de nossos clientes	
	CS4	37	We periodically evaluate the importance of our relationship with our customers	Medimos e avaliamos o relacionamento com os nossos clientes	
Environmental Dynamism	ED1	38	Major changes in the modes of production and/or service provision	Ocorreram grandes mudanças nos modos de produção e/ou prestação de serviços	Azadegan et al. (2013)
	ED2	39	Frequent and major changes in government regulations	Ocorreram mudanças frequentes e importantes nos regulamentos governamentais	
	ED3	40	Frequent and major changes in the number of competitors	Ocorreram mudanças frequentes e importantes no número de concorrentes	
Operational Performance	OP1	41	Unit cost of manufacturing	Custo unitário do produto	Finger et al.(2014) Furlan et al. (2011)
	OP2	42	Conformance to product specifications	Conformidade com as especificações do produto (qualidade exigida)	
	OP3	43	On time delivery performance	Pontualidade na entrega do produto	
	OP4	44	Flexibility to change product mix/volume	Capacidade em mudar rapidamente o mix/volume do produto (tipo de produto / quantidade)	
	OP5	45	On time new product launch	Introdução de novos produtos no mercado	

* The questions were mixed for application

3.3.5 Sample and respondent profile

The scale was validated empirically through a sample of packaging firms through a survey. According to Associação Brasileira de Embalagem (ABRE), the population in the packaging industry is approximately 880 firms. The sample was composed of 208 firms. After eliminating surveys with excessive missing data we obtained 206 completed responses. The survey includes the following segments of the packaging industry: (1) **metal** packaging, (2) carton packaging, **paper** packaging, cardboard and corrugated paper, (3) **plastic** flexible packaging, rigid and semi-hard, (4) **glass** containers, (5) **textile** packaging, (6) **others**. Respondents were owners, directors, or production managers.

The sample consists mainly of medium-sized and large firms; the metal sector represents 9.2%, paper 34% and plastic 35%. These values are shown in Table 15. Our sample is equivalent to a percentage of gross value added, also displayed on the site by the Brazilian Packaging Association (ABRE). This allows us to say that the study represents significant sectors of the packaging industry in Brazil. In addition, the major regions of Brazil have been represented in the sample, and when compared with the population showed a correlation of 99%, indicating that the sample represents the study population. Respondents sampled are mainly the production department, managers, with an average of twelve years of work in the firm, averaging six years working the current position, and seventeen years of experience in the packaging industry.

Table 15 - Respondent profile

Packaging Industry								
Sector	%	%GVA*	Size	%	Region	Population (*N*=800)	Sample (*N*=206)	Correlation (pop. x sample)
Metal	09.2	17.14	Microenterprises	04.4	Southeast	66.70%	60.19	0.99
Paper	34.0	34.30	Small	17.0	South	26.93%	32.04	
Plastic	35.0	39.07	medium-sized	59.7	Northeast	4.32%	4.85	
Others	21.8	09.49	Large	18.9	Midwest	1.14%	2.91	
					North	0.91%	0.00	

Respondents						
Department	%	Position	%	Firm time	Position time	Experience time
Production	85.9	President	05.0	12 years	6 years	17 years
Logistic	05.0	Director	07.8			
Human Resources	01.5	Manager	51.5			
Others	07.6	Supervisor	16.5			
		Coordinator	15.5			
		Others	03.7			

*Gross value added (Source: Brazilian Packaging Association - ABRE)

3.3.6 Data collection

Data collection happened during the months of October and December 2015. The interviewer contacted interviewees by telephone, inviting them to participate in the survey about operational capabilities. Interviewees had the option to answer the questionnaire at the time, or schedule an appointment that best fit him. To maintain the homogeneity of the survey, all the interviewees belonged to the packaging industry, with positions of director or production manager.

3.3.7 Confirmatory factor analysis - measure validation and reliability

We did confirmatory factor analysis (CFA) to validate the model of operational capabilities, allowing the construction of summed scales (Brown, 2006). Missing data were estimated by the average of the responses for the respective item (McDonald & Ho, 2002). Our model includes capabilities that belong to the Across-the-Board Capabilities group, Standalone Capabilities group, and Performance group (see constructs Table 16). In total, three models have been tested.

Table 16 - Operational Capabilities group

Across-the-Board Capabilities	Standalone Capabilities		Performance
	Upstream and Downstream	Operational	
Continuous Imp.	Supplier Manag.	Operat. Efficiency	Operational
Learning	Customer Support	Innovation	
Information Manag.		Flexibility	
		Customization	

First, after CFA was conducted for the Across-the-Board Capabilities group, we find that Learning Capability and Continuous Improvement Capability did not have discriminant validity, thus, these two constructs were grouped. Although they are different constructs, when analyzed together, discriminant validity can be compromised. The proximity of these two capabilities is logical. Continuous Improvement Capability is in the dynamics of learning (Swink & Hegarty, 1998). We can say that learning precedes continuous improvement. The combination of the two constructs (Continuous Improvement Capability and Learning Capability) generated a new construct called Continuous Learning.

The initial Across-the-Board Capabilities confirmatory model test resulted in a poor model fit: the Chi-square value with 142.66 degrees of freedom is 53 (p = 0.00; ratio of Chi-square to the degrees of freedom = 2.69), NFI = 0.81; IFI = 0.87, TLI = 0.84; CFI = 0.87, and RMSEA = 0.091. Six items (IM4, CI1, LE2, LE4, CI4, and LE1) show unacceptably large variance in measurement errors or low loadings of indicators. Thus, these items were deleted, one by one, from the measurement model (see Appendix 29). The test of the revised model provides good model fit: the Chi-square value with 15.17 degrees of freedom is 8 ($p = 0.056$; ratio of Chi-square to the degrees of freedom = 1.89). NFI = 0.95, IFI = 0.98, TLI = 0.96; CFI = 0.98, and RMSEA = 0.066.

Second, after CFA was conducted for the Standalone Capabilities group, this group was divided into Upstream/Downstream and Operational. In the Upstream/Downstream group the initial confirmatory model test resulted in a model fit with improvement opportunities: the Chi-square value with 42.89 degrees of freedom is 19 ($p = 0.001$; ratio of Chi-square to the degrees of freedom = 2.25), NFI = 0.91; IFI = 0.95, TLI = 0.92; CFI = 0.95, and RMSEA = 0.078. Two items (CS1 and SM1) show unacceptably large variance in measurement errors or low loadings of indicators. These items were deleted, one by one, from the measurement model (see Appendix 29). The test of the revised model provides good model fit: the Chi-square value with 19.33 degrees of freedom is 8 ($p = 0.013$; ratio of Chi-square to the degrees of freedom = 2.41). NFI = 0.94, IFI = 0.96, TLI = 0.94; CFI = 0.96, and RMSEA = 0.083.

Third, in the Operational Standalone group, we find that Flexibility Capability and Customization Capability did not have discriminant validity. These two constructs were grouped. Although they are different constructs, when analyzed together discriminant validity can be compromised. Customization and Flexibility are indissociable variables, since flexibility is the means by which the firm can develop the customization of its products(Vickery et al., 1997; Zhang et al., 2003). Flexibility and Customization were grouped in the construct Flexibility.

The initial Operational Standalone group confirmatory model test resulted in a poor model fit: the Chi-square value with 253.09 degrees of freedom is 116 (p = 0.00; ratio of Chi-square to the degrees of freedom = 2.18), NFI = 0.76; IFI = 0.85, TLI = 0.82; CFI = 0.85, and RMSEA = 0.076. Eight items (CT1, OE1, IN1, FL4, FL3, CT4, OE2, and CT2) show unacceptably large variance in measurement errors or low loadings of indicators. These items were deleted, one by one, from the measurement model (see Appendix 29). The test of the revised model provides good model fit: the Chi-square value with 40.01 degrees of freedom is 24 (p = 0.021; ratio of Chi-square to the degrees of freedom = 1.66). NFI = 0.92, IFI = 0.96, TLI = 0.95; CFI = 0.96, and RMSEA = 0.057.

Fourth, the initial Performance confirmatory model test resulted in a reasonable model fit: the Chi-square value with 31.82 degrees of freedom is 13 (p = 0.003; ratio of Chi-square to the degrees of freedom = 2.44), NFI = 0.84; IFI = 0.90, TLI = 0.83; CFI = 0.89, and RMSEA = 0.084. Table 17 shows the best models fit.

Table 17 - Best Models Fit

	CMIN	DF	P	CMIN/DF	NFI	IFI	TLI	CFI	RMSEA
Reference				*<3*	*>.90*	*>.90*	*>.90*	*>.90*	*<1*
Across-the-Board Capabilities	15.17	8	0.056	1.89	0.95	0.98	0.96	0.98	0.066
Standalone Capabilities Upstream/Downstream	19.33	8	0.013	2.41	.94	.96	.94	.96	0.083
Standalone Capabilities Operational	40.01	24	0.021	1.66	.92	.96	.95	.96	0.057
Operational Performance	31.82	13	0.003	2.44	.84	.90	.83	.89	0.084

In sequence, we conducted reliability, content, convergent, and discriminant validity. First, to establish content validity, a rigorous process was used to develop and validate the survey instrument, modeled on previous empirical studies(*e.g*. Ahire & Dreyfus, 2000; Azadegan, Patel, Zangoueinezhad, & Linderman, 2013b; Bessant et al., 2001; Brito, Brito, & Hashiba, 2014; Cua et al., 2001; Escrig-Tena & Bou-Llusar, 2005; Furlan et al., 2011; Kortmann et al., 2014; S. Li et al., 2005; Pagell & Krause, 2004; Paiva, Teixeira, Vieira, & Finger, 2014; Stanley & Wisner, 2001; Tu et al., 2004; Zhang et al., 2003). Besides the previous literature, we used to reliability executive interviews and pilot tests to establish validity.

To establish to reliability and convergent validity, we employed exploratory factor analysis (EFA) to ensure unidimensionality of the scales (see Appendix 30), followed by composite reliability for assessing construct reliability. The limit for composite reliability is 0.70 (Nunnally & Bernstein, 1994). Composite reliability values in Table 18 indicate that all constructs are reliable for this research. Next, we examined the possibility of multicollinearity among the remaining items by computing the variance inflation factor (VIF), which evaluates the degree to which each variable can be explained by other variables (Hair, Anderson, Tatham, & William, 1998). All VIFs are less than 2, well below the maximum acceptable cut-off value of 5. This indicates a lack of evidence of multicollinearity (see Table 18). In addition, to evaluate convergent validity, we computed the average variance extracted (AVE) for each construct (see Table 18) (Fornell & Larcker, 1981).

Table 18 - Standardized factor loadings, composite reliability, and AVEs for the measurement model

Dimensions	Capabilities	Indicator	Loadings	VIF <3	Composite Reliability >.70	AVE >.50
Across-the-Board Capabilities	Continuous Learning	LE3	0.72	1.62	0.694	0.42
		CI2	0.55	1.30		
		CI3	0.67	1.54		
	Information Management Capability	IM1	0.79	1.93	0.709	0.51
		IM2	0.74	1.77		
		IM3	0.60	1.47		
Standalone Capabilities (Upstream/ Downstream)	Supplier Management	SM2	0.78	1.87	0.800	0.55
		SM3	0.64	1.55		
		SM4	0.79	2.00		
	Customer Support	CS2	0.63	1.43	0.667	0.44
		CS3	0.65	1.51		
		CS4	0.72	1.60		
Standalone Capabilities (Operational)	Innovation	IN2	0.68	1.60	0.738	0.49
		IN3	0.84	1.84		
		IN4	0.55	1.39		
	Flexibility	CT3	0.64	1.42	0.703	0.44
		FL1	0.63	1.43		
		FL2	0.72	1.54		
	Operational Efficiency	OE3	0.80	1.89	0.730	0.52
		OE4	0.78	1.87		
		OE5	0.56	1.50		
Performance	Operational	OP1	0.24	1.09	0.526	0.23
		OP2	0.41	1.17		
		OP3	0.52	1.22		
		OP4	0.51	1.23		
		OP5	0.53	1.29		

Operational Performance has not indicated convergent validity (see Table 18). Therefore, in the regressions operational performance will be used separately, item by item. Average scores will not be used for these constructs. Performance outcomes that are concrete singular should be captured individually (Mackelprang & Nair, 2010).

Finally, discriminant validity was tested. A constrained CFA model was used for each possible pair of constructs in which the correlations among this pair of constructs are fixed to 1. This model was subsequently compared to the original unconstrained model, in which the correlations among constructs are freely estimated(O'Leary-Kelly & Vokurka, 1998). Table 19 shows discriminant validity analysis.

Table 19 - Discriminant validity analysis

Construct pairs	Unconstrained		Constrained		$\Delta\chi^2$
	χ^2	df	χ^2	Df	
Continuous Learning x Information Management	15.17	8	28.29	9	13.12***
Supplier Management x Customer Support	19.33	8	61.67	9	42.34***
Flexibility x Innovation	08.99	8	91.64	9	82.64***
Innovation x Operational Efficiency	22.53	8	101.69	9	79.16***
Flexibility x Operational Efficiency	13.95	8	80.24	9	66.29***

***Significant at the 0.05.

In our study, all the differences of $\chi2$ between the fixed and unconstrained model were significant at 0.05. The constructs are different. After confirmatory factor analysis, we run the averages and correlations presented in Table 20 and Table 21.

Table 20 – Operational Capabilities Mean

Capabilities	N	Mean	Std. Deviation
Continuous Learning	206	4.03	.70
Information Management	206	3.94	.85
Customer Support	206	4.47	.61
Flexibility	206	3.96	.71
Innovation	206	3.74	.82
Operational Efficiency	206	3.92	.72
Supply Management	206	3.90	.86

Table 21 - Correlation

Pearson Correlation *N*=206	Continuous Learning	Customer Support	Flexibility	Information Manag.	Innovation	Operational Efficiency
Continuous Learning						
Customer Support	.392**					
Flexibility	.350**	.335**				
Information Management	.606**	.492**	.258**			
Innovation	.448**	.378**	.310**	.420**		
Operational Efficiency	.381**	.459**	.406**	.433**	.432**	
Supply Management	.548**	.501**	.226**	.424**	.290**	.369**

**. Correlation is significant at the 0.01 level (2-tailed)

3.3.8 Statistical technique

In the quantitative phase, we analyzed the relationship between operational capabilities and operational performance. Operational Capabilities were measured using the following scales: Across-the-Board Capabilities with Information Management and Continuous Learning, and Standalone Capabilities with Innovation, Flexibility, Supply Management, Operational Efficiency, and Customer Support. Operational performance was measured using the scales cost, quality, delivery, flexibility, and innovation(Finger et al., 2014; Furlan et al., 2011).

The data were analyzed using linear regressions. The dependent variables were operational performances. Independent variables were the operational capabilities. The control variables were size and sector. We controlled for size since larger firms could have access to more or better resources than smaller firms to develop operational capabilities. While smaller firms may have more flexibility and the ability to develop operational capabilities more quickly we also control sector because in packaging industry there are technological and operational differences between them. Each sector serves different markets with specific demands (Drnevich & Kriauciunas, 2011).Statistical software used was the SPSS (Statistical Package for Social Sciences).

4 RESULTS

In this chapter we present the results of qualitative and quantitative phase.

4.1 Analysis of qualitative data

In this chapter we will work within-case and cross-case analysis of the four cases: Label_Case, Flexi_Case, Paper_Case, and Metal_Case.

The operational capabilities found in the firm constitute two groups. The first group is called Across-the-Board Capabilities. The term across indicates that the operational capabilities found are dynamics (first order). This group provides support in developing other operational capabilities belonging to the second group, Standalone Capabilities. Standalone means that these operational capabilities (zero order) are inherent to the operating production process.

4.1.1 Within-Case analysis: Label_Case

Label_Case is an American multinational company that uses different types of operational practices exceptionally well. The main operational practices observed in the company were Total Quality Management (TQM), Just in Time (JIT), Supply Chain Management (SCM), Total Productive Maintenance (TPM), Human Resources Management (HRM), Enterprise Lean Manufacturing (ELS), and Environment, Health and Safety (EHS). In general, its practices are integrated. According to the production manager, "practices are not individual; they integrated with each other." This was evident when the firm solved a problem.

Resolution of a problem usually occurs through a plan of action involving several departments and multiple operational practices. According to the manager of the supply chain, "If we have a supply problem, we put everyone in the room and open a joint action plan." Over time, the integration of bundles of operational practices not only assists in solving problems; it promotes the development of operational capabilities.

Across-the-Board Capabilities observed in Label_Case include Information Management Capability, Continuous Improvement Capability, and Learning Capability. Information Management Capability is the company's ability to organize and manage its information. The practices that constitute this capability in Label_Case are as follows: Forecast, Objectives, Goals, Strategies and Measures (OGMS), Key Performance Indicators (KPI), Visible Management Systems (VMS), and A3 problem-solving practices. The A3 process is a Toyota-pioneered practice of getting a problem, an analysis, a corrective action, and an action plan written down on a single sheet of large paper, often with the use of simple graphics. OGMS establishes a database that provides transparency in monitoring the company's performance indicators. KPIs are a way to control operational indicators. Label_Case has sets of indicators by department, detailed in sub-indicators and monitored daily through the VMS practice. For indicators that do not reach the expected performance, an A3 problem-solving practice is used to collect, structure, and identify possible solutions. Considering the amount and complexity of information circulating in the company and its plants (more than 50), the Information Management Capability is a strategy for developing other features of operational capabilities. Thus, we have classified it as an Across-the-Board Capability.

Continuous Improvement Capability was observed in Label_Case through the use of practices related to the Enterprise Lean Sigma methodology. Practices such as Kaizen, Thank You-New Idea, Loop, and Root Cause of Problem were considered part of this capability. Kaizen seeks to improve the Label_Case's productivity. This practice simplifies work, eliminates waste, and improves employee working conditions. For example, the company started Kaizen for quick tool changes. An ELS manager said that "in the beginning with 80 employees, we produced 4 million per square meters. After the application of Kaizen, our capacity doubled with the same number of employees."The practice Thank You-New Idea promotes improvements in production from ideas given by employees. The best ideas receive a gift card. Loop is a practice in which the production process is filmed in order to simplify and streamline the employees' activity. Root Cause of Problem identifies the initial cause of a problem, enabling improvements at different levels of the process. These practices constantly improve processes and products and strengthen the Continuous Improvement Capability. This is an Across-the-Board Capability because it can affect the development of other operational capabilities.

Learning Capability is developed through formalization, application, and transfer of knowledge. Some practices to help in developing this capability observed in Label_Case include Leadership Principles, Action Plan, Management of Change (MOC), Managing for Daily Improvement (MDI), and Training and Development Plan. Principles of Leadership is a practice heavily used by the company. It is applied in evaluating employees. Aspects such as confidence, collaboration, and enforcement are part of this practice. The Action Plan is used by departments to record and track requests. The MOC examines how the proposed change will have an impact on other activities. It captures the knowledge of the departments involved in the change, and at the same time, it tells how the change will reconfigure existing knowledge. The MDI are meetings that take place every day at three different levels of staff. This practice encourages the generation and sharing of knowledge. The Training and Development Plan is divided into mandatory and auxiliaries. The mandatory training is required by law. The auxiliary training is complementary and focuses on the autonomy of the employees for execution of their activities. The training, in general, formalizes, implements, and at the same time, transfers knowledge. Combined, these practices contribute to the development of Learning Capability by promoting and systematizing knowledge. This is an Across-the-Board Capability, because it creates a foundation on which knowledge can be used to improve or create Standalone Capabilities.

The second group observed at Label_Case is comprised of the Standalone Capabilities and is divided into three sub-groups: upstream, operational, and downstream. Upstream refers to Supplier Management Capability. Operational represents the capabilities that are directly related to production, including Operational Efficiency Capability, Innovation Capability, and Flexibility Capability. And finally, downstream we have Customer Support Capability. These capabilities are considered Standalone because they are developed from market demand, with the purpose of adding value for the customer.

Supplier Management Capability uses practices such as Supplier Selection, Supplier Relationship, and Supplier Evaluation. Supplier Selection may be done by market research, or in the form of a request for information (RFI). This form is posted on the internet so that suppliers can register. After this first step, suppliers respond to a questionnaire. The company then selects some suppliers and forwards them a request for quotation (RFQ). With the RFQ completed, Label_Case selects two or three suppliers to make a visit and check financial and infrastructure issues, and then pre-approves the candidate. Final approval is given by technical support, which has the function of testing the raw material in the machine.

Label_Case works with an average of three suppliers for raw materials and allows new entrants; however, according to the purchasing manager "We have a long history with our suppliers." Supplier Relationship classifies the suppliers as strategic, collaborative, transactional, or entrants. The strategic suppliers are those that have the greatest supply chain disruption risk; also, they are innovative and always seek cost reduction strategies. For these, the company seeks to strengthen the relationship. The supply chain manager said, "We send a forecast with 6 months of vision so that our supplier can be programmed as well." Collaborative suppliers are the suppliers that attend the company's needs for innovation and cost reduction, but only when asked. Transactional suppliers are the suppliers that serve the purchase orders, typically commodities. Last, entrants are considered to be challengers; there is no relationship yet, because they are just starting to work with Label_Case. Currently the company has 35% of its suppliers at the strategic level, 40% are collaborative, transactional are 20%, and 5% are entrants.

Suppliers can change classification, based on their evaluation. Supplier Evaluation is a formal practice that happens every six months. According to the purchasing manager said, "By the standard of ISO 9000, we are required to have an evaluation system of our suppliers with active items." The evaluation takes into account quality, timeliness, and relationship. In addition, Label_Case also considers the strategic level of the supplier, its availability in trying to resolve a problem, and a recurrence of the problem. Sometimes the supplier is strategic but is below the level of satisfaction; in this case, the quality department tries to work on its deficiencies so that the next evaluation improves.

In respect to Operational Efficiency Capability, the main operational practices identified in this capability were Lead time, JIT, TPM, TQM, EHS. The production is pushed, but the company works with a forecast of 75% accuracy. The Lead Time is one week forward of production. On the other hand, the cutting department works with a pull system. This is only possible because there is a minimum stock of finished products; therefore, the company can apply the Just in Time practice with its customers. Depending on customer location, the Lead Time between order and delivery is up to 24 hours.

Other practices related to production efficiency are TPM, EHS, and TQM. The company works with a schedule for preventive and predictive maintenance, seeking to avoid corrective maintenance. The practices of TPM, used together with the practices of EHS, cause a reduction in accidents and promote a safer and thus more productive environment. TQM ensures quality and standardized processes. As the safety manager said, "If we have standards for safety [...] we begin to have predictability [...]. It is difficult to measure but it helps in our productivity, low variability, less returns, less claims, and more satisfied customers."

Innovation Capability is characterized by practices of Development and Implementation of New Machinery and Equipment and the Development of New Processes. The company has three excellence centers for R&D. One is located in Asia, one in the USA and the other in Europe. In one of the visits to the R&D center in the USA, the project manager brought a manipulative technology that has been implemented in Brazil. According to him, "this technology facilitates the work of employees because it allows them to move rollers weighing 80 kilos easily and safely." For the President of the Label_Case, innovation is part of the process and is indispensable for the company to maintain market leadership. In his words, "there is a group of researchers in various parts of the world. [...] There are people thinking here two years, five years, ten years, twenty years, it will be. [...]. "

Innovation is part of the productive activity of the Label_Case. The modification of the structure of a product may involve the use of a new raw material, which in some cases requires the purchase or adaptation of a new machine and consequently the design of a new process. The company promotes innovation through annual forums for the exchange of ideas and new technologies among plants and through meetings with suppliers called "innovation days" to develop new projects.

Although Label_Case has a production process for large batches, the Flexibility Capability happens through practices such as Customization, Conjugation Products by Machine, and Small Batches Delivery. Customization is related to the Label_Case's ability to meet a specific request for its customers. In this case, customization is not a capability because it is not inherent to the productive process of the company. It happens by customer demand; therefore, it is "make order". The Conjugation Products by Machine occurs through software that distributes the production, combining product families in order to minimize the setup of the machine, while allowing diversification of the types of products produced. The schedule can be adjusted by the programmer in order to meet an urgent demand of a strategic customer. The Small Batches Delivery is possible because the cutting machines are programmed to cut in different sizes. In addition, the route planner creates routes maximizing the space of the truck.

Customer Support Capability includes Service Level Agreement, Customer Relationship, and Responsiveness practices. In the Service Level Agreement, Label_Case offers projects to improve the productivity of its strategic customers, because they are mostly family businesses with low-tech manufacturing and low use operational practices. However, they serve multinational companies and may thus increase the market share of Label_Case. So, to improve the technology of its customers, Label_Case offers lending of machinery and equipment. To improve the level of its operational practices, Label_Case carries out projects involving diagnostics, implementation, and monitoring of practices in the production process of its customers. These actions increase the efficiency and productivity of its customers, and consequently, the sales volume of Label_Case. According to the sales manager, "If they sell more, we sell more". One of the projects developed by Label_Case for one of its customers was the reduction of setup. The ELS manager said, "We went to a customer to work with them on the setup. Before, the setup was 1 hour and 10 minutes, but after our work, it was down to 30 minutes. We increased their productivity by 30%." This corresponded directly to an increase in the customer's demand for Label_Case's products.

The relationship with customers happens through the departments of customer service, technical service, and after-sales. These departments serve to receive and resolve complaints. They monitor problems and consult with customers. More than 30% of problems are solved as they occur. If Label_Case cannot solve the problem at the time, it opens a report. The customer response is monitored through indicators. According to the quality manager, "A complaint needs an answer, for agreeing or negating the customer's request." All complaints are reviewed and each report closed, and the customer receives a survey to report its level of satisfaction with the response, based on speed of response, and technical quality.

When analyzing Label_Case, we perceive a relationship between Across-the-Board Capabilities and Standalone Capabilities. An example of how Across-the-Board Capabilities help in the development of Standalone Capabilities can be seen in one of the MDI meetings. The production manager through VMS noted that the indicator of the machines was lower than expected. The continuous improvement manager proposed a Kaizen. The next step was to create a plan of action. A new map of processes was proposed and the employees were trained and received techniques for a quick tool change to reduce the set-up of the machines. The last step was to implement preventive maintenance practices. Thus, the set of Across-the-Board Capabilities (Information Management Capability, Continuous Improvement Capability, and Learning Capability) and Standalone Capabilities (Supplier Management Capability, Operational Efficiency Capability, Innovation Capability, Flexibility Capability, and Customer Support Capability) form a capability second order called Operational Management Capability. Table 22summarizes the operational capabilities and operational practices that we observed in Label_Case. Detailed spreadsheet with the analytical categories is Appendix 17.

Table 22 – Operational Capabilities_ Label_Case

Operational Practice	Dynamic Capabilities			Evidence*		
				I*	D*	O*
Forecast Objectives, Goals, Strategies and Measures Key Performance Indicator (KPI) Visible Management System (VMS) A3	Information Management Capability	Across-the-Board Capabilities	OPERATIONAL MANAGEMENT CAPABILITY	✔	✔	✔
Kaizen Thank you Loop Root cause of problem	Continuous Improvement Capability			✔	✔	
Leadership Principles Action Plan Management of Change (MOC) Managing for Daily Improvement (MDI) Training and Development Plan	Learning Capability			✔	✔	✔
	Operational Capabilities	Standalone Capability				
Supplier Selection Supplier Relationship Supplier Evaluation	Supplier Management Capability			✔	✔	
Lead time Just in Time (JIT) Total Productive Maintenance (TPM) Total Quality Management (TQM) Environmental, Health, and Safety (EHS)	Operational Efficiency Capability			✔	✔	✔
Development and Implementation of New Machinery and Equipment Development of New Processes	Innovation Capability			✔	✔	
Customization Conjugation Products by Machine Small Batches Delivery	Flexibility Capability			✔	✔	✔
Responsiveness Customer Relationship Service Level Agreement	Customer Support Capability			✔	✔	✔

* I - interviews; D – documentation; O – observation

4.1.2 Within-Case analysis: Flexi_Case

Flexi_Case is an American multinational firm that produces flexible packaging and uses Best Manufacturing Practices (BMP) in its operations. The main operational practices used by the company are Total Quality Management (TQM), Just in Time (JIT), Supply Chain Management (SCM), Total Productive Maintenance (TPM), Human Resource Management (HRM), and Environmental, Health, and Safety (EHS). All these practices are integrated into the management system used by Flexi_Case, called World Class Operations Management (WCOM).

WCOM is a set of practices which aims at the continuous improvement of production. It involves the following areas: Autonomous Management, Focused Improvement, Environmental, Health, and Safety, Progressive Quality, Logistics, Environment, Planned Maintenance, Product Anticipated Management, and Education and Training. WCOM serves to support production efficiency and develop cost reduction projects.

Cost reduction projects are implemented every four months and involve a set of operational practices. These projects are based on the results of the Flexi_Case's indicators. According to the industrial manager, "We launched the end of 2013 [...] five groups to reduce shears and scraps, [...] that brought an amount of around R$3.000.000.00 cost reduction for 2014." The intensive use of different practices over time can lead to the development of an operational capability.

Operational capabilities found in Flexi_Case constitute two groups, Across-the-Board Capabilities and Standalone Capabilities. Across-the-Board Capabilities constitute: Information Management Capability, Continuous Improvement Capability, and Learning

Capability. Standalone Capabilities include: Supplier Capability Management, Operational Efficiency Capability, Innovation Capability, Flexibility Capability, Customization, and Customer Support Capability.

Information Management Capability is constituted by practices such as: Forecast, Key Performance Indicators (KPI), Material Requirements Planning (MRP), Sales and Operational Planning (S&OP), and Visible Management Systems (VMS). These practices provide data that is processed into operational information. This capability is only developed when information adds value to the firm. For example, Sales and Operational Planning (S&OP) provides data for the Material Requirements Planning (MRP) to be performed, which in turn centralizes all information inputs from all Brazilian plants and distributes the production according to machine availability. This reduces the risk of production standstill and positively impacts the machine indicators.

Key Performance Indicators (KPIs) are presented through the Visible Management Systems (VMS). Indicators are exposed on displays scattered around the firm; any employee or visitor has access. The KPIs are monitored daily and their closing occurs monthly. When the results do not reach the expected target, working groups are created with the aim of reversing the situation through the actions of continuous improvement.

Continuous Improvement Capability is developed through Kaizen, Matrix Cost-Cutting Processes, and Root Cause of the Problem practices. This capability is based on Cost-Cutting projects. For the development of these projects, Flexi_Case works with a tool called Quick Assessment. In this tool are inserted information about volume demands, current efficiency, quality, and costs (labor, materials, raw materials, and others). As a result, it shows the potential losses in cost and efficiency in tons or kilograms, and also how much the firm is losing financially because of its inefficiencies. From this information, the Flexi_Case creates a committee that develops action plans to improve efficiency and reduce costs. Every four months, the tool is revisited and new plans of action for reducing costs are launched. According to the WCOM coordinator in Latin America, "If the problem is the loss of plant material, which is really the biggest cost that we have, we will implement a scrap project.” Usually projects involve multiple functions and multiple practices. For example, when a leading indicator of production Overall Equipment Effectiveness (OEE) is below the target, the following departments are involved: maintenance and quality. Maintenance is concerned with the reduction of breakdowns, quality improvements and reduced losses. These improvements are driven through the practices of Kaizen and Root Cause of the Problem, which are used to map the problem and draw a new process for production. The integration between departments facilitates generation of continuous improvement ideas, creates solutions to reduce costs and promotes learning at Flexi_Case.

Learning Capability is composed of the following operational practices: Eight Disciplines of Problem Solving (8D), Daily Management System, Integrative Action Plan, and Training &Development. One of the factors that help in the development of Learning Capability in Flexi_Case is the knowledge of its employees; on average they have more than 15 years of experience working for Flexi_Case. This creates an accumulation of knowledge that can be used by the firm through information sharing practices. These practices will be used to transfer knowledge among employees, generating new learning. Moreover, with time, experienced employees more easily detect possible solutions to operational problems.

One of the practices that help the transition of knowledge is the Daily Management System. This practice happens through daily, weekly, and monthly meetings. The daily meetings are composed of representatives of different departments. At the meetings, representatives of each department talk about the indicators and the problems in their departments. The indicators that are below the target are directed to a multifunctional action plan. The problems that are not resolved at this meeting will be transferred to their weekly meeting. At the weekly meeting, managers of each department are present. The problems that came from the first meeting are analyzed again. If there is no solution, the problem goes to the monthly meeting. In monthly meetings, chronic problems that need investment and support of the board are discussed. At all meetings, practices such as fishbone diagrams, integrated action plans and Eight Disciplines of Problem Solving (8D) are used. The use of these practices together helps to register and to transfer knowledge among the employees.

The effective use of operational practices requires the training of employees. Flexi_Case uses a competence matrix to direct training. From a theoretical test, the HR function identifies the gaps and directs specific training for the employees to develop their competence. The training also occurs when implementing a new practice, to involve employees in the new responsibility. For example, for autonomous management, in which the employees began to perform small maintenance of machines, there was training in each of the four steps involved in its implementation. Training and development is a practice that provides support for all departments. Its function is to identify and reduce possible gaps in manual labor that are impacting operational efficiency. Operational capabilities such as Information Management, Continuous Improvement, and Learning have the aim of supporting the development of Standalone Capabilities.

The second group is comprised of the Standalone Capabilities and is divided into three sub-groups, upstream, operational, and downstream. Upstream refers to Supplier Management Capability. Operational represents the capabilities that are directly related to production, including Operational Efficiency Capability, Innovation Capability, Flexibility Capability, and Customization Capability. And finally, downstream we have Customer Support Capability.

Supplier Management Capability uses practices such as Supplier Selection, Supplier Relationship, and Supplier Evaluation. The Supplier Selection is done through homologation. According to the logistics coordinator this process can take "[...] six months or one year." She also emphasizes "[...] for us to replace an adhesive that has been run on a line for 10 years involves major work; you need to test the new raw material making a small batch, then a larger lot, and go up [...]. Also, we have been using that supplier for a long time, buying on average a little more than 30 tons per month." Although the approval process is slow, it helps the company to ensure adequate performance of the raw material on its machines, as well as on the machines of its customers.

The concern of Flexi_Case is that the performance of a new raw material might be worse than the one that is currently in use. This preoccupation is justified because most of the raw materials of the firm are chemical combinations. Even if another supplier follows the technical specifications required by Flexi_Case, its performance can fluctuate, for different uncontrollable reasons. The logistics coordinator mentions that "[...] if we exchange all raw material and it all turns out wrong, we'll have to throw it all away. Then no one will take the risk to make a change."The difficulty in approving new raw materials leads the company to establish a long-term relationship with its suppliers.

The long-term relationship, however, does not necessarily result in value creation. There is a dependency of the firm on the supplier based on the functionality of its raw material, both in Flexi_Case's machines and customers 'machines. We emphasize that we are not talking about quality, but performance of the raw material in the machinery. A new supplier could generate performance problems and consequently financial losses, a risk that Flexi_Case is not willing to take. Thus, the value of the supplier is in the performance of its raw material and not necessarily in the relationship between firms.

Another point to consider is the restricted number of suppliers for raw materials. For polyester film, there is one supplier in Brazil. For BOPP film and adhesive, are three suppliers. Resin is a monopoly; only one firm provides it in Brazil. This creates a dependency on existing suppliers, and even when Flexi_Case seeks international alternatives, import taxes often make the purchase of raw materials unfeasible. Even with this difficulty, Flexi_Case tries whenever possible to strengthen the relationship with its suppliers, especially the locals that can provide it with after-sales service, consignment stock, or improvement of a raw material. The limited number of suppliers for raw materials forces the firm to have a relationship with them long-term. However, the situation is not a choice of Flexi_Case, but a determination of the market. Its suppliers are not adequately developed to create value in the relationship; and its evaluation is limited the fulfillment of the trade agreement.

Evaluation of suppliers is a practice that is beginning to be deployed. Today, Flexi_Case evaluates the On Time In Full (OTIF) performance of its suppliers, but according to the logistics manager, this indicator does not have the same rigor as when it used to evaluate customer satisfaction. "We have OTIF. But I will tell you that is something that is beginning [...]. We use it for some of our suppliers [...] in order to maintain the commercial relationship [...] but we do not have a plan, [...] that this information will not change, for example, business relations with the supplier [...]."However, the monitoring of indicators from the WCOM system is leading Flexi_Case to develop actions to create a closer relationship with its suppliers, because, with the indicators, the firm is realizing that suppliers have a significant impact on its operational efficiency.

With respect to Operational Efficiency Capability, the main operational practices identified in this capability were Lead time, JIT, TPM, TQM, EHS, and Environmental Sustainability. This capability shows the integrated use of operational practices. For example, for the lead time to happen properly, the practices of Forecast and Just in Time need to be aligned. The purchasing department needs to know how much to buy, considering the lead times for domestic and imported raw materials. The inventory level will also be different depending on the type of raw material. Flexi_Case effectively manages JIT and Lead Time practices, using techniques such as value stream mapping that document, analyze, and improve the flow of information or materials required to produce the product or service for a customer.

Another practice developed and controlled by Flexi_Case is Total Productive Maintenance (TPM). This practice uses preventive, predictive and corrective maintenance, and works with autonomous management with the production employees. The autonomous management is done by machine. There are four stages in which employees are trained to do maintenance of the machines. At first, they only indicate that the machine is in trouble. In the second, they point out the problem. In the third, they make small repairs, such as tightening screws. Finally, in the fourth stage, they begin to be responsible for basic maintenance of the machine. The whole process is accompanied by the maintenance and work safety departments.

Environmental, Health, and Safety is one of the main practices of Flexi_Case. Its guidelines come from the parent company in the United States; where there is an exclusive board monitoring Environmental, Health, and Safety indicators of all plants. The control of worker protection is strict. The reports are monitored and questioned, as observed in the interview with the security engineer "[...] the board always questions us [...] because it is not of their culture for a person to go into a machine and press a button knowing she will get hurt. They really believe it (security), for them it is unacceptable that people do not follow the rules."To Flexi_Case, safety comes first, followed by quality or profitability.

Linking the practices of Environmental, Health, and Safety, we observe the Environmental Sustainability practices. The firm works with energy consumption reduction projects, reduction of natural gas, and reduced energy impacting the environment. Flexi_Case also recycles its trimmings and scraps and transforms them in to new products. The use of these practices together promotes a safe environment for employees and also for society. Sustainability practices are sources of cost reduction and innovation.

The firm operates in a market where differentiation adds value to the clients of its customers, which means that Flexi_Case has innovation in its DNA. The end customer more and more demands new products in smaller time cycles, so consequently new packaging is also designed to serve this market when a new package is created, it is often necessary to make adaptations of machinery, equipment, and processes, which can be done by external firms or by an internal working group.

Considering the particularities of Flexi_Case and the lack of skilled labor in the region where it operates, over time it has been developing an Innovation Capability both for the development of machinery and equipment, as well as for new processes. It is supported by a team of over 60engineers and technicians who can create customized equipment for the demands that arise. In the technical visit conducted, the PCP coordinator showed us one of the machines that were reformed by the maintenance department. After the adjustment of the machine, its productivity increased by 40%. Innovation Capability is also supported by the multinational structure of the company, which has an R&D center to support the plants.

The R&D center in the United States has a team of over 80 engineers working on creating new products and processes. The industrial manager reported "The guys are four or five years ahead of the market so, we have a center for engineers in the United States just doing it, just helping us, just for us proposing new structures, new projects, and new processes."In addition to this, another source of innovations is the WCOM management system. It enabled the implementation of autonomous management, in which the employees are responsible for their machines' maintenance (see details in Operational Efficiency Capability). With this process, the worker becomes the "owner" of the machine, causing him to understand better the functioning of the machine he operates. This procedure helped Flexibility Capability because employees began to better manage the exchange of products in the machine, increasing the speed and decreasing its setup.

Flexibility Capability happens through practices such as Flexibility Machines, Flexibility of Delivery, Flexibility of Raw Material, and Small Batches. Flexi_Case operates in a market with a variety of products required by its customers. The company needs to produce small batches, which consequently generates a greater number of setups. To minimize this fact, PCP works with a schedule based on categories of products, where the operating programming takes into consideration the product family. Facilitators of this process are the raw materials, because they are flexible and can be used in different products. In addition, there are alternative raw materials used when there is an emergency or off schedule demand.

Requests from customers for deliveries outside the planned programming recur, either in advance or delayed. The main customers work in the Kanban system with orders on quarterly basis; with that, they have a balance and can make withdrawals as needed. Flexi_Case can minimize this problem with the practices of Forecast and S&OP. Even so, in some cases, to meet the customers' demand, the firm loses productivity or increases its level of stock. Its products are customized for a particular line of the customer, so it is unfeasible to sell them another customer.

Customization Capability consists of the practices of Process Modularity and Product Modularity. Customization is inherent in the consumer goods and very dynamic markets where Flexi_Case operates. Today the firm works with more than 2,000 items, of which

170 correspond to 70% of revenues. According to the production manager "Chocolate cookie, you know? Yeah ... The guy sells a cement unit; [...] it will be able to have accuracy, like, 95%. It does not exist in the packaging market. The guy will have accuracy in it of 50%, 70%. Normally, the volume is correct. For example, the X firm buys always between 15 and 20 tons per month. Volume is correct, but what products will it buy. If it will be chocolate or strawberry toast, it varies."With that, the company needs to work with modularity of products and processes to meet the customer and, at the same time, maintain its operational efficiency.

Customer Support Capability includes Customer Relationship, Responsiveness, and Service Level Agreement practices. Flexi_Case had a policy of treating all customers equally. However, from the management of indicators, it was noted that approximately 20% of customers represented 80% of revenues. With this, customers were classified into A, B, and C. This division enabled the development of an action plan directed at strengthening the relationship with customer type A.

Type A customers receive special attention in the control of indicator On Time In Full (OTIF). For customers with results below the target, a root cause practice is applied. The result of the last root cause taken showed that the main cause of the window was below the target programming of customers. It was found that 99% of the customers were junior programmers in their work, and they did not know how to make a real analysis of the quantity to be purchased, because they did not analyze the average sales history. They simply looked at the software and made the order. With this recognition, Flexi_Case started training the programmers of these customers to help them in managing their activities. This involved finished products inventory, inventory of raw materials, sending requests, and purchase forecast. The result of this training generated two main gains, the first, increased OTIF for customers, and the second, increased operational efficiency for both sides.

OTIF is also an indicator used to measure the Flexi_Case's responsiveness capacity with its customers. To help this indicator, the firm maintains the customer support department, in which every request or complaint is properly registered and answered. In addition to this, the Flexi_Case seeks to develop a mutually dependent relationship with its customers. By owning a solid financial structure, it can invest resources in improving the performance of its customers. There are cases of financial subsidies, other lending machines, and in cases of special customers they get in installation in-house within their customer plant. Thus, Flexi_Case creates value in the business relationship with its customers. Table 23summarizes the operational capabilities and operational practices observed at Flexi_Case. Detailed spreadsheet with the analytical categories is Appendix 18.

Table 23 – Operational Capabilities_ Flexi_Case

Operational Practice	Dynamic Capabilities			Evidence*		
				I*	**D***	**O***
Forecast Key Performance Indicators (KPI) Material Requirements Planning (MRP) Sales and Operational Planning (S&OP) Visible Management Systems (VMS)	Information Management Capability	Across-the-Board Capabilities	OPERATIONAL MANAGEMENT CAPABILITY	✔	✔	✔
Kaizen Matrix Cost-Cutting Processes Root Cause of the Problem Practices	Continuous Improvement Capability			✔	✔	
Eight Disciplines of Problem Solving (8D) Daily Management System Integrative Action Plan Training & Development	Learning Capability			✔	✔	✔
	Operational Capabilities	Standalone Capability				
Supplier Selection Supplier Relationship Supplier Evaluation	Supplier Management Capability			✔	✔	
Lead time Justin Time (JIT) Total Productive Maintenance (TPM) Total Quality Management (TQM) Environmental, Health, and Safety (EHS)	Operational Efficiency Capability			✔	✔	✔
Development and Implementation of New Machinery and Equipment Development of New Processes	Innovation Capability			✔	✔	
Flexibility Machines Flexibility of Delivery Flexibility of Raw Material Small Batches	Flexibility Capability			✔	✔	✔
Process Modularity Product Modularity	Customization Capability			✔	✔	✔
Responsiveness Customer Relationship Service Level Agreement	Customer Support Capability			✔	✔	✔

* I - interviews; D – documentation; O – observation

4.1.3 Within-Case analysis: Paper_Case

Paper_Case is a Brazilian firm that produces paper packaging and uses Best Manufacturing Practices (BMP) in their operations. The main operational practices used by the company are Total Quality Management (TQM), Housekeeping (cleaning and organization of the firm), Justin Time (JIT), Supply Chain Management (SCM), and Total Productive Maintenance (TPM). The firm also works with certifications of ISO 9000, ISO 26000, Forest Stewardship Council (FSC), and is beginning to implement Food Safety Management System (FSSC 22000).

Operational practices and certifications are intended to meet customer requests. The food industry is one of the customers with greater requirements. Paper_Case provides packaging for the food industry, and therefore must follow the same standards used in food production. Thus, operational practices are monitored by the firm and audited by external companies and in some cases for audit by customers as well. As the production manager to serve the food industry "you have to have the same level cleaning, organization, and aseptic factories that produce food for children." Although it is clear that Paper_Case has a reactive response to requests from its customers, the implementation of these operational practices favors the development of operational capabilities.

Operational capabilities found in the Paper_Case constitute two groups, Across-the-Board Capabilities and Standalone Capabilities. In Across-the-Board Capabilities, we observe: Information Management Capability, Continuous Improvement Capability, and Learning Capability. Standalone Capabilities include: Supplier Capability Management, Operational Efficiency Capability, Innovation Capability, Flexibility Capability, Customization Capability, and Customer Support Capability.

Information Management Capability is composed of practices such as: Forecast, Key Performance Indicators (KPI), Manual Control of Information (Logbook) and Visible Management Systems (VMS). Paper_Case uses the SAP system to manage their information. Operational data is entered daily and transformed into KPIs. The main KPI monitored by Paper_Case is the overall efficiency. This indicator is subdivided into time production and finishing, which are monitored daily by the employees through the SAP system.

Data on the firm's KPIs are entered into the SAP system. In addition, Paper_Case uses Control Handbook of Information. This practice aims at reporting the day-to-day production, in which the problems and adjustments of the machines are noted in panels in real time, to be discussed in daily meetings. The use of different practices for generating a database makes the Paper_Case have more reliable information. These data are demonstrated through Visible Management Systems (VMS). Indicators as Housekeeping, 5S, and industrial accidents are recorded in different places in the firm. For the industrial director, "an information system is only complete when the data is integrated and used to continuously improve the production process."

Continuous Improvement Capability is developed through practice as Cost Out, Risk Analysis for Prevention (RAP), and Tree Diagram. The main source for continuous improvement of Paper_Case is requests and complaints from customers. It seeks to meet them whenever possible, creating opportunities for improvement.

One way to continuous improvement is the certifications. The latest of these is the Forest Stewardship Council (FSC). This certification ensures the wood is reforested complies with legal questions of the environment. Demanded by the food industry, this certification has improved many internal processes of the firm. According to the quality manager, "[...] the certification process involves audits. Recently we had one that lasted more than fifteen days. We had non-conformities, which will require investment and improvements."These improvements are in the planning for next year, and are expected to reach two million dollars in infrastructure investments.

Over time the infrastructure was neglected by Paper_Case, but now it will be maintained as it needs to meet the non-conformities identified in customer audits. Investments will be made to microbiological air controls, contamination, and dust, among others. As the quality supervisor said, "[...] the client has warned us either we have the certification or they will not buy from us."

Practices such as Cost Out and Risk Analysis for Prevention (RAP), also support Continuous Improvement Capability. Daily employees of Paper_Case meet to discuss KPIs. When any of them are below expectations, it opens a Tree Diagram. This diagram has the function to find the root cause of the problem.

Learning Capability is constituted by operational practices Emergency Action Plan, Multidisciplinary Meetings, Plan-do-check-act (PDCA), and Training & Development. One of the factors that help the development of this capability in Paper_Case is the long experience of its employees. From the interviews conducted, eleven of sixteen employees had more than fifteen years of work. On the one hand, these damages a little the generation of new ideas, on the other hand it helps to consolidate the learning process. With time employees accumulate knowledge and can transfer it easily between work teams. Knowledge in Paper_Case is also acquired from the Training & Development. The training of its employees is carried out by internal teams, consultants, and suppliers. Some suppliers when selling to the Paper_Case already include training for employees. In addition, each year the firm's managers complete a training matrix and forward it to HR. The trainings are directed to currently and newly hired employees, and are focused on occupational safety and proper use of machinery and equipment.

When a new worker is hired, he is trained by another worker with hierarchical higher level than him. Similarly promoted employees are trained by more experienced. According to the R&D manager, "you will always be trained in practice daily; you will receive guidance from someone with a superior position to him. [...] This is a feature of the paper factory."In this interview it is clear the importance of the experience of older employees in training beginners. The employees' experience also helps in problem solving, usually discussed in daily meetings.

Daily Multidisciplinary Meetings are conducted involving different departments such as production, PCP, maintenance, marketing, among others. At these meetings indicators of efficiency, quality, safety, and also operational problems are discussed. When an indicator is below target or there is a problem to be solved, the employees open Emergency Action Plans or PDCA. An Emergency Action Plan is open when there is a problem that needs to be addressed with some urgency. PDCA is used to address more complex problems, such as non-conformities identified in audits. Operational capabilities such as Information

Management, Continuous Improvement, and Learning seek to support the development of Standalone Capabilities.

The second group is comprised of the Standalone Capabilities and is divided into three sub-groups, upstream, operational, and downstream. Upstream refers to Supplier Management Capability. Operational represents the capabilities that are directly related to production, including Operational Efficiency Capability, Innovation Capability, Flexibility Capability, and Customization Capability. And finally, downstream we have Customer Support Capability.

Supplier Management Capability uses practices such as Supplier Selection, Supplier Relationship, and Supplier Evaluation. One of the requirements for Supplier Selection is the certifications. This is a request demand by customers from Paper_Case and a factor of possible disqualification. For example, cellulose suppliers must possess the certification FSC to compete for one bid. In addition, there are other points that are considered in the selection and approval of a supplier such as quality of raw materials, financial health, legal aspects, and price. However, although there are criteria for selection and approval of suppliers, the quality coordinator believes it is still a weak point of the firm. It is not performed from a strategic vision, perhaps because there are few entrants and the firm has a long-term Supplier Relationship.

Paper_Case has been in the market for 124 years and is the only firm that works with special papers in Latin America. On the one hand this is an advantage, on the other; this reduces the number of its suppliers. There are few suppliers for supply of the main raw materials used by it, such as cellulose. Some have already worked with Paper_Case for over 60 years. Suppliers recognize its importance as a client in the papers market and invest time and money in this relationship. For instance, one of its suppliers financed half the amount spent for a titanium dispersion treatment facility. For the PCP coordinator, "[...] the supplier realized that if it improved our efficiency, we would increase consumption also [...]". Suppliers are also sources for new technologies and provide training for the Paper_Case in order to strengthen relationships and improve service.

Formal Supplier Evaluation is restricted to the purchasing department. However, the production manager and finishing manager are usually consulted verbally on the performance of suppliers. They reported that when there is a failure in the process, they open a form to analyze the problem. These forms, daily meetings, and indicators guided by the requirements of the ISO 9000 helps department purchases evaluation suppliers. The evaluation is conducted every three months and is directed to critical suppliers. Research findings are sent to the quality committee. For suppliers who have not achieved satisfactory results a corrective action plan is opened, which is prepared in conjunction with the supplier and monitored by Paper_Case.

Quality coordinator believes this is a step that can be improved, and that the implementation of the FSSC certification will promote an improvement in the evaluation of suppliers. This certification requires additional control, dividing them into critical and non-critical criteria FSSC certification is related to the origin of the raw material, in this case cellulose, which should not come from indigenous forest areas and needs to be replanted. Non-critical are related to indicators known in ISO 9000. For the quality coordinator, the proper management, of suppliers can improve the operational efficiency of the firm.

In respect to Operational Efficiency Capability, the main operational practices identified in this capability were Lead Time, Just in Time (JIT), Environmental, Health, and Safety (EHS), Total Quality Management (TQM), and Total Productive Maintenance (TPM).There is a concern of the firm so that these practices are aligned and generate consistent results. For example, Forecast is done with overview of three months by the commercial department, and then it is communicated to the PCP department that does a master production scheduling. From this programming are made weekly adjustments to reduce the Lead Time and at the same time meet the emergency requests from customers.

To maintain an efficient production process, Paper_Case works with the Just in Time system. To do so, it follows two principals' strategies. First, suppliers need to restore its raw materials within three to four days. Second, the firm works with a make-to-stock strategy with its major customers. For the firm not to lose competitiveness with this strategy, it needs a good level of accuracy in predicting demand and an effective control in the other operational practices such as TPM, TQM, and EHS.

Environmental, Health, and Safety is being restructured in Paper_Case. Although the firm follows the legislation on occupational safety, and has a low accident rate, still there are points to be improved. As to the security engineer said, “Recently the worker put his hand inside a machine running and broke his arm. The accident could have been worse."Recently the Ministry of Labor and Employment through the regulatory norm NR12 required several structural changes in the firm. This regulation aims to ensure that employees do not take risks that might lead them to an accident at work. Paper_Case is working to adapt its structure and machines to satisfy the new rules.

Total Productive Maintenance (TPM) consists of an annual planning, preventive and predictive, maintenance. Indicators on the efficiency of the machines are monitored daily, demonstrating that the amount of corrective maintenance is above the desired target. For this, the maintenance engineering department was restructured. New employees were hired, investments in machinery and equipment were performed, and PDC. As were designed for monitoring and resolution of major problems.

Total Quality Management (TQM) is an important aspect for Paper_Case. There is a team of over 40 employees in the quality department to ensure flawless products. The firm also has machines with modern equipment that scan the paper and indicate possible imperfections. A sample of every coil of paper is collected for analysis of its quality, which is then filed for future tracking. Moreover, periodically sample papers that are used for food packaging go to an institute in Europe for approval. The reports serve to indicate the absence of chemical waste and are sent to Paper_Case customers.

Even with all this precaution with the quality, Paper_Case receives recurring complaints from its customers. The problem is not the measured quality of the product, such as paper weight, thickness, or porosity of the paper, but the attributes of the paper, which is inherent in paper manufacturing, such as fault in the paper coil, color adjustment or even the product functionality on the client machine. Although there is a quality process with the use of equipment and human inspection, sometimes failure is inherent in the production process. The SAC manager said, Paper_Case “is not in control of physical characteristics, which can be the case, but the big problem are the attributes."To mitigate this problem, the firm constantly invests in innovation of its machines and processes.

Innovation Capability is characterized by practices of Development and Implementation of New Machinery and Equipment and the Development of New Processes. Paper_Case sells for many multinational companies with highest level of requirements. One is product reliability. As a result, the firm invests in machinery and equipment that are able to produce the paper with maximum quality. Whenever necessary investments in this area are carried out, they are always present in the budget of the firm. Paper_Case recently acquired new lasers that were installed on the machines. They aim to identify problem attributes of the paper. Laser film sheets detect the defect, and issue a report identifying the location of the problem.

The processes of Paper_Case are constantly updated in order to reduce failures in the processes, and also introduce new processes due to new products. The R&D department is responsible for designing the new processes, and the quality department ensures that processes are being carried out within the specified processes. This process re-engineering is constant in Paper_Case for two reasons. First, it produces a wide range of customized products for its customers. Typically, each new product involves specific processes. Second, the firm has different certifications, which do not always have the same requirements, requiring in some cases that processes are created or redesigned.

Flexibility Capability happens through practices such as Flexibility Machines, Flexibility of Delivery, Flexibility of Raw Material, Scheduling by Product Category, and Small Batches. One of the competitive criteria of Paper_Case is its flexibility. According to the purchasing manager, "We have flexibility and speed to meet the specific needs of our customers while maintaining a good quality." This can be seen in the firm through the use of their machines, raw materials, delivery dates, and size of the produced batches.

Paper_Case has machines with capacity to produce different products. Its main raw material, cellulose, also allows such diversification. Products are produced in large or small batches, creating an advantage for the firm, as its customers require customized products and small batches. This advantage is amplified, because its main competitors are outside Brazil, and produce only on a large scale. Delivery flexibility is another feature of Paper_Case, as the PCP coordinator said, "If today a client calls me asking for brown paper in five days, and the request is profitable for the firm, we will do it."However, although flexibility can be found in different parts of Paper_Case, its jobs are fixed. The production manager said, "If I get an employee here, I cannot let him work there. He has no specific training for this."

Flexibility allows the firm to offer its customers a diverse portfolio of products; however, this is a constant challenge because it must reconcile production and operational efficiency. One of the ways found to reduce this impact has been organizing Lead Time using Scheduling by Product Category. For each machine, there is a range of products directed toward increasing its production capacity with the lowest possible cost. This strategy is also used for customized products.

Customization Capability consists of the practices of Customization on a Large Scale, Customization Product Variety, and Quick Response for Customization. Paper_Case works with a wide variety of products, which are differentiated by type of paper, weight, and color. Each change in these items, generates a particular specification, and is considered a different product since part of the process is modified.

The firm works with different product lines, some more mature with greater predictability, and others still growing and less predictability. Most mature products, even customized, are produced in large batches, since the machines have good production capacity. Products growth is more specific and meets the request of a single client, forcing the firm to produce smaller batches. Usually these products have added value and unique specificity. Paper_Case seeks to balance the customization of products with operational efficiency, maintaining a proper sequence of products. As the PCP coordinator said, "We call flow. Each color change we have a seven-washing flow." For this, production begins producing the lightest color and gradually entering darker colors. Customization is a competitive advantage for Paper_Case because there is no other firm in Brazil that works with intense colors and meets the needs of this market demand.

Customer Support Capability includes Customer Relationship, Responsiveness, and Service Level Agreement practices. Paper_Case takes special care of their customers. It always seeks to serve them, even if this compromises its operational efficiency. The Paper_Case focus is responsiveness.

Although Paper_Case meets the demands of its customers, this happens reactively. For example, recently the firm had a problem with the functionality of its product for product line customer. The paper of Paper_Case was running on the client machine when it began to wrinkle. This is a problem that is not possible to be identified in the quality process, it depends on the client machine type. The production manager reported that the problem started after the customer changed their machines to a higher speed. The problem was resolved some time later with the improvement in the composition of the product. This is an example of reactive response of the firm to customers.

Responsiveness of Paper_Case to its customers is recognized by the satisfaction surveys that the firm conducted annually. When there is a point of dissatisfaction from customers, the firm opens an action plan. This procedure is conducted whenever a problem with the client is observed. There is a commitment on the part of employees in solving problems and this promotes customer satisfaction. As the SAC manager said, "The after-sales assistance is a differential of the firm."

However, although there is an effort to meet customer requirements, the fact that Paper_Case acted reactively caused it to lose some customers. The PCP coordinator reported that he was surprised when one of his clients suddenly stopped buying from Paper_Case; it began importing paper. This customer modernized its machines, and the Paper_Case products became obsolete. It can be noticed here that the fact that Paper_Case served its customers reactively can indicate a weak relationship with them, because if it was a strong relationship the firm would know the customer's intention to modernize its machines in advance.

Even so, the firm seeks to maintain a relationship of trust with its customers, starting with the product reliability.

This is an important aspect, because Paper_Case sells the product by weight, and the customer buys in square meters. This means that if the customer purchases forty grams of paper per square meter, and the firm delivers forty-one, the customer will be losing money, because it is unable to produce more products with the this quantity. Thus, Paper_Case’s relationship with its customers is focused on the correct product delivery and quick customer response through the SAC and technical support.

Paper_Case's technical support has employees who know the customer's production process. They diagnose easily a defect is in the product or the customer's production process. This level of knowledge helps Paper_Case to maintain a close relationship with its customers. But unlike its suppliers that create value in the relationship, investing in training and financing of fixed assets, the level of service of Paper_Case to its customers is more focused on technical assistance. As the PCP coordinator said, "We received the investment services and technology from our suppliers, but we could not offer the same service to our customers."Table 24summarizes the operational capabilities and operational practices observed at Paper_Case. A detailed spreadsheet with the analytical categories is Appendix 19.

Table 24 – Operational Capabilities_Paper_Case

Operational Practice	Dynamic Capabilities			Evidence*		
				I*	D*	O*
Forecast Key Performance Indicators (KPI) Manual Control of Information (Logbook) Visible Management Systems (VMS)	Information Management Capability	Across-the-Board Capabilities	OPERATIONAL MANAGEMENT CAPABILITY	✔	✔	✔
Cost Out RAP - Risk Analysis for Prevention Tree Diagram	Continuous Improvement Capability			✔	✔	✔
Emergency Action Plan Multidisciplinary Meetings Plan–do–check–act (PDCA) Training & Development (Human Resources)	Learning Capability			✔	✔	
	Operational Capabilities	Standalone Capability				
Supplier Selection Supplier Relationship Supplier Evaluation	Supplier Management Capability			✔	✔	
Lead Time JIT - Just in Time (JIT) Total Productive Maintenance (TPM) Total Quality Management (TQM) Environmental, Health, and Safety (EHS)	Operational Efficiency Capability			✔	✔	✔
Development and Implementation of New Machinery and Equipment Development of New Processes	Innovation Capability			✔	✔	✔
Flexibility Machines Production Scheduling Flexibility of Raw Material Scheduling by Product Category Small Batches	Flexibility Capability			✔	✔	
Customization on a Large Scale Product Variety Quick Response for Customization	Customization Capability			✔	✔	✔
Responsiveness Customer Relationship Service Level Agreement	Customer Support Capability			✔	✔	

* I - interviews; D – documentation; O - observation

4.1.4 Within-Case analysis: Metal_Case

Metal_Case is a Brazilian company that produces metal packaging and uses Best Manufacturing Practices (BMP) in their operations. The main operational practices used by the company are Total Quality Management (TQM), Just in Time (JIT), Supply Chain Management (SCM), Total Productive Maintenance (TPM), Environmental, Health, and Safety (EHS), Development and Implementation of New Machinery and Equipment, and Development of New Processes.

Since 1980, Metal_Case has been investing in operational practices. They are essential for the firm to remain competitive in the market in which it operates the paint industry. The paint market in Brazil is concentrated in three multinationals. This situation creates an aggressive competition from packaging firms that want to sell to these multinationals. Another aspect that affects competition for Metal_Case is its raw material, steel. Steel represents 70% to 80% of the production of metallic packaging, and in Brazil, it is monopolized by Companhia Siderúrgica Nacional (CSN). If Metal_Case is not able to negotiate for better prices, then it needs to invest in its internal resources and its capabilities to generate competitive advantage.

Operational capabilities found in Metal_Case constitute two groups, Across-the-Board Capabilities and Standalone Capabilities. Across-the-Board Capabilities are: Information Management Capability, Continuous Improvement Capability, and Learning Capability. Standalone Capabilities include: Supplier Management Capability, Operational Efficiency Capability, Innovation Capability, Flexibility Capability, and Customer Support Capability.

Information Management Capability is composed of practices such as: Forecast, Key Performance Indicators (KPI), and Operational Manager Report Manual. The Metal_Case works in Kanban system with its main clients; this means that it has an accurate Forecast with three months in advance. Forecast for the others clients are done from the production data reported by employees from the shop floor. In each machine there is a report that is manually completed by the employees with information about the amount produced, damage, and downtime of the machines. These reports support the KPIs for the firm.

Metal_Case controls its KPIs through daily meetings. These meetings are held with almost all departments, including production, quality, maintenance, logistics, health and occupational safety, and purchases. The production manager argues that "from the numbers we can see what happened, look at the report and take actions to combat the problem." These data are an important source for the development of Continuous Improvement Capability.

Continuous Improvement Capability is developed through practice the Root Cause of the Problem, Simplification, and Waste Management Teams. Metal_Case invests in various continuous improvement programs. The firm created a project called simplification to generate new ideas. Monthly every employee writes twelve ideas suggesting improvements in processes, product quality, work safety, and others. All ideas are evaluated and analyzed. Its approval depends on its applicability, safety, and financial viability. Independent of whether the idea is approved or rejected, all employees receive feedback. Metal_Case has a multifunctional team that is responsible for executing the approved ideas. Every six months there is a vote where the best ideas are selected and awarded. Metal_Case organizes a party called "Project Party" for this. Winning ideas are usually those that bring economic results.

Metal_Case operates in a competitive market and hence, cost reduction is a constant concern of the firm. To help it in these processes, Metal_Case created another project called Waste Not using Waste Management Teams practices. This project involves five employees from different departments. Employees analyze, discuss, propose solutions, and monitor problems encountered in the different departments of the firm. The Project's purpose is to improve processes and reduce costs. Solutions are proposed in partnership with the department monitored. The department creates an Action Plan using Root Cause of the Problem practice, and an audit is conducted by the team of Waste Not. Continuous Improvement Capability helps reinforce Learning Capability.

Learning Capability is constituted by operational practices Action Plan, Leadership Principle, Multidisciplinary Meetings Daily, and Training & Development (Human Resources). Action Plan is used to solve problems. It records the problems and solutions, and is a source of learning for future occurrences. Action Plan is discussed in the Multidisciplinary Meetings Daily. These meetings occur every day at 9:00am, and last for fifteen minutes, involving different departments of the firm. They discuss KPIs, problems in the production process, work accidents, quality, new projects, machine stops, and others. According to the maintenance manager "We have a daily meeting, with all departments. [...] We have a wide vision of the firm. [...] We discuss performance and difficulties day to day."Meetings help group decisions, because when they are discussed by different departments, employees are more committed to solving a problem. Meetings also favor Leadership Principles.

Leadership among employees is encouraged in Metal_Case. Employees work a long time in the firm and are familiar with all its operational processes. Most respondents have over 20 years of experience and were hired when they were trainees. Metal_Case has a culture of hiring young people and develop their careers within the firm, providing a long-term relationship with their employees. This gives these employees a sense of duty to the firm, and a relationship of friendship and cooperation between them.

The maintenance manager believes that employees are a differential of Metal_Case; he said "Employees have concern and interest to improve." He still believes that “It is no use to change the process, we need to change the concept, and we need to change people's heads. [...] It does not matter if I want to do something if employees do not." Other interviewees agreed that the climate of the firm is friendly and this favors the permanence of employees for so long. The purchasing manager emphasizes "Here we give our sweat, not our blood. Here there is a balance between personal and professional life."

For Metal_Case, its employees are a valuable and irreplaceable resource. Its employees receive Profit Sharing Plan and are trained continuously. Training and years of experience of the employees makes Metal_Case develop Learning Capability, which together with Information Management Capability and Continuous Improvement Capability favors the development of Standalone Capabilities.

The second group is comprised of the Standalone Capabilities and is divided into three sub-groups, upstream, operational, and downstream. Upstream refers to Supplier Management Capability. Operational represents the capabilities that are directly related to production, including Operational Efficiency Capability, Innovation Capability, and Flexibility Capability. And finally, downstream we have Customer Support Capability.

Supplier Management Capability uses practices such as Supplier Selection, Supplier Relationship, and Supplier Evaluation. Although the steel represent 80-90% the cost of packaging, and is provided by a single supplier in a monopoly system, Metal_Case selects its other suppliers through bids. Annually the firm calls its suppliers to present their proposals. Metal_Case needs to negotiate well with its other suppliers in order to obtain some advantage in the price of raw material, because there is no negotiation in steel. The R&D manager noted that "all firms pay the same price for steel." Besides paying the same price as its competitors for steel, Metal_Case purchases steel three months in advance. This means that the firm needs to be precise about quantity to be purchased, so the volume of its stock does not increase. Therefore, the purchase of other raw materials becomes an important strategic factor for Metal_Case.

Approval of a new supplier involves time and trust. Metal_Case needs to ensure that the new supplier will be able to supply it as agreed. The production coordinator emphasized that "price, quality, delivery is important, but reliability in supplies is more important." To Metal_Case the important thing is not only the best price, but the best deal. The purchasing manager reported that in addition to price, the supplier must be approved by the technical department of Metal_Case, he said "[...] Supplier may have a price 10% lower, but if it does not deliver the right amount, if there is tax problems, and there is quality problems, [...] it is not good for me."

Furthermore, approval of a new supplier depends on the test of the raw material performed on the machines of Metal_Case by the technical department. In some cases, the raw material for a new supplier may meet the specifications stipulated by Metal_Case; however, if the performance of the new raw material reduces the speed of the Metal_Case machines, it will not meet the needs of the firm. Therefore, the change of suppliers in Metal_Case is not so common, and depends on the approval of the technical department. This fact favors a long-term relationship between Metal_Case and its suppliers.

Metal_Case usually works with two suppliers, one with 80% and another 20% of the sales of raw materials. Relationships with suppliers are a partnership. Suppliers help to improve the operational process of Metal_Case through benchmarking competitors that supplier serves. They provide information and market trends, and often quick solutions for critical issues of Metal_Case. Frequently meetings among Metal_Case and its main suppliers are conducted to solve problems.

Suppliers are also partners in the development of new technologies, such as presentation of new equipment and development of raw materials with the best performance. Metal_Case participates in monthly meetings with its main suppliers to discuss problems related to raw materials and new trends of metal packaging. Suppliers contribute to innovations of metal packaging. All of these aspects help Metal_Case evaluate its suppliers.

Metal_Case suppliers are evaluated every six months. Evaluation is made by purchasing department, quality department, and department that the supplier serves. Evaluation criteria are linked with the contract. Each department makes a part of the evaluation and gives a score from 1 to 10 for questions about its department. When there is non-compliance, Metal_Case together with the supplier opens a corrective action plan. This action plan is monitored by Metal_Case until the problem is resolved. In cases of non-resolution, the supplier contract can be canceled, but that is the last resort.

In respect to Operational Efficiency Capability, the main operational practices identified in this capability were Lead Time, Just in Time (JIT), Total Productive Maintenance (TPM), Total Quality Management (TQM), and Environmental, Health, and Safety (EHS). Metal_Case has invested in operational practices since 1980. As a result it has several awards related to Total Quality Management (TQM). Quality is a pillar of the Metal_Case organizational strategy. For it the correct term for quality is not quality of management, but quality management. Focus on quality makes all employees consider the quality as their responsibility, not the responsibility of a specific department. The quality department of the firm uses a tool called 'eye on quality management'. This tool includes aspects of the Balanced Scorecard (BSC) and is present in the whole management firm.

According to the quality manager, 100% of Metal_Case products are tested before being sent to their customers. Quality tests include tumbling, openness, and leakage of the package. Furthermore, the quality department makes weekly internal audits to investigate the product, process and service quality. The firm also receives external audits and audits of its customers, especially those that work with Metal_Case in the Kanban system.

Kanban, production in large batches, and reduced number of types of products, facilitate the JIT practices, and reduces the setup time for Metal_Case. JIT practices need to be aligned with Forecast and Lead Time practices, because the main raw material used by the firm, steel, is bought with three months advance. This means that the request of the raw material of January will be delivered in April; therefore, if the firm does not control its Forecast adequately and does not plan its lead time correctly, it may lose productivity while increasing their costs.

Stock level of raw material must be carefully controlled, because the firm has a limited physical space, preventing purchases in large batches. The purchasing manager said Metal_Case lose some business opportunities abroad, because there is no place to store. For him, one of the Metal_Case differentials is in managing its stock; the other is related to its production capacity of the machines.

Metal_Case prepares an annual schedule of preventative maintenance for monitoring of machinery and equipment. They happen almost every week with the support of the PCP department. According to the maintenance manager, "We analyze the equipment, define points of maintenance, monitor performance, and monitor the functioning of the machines." Metal_Case uses a management system that helps the maintenance department to organize its deadlines. Schedule of machines maintenance are monitored and can be adjusted to be anticipate or postpone. Corrective maintenance also helps to adjust the schedule. Maintenance department also works in the adaptation of machines to develop new processes and changes that leave them safer for employees.

Environmental, Health, and Safety practice is a concern of Metal_Case. There are security lanes in production, employees have safety equipment, and the number of accidents is low. Recently, the firm has invested in the enclosure of its machines to adapt the

Regulatory Standard of the Ministry of Labour. Work safety also is considered when a new product is developed. The department of maintenance has expertise in innovation.

Innovation Capability is characterized by practices of Development and Implementation of New Machinery and Equipment and the Development of New Processes. One of the strategies used by Metal_Case to achieve market leadership was investing in innovation, considered as one of the firm pillars. Every year Metal_Case launches new products. It has a large number of patents and exports its know-how in technology to European firms. The main product of Metal_Case, paint tin, has had the same format for more than 100 years, so, when it created a new mechanism for closing the paint tin, it expanded its market and achieved leadership in its sector. For the production coordinator innovation "is one of the strengths of Metal_Case". The R&D manager reinforces this idea by saying "paint tin is 100 years old, Metal_Case was the only firm that dared to change it."

Metal_Case constantly invests in innovation, mainly incremental. Innovation processes involve the participation of its employees, called ‘inventors’, and receive commercial support from its customers. Innovation of products also involves the R&D department to develop new processes, the maintenance department, to create new tools, and the quality department to ensure that the new product meets all required specifications. Creation of machinery and equipment is a common practice of the maintenance department. Developing their own equipment makes Metal_Case able to invest in lower than market technology cost.

For investment in new technologies, Metal_Case created a committee with representatives from different departments, including the board. This committee aims to maintain modernized machinery and equipment of the firm. According to the R&D manager "When we launched the expanded paint tin, we built a production line to manufacture it, [...] the line was fully automated." However, an innovation only becomes commercial if it is done on a large scale. Product customization on a small scale is not a reality for Metal_Case, which seeks to compensate for this by investing in practices that promote its Flexibility Capability.

Flexibility Capability happens through practices such as Customization Lithography, Deadline for Delivery, Manufacturing Cell, and Production Scheduling. Metal_Case lithography enables it to customize some products, but always in large batches for reasons of cost. The anticipation of deliveries to its clients is another way has flexibility. When this occurs, Metal_Case uses appropriate sequences of production to maintain its productivity. The financial coordinator admits that the production of small batches depends not only on the change process, but investment in machinery to adapt the production line. Today the production of small batches impacts the increase in setup and consequently the loss of efficiency of Metal_Case.

Another aspect that helps Flexibility Capability is rotated among employees in manufacturing cells. Rotation is monthly and requires training of employees, as well as a careful analysis of what machine the employee is authorized to operate. The production manager highlights some advantages of rotation. First, when an employee is absent, production does not stop, because there are substitutes for him. Second, employees have fewer injures, because they are not exposed to the same routine every day. Third, employees feel less bored, which reduces complaints and absence at work. This capability is important to keep customers satisfied.

Customer Support Capability includes Customer Relationship, Responsiveness, and Service Level Agreement practices. Metal_Case works with Kanban system with some of its customers, creating a close relationship and some dependence. In addition, it seeks partnerships with its customers to commercialize new products. In this case the customer has buying priority of the new product, but it is not exclusive. Another strategy used by Metal_Case to maintain this close relationship is to buy raw material for its customers. Metal_Case produces metal packaging for the paint industry and, at the same time, it uses paints to make the lithography of its tins. This fact creates interdependence and promotes the relationship between Metal_Case and its customers. Metal_Case also indicates an employee responsible for monitoring the order from its customers, from entry to delivery. This type of service facilitates communication with the customer and avoids possible misunderstandings.

Responsiveness of Metal_Case seeks to meet the needs of its customers. Innovation helps this process because it allows the firm to deliver its product with more quality and functionality. For example, Metal_Case created packaging for paints, called expanded gallon. Expanded gallon facilitates its stacking in the logistics process, it allows a larger number of paint tins in the truck, and also facilitates the storage shelf of resellers' shops. This new gallon of paint has generated savings in transport costs, handling, and storage for Metal_Case. It also created a transparent lid to the paint tin; it facilitated the sale of custom inks to Metal_Case customers in reseller shops. Besides these, there are other incremental innovations that are designed to better represent and distribute the product to its customer. Responsiveness and innovation are differentiators for Metal_Case, which operates in a market considered to be traditional.

To consolidate this capability Metal_ Case also uses Service Level Agreement practices. Kanban system is one of them, because it allows Metal_Case to manage inventory for its customers. Another is technical assistance that enables rapid problem solving. Metal_Case also invests in the modernization of its customers' production lines for launching new products. This investment helps to consolidate the relationship and the level of service offered to customers. Table 25summarizes the operational capabilities and operational practices observed at Metal_Case. A detailed spreadsheet with the analytical categories is Appendix 20.

Table 25 – Operational Capabilities_Metal_Case

Operational Practice	Dynamic Capabilities			Evidence*		
				I*	D*	O*
Forecast Key Performance Indicators (KPI) Operational Manager Report	Information Management Capability	Across-the-Board Capabilities	OPERATIONAL MANAGEMENT CAPABILITY	✔	✔	✔
Root cause of the problem Simplification Project Waste Management Teams	Continuous Improvement Capability			✔	✔	
Action Plan Leadership Principle Multidisciplinary Meetings Daily Training & Development (Human Resources)	Learning Capability			✔	✔	✔
	Operational Capabilities	Standalone Capability				
Supplier Selection Supplier Relationship Supplier Evaluation	Supplier Management Capability			✔	✔	
Lead time Just in Time (JIT) Total Productive Maintenance (TPM) Total Quality Management (TQM) Environmental, Health, and Safety (EHS)	Operational Efficiency Capability			✔	✔	✔
Development and Implementation of News Machinery and Equipment Development of News Process	Innovation Capability			✔	✔	
Customization Lithography Deadline for Delivery Manufacturing Cell Production Scheduling	Flexibility Capability			✔	✔	✔
Customer Relationship Responsiveness Service Level Agreement	Customer Support Capability			✔	✔	✔

* I - interviews; D – documentation; O – observation

4.1.5 Cross-case analysis

We find similarities and differences in case Label_Case, Flexi_Case, Paper_Case, and Metal_Case. Among the similarities found that 1) management focused on results; 2) decision making based on indicators; 3) use bundles of operational practices to develop operational capabilities; 4) use of robust and sophisticated operating systems, but complemented by Excel spreadsheets; 5) former, expert, and dedicated employees; 6) training constantly, usually performed by employees with more experience; 7) employees who learn by doing; 8) continuous improvement in operational processes; 9) creation of tools and equipment to adjust to new processes; 10) concern for customer satisfaction; 11) preventive maintenance continues; 12) time to market the firm. This set of factors involves time and investment in financial, human and physical resources, and somehow are related to the development of operational capabilities.

The following differences were observed: 1) Metal_Case and Paper_Case have a closer relationship with its suppliers. Label_Case and Flexi_Case have a more difficult relationship with suppliers, because a large part of the raw material is imported. 2) Label_Case and Metal_Case, have principles of leadership that make a difference in the implementation of operational practices in maintenance. However, Flexi_Case and Paper_Case leadership is not as explicit, although the commitment of the employees with the activities has been established. 3) Label_Case, Flexi_Case, and Metal_Case have a high level of (work safety) and a low tolerance for accidents. Paper_Case, despite having safety standards, it is still seeking excellence in this area. 4) Flexi_Case and Paper_Case have an operational physical structure that favors the customization of products. Label_Case and Metal_Case compensate for the absence of customization with flexible processes. Finally, Label_Case and Flexi_Case, have a multinational structure, with many plants that encourages innovation and benchmarking of best operational practices. The heterogeneous knowledge is generated and transferred much more quickly, giving them advantage over their competitors. Paper Case and Metal_Case have other plants and benchmarking of best operational practices. But, knowledge is more homogeneous because the plants are Brazilian, and despite having advantage over their domestic competitors, they do not achieve the same level of competitiveness compared to global markets. The description of the operational practices and operational capabilities are described in Table 26.

Table 26– Relationship between operational practices and operational capabilities by cases

Operational Practice	Label_ Case	Flexi_ Case	Paper_ Case	Metal_ Case	Operational Capabilities
Kaizen	*	*			Continuous Improvement Capability
Thank you	*				
Loop	*				
Root cause of the problem	*	*		*	
Matrix Cost-Cutting Processes		*			
Cost Out			*		
RAP - Risk Analysis for Prevention			*		
Tree Diagram			*		
Simplification Project				*	
Waste Management Teams				*	
Leadership Principles	*			*	Learning Capability
Action Plan	*	*	*	*	
Management of Change (MOC)	*				
Managing for Daily Improvement (MDI)	*	*	*	*	
Training & Development Plan	*	*	*	*	
Eight Disciplines of Problem Solving (8D)		*			
Plan–do–check–act (PDCA)			*		

To be continued

Operational Practice	Label_ Case	Flexi_ Case	Paper_ Case	Metal_ Case	Operational Capabilities
Forecast	*	*	*	*	Information Management Capability
Objectives, Goals, Strategies and	*				
Measures	*				
Key Performance Indicator (KPI)	*	*	*	*	
Visible Management System (VMS)	*	*	*		
A3 Practice	*				
Material Requirements Planning (MRP)		*			
Sales and Operational Planning (S&OP)		*			
Manual Control of Information (Logbook)			*		
Operational Manager Report				*	
Supplier Selection	*	*	*	*	Supplier Management Capability
Supplier Relationship	*	*	*	*	
Supplier Evaluation	*	*	*	*	
Lead time	*	*	*	*	Operational Efficiency Capability
Just in Time (JIT)	*	*	*	*	
Total Productive Maintenance (TPM)	*	*	*	*	
Total Quality Management (TQM)	*	*	*	*	
Environmental, Health, and Safety (EHS)	*	*	*	*	
Development and Implementation of New Machinery and Equipment	*	*	*	*	Innovation Capability
Development of New Processes	*	*	*	*	
Customization (part of product)	*			*	Flexibility Capability
Scheduling by Product Category	*		*		
Small Batches	*	*	*		
Flexibility of Machines		*	*		
Flexibility of Delivery		*		*	
Flexibility of Raw Material		*	*		
Production Scheduling			*	*	
Manufacturing Cell				*	
Process Modularity		*			Customization Capability
Product Modularity		*			
Customization on a Large Scale			*		
Product Variety			*		
Quick Response for Customization			*		
Responsiveness	*	*	*	*	Customer Support Capability
Customer Relationship	*	*	*	*	
Service Level Agreement	*	*	*	*	

4.1.6 Discussion and propositions

Theoretical framework has shown that operational practices are not operational capabilities. Operational practices are "standardized procedures that are easy to articulate and well-defined" (Wu et al., 2012, pp. 123). The purpose of a practice is easily identified. For example, TQM consists of a set of practices that aims to achieve a high level of quality in processes and products of the firm (Dean & Bowen, 1994; Hackman & Wageman, 1995; Powell, 1995). JIT, in turn, is focused on reducing and eliminating all forms of waste (Brown & Mitchell, 1991; Montabon et al., 2007). Both TQM and JIT are generic operational practices and readily observable. They are shaped by a standardized structure, explicit content, and predefined activities. An operational practice is ready for use as soon as the decision maker decides to implement it. JIT, for instance, is usually represented by time reduction of set-up, pull production system, JIT delivery by suppliers, layout of equipment, and adherence to the daily schedule (Mackelprang & Nair, 2010; Matsui, 2007; Montabon et al., 2007). This set of structured activities simplifies the implementation of operational practices and promotes their transfer among firms.

On the other hand, operational capabilities are "firm-specific sets of skills, processes, and routines, developed within the operations management system that are regularly used in solving its problems through configuring its operational resources" (Wu et al., 2010, pp. 726). They are unique and idiosyncratic, and are subject to a high level of complexity and causal ambiguity. Its trajectory is path dependent, and can be affected by the experience of the firm, research and development, imitation, and decision making (Rockart & Dutt, 2015). Embedded in routines and operational processes, operational capabilities need time, management attention, and continuity in the use bundles of operational practices. Differently from operational practices, the operational capabilities cannot be implemented, they emerge gradually over time, based on the experience, unique history of the firm, and problems that decision makers have had to face. The time spent for the development of a capability will depend on just how it is heterogeneous, and the firm's learning ability. Table 27 summarizes the differences between operational practices and operational capabilities.

Table 27– Differences between operational practices and operational capabilities.

Operational Practices	Operational Capabilities
Generic	Unique
Ready for use	Path dependent development
Standardized	Idiosyncratic
Explicit	Tacit
It involves knowledge	It involves learning
Simple	Complexity

Practices can be important drivers of high performance in today's manufacturing environment, but investments in practices, per se, do not constitute capabilities. The development of a capability consists of practices-performance inter-linked to specific performance gains (Narasimhan et al., 2005). When an operational practice is implemented, over time, this practice ceases to be generic and explicit; it acquires tacit aspects, and becomes unique. Table 28 shows the transition between operational practices and operational capabilities.

Table 28–Relationship between operational practices and operational capabilities

Operational Practices:	Evidence (interviewed)	Operational Capabilities
Kaizen	ELS manager, "In the beginning with 80 employees, we produced 4 million per square meters. After the application of Kaizen, our capacity doubled with the same number of employees."[Label_Case]	Continuous Improvement Capability
Matrix Cost-Cutting Processes	WCOM coordinator in Latin America, "If the problem is the loss of plant material, which is really the biggest cost that we have, we will implement a scrap project."[Flexi_Case]	
Training & Development Plan	R&D manager, "You will always be trained in practice daily, you will receive guidance from someone with a superior position to him. [...] This is a feature of the paper factory."[Paper_Case]	Learning Capability

To be continued

Operational Practices:	Evidence (interviewed)	Operational Capabilities
Managing for Daily Improvement (MDI)	Maintenance manager, "We have a daily meeting, with all departments. [...] We have a wide vision of the firm. [...] We discuss performance and difficulties day to day". [Metal_Case]	
Key Performance Indicator (KPI)	Production manager, "from the numbers we can see what happened, look at the report and take actions to combat the problem." [Metal_Case]	Information Management Capability
Manual Control of Information (Logbook)	Industrial director, “An information system is only complete when the data is integrated and used to continuously improve the production process.”[Paper_Case]	
Supplier Evaluation	Purchasing manager, "by the standard of ISO 9000, we are required to have an evaluation system of our suppliers with active items." [Label_Case]	Supplier Management Capability
Supplier Relationship	PCP coordinator, "[...] the supplier realized that if it improved our efficiency, we would increase consumption also [...]".[Paper_Case]	
Total Quality Management (TQM), Environmental, Health, and Safety (EHS)	Safety manager, “if we have standards for safety as well as TQM [...] we begin to have predictability [...]. It is difficult to measure but it helps in our productivity, low variability, less returns, less claims, and more satisfied customers."[Label_Case]	Operational Efficiency Capability
Total Productive Maintenance (TPM)	Maintenance manager, "We analyze the equipment, define points of maintenance, monitor performance, and monitor the functioning of the machines."[Metal_Case]	
Development of New Processes	Industrial manager "The guys are four or five years ahead of the market So, we have a center for engineers in the United States just doing it, just helping us, just for us proposing new structures, new projects, and new processes." [Flexi_Case]	Innovation Capability
Development and Implementation of New Machinery and Equipment	R&D manager "when we launched the expanded paint tin, we built a production line to manufacture it, [...] the line was fully automated." [Metal_Case]	
Flexibility of Delivery	Purchasing manager, "We have flexibility and speed to meet the specific needs of our customers while maintaining a good quality."[Paper_Case]	Flexibility Capability
Manufacturing Cell	Production manager, “Every week I choose a different machine for my employee to work.” [Metal_Case]	
Process Modularity and Product Modularity	Production manager "Chocolate cookie, you know? Yeah ... The guy sells a cement unit; [...] it will be able to have accuracy, like, 95%. It does not exist in the packaging market The guy will have accuracy in it of 50%, 70%. Normally, the volume is correct. For example, the X firm always buys between 15 and 20 tons per month. Volume is correct, but what products will it buy. If it will be chocolate or strawberry toast, it varies." [Flexi_Case]	Customization Capability

To be continued

Operational Practices:	Evidence (interviewed)	Operational Capabilities
Product Variety	PCP coordinator, "We call it flow. Each color change we have a seven-washing flow." [Paper_Case]	
Customer Relationship	ELS manager, "We went to a customer to work with them on the setup. Before, the setup was 1 hour and 10 minutes, but after our work, it was down to 30 minutes. We increased their productivity by 30%." [Label_Case]	Customer Support Capability
Service Level Agreement	SAC manager, "The after-sales assistance is a differential of the firm." [Paper_Case]	

Kaizen practice is an example of interaction between operational practice and operational capability (see Table 28). Kaizen is a set of practices that allows continuous improvement of manufacturing processes. Employees are trained to lead their own projects. In the case Label_Case, one of the projects involving Kaizen was Quick-Change Tool, also called Single Minute Exchange of Die (SEMED). After the realization of the Kaizen, the firm has reduced setup time, increased the speed of the machines, and implemented best maintenance practices. Implementation of these bundles of operational practices, over time, has enabled improvements in the production process, impacting positively on Label_Case's performance. ELS manager said, "Our capacity doubled with the same number of employees."

Operational practices take time to be effective and achieve its final shape. When an operational practice is in fact implemented and is in use, it goes through a process that is path dependent, which caused evolution in it. An operational practice, five years later is not the same practice when it was implemented; several other elements are incorporated into it over time, such as tacit aspects, idiosyncratic decisions, and learning, among others. Its complexity increases as a result of combination of different operational practices interacting with each other. Table 29 shows how time is an important factor for the development of operational capabilities.

Table 29– Firm Experience

Firm	Operates (years)	Job position	Argument
Label_Case	> 60	Sales manager	The company needs time to access the level of capability. We have over 60 years experience in the market
		Production manager	We are evolving over time. However we need to continue this process of evolution, to reach the optimal level. To achieve this we have invested in training.
Flexi_Case	> 60	Industrial director	In fact, this industry, it has developed over the years. This firm has a strong international expertise, and time to market
		Paints Manager	We realize that our competitors have not reached the level that we are. Firm needs time, strategic planning, management methodologies, and leadership.
Paper_Case	> 125	Export Manager	We have tradition. We are a factory of 124 years. We have a soled reputation. We have experience and respect of our customers. We have achieved this over time.
		Production manager	Our employees are old. They have a lot of experience because they are with us for long time.
Metal_Case	> 60	Production manager	Our difference is the level of knowledge of employees (most with more than 15 years). We create an internal environment that promotes the innovation over time.
		Sales manager	We are better than our competitors. This was a long-term work. There is a distance between us and them, in quality, delivery speed, and customer service. Competitors talk a lot about it: - One day I'll be Metal_Case.

Operational practices also are not exactly the same in every firm. They can change type, different practices can lead to the same result; name, the same operational practices may have different names; and structure, operational practices can use different protocols, tools, techniques, and other ways of doing things (Wu et al., 2012). For instance, Total Quality Management (TQM) is a practice made up of a sub-set of practices; they are used as the firm's goals. Powell (1995) argues that TQM is an integrated management philosophy that adds a set of practices that emphasize reducing rework, measurement of results, and reducing costs, among others. Our four cases analyzed showed the presence of TQM practices, but each firm presented its own way to operationalize it (see Table 30).

Table 30 – Operational practices and Total Quality Management

Total Quality Management (TQM)			
Label_Case	**Flexi_Case**	**Paper_Case**	**Metal_Case**
5 S	Certifications	Certifications	Audit
Control and Tracking of the Quality	Committee Product Quality Problems	Environmental Management	Certifications
House of Quality Practice	Machine Warning Mechanisms	Hazard Analysis and Critical Control Points (HACCP)	Product Traceability
Monitoring of Buyer Satisfaction	Non-Compliance Report	House Keeping and 5S	Quality Assurance
Process Management	Process Management	Measuring Equipment	Quality Control
Product Management	Product Management	Process Management	Quality of Raw Material
Quality Function Deployment (QFD)	Product Quality	Product Management	Quality Process
Quality Culture	Quality Test	Quality Analysis of Raw Materials	Quality Product
Quality Response to Buyer	Raw Material Quality	Reuse Scrap	Quality Service
Raw Material Quality	Traceability	Test Sample	Reliability
	Visual Control of Worker		

Table 30 shows that TQM is formed by bundles of inter-linked practices. So, if a firm only uses the 5S practice, it is not complete TQM. However, by including other operational practices related to quality, it can be said that its production process uses TQM.

The same applies to the development of an operational capability. "One swallow does not make a summer". A single operational practice will not be enough to develop an operational capability. Individually they are inconsistent (Benner & Tushman, 2003), but in conjunction with other operational practices, such as Lead Time, JIT, TQM, TPM, among others, they may facilitate the development of operational capabilities. For this to happen, operational practices need time, favorable environment, employee experience, and intensive and continuous use. The logistics manager of Flexi_Case reports that "My product must be in the customer's hand on the first day of the month, then I need to consider raw material, lead time, production scheme, transport [...] it is not one thing or another", and the production manager reinforces "all practices are applied to improve the performance of the firm." Thus we present the first proposition:

Proposition 1 – Different sets of inter-linked operational practices over time can develop into different operational capabilities in each firm.

However, not all operational capabilities are equal. From the coding of the four cases examined in this study, our results showed that operational capabilities have different functions. Some have the role of increasing the performance of the firm, while others reinforce, modify or reconfigure these first. We summarize them in two major categories: Standalone Capabilities and Across-the-Board Capabilities (see Figure 16).

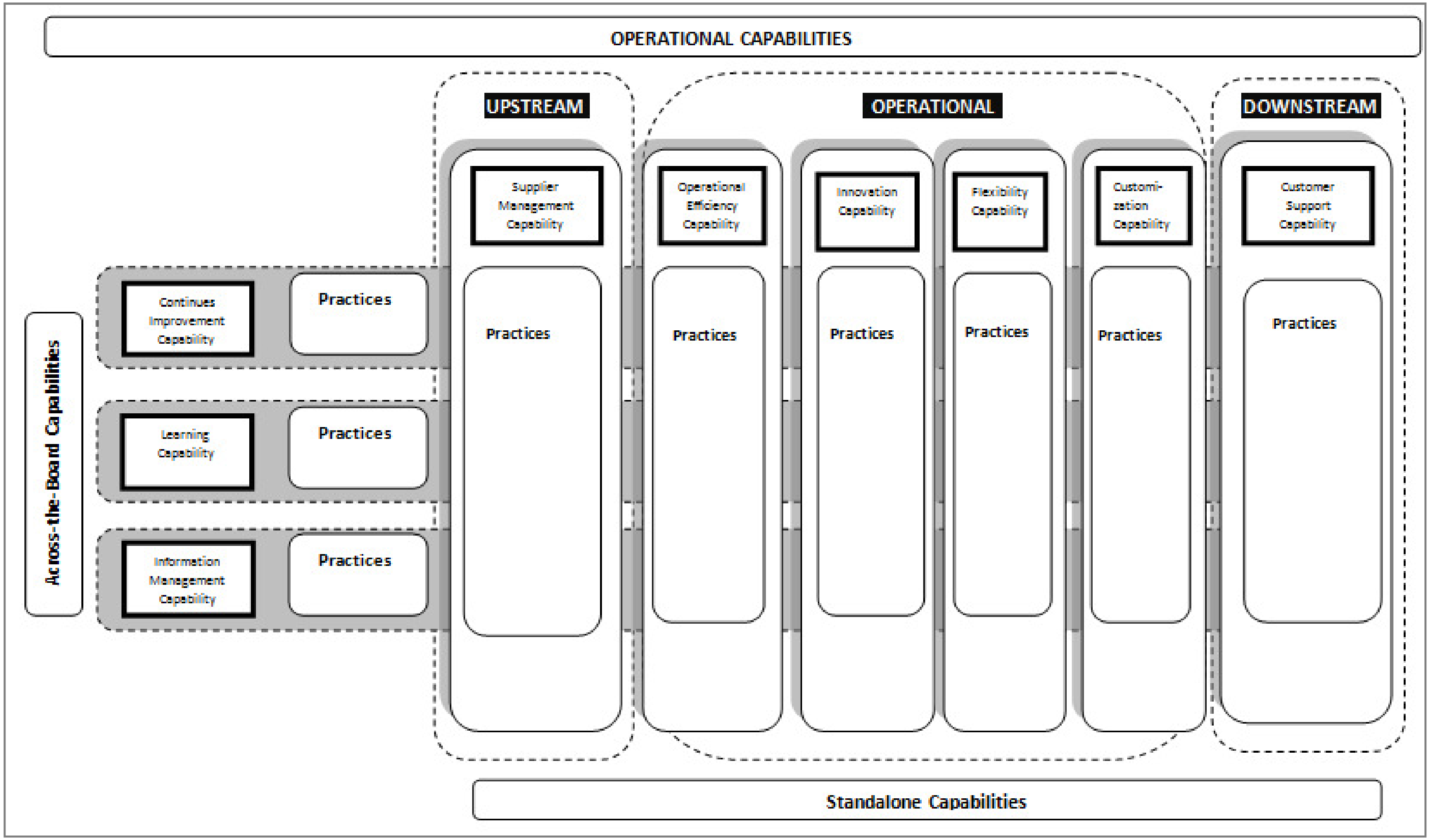


Figure 16 – Operational Management Capabilities Model

Standalone Capabilities are also called, zero order, substantives, ordinaries, or zero order capabilities (Schilke, 2013; Zahra et al., 2006; Zollo & Winter, 2002). All these names, however, are merely semantic; since they have the same meaning with same goal, improve the performance of the firm. They are operational capabilities that reconfigure the organizational resource base (Collis, 1994; Schilke, 2013; Zollo & Winter, 2002). Standalone Capabilities have as purpose to solve problems, achieve results, and develop new products through configuring its operational resources (Wu et al., 2010; Zahra et al., 2006). They are established from the operational function of the firm representing “how you earn your living” (Cepeda & Vera, 2007, pp. 426).

In the four cases analyzed, Label_Case, Flexi_Case, Paper_Case, and Metal Case, we have identified: Supply Management Capability, Operational Efficiency Capability, Innovation Capability, Flexibility Capability, and Customer Support Capability. Customization Capability was found only with Flexi_Case and Paper_Case. Standalone Capabilities may differ among firms; its development depends on the industry in which it operates and the customers they serve. For instance, Paper_Case and Flexi_Case operate in a dynamic market, with constant requests of their clients, in the great majority multinationals. They need to adapt their production process and develop specific capabilities such as flexibility and customization to be able to meet the needs of their customers. On the other hand, Label_Case and Metal_Case operate in a more traditional market, and if on one side, their production processes are more predictable, on the other, they need to focus on Innovation Capabilities and Operational Efficiency Capability to continue as market leaders. However, independent of the type of Standalone Capabilities that the firm presents, its basic characteristic is to achieve specific results of operations;

therefore, they have a direct relationship with performance. Considering the context, we formulate the second and third propositions:

Proposition 2 – Standalone Capabilities are operational capabilities adapted to the firm's operational needs and focused on performance.

Proposition 3 –Standalone Capabilities include of Supply Management Capability, Operational Efficiency Capability, Innovation Capability, Flexibility Capability, Customization, and Customer Support Capability.

Across-the-Board Capabilities are first order capabilities; they have direct and indirect influence on the development of new capabilities (Schilke, 2013; Zollo & Winter, 2002). Across-the-Board Capabilities are capability combinations able to reconfigure current operational capabilities, and at the same time to help the development of others (Collis, 1994; Eisenhardt & Martin, 2000; Teece et al., 1997; Zahra et al., 2006). They represent "how you change your operational routines" (Cepeda & Vera, 2007, pp. 426).

When we analyze the interviews for this study, we noticed that some operational capabilities encompassed other capabilities supporting their development. They were called Across-the-Board Capabilities. In total, three of them were found: Continuous Improvement Capability, Learning Capability, and Information Management Capability (see Figure 16).

Across-the-Board Capabilities contribute to the development of Standalone Capabilities. For instance, when the KPIs were classified as belonging to the

Information Management Capability, we observe their presence in different Standalone Capabilities. According to the Flexi_Case production manager "Each department has their own indicators. [...] in the meetings each department talks about their indicators. If the department is with some poor indicator, it needs to open an action plan. The department needs to create a strategy to achieve its target."Decision makers use information to direct or redirect their decisions, and this will affect the shape of other operational capabilities. For example, if the level of service's KPI is below the target, and one of the problems is the lack of flexibility in product delivery, managers will have to find solutions to meet this demand. By measuring the customer service level, indirectly Information Management Capability will influence Flexibility Capability. Across-the-Board Capabilities can contribute to the output through its moderating function between Standalone Capabilities and performance (Helfat & Peteraf, 2003).

Across-the-Board Capabilities are present in different Standalone Capabilities. They have the role of helping develop the Standalone Capabilities. This classification into two different groups allows us to combine variables such that the effects of the interactions between them can be analyzed (Bailey, 1994; Doty & Glick, 1994). Table 31shows presence of Across-the-Board Capabilities in Standalone Capabilities. The highlight is for Operational Efficiency Capability with more intersections. This operational capability is composed of practices such as Lead time, JIT, TPM, TQM, and EHS, which aim for continuous improvement, learning, and information management, creating a logical relationship among the variables. We emphasize also relationship among Across-the-Board Capabilities and Customer Support and Supplier Management in Table 31 Based on this; we suggest the fourth and fifth propositions.

Table 31 – Relationship between Across-the-Board Capabilities and Standalone Capabilities

CAPABILITIES			Standalone Capabilities					
			Customer Support	Flexibility	Innovation	Operational Efficiency	Supplier Management	Customi-zation
Label_Case	Continuous Imp.	Across-the-Board Capabilities	6	0	0	18	0	-
	Information M.		3	4	1	50	18	-
	Learning		1	0	0	24	1	-
Flexi_Case	Continuous Imp.		6	2	3	27	1	1
	Information Mg.		13	4	1	53	12	1
	Learning		9	1	8	36	0	0
Paper_Case	Continuous Imp.		1	0	1	5	1	0
	Information Mg.		10	12	2	46	6	5
	Learning		19	14	7	53	15	1
Metal_Case	Continuous Imp.		0	1	0	6	1	-
	Information Mg.		11	0	1	25	6	-
	Learning		9	6	2	21	2	-

Proposition 4 – Across-the-Board Capabilities influence the development of Standalone Capabilities.

Proposition 5 –Across-the-Board Capabilities include Continuous Improvement Capability, Learning Capability, and Information Management Capability.

Across-the-Board Capabilities are composed of best practice bundles. They are developed over time, using learning mechanism as path dependence (Anand, Ward, Tatikonda, & Schilling, 2009; Eisenhardt & Martin, 2000) and are influenced by the dynamism of the market (Teece et al., 1997). This means that, as well as the Dynamic Capabilities, Across-the-Board Capabilities are capability combinations, able to exploit current operational capabilities, and at the same time support the development of other operational capabilities (Collis, 1994; Eisenhardt & Martin, 2000; Teece et al., 1997; Zahra et al., 2006).

Table 32 shows how Across-the-Board Capabilities can be characterized as Dynamic Capabilities. In the four cases analyzed we have identified the same Across-the-Board Capabilities: Continuous Improvement Capability, Learning Capability, and Information Management Capability. Although they are equal, each capability presents its own development of maturity within the analyzed cases.

Table 32 – Relationship between Across-the-Board Capabilities and Dynamic Capability

Operational Capabilities	Firm	Argument
Continuous Improvement Capability	Label_Case	All processes can be improved, we always think: what if instead of doing it now, I did in another step. Let's test. It is ever changing, since I'm here at the firm, I think this is the 3rd or 4th different process of product development. Each change affects different departments and their routines. [*Manager PTI Brazil*]
	Flexi_Case	Next year will be better than this. So, next year we will be seeking to improve. We always seek continuous improvement. [...] We always have stricter goals and objectives. It impacts on production in general [...] in various processes (practices) that serve different departments. [*Continued Improvement Coordinator*]
	Paper_Case	We are working to have a culture of maintenance. We need to plan and analyze the plant through proper engineering maintenance, but I am not speaking only of investment engineering, I am talking about improving equipments/machines. Study the equipment and check where is failing and promote an improvement to that equipment/machine. [...] When there is a corrective action to maintain, we need to investigate, because it was a failure on preventive maintenance. [...] There are improvement actions so the problem does not happen again. Usually these problems are generated because the processes change rapidly, and the machines do not change at the same speed.[*Maintenance Manager*]
	Metal_Case	We have an improvement project. How it works: employee sends an idea for the project. There is a selection, a vote etc., and every six months we do a party to celebrate. In this party we award the best ideas that have brought economic results for the firm. For example, one of the winning ideas was mine. I created a feeder that eliminated the employee's physical effort to handle the raw material and put in the machine. We created an automatic feeder. This idea was awarded because besides the ergonomic, we decreased the waste of raw material. [*Production Coordinator*]
Learning Capability	Label_Case	We have a training matrix. Each department (quality, maintenance, production, etc.) indicates their training for human resources. These trainings are monitored. We have goals. [...] Our training (quality) are chosen according to Pareto complaints, and are usually performed along with production training. [...] We need to train, train, and train, employees must create a history of what needs to be done. [*Quality Manager*]
	Flexi_Case	Each pillar (progressive quality, planned maintenance, autonomous management, logistics, security, environmental sustainability, anticipated product management, and education and training) has its projects demand. Reduce time inventory, reduce lead time of a product, or reduce lead time of a whole process. Each plant will create their projects. [...] If problems happen in these projects, we create a plan of action to solve it. Sometimes it involves different departments. If the problem persists, we use a tool called 8D, which is basically a PDCA. We use quality tools, cause and effect, and 5 Whys. If even so, the problem still has not been solved, we open a four-month project using other tools. [*Continued Improvement Coordinator*]
	Paper_Case	We participate in the daily meeting. We finished a meeting now. These meetings involve production, quality, maintenance, and occupational safety. We talked about what happened the day before. Each sector brings a list of open notes (problems) of the four machines. Every day we discuss the open notes [...]. In these meeting we also define what is urgent. Everything that is urgent needs to be solved immediately. When the

		problem is not urgent, we have a weekly schedule. It is a list discussed at the meetings. [*Production Supervisor*]
	Metal_Case	We are very charged for efficiency and quality. But this is the result. To achieve this result we need a work team that shares our thoughts, that fights together. I think this is an important point. It is essential you engage people to get the results that the firm needs, and show the importance of it to them. Look, we strive and the results are these. For example, our scrap is low, we reached the target, but it is not achieving the target by target, employees need to feel valued. [*Production manager*]
Information Management Capability	Label_Case	Earlier this year OEE indicator of the V6machine was 40%. I met my team and said: What do we need to do to improve performance of this machine? [...] As only OEE was measured. [...] It was hard to know the problem of the machine. Today, we have a meeting every Thursday, specifically to talk about the productivity of the V6machine. [...] Instead of looking only at OEE indicator, which is the macro indicator, we decided to detail this indicator in three components: Speed, quality, and number of stops [...] Today V6 machine's performance is approximately 60%. [*Production manager*]
	Flexi_Case	We have a meeting to discuss our indicators. Production indicators, volume, rework, cleaning, inspection, lubrication, and absence of overtime, among others. Each department has their own indicators. […] At this meeting each department talks about a lot of indicators. If the department is with some poor indicator, it opens an action plan. The department needs to create a strategy to achieve its target All indicators and their faces are shown in panels throughout the firm.[Production manager]
	Paper_Case	We always monitored overall efficiency. Overall efficiency is our guide. I know how many tons we produced, or failed to produce. For example, if I am producing white paper, [...] I need to produce forty thousand tons. On the other hand, if I am producing colored paper, my number of production is approximately ten, twelve tons. My guide is always overall efficiency. Because it shows everything to me. When looking at overall efficiency at the same time I'm looking at time, production, and product indicators. If my overall efficiency is on target, that's fine, but if it declines, I need to be alert. What is problem? Time, production or product.[Production manager]
	Metal_Case	Today I know what each employee produces, and the result that he has given. I have a working team to give me support. Among them we have engineers and interns. Today there is an intern daily analyzing the production process. If a problem is identified, quickly we try to solve it. If an indicator is below 70%, I need a plan of action. […]This is our spreadsheet of indicators; it is reviewed daily in a meeting that involves different departments. [Production manager].

Continuous Improvement Capability in Label Case, Flexi Case, and Metal Case is based on systematic programs of continuous improvement, such as Kaisen, WCOM, and Simplification Project. Employees are instructed on the procedures and steps of each project related to continuous improvement. All projects have similar characteristics; they are focused on problem solving and reduce operational costs. Although Paper_Case does not have a structured program for continuous improvement, it develops actions to improve operational efficiency. Continuous improvement process is related to the firm's learning ability.

Continuous improvement is a first order capability that operates on the firm’s zero order capabilities, improving them continuously (Collis, 1994; Zollo & Winter, 2002). It is defined as a systematic effort which seeks to find new ways that improve operational process, creating and modifying routines that increase efficiency of the firm (Anand et al., 2009; Zollo & Winter, 2002). When properly implemented, it helps to integrate, adapt, or change its operational processes. Continuous Improvement Capability was identified by reinforcing and modifying the structure of other operational capabilities in the four cases examined. We realized that this happened because the firms had operational practices that encouraged knowledge, learning, and managers willing to build a culture of continuous improvement.

Learning Capability was observed in all four cases, Label Case, Flexi_Case, Paper_Case, and Metal_Case. These firms have operated a long time in the market for at least 60 years or more. They have old and experienced employees that constantly promote both formally and informally learning. Informal learning occurs through the exchange of information between employees, considering firms to have workers together for a long time. Formal learning occurs through meetings, training, action plans for solving the problems, and management tools. The leadership has also been observed as an important mechanism for learning. It allows the exchange of information among employees, promoting learning among them.

Learning Capability is a first order capability that helps to develop on the firm's zero order capabilities. It constitutes the firm's systematic methods for modifying operational practices and routines, and can be thought of as 'learning-to-learn' (Collis, 1994; Zollo & Winter, 2002). It is developed over time through the employees' knowledge accumulation. Operational practices create mechanisms that promote knowledge. They help employees understand the processes of the firm and develop effective routines for their activities. Another mechanism of learning is small errors. They force employees to pay more attention to processes, contributing to their experience and accumulation of knowledge (Eisenhardt & Martin, 2000; Kogut & Zander, 1992). Knowledge happens through cross-functional interaction between areas (Paiva et al., 2008). It needs to be generated, transferred, and learned by employees (Kogut & Zander, 1992).

Learning Capability connects external and internal knowledge, involves information systems, research and development, and the intensive use bundles of operational practices. According to Eisenhardt & Martin (2000, pp. 1114), "Learning mechanisms guide the evolution of dynamic capabilities." Therefore, coevolution of learning mechanism leads to the dynamic capability (Teece et al., 1997; Winter, 2003; Zollo & Winter, 2002)

Information Management Capability has great influence on the development of Standalone Capabilities. Performance indicators help managers monitor their processes and identify bottlenecks in production. Label_Case and Flexi_Case use a structured methodology to present their indicators. They have panels in different parts of the firm, including the production, with updated data of the indicators and targets. Anyone can visualize the progress of indicators, and check whether they are inside or outside the targets. Indicators have the role of monitoring the partial and overall results of the firm. Metal_Case and Paper_Case also have indicators, but they are not presented in a systematic way. Each department is responsible for its indicators; there is no dissemination of the indicators in the internal environment of the firm, which means that not all employees know them.

Information Management Capability is also a first order capability that supports the changes in the firm's zero order capabilities (Collis, 1994; Zollo & Winter, 2002). The system of information is part of the intricate chain of assets and capabilities (Wade & Hulland, 2004). It integrates the complexity of the production process (Wu et al., 2010). It generates information that can be transformed into knowledge, benefiting Learning Capability and Continuous Improvement Capability. Dynamic Capabilities as well as the Information Management Capability uses real-time information, such as inventory, sales, and production schedules to reconfigure the resources of the firm. This information helps managers in decision making, in rapid problem solving, and to better understand the production process, adapting it to market changes (Eisenhardt & Martin, 2000). However, information is affected by the quality, quantity, and context. Thus, it requires real inputs, so that its output can help to develop other operational capabilities. Information Management Capability will seldom contribute directly to sustained competitive advantage; it is part of a complex chain of assets and other capabilities that can be achieve sustainable performance (Wade & Hulland, 2004).

Across-the-Board Capabilities consist of Continuous Improvement Capability, Learning Capability, and Information Management Capability. All of them are meant to be the Dynamic Capability (Anand et al., 2009). Table 33 shows the number of sources, representing the respondents, and the number of references, indicating how many times a capability was observed by case.

Table 33 – Sources and reference of Across-the-Board Capabilities

Across-the-Board Capabilities	Label_Case		Flexi_Case		Paper_Case		Metal_Case	
	Sources	**References**	**Sources**	**References**	**Sources**	**References**	**Sources**	**References**
Continuous Imp.	13	65	15	76	5	17	8	63
Learning	19	251	16	152	14	146	15	164
Information Manag.	21	231	18	187	14	113	11	129

Using Across-the-Board Capabilities the firm can analyze, improve, or even change their practices and operational routines continuously. This means that Across-the-Board Capabilities have a direct effect on Standalone Capabilities and indirect in the performance of the firm. Based on this, we present the sixth proposition:

Proposition 6– Across-the-Board Capabilities are Dynamic Capabilities.

Whether capabilities is or is not present is only the first part of the question. Label_Case, Flexi_Case, Paper_Case, and Metal_Case have both Across-the-Board Capabilities and Standalone Capabilities, but not at the same level of maturity. This happens because different factors can interfere with this process. For example, market dynamics is a factor that influences the development of certain capabilities (Eisenhardt & Martin, 2000). Changes in moderately dynamic markets alter the production process of the firm, which needs to adapt to what the industry is demanding. So, a capability may be more important in certain contexts than others (Schilke, 2013).

Even operational capabilities being considered an internal resource per firm, developed through implementation bundles of operational practices, employee training, investment in new machinery, and others, they are also influenced by competitors' initiatives, normative changes, scientific discoveries, etc. Then, a firm can use exploration for new possibilities that are present in the market, and at the same time, adequately and efficiently exploitation of internal resources can generate an advantage over its competitors in the development of future operational capabilities that are being indicated by the market (March, 1991; Zollo & Winter, 2002). What we can observe is that the operational capabilities are different in their type and level. Table 34 and Figure 17 show the observed variability of operational capabilities. However, we note that Figure 17 does not represent the intensity or importance of operational capabilities in the cases analyzed (for this see Table 35 and Table 36), it shows just how many times the operational capabilities were coded, suggesting a variability.

Table 34– Source and reference of Standalone Capabilities

Operational Capabilities	Label_Case		Flexi_Case		Paper_Case		Metal_Case	
	Sources	References	Sources	References	Sources	References	Sources	References
Continuous Imp.	13	65	15	76	5	17	8	63
Learning	19	251	16	152	14	146	15	164
Information Manag.	21	231	18	187	14	113	11	129
Supplier Manag.	15	234	13	143	12	242	14	301
Operat. Efficiency	20	509	17	363	17	432	17	449
Innovation	9	81	14	62	9	34	13	86
Flexibility	9	52	12	42	11	117	7	76
Customization	-	-	9	47	11	89	-	-
Customer Support	16	87	15	132	15	233	15	200

NVivo

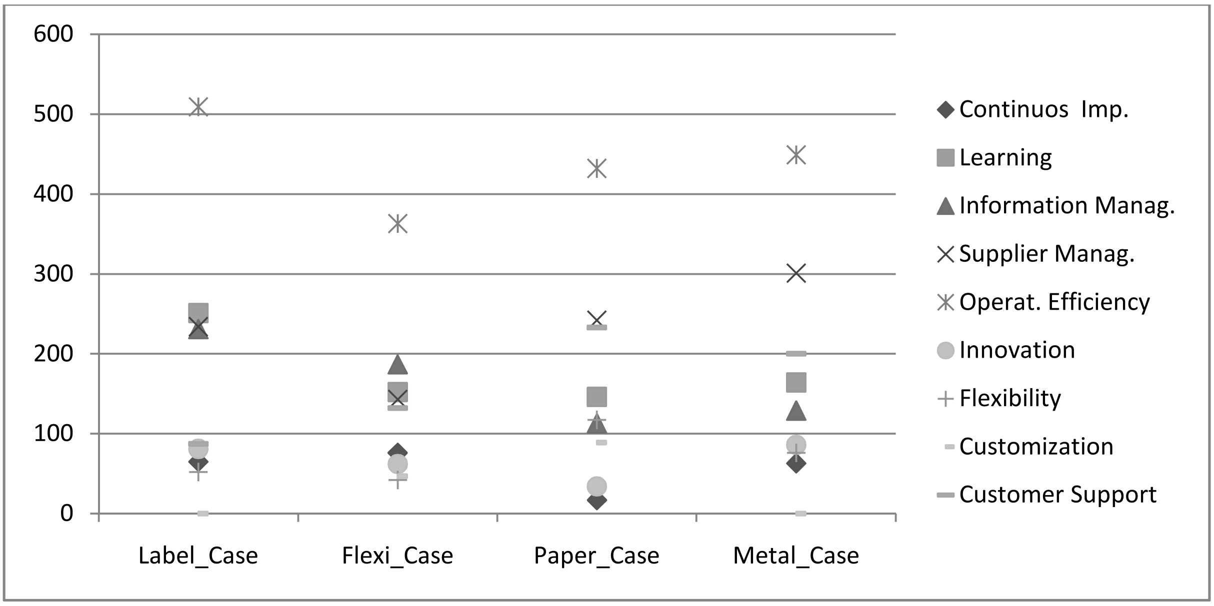


Figure 17– Development levels of operational capabilities

In addition, we analyze the strength in which each capability was identified in each firm (see Table 35 and Table 36).

Table 35 – Level Operational Capabilities

Operational Capabilities	Firm	Evidence* I*	D*	O*	Summary	Level
Continuous Improv. Capability	Label_Case	✔	✔		Continuous improvement program - Kaisen and Managing for Daily Improvement (MDI)	High
	Flexi_Case	✔	✔		Continuous improvement program – Kaisen and Managing for Daily Improvement (MDI) - Beginning	Medium
	Paper_Case	✔	✔	✔	Managing for Daily Improvement (MDI)	Medium
	Metal_Case	✔	✔		Continuous improvement program - Simplification Project and Managing for Daily Improvement (MDI)	High
Learning Capability	Label_Case	✔	✔	✔	Managing for Daily Improvement (MDI), Training & Development Plan, and Action Plan	High
	Flexi_Case	✔	✔	✔	Managing for Daily Improvement (MDI), Training & Development Plan, and Action Plan	High
	Paper_Case	✔	✔		Managing for Daily Improvement (MDI), Training & Development Plan, and Action Plan	High
	Metal_Case	✔	✔	✔	Managing for Daily Improvement (MDI), Training & Development Plan, and Action Plan	High
Informat Manag. Capability	Label_Case	✔	✔	✔	Operational indicators (detailed) and visual indicators system	High
	Flexi_Case	✔	✔	✔	Operational indicators (detailed) and visual indicators system	High
	Paper_Case	✔	✔	✔	Global indicators	Low
	Metal_Case	✔	✔	✔	Operational indicators (detailed)	Medium
Supplier Manag. Capability	Label_Case	✔	✔		Approval, monitoring, and evaluation	High
	Flexi_Case	✔	✔		Approval	Low
	Paper_Case	✔	✔		Approval	Low
	Metal_Case	✔	✔		Approval, monitoring, and evaluation	High
Operational Efficiency Capability	Label_Case	✔	✔	✔	Daily control of operational indicators	High
	Flexi_Case	✔	✔	✔	Daily control of operational indicators	High
	Paper_Case	✔	✔	✔	Daily control of operational indicators	High
	Metal_Case	✔	✔	✔	Daily control of operational indicators	High
Innovation Capability	Label_Case	✔	✔		R&D Center in Europe, India, and the United States	High
	Flexi_Case	✔	✔		R&D Center in the United States	High
	Paper_Case	✔	✔	✔	R&D Internal department	Medium
	Metal_Case	✔	✔		R&D Internal department	High
Flexibility Capability	Label_Case	✔	✔	✔	Finished product (Cut) and Delivery	Low
	Flexi_Case	✔	✔	✔	Small Batches, Machines, Delivery, and Raw Material	High
	Paper_Case	✔	✔		Small Batches, Machines, and Raw Material	Medium
	Metal_Case	✔	✔	✔	Production Scheduling and Delivery	Low

To be continued

Operational Capabilities	Firm	Evidence*			Summary	Level
Customization Capability	Label_Case				Cut	Low
	Flexi_Case	✔	✔	✔	Process Modularity and Product Modularity	High
	Paper_Case	✔	✔	✔	Process Modularity	Medium
	Metal_Case				Lithograph	Low
Customer Support Capability	Label_Case	✔	✔	✔	Responsiveness, Customer Relationship, and Service Level Agreement	High
	Flexi_Case	✔	✔	✔	Responsiveness, Customer Relationship, and Service Level Agreement	High
	Paper_Case	✔	✔		Responsiveness, Customer Relationship, and Service Level Agreement	High
	Metal_Case	✔	✔	✔	Responsiveness, Customer Relationship, and Service Level Agreement	High

* I - interviews; D – documentation; O - observation

Table 36 –Level Operational Capabilities (Resume)

Operational Capabilities/Firms		Label_Case	Flexi_Case	Paper_Case	Metal_Case
Across-the-Board Capabilities	Continuous Imp.	High	Medium	Medium	High
	Learning	High	High	High	High
	Information Manag.	High	High	Low	Medium
Standalone Capabilities	Supplier Manag.	High	Low	Low	High
	Operat. Efficiency	High	High	High	High
	Innovation	High	High	Medium	High
	Flexibility	Low	High	Medium	Low
	Customization	Low	High	Medium	Low
	Customer Support	High	High	High	High

Operational capabilities can be found at different levels of development within the firm and among firms, or still exist in some firms, while others do not. Evolution of the trajectory of an operational capability depends on the firm's learning ability, its previous experience, as well as their employees, and investment in new technologies (Rockart & Dutt, 2015). This way, an operational capability may be at an early stage while others may be in mature stages (Helfat & Peteraf, 2003; Rockart & Dutt, 2015). For example, Operational Efficiency Capability was shown to be in a mature stage in the four cases analyzed, while Customization Capability has been identified at an early stage in two cases (Flexi_Case and Paper_Case) and absent in the other two (Label_Case and Metal_Case). Based on this, we suggest the seventh proposition.

Proposition 7 – Across-the-Board Capabilities and Standalone Capabilities have different levels of maturity within the firm and among different firms.

Next we present an analogy about Across-the-Board Capabilities and Standalone Capabilities based on running.

4.2 Operational capabilities: an analogy based on running

Metaphors are used in operations management to explain complex phenomena by comparing than to common, everyday activities. Wu et al. (2010) use the metaphor of a restaurant kitchen to differentiate resources, operational practices, and operational capabilities. Resources are all assets, tangible and intangible, such as the stove, utensils and the talent of individuals. Operational practices are considered recipes. Operational capabilities are represented by the chef's ability to develop dishes that reflect the history, style, and customer preference (Wu et al., 2010). Ferdows & Thurnheer (2011) introduce the notion of "fitness programs" in production, differentiating Lean and Fit. "Lean" indicates common exercises that benefit a variety of types of sports; the function of these exercises is to improve the agility, strength, and stamina of the athletes. Similarly, a "production system becomes leaner when it reduces waste and activities that do not add value for its customers" (Ferdows & Thurnheer, 2011, pp. 916). Fit, in turn, indicates specific exercises that are needed for a particular sport. A production system "becomes fitter when it improves and expands its core capabilities" (Ferdows & Thurnheer, 2011, pp. 916). The authors emphasized that fitness exercises are more effective if they are built on a foundation of lean.

Following the authors Wu et al. (2010) and Ferdows & Thurnheer (2011), we will use running as an analogy to facilitate the comprehension of our findings that emerged from the analysis of 73 interviews corresponding to the four cases that compose this study. We found two groups of operational capabilities called Across-the-Board Capabilities and Standalone Capabilities. Each of the groups is analogous with foundation and functional training programs developed for runners.

Foundation Training in a running program develops strength and stamina[1]. It includes weight training, Pilates, and stretching. Weight training develops the overall strength of the muscles. Pilates aims to strengthen the core (hamstrings, glutes, hips, lower back, and oblique muscles). Stretching improves flexibility. All three of these exercises are responsible for preparing the body and the muscles to endure the impact that running brings to the joints. They are foundation exercises which benefit a variety of physical activities in the same way Across-the-Board Capabilities provide the foundation to the development of specific operational capabilities.

Across-the-Board Capabilities provides "strength" in the sense of support, and "stamina" in the sense of enabling the development of other operational capabilities. Across-the-Board Capabilities are cross-functional and include Information Management Capability, Continued Improvement Capability, and Learning Capability. Information Management Capability integrates the complexity of the production process and the management and transformation data into knowledge (Setia & Patel, 2013). Continuous improvement involves increasing, refining, and reinforcing existing operational processes (Swink & Hegarty, 1998; Wu et al., 2010, 2012). Learning Capability connects external knowledge to internal knowledge and provide the development of organizational learning (Y. Li et al., 2010). These operational capabilities are important because they create a knowledge base for the firm, enabling it to respond faster to market changes (Ferdows & Thurnheer, 2011).

In addition, Across-the-Board Capabilities can answer a question raised by Hayes & Pisano (1996, pp. 38): "How should the company - given the difficulty of predicting the

[1]Information about training for runners was validated by two physical educator

future in today's turbulent world - select which capabilities to develop?"One possible answer is that once Across-the-Board Capabilities are developed, they establish a capacity to create, maintain, or reconfigure other operational capabilities (Cohen & Levinthal, 1990; Zahra & George, 2002)such as Standalone Capabilities, that are analogous with functional training programs developed for runners.

Functional Training in a running program increases the runner's speed. It includes running education, interval and progressive training methods, and fartlek methods. Running education involves exercises that improve posture and running movement. Interval training (shots) is intense running, followed by brief pauses. Progressive training methods are repetitions that serve to adapt the body to different speed levels. Fartlek is the variation of intensity of the running, which includes routes with climbs, descents, training in the sand, grass and asphalt. These exercises are responsible for improving the static and movement posture other runner to optimize the use of her/his muscles, refine the execution of the running, and improve individual performance. These exercises are specific to running, in the same way Standalone Capabilities can be considered firm-specific, because they are developed to serve a firm′s specific demands.

Just like there are exercises programs to increase the speed of the runner, Standalone Capabilities are created to allow production to achieve its goals. These include Supplier Management Capability – upstream; Efficiency Management Capability, Innovation Capability, and Flexibility Capability – operational; and Customer Support Capability - downstream. Supplier Management Capability positively impacts delivery time and reduces operating costs (Yeung, 2008). Efficiency Management Capability reduces scrap and increases productivity. Innovation Capability seeks to change pre-established technological trajectories (Benner & Tushman, 2003). Flexibility Capability is the operational response capacity of the firm to make changes in its inputs and outputs (Swink & Hegarty, 1998; Wu et al., 2010). Customer Support Capability is the ability to improve the operations of firm's customers. The Standalone Capabilities are aligned with a specific operational strategy, so they may charge according to competitive priorities established by a firm.

Like Ferdows and Thurnheer (2011) who believe superior factories are not just lean but also fit, we understand that superior firms should not focus only on Standalone Capabilities; they must also develop Across-the-Board Capabilities. Both types of operational capabilities are innately complementary. Firms that have Across-the-Board Capabilities create "strength" and "stamina" and can develop new Standalone Capabilities with more "speed" as demanded by the market Organizations that ignore the Across-the-Board Capabilities become fragile, and over a long time, this can affect the maintenance of the Standalone capabilities (Figure 18).

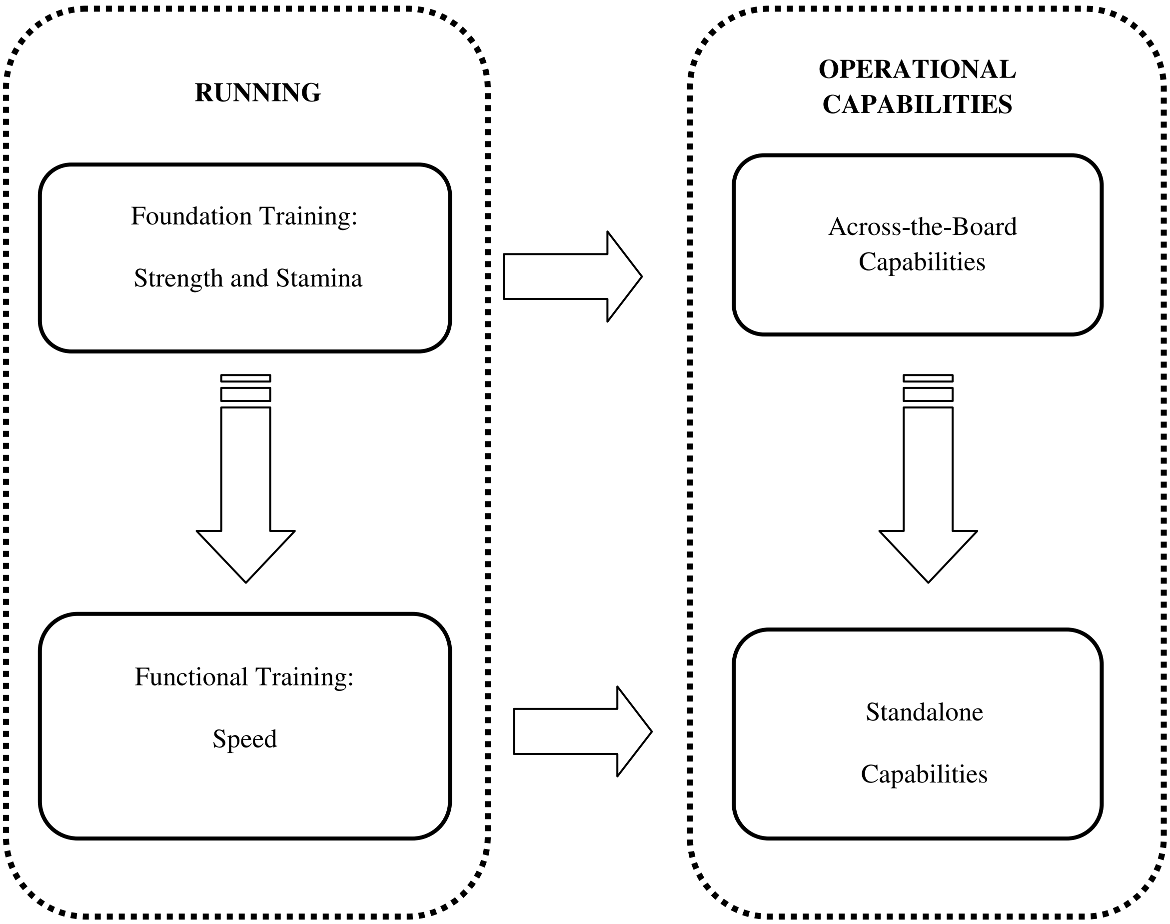


Figure 18–Equivalence between Running and Operational Capabilities

The metaphorical analysis of operational capabilities helps us understand three main issues. First, operational capabilities should not be considered as a closed and complete model. Second, the Across-the-Board Capabilities create a favorable condition for the development of other operational capabilities. And finally, Standalone Capabilities can be adjusted according to the specific needs of the firm. We show the analogy of running in Figure 19 and Figure 20.We also emphasize that the exercises of training programs (strength and functional) are equivalent to bundles of operational practices, and that other resources (physical, human, and financial) should be considered in this process.

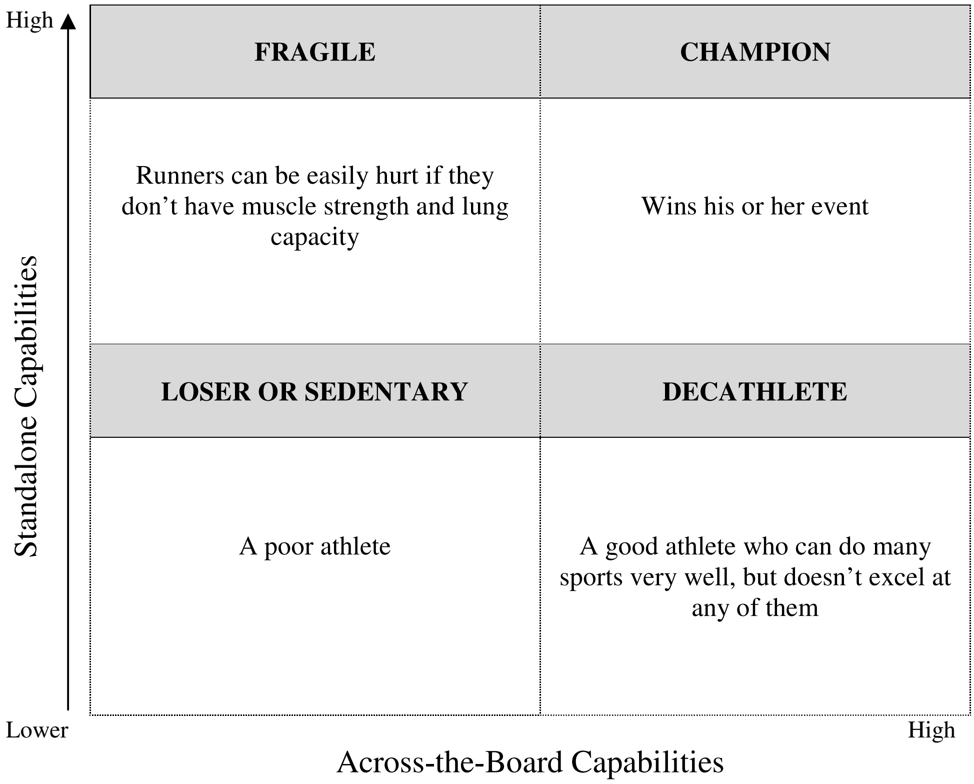


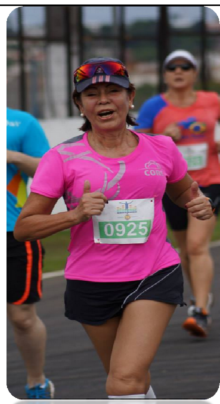
Figure 19–Analogy between types of runners and operational capabilities

Professional runners do strength and functional training with high level of intensity and regularly – Champion

Semi-professional runners do strength and functional training, but with low level of intensity and regularly - Decathlete

My cousin

My brother-in-low



My mother-in-low

My sister-in-low

Amateur runners do only strength training irregularly – Fragile

My husband

Me

My niece

My niece

Figure 20–Level runners

4.3 Analysis of quantitative data

Some important clarifications are needed before we introduce hypotheses and results of the regressions. First, operational capabilities used in this stage are a result of the qualitative stage. Second, before using operational capabilities, we conducted a confirmatory factor analysis (CFA). Results showed us that Learning Capability and Continuous Improvement Capability do not have discriminant validity, thus, these two constructs were grouped creating a new construct called Continuous Learning. The same occurred with Flexibility Capability and Customization Capability. These two operational capabilities did not show discriminant validity, and they were grouped in the construct Flexibility. Therefore, Across-the-Board Capabilities remained with Information Management and Continuous Learning, and Standalone Capabilities with Innovation, Flexibility, Supply Management, Operational Efficiency, and Customer Support. Third, operational performance has not indicated convergent validity, so we operationalize it individually from unit cost, quality, delivery, flexibility, and innovation.

We did residual analysis using the Durbin-Watson test. We found values between 1.90 and 2.10. Durbin-Watson test is widely used for the autocorrelation between the residues. This test is a means test. Null hypothesis is that there is no correlation between residues. The main idea is to compute a weighted sum of the residues, for us detect a pattern in their behavior. Finally, if the value of the statistic Durbin-Watson is close to 2, there is evidence that there is no correlation between residues. Thus, we can say that there are no problems in the residual analysis.

4.3.1 Theoretical hypotheses

Across-the-Board Capabilities are considered first order capabilities. In this quantitative stage, they are characterized as Information Management and Continuous Learning. These operational capabilities are based on knowledge, and therefore, act as support for the development Standalone Capabilities.

According to Kogut and Zander (1992), knowledge consists of information (*e.g.*, who knows what) and of know-how (*e.g.*, what is known). Information is a sine-qua-non in managing knowledge. But managing information within the firm extends beyond robust investments in digital infrastructure (Flynn & Flynn, 1999). Acquisition of technology investments (ITs) is not enough; the firm needs to develop an information system (IS) able to leverage ITs for building capabilities (Setia & Patel, 2013; Wade & Hulland, 2004). Information is an input to knowledge (Cohen & Levinthal, 1990). The function of the Information Management Capability is to transform data into good information to assist managers in decision-making and support the learning process of the firm.

The learning process is linked to information assimilation based on pre-existing knowledge of the firm (Cohen & Levinthal, 1990). Information and the cross functional orientation integrates and extends the knowledge of the firm, allowing managers to explore with efficiency their internal resources, favoring the creation and sustaining operational capabilities (Paiva et al., 2008). Process cumulative knowledge may lead to the development of a Learning Capability (Zollo & Winter, 2002). Learning mechanisms help in the development of practices and operational routines, and are associated with the continuous improvement process of the firm. For example, it can reduce lead time and cycle time, reduce the delivery time to the customer, or improve the level of customer service. Different operational practices can be applied to develop this capability, such as Lean Management, Six Sigma, and Kaizen. All of these practices involve learning and constant reconfiguration of operational processes (Anand et al., 2009; Bessant, Caffyn, & Gallagher, 2001). Furthermore, continuous improvement initiatives "can provide organizations the agility and consistency necessary to continually update operational processes" (Anand et al., 2009, pp. 459).

The role of Across-the-Board Capabilities in the Standalone capabilities-performance context requires specific attention (Helfat & Winter, 2011). Across-the-Board Capabilities are capabilities that contribute how the firm finds new ways to create value and are a way for the development of Standalone Capabilities, operationalized by Innovation, Flexibility, Supply Management, Operational Efficiency, and Customer Support. Thus, we propose the first hypothesis.

H 1– Across-the-Board Capabilities have a positive relationship with Standalone Capabilities.

H 1a – Continuous Learning Capability has a positive relationship with Standalone Capabilities.

H 1b – Information Management Capability has a positive relationship with Standalone Capabilities.

Standalone Capabilities are considered zero order capabilities. In this quantitative stage, we identified the following Standalone Capabilities: Supply Management Capability, Operational Efficiency Capability, Innovation Capability, Flexibility Capability, and

Customer Support Capability. Previous studies have been associating these capabilities with operational performance.

Supply Management Capability consists bundles of practices that can lead to improved performance (Kaynak & Hartley, 2008). Supply chain managers build practices to gain operational efficiency while simultaneously searching for opportunities to gain business performance (Kristal et al., 2010; Yeung, 2008). Implementation of SCM not only directly improves operational performance, but also indirectly enhances customer satisfaction and performance (Ou, Liu, Hung, & Yen, 2010).

Operational Efficiency Capability consists of bundles of best operational practices (TQM, JIT, TPM, lead time, etc.). Over time, intensive use of these best practices may lead to high levels of manufacturing performance (Cua et al., 2001; Shah & Ward, 2003). For that, operational practices need to be integrated with each other so that they achieve the firm's goals (Davies & Kochhar, 2002; Droge et al., 2004).

Innovation Capability is associated with different competitive priorities, and also has varying impact on different operational performance dimensions (Peng, Schroeder, & Shah, 2011). From the use of new technologies, it can provide competitive advantage to the firms, through performance of ROI or growth, new markets, and products (Coates & McDermott, 2002). Innovation Capability is an important predictor of the performance gain.

Flexibility Capability is associated with better business performance (Anand & Ward, 2004).The relationship between manufacturing flexibility and firm performance can be moderated by operational absorptive capacity and operational ambidexterity. Firms that develop the ability to explore capabilities with respect to exploitation and exploration are better positioned to leverage manufacturing flexibility to achieve high performance (Patel et al., 2012).

Customer Support Capability begins with the integration of the customer in the production process of the firm. The inclusion of customer focus in the operational management is related to better performance (Kaynak & Hartley, 2008). Customer oriented manufacturing is an important drivers of high performance (Narasimhan et al., 2005). Customer-firm-supplier relation management positively impacts a firm's operational performance (Ou et al., 2010).

Standalone Capabilities determine the efficiency in which the firm transforms inputs into outputs. They reflect the expertise of the firm, and help the firm achieve its goals. Overall, Standalone Capabilities can be important predictors of operational performance (Avella & Vázquez-Bustelo, 2010). Operational performance was operationalized by unit cost, quality, delivery, flexibility, and innovation. Therefore, we propose the second hypothesis.

H 2– Standalone Capabilities have a positive relationship with operational performance.

H 2a – Customer Support has a positive relationship with Operational Performance.

H 2b – Flexibility has a positive relationship with Operational Performance.

H 2c – Innovation has a positive relationship with Operational Performance.

H 2d – Operational Efficiency has a positive relationship with Operational Performance.

H 2e – Supply Management has a positive relationship with Operational Performance.

First order capabilities influence zero order capabilities, which in turn have an impact on performance (Collis, 1994; Peteraf, Di Stefano, & Verona, 2013; Zollo & Winter, 2002). In other words, Across-the-Board Capabilities from Information Management and Continuous Learning can influence operational performance indirectly embedded Standalone Capabilities (Schilke, 2013). In this logic, Across-the-Board Capabilities can moderate the relationship between Standalone Capabilities and operational performance.

Collis (1994) argues that a possible explanation for inconclusive results in some studies between zero order capabilities and performance could be explained by the variance of the remaining first order capabilities. Moderating effect of Across-the-Board Capabilities happens through learning mechanisms, continuous improvement practices, and management of operational information. For example, the effect of learning "will improve competitive advantage in the competition for primacy" but, "learning processes do not necessarily lead to increases in average both performance and variation" (March, 1991, pp. 83). Thus, we can say that Across-the-Board Capabilities can indirectly influence Standalone Capabilities' performance. We operationalize Across-the-Board Capabilities by Information Management and Continuous Learning. Standalone Capabilities was operationalized by Innovation, Flexibility, Supply Management, Operational Efficiency, and Customer Support. And, Operational performance was operationalized by unit cost, quality, delivery, flexibility, and innovation.

H 3– Across-the-Board Capabilities moderate the relationship between Standalone Capabilities and operational performance.

H 3a – Across-the-Board Capabilities moderate the relationship between Standalone Capabilities and Unit Cost.

H 3b – Across-the-Board Capabilities moderate the relationship between Standalone Capabilities and Quality.

H 3c – Across-the-Board Capabilities moderate the relationship between Standalone Capabilities and Delivery.

H 3d – Across-the-Board Capabilities moderate the relationship between Standalone Capabilities and Flexibility.

H 3e – Across-the-Board Capabilities moderate the relationship between Standalone Capabilities and Innovation.

Based on the development of hypotheses we present the theoretical framework in Figure 21:

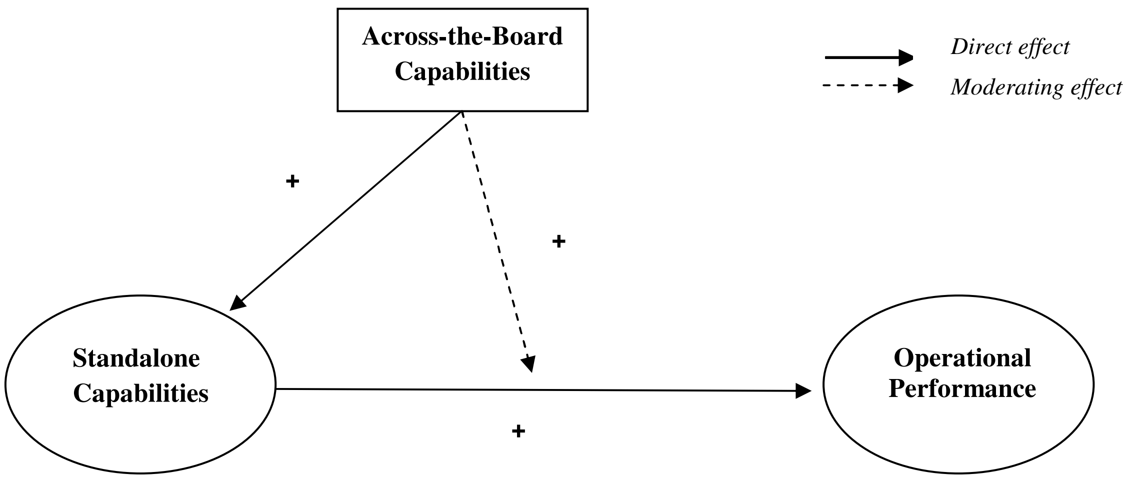


Figure 21–Theoretical framework

4.3.2 Results and discussion of hypotheses

After confirmatory and descriptive data analysis, we conducted three sets of regressions. The first set of regressions is between Across-the-Board Capabilities and Standalone Capabilities for testing H1. The second are between Standalone Capabilities and

Operational Performance, and aimed to test H2. Finally, the third set of regressions are between Standalone Capabilities and Operational Performance, moderated by Across-the-Board Capabilities, and aimed to test H3. Before running the regressions, to mitigate the potential threat of multicollinearity, we mean-centered all independent variables.

H 1– Across-the-Board Capabilities have a positive relationship with Standalone Capabilities.

H 1a – Continuous Learning Capability has a positive relationship with Standalone Capabilities.

H 1b – Information Management Capability has a positive relationship with Standalone Capabilities.

We show H1 results in Table 37 with the main results of linear regression models. We grouped the fifteen different models, showing the coefficients and p-value of each variable, as well as the models' statistics, with R square and adjusted R square. Next we describe and analyze the results with the theory.

Table 37 – Regressions - H1

Independent variable	Dependent variable: Standalone									
	Customer Support		**Flexibility**		**Innovation**		**Operational Efficiency**		**Supply Management**	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
(Constant)	.140	.368	.662	.786	.038	.264	.189	.420	.148	.370
Size	-.045 (.451)	**-.127** ** (.015)	**-.169**** (.012)	**-.221***** (.001)	.048 (.547)	-.042 (.560)	-.051 (.471)	**-.136**** (.032)	-.007 (.934)	-.102 (.151)
Metal	.122 (.473)	.132 (.364)	.092 (.629)	.135 (.449)	-.019 (.934)	.030 (.882)	-.133 (.505)	-.113 (.521)	-.312 (.189)	-.232 (.244)
Paper	-.036 (.763)	-.052 (.608)	-.169 (.207)	-.167 (.182)	-.283† (.075)	**-.288**** (.040)	-.051 (.717)	-.064 (.602)	-.023 (.888)	-.018 (.895)
Plastic	-.019 (.875)	.029 (.775)	**-.336**** (.012)	**-.264**** (.036)	-.230 (.146)	-.135 (.333)	-.033 (.814)	.028 (.823)	-.260 (.116)	-.126 (.364)
Continuous Learning		**.138**** (.040)		**.294***** (.000)		**.361***** (.000)		**.196**** (.016)		**.548** *** (.000)
Information Management		**.307***** (.000)		.098 (.147)		**.235** ** (.002)		**.293***** (.000)		**.171** ** (.023)
R2 Square	0.007	.284	0.067	.200	0.023	.257	0.005	.233	0.022	.328
Adjusted R2 Square	-0.013	.263	0.048	.176	0.004	.235	-0.015	.210	0.003	.308

p-values for each unstandardized parameter estimate are in parentheses. †*p*<0.10. ** p<0.05; *** p<0.01

Continuous Learning Capability has a positive and direct relationship with all Standalone Capabilities, Customer Support (0.138) p-value 0.040, Flexibility (0.294) p-value 0.000, Innovation (0.361) p-value 0.000, Operational Efficiency (0.196) p-value 0.016, and Supply Management (0.548) p-value 0.000. Size showed a negative coefficient among Continuous Learning and Customer Support, Flexibility, and Operational Efficiency. Paper industry showed a negative coefficient between Continuous Learning and Innovation, and plastic industry showed a negative coefficient between Continuous Learning and Flexibility.

For Continuous Learning Capability development, the firm needs to have a solid knowledge base. Organizational knowledge as a resource is developed through cross-functional interaction among different areas (Paiva et al., 2008). Knowledge is antecedent of Continuous Learning Capability. This capability belongs to the Across-the-Board Capabilities group, and may be compared to a dynamic capability (Anand et al., 2009). Different from Standalones Capabilities that have the function to solve an operational problem or achieve a specific result(Zahra et al., 2006), Across-the-Board Capabilities build, change and/or reconfigure Standalones Capabilities (Teece et al., 1997). So, Continuous Learning Capability can also provide the creation of new operational capabilities, transforming internal, and external knowledge in practices and operational routines (Eisenhardt & Martin, 2000; Teece et al., 1997; Winter, 2003; Zollo & Winter, 2002). Over time, learning can improve production efficiency or improve customer responsiveness(Zahra et al., 2006). For example, kaizen practice involves knowledge of employees and can improve operational routines, having positive effect on production efficiency. *Thus, we observed support for Hypothesis 1a - Continuous Learning Capability has a positive relationship with Standalone Capabilities.*

Information Management Capability also has a positive and direct relationship with all Standalone Capabilities, Customer Support (0.307) p-value 0.000, Innovation (0.235) p-value 0.002, Operational Efficiency (0.293) p-value 0.000, and Supply Management (0.171) p-value 0.023. Flexibility (0.098) p-value 0.147 showed a coefficient that is not statistically significant. Size showed a negative coefficient among Information Management and Customer Support, Flexibility, and Operational Efficiency. Paper industry showed a negative coefficient between Information Management and Innovation, and plastic industry showed a negative coefficient between Information Management and Flexibility.

Information Management Capability uses real-time information, such as inventory, sales, and production schedules to reconfigure the resources of the firm to integrate and support the coordination of operational processes. Although many studies work on the integration of the supply chain(S. Li et al., 2005; Zhao et al., 2011), we work with the internal integration of information that provides access and visibility for workers to monitor the firm's operational performance. But, there are external information, such as customer requests, which are outside the firm and may explain the negative relationship between Information Management Capability and Flexibility Capability. Information management increases organizations' capacity to process the amount of information inherent in a complex manufacturing environment(Flynn & Flynn, 1999). In addition, it can decrease the time to problem resolution, and reduce errors and delays associated with manual processes (Bharadwaj, Bharadwaj, & Bendoly, 2007). Information management can still improve information flow, standardization and integration of activities, and propose the adoption of operational best-of-practice to replace inefficient processes (Bharadwaj et al., 2007; Gattiker & Goodhue, 2005). Information Management Capability shapes a basis for knowledge and can help build, change and/or reconfigure Standalone Capabilities (Teece et al., 1997). *Thus, we observed support for Hypothesis 1b - Information Management Capability has a positive relationship with Standalone Capabilities.* Hypothesis 1 was confirmed in this study.

Next, we describe the hypotheses H2 results in Table 38 with the main results of linear regression models. We grouped the ten different models, showing the coefficients and p-value of each variable, as well as the models' statistics, with R square and adjusted R square. Next we describe and analyze the results with the theory.

H 2– Standalone Capabilities have a positive relationship with Operational Performance.

H 2a – Customer Support Capability has a positive relationship with Operational Performance.

H 2b – Flexibility Capability has a positive relationship with Operational Performance.

H 2c – Innovation Capability has a positive relationship with Operational Performance.

H 2d – Operational Efficiency Capability has a positive relationship with Operational Performance.

H 2e – Supply Management Capability has a positive relationship with Operational Performance.

Table 38 - Regressions - H2

Independent variable	Dependent variable: Operational Performance									
	Unit cost (OP1)		**Quality (OP2)**		**Delivery (OP3)**		**Flexibility (OP4)**		**Innovation (OP5)**	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
(Constant)	3.075	3.061	4.392	4.344	4.163	4.057	4.380	4.304	3.662	3.612
Size	.079	.099	-.079	-.066	-.047	-.021	-.082	-.053	.127	.129
	(.288)	(.175)	(.272)	(.354)	(.611)	(.806)	(.300)	(.470)	(.152)	(.129)
Metal	-.161	-.276	**-.410****	**-.472****	-.123	-.094	-.283	-.287	**-.532****	**-.573****
	(.443)	(.178)	(.045)	(.020)	(.641)	(.702)	(.210)	(.170)	(.036)	(.017)
Paper	-.260†	-.272†	-.278†	-.246†	-.084	-.042	-.256	-.245†	**-.775*****	**-.679*****
	(.077)	(.057)	(.053)	(.080)	(.647)	(.807)	(.105)	(.093)	(.000)	(.000)
Plastic	-.246†	**-.332****	-.082	-.065	-.236	-.195	-.296†	**-.330****	**-.362****	-.311†
	(.094)	(.022)	(.563)	(.645)	(.196)	(262)	(.059)	(.026)	(.040)	(.066)
Customer Support		**.371*****		**.340*****		**.260****		**.233****		**.276****
		(.001)		(.001)		(.043)		(.033)		(.027)
Flexibility		-.025		.021		-.001		-.034		-.008
		(.766)		(.796)		(.993)		(.692)		(.936)
Innovation		-.072		.068		.055		-.041		**.296*****
		(.318)		(.340)		(.528)		(.578)		(.001)
Operational Efficiency		.118		-.048		**.320****		**.449*****		.097
		(.188)		(.581)		(.003)		(.000)		(.352)
Supply Management		**-.276*****		-.042		.053		-.123†		-.086
		(.000)		(.553)		(.537)		(.093)		(.300)
R2 Square	0.025	0.124	0.039	0.116	0.010	0.173	0.024	0.204	0.102	0.238
Adjusted R2 Square	0.006	0.084	0.020	0.076	-0.010	0.135	0.005	0.167	0.084	0.203

p-values for each unstandardized parameter estimate are in parentheses. †*p*<0.10. ** p<0.05; ***p<0.01

Customer Support Capability has a positive and direct relationship with all operational performance variables, unit cost (0.371) p-value 0.001, quality (0.340) p-value 0.001, delivery (0.260) p-value 0.043, flexibility (0.233) p-value 0.033, and innovation (0.276) p-value 0.027. Metal, Paper, and Plastic industry showed a negative coefficient. The result of these regressions reflects a characteristic of the packaging industry. Firms in this sector are intermediate links in the supply chain. They receive prefabricated raw material and convert it into packaging for different types of industries (food, cosmetics, clothing, etc.). These customers, often multinational companies lead this chain. Customer Support Capability comprises bundles of practices that are employed for the purpose of managing customer complaints, long-term relationships, and customer satisfaction (S. Li et al., 2005). Researchers have investigated and found positive results in the relationship between customer and performance (Babakus, Bienstock, & Van Scotter, 2004; Vickery, Jayaram, Droge, & Calantone, 2003). When properly managed, Customer Support Capability can positively affect the operational performance of the firm as shown in Table 38.*Thus, we observed support for Hypothesis 2a - Customer Support Capability has a positive relationship with Operational Performance.*

We failed to observe support for Hypotheses Hypothesis 2b - Flexibility Capability has a positive relationship with Operational Performance. The coefficients between Flexibility Capability and Operational Performance are not significant (see Table 38). Previous studies indicate that Flexibility is needed to serve customers (Zhang et al., 2003), but that customers are unwilling to pay more because machines and workers are flexible (Patel et al., 2012). Combining flexibility and operational performance can be a challenge for any industry. According to Kortmann et al. (2014, pp. 483) “Overemphasizing strategic flexibility and diversification can also lead to inferior returns on investments through pursuing future opportunities at the cost of current operations."

Table 38 showed a positive relationship between Innovation Capability and Innovation Performance (0.296) p-value 0.001.The other operational performance variables did not present significant coefficients. Metal and Paper industry showed a negative coefficient. Innovation Capability increases the responsiveness to customer needs (Kim et al., 2012); it benefits research for new technologies and helps the development of new products (Peng et al., 2008). Despite the packaging industry not operating in technologically advanced environments (Benner & Tushman, 2003), it provides to industries that constantly innovate, benefiting this capability. *We found partially support Hypothesis H1c - Innovation Capability has a positive relationship with Operational Performance.*

Table 38 also shows that Operational Efficiency Capability has a positive relationship with Delivery Performance (0.320) p-value 0.003 and Flexibility Performance (0.449) p-value 0.000; the other variables of Operational Performance showed no significant coefficients. Plastic industry showed a negative coefficient. This capability is bundles of practices composed of Lead time, JIT, TPM, TQM, EHS, among others. Operational practices when applied individually can have inconsistent results (Benner & Tushman, 2003), but, interrelated they can show positive results with performance (Cua et al., 2001; Droge et al., 2004; Flynn et al., 1994; Jiménez-Jiménez & Martínez-Costa, 2009; Shah & Ward, 2003). We call these bundles of practices interlinked (Lead time, JIT, TPM, TQM, EHS) of Operational Efficiency Capability, because we believe that they improve both operational efficiency and effectiveness. Positive relationship among Operational Efficiency Capability and Delivery Performance and Flexibility Performance are related to responsiveness to the customer. These two performances are essential for the packaging industry customers, because they need packaging to complete their production (delivery on time), and at the same time diversified mix (flexibility). Despite Flexibility Capability (machines, people, and processes) not showing significant results (see Table 38), we believe that packaging firms are able to achieve Operational Flexibility to use specific strategies for this purpose. For example, it can work with accurate forecasting partnerships with their customers; they can be stocked if semi-finished products (Kanban), and sometimes, it can outsource part of their production. *Therefore, we found partially support Hypothesis 2d - Operational Efficiency Capability has a positive relationship with Operational Performance.*

Finally, controlling for industry effects, we saw a significant negative relationship between Supply Management Capability and Unit Cost Performance (-0.276) p-value 0.000. Others operational performance (Quality, Delivery, Flexibility, and Innovation) did not show significant coefficients (see Table 38). One possible explanation is that the Packaging industry utilizes many imported raw materials. Supply chain partners become more geographically dispersed (Bozarth, Warsing, Flynn, & Flynn, 2009), making it difficult to establish a relationship strategy and negotiated prices. In this sense, the relationship between buyer-supplier is much more transactional than relational. Furthermore, monopolies, common in the packaging industry, can compromise price negotiation. However, this result is contrary to the expected and we do not have a clear explanation about it. We believe that investment in Supply Management Capability is long term and that benefits are shared with other operational capabilities. Managing the supply is clearly a challenging mission for this industry. However, the negative relationship between supply management and cost performance has been observed in other studies

(Bozarth et al., 2009; Corsten, Gruen, & Peyinghaus, 2011). Industry type and company strategy may negatively influence the relationship influence a negative result between supply and cost. *Thus, we failed to observe support for Hypothesis H2e - Supply Management Capability has a positive relationship with Operational Performance. But as a whole the Hypothesis H2 was partially supported.*

Finally, our hypothesis H3 is proposed. Table 39, Table 40, Table 41, Table 42, and Table43 shows the results of moderations with the same structure as Tables on H1 and H2.

H3 - Across-the-Board Capabilities moderate the relationship between Standalone Capabilities and Operational Performance

H 3a – Across-the-Board Capabilities moderate the relationship between Standalone Capabilities and Unit Cost

H 3b – Across-the-Board Capabilities moderate the relationship between Standalone Capabilities and Quality

H 3c – Across-the-Board Capabilities moderate the relationship between Standalone Capabilities and Delivery

H 3d – Across-the-Board Capabilities moderate the relationship between Standalone Capabilities and Flexibility

H 3e – Across-the-Board Capabilities moderate the relationship between Standalone Capabilities and Innovation

Table 39 - Across-the-Board Capabilities moderation between Standalone Capabilities and Unit Cost

Independent variable	Dependent variable: Operational Performance - Unit cost (OP1)					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
(Constant)	3.075	3.061	3.099	3.118	3.069	3.118
Size	.079	.099	.086	.086	.097	085
	(.288)	(.175)	(.256)	(.270)	(.213)	(.282)
Metal	-.161	-.276	-.267	-.280	-.248	-.263
	(.443)	(.178)	(.194)	(.185)	(.238)	(.224)
Paper	-.260†	-.272†	-.279†	-.276†	-.271†	-.280†
	(.077)	(.057)	(.053)	(.061)	(.067)	(.062)
Plastic	-.246†	**-.332****	**-.326****	**-.336****	**-.316****	**-.316****
	(.094)	(.022)	(.025)	(.023)	(.032)	(.037)
Customer Support		**.371*****	**.372*****	**.393*****	**.361****	**.368****
		(.001)	(.001)	(.001)	(.003)	(.003)
Flexibility		-.025	-.046	-.045	-.052	-.061
		(.766)	(.591)	(.604)	(.559)	(.512)
Innovation		-.072	-.096	-.101	-.092	-.093
		(.318)	(.205)	(.196)	(.243)	(.252)
Operational Efficiency		.118	.114	.111	.118	.111
		(.188)	(.210)	(.226)	(.209)	(.243)
Supply Management		**-.276*****	**-.315*****	**-.323*****	**-.316*****	**-.322*****
		(.000)	(.000)	(.000)	(.000)	(.000)
Continuous Learning			.128	.109	.123	.122
			(.230)	(.330)	(.267)	(.293)
Information Management			-.014	-.016	-.011	-.006
			(.864)	(.850)	(.903)	(.945)
LearningXCustomer				.121		.244
				(.472)		(.232)
LearningXFlexibility				-.085		-.008
				(.531)		(.962)
LearningXInnovation				-.055		-.137
				(.633)		(.357)
LearningXOp.Efficiency				.042		-.020
				(.736)		(.900)
LearningXSupply				-.049		-.043
				(.614)		(.734)
InformationXCustomer					-.038	-.145
					(.768)	(.364)
InformationXFlexibility					-.077	-.099
					(.392)	(.402)
InformationXInnovation					.033	.098
					(.656)	(.315)
InformationXOp.Efficiency					.051	.085
					(.549)	(.458)
InformationXSupply					-.042	-.019
					(.649)	(.875)
R2 Square	0.025	0.124	0.131	0.138	0.137	0.146
Adjusted R2 Square	0.006	0.084	0.082	0.065	0.063	0.049
F	1.297	3.096	2.669	1.886	1.868	1.503
p-value	0.272	0.002	0.003	0.024	0.026	0.081
Change R^2		0.078	-0.002	-0.017	-0.002	-0.014
Change in F		1.799	-0.427	-0.783	-0.018	-0.365
p-value (change)		-0.270	0.001	0.021	0.002	0.055

p-values for each unstandardized parameter estimate are in parentheses. †*p*<0.10, ** p<0.05; ***p<0.01

Table 40 - Across-the-Board Capabilities moderation between Standalone Capabilities and Quality

Independent variable	Dependent variable: Operational Performance – Quality (OP2)					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
(Constant)	4.392	4.344	4.243	4.241	4.254	4.245
Size	-.079	-.066	-.035	-.030	-.031	-.028
	(.272)	(.354)	(.636)	(.690)	(.687)	(.717)
Metal	**-.410****	**-.472****	**-.465****	**-.433****	**-.440****	**-.431****
	(.045)	(.020)	(.021)	(.037)	(.034)	(.044)
Paper	-.278†	-.246†	-.227	-.200	-.211	-.199
	(.053)	(.080)	(.107)	(.165)	(.144)	(.175)
Plastic	-.082	-.065	-.059	-.058	-.064	-.064
	(.563)	(.645)	(.678)	(.685)	(.658)	(.664)
Customer Support		**.340*****	**.381*****	**.361****	**.353****	**.345****
		(.001)	(.001)	(.002)	(.003)	(.005)
Flexibility		.021	.031	.027	.041	.044
		(.796)	(.709)	(.751)	(.637)	(.625)
Innovation		.068	.095	.087	.083	.078
		(.340)	(.203)	(.259)	(.282)	(.327)
Operational Efficiency		-.048	-.025	-.029	-.034	-.032
		(.581)	(.782)	(.747)	(.709)	(.735)
Supply Management		-.042	-.015	-.014	-.022	-.020
		(.553)	(.847)	(.859)	(.774)	(.803)
Continuous Learning			-.024	-.023	-.001	-.008
			(.815)	(.830)	(.991)	(.946)
Information Management			-.113	-.111	-.136	-.129
			(.173)	(.191)	(.124)	(.160)
LearningXCustomer				-.126		-.124
				(.444)		(.533)
LearningXFlexibility				.018		-.001
				(.891)		(.995)
LearningXInnovation				.015		.056
				(.893)		(.700)
LearningXOp.Efficiency				-.084		-.083
				(.490)		(.599)
LearningXSupply				.021		.021
				(.822)		(.867)
InformationXCustomer					-.056	-.024
					(.655)	(.879)
InformationXFlexibility					-.003	.035
					(.974)	(.761)
InformationXInnovation					-.021	-.042
					(.779)	(.660)
InformationXOp.Efficiency					-.042	-.017
					(.620)	(.878)
InformationXSupply					.008	.002
					(.926)	(.987)
R2 Square	0.039	0.116	0.128	0.137	0.134	0.140
Adjusted R2 Square	0.020	0.076	0.078	0.064	0.061	0.042
F	2.024	2.862	2.582	1.877	1.833	1.428
p-value	0.092	0.003	0.004	0.025	0.029	0.110
Change R^2		0.056	0.002	-0.014	-0.003	-0.019
Change in F		0.838	-0.280	-0.705	-0.044	-0.405
p-value (change)		-0.089	0.001	0.021	0.004	0.081

p-values for each unstandardized parameter estimate are in parentheses. †*p*<0.10, ** p<0.05; ***p<0.01

Table 41 - Across-the-Board Capabilities moderation between Standalone Capabilities and Delivery

Independent variable	Dependent variable: Operational Performance – Delivery (OP3)					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
(Constant)	4.163	4.057	4.140	4.162	4.091	4.085
Size	-.047	-.021	-.045	-.035	-.013	-.012
	(.611)	(.806)	(.618)	(.706)	(.883)	(.894)
Metal	-.123	-.094	-.119	-.073	-.007	.016
	(.641)	(.702)	(.629)	(.772)	(.978)	(.951)
Paper	-.084	-.042	-.059	-.023	.013	.018
	(.647)	(.807)	(.732)	(.896)	(.938)	(.920)
Plastic	-.236	-.195	-.213	-.226	-.219	-.203
	(.196)	(262)	(.219)	(.198)	(.206)	(.253)
Customer Support		**.260****	.200	.223	.197	.211
		(.043)	(.131)	(.105)	(.164)	(.146)
Flexibility		-.001	.018	.013	.026	.016
		(.993)	(.859)	(.903)	(.804)	(.883)
Innovation		.055	.055	.052	.017	.035
		(.528)	(.544)	(.578)	(.854)	(.715)
Operational Efficiency		**.320****	**.292****	**.296****	**.305****	**.310****
		(.003)	(.008)	(.007)	(.006)	(.006)
Supply Management		.053	.076	.061	.065	.058
		(.537)	(.415)	(.527)	(.486)	(.553)
Continuous Learning			-.168	-.227†	-.164	-.168
			(.188)	(.088)	(.209)	(.221)
Information Management			.183†	.162	.100	.080
			(.072)	(.117)	(.347)	(.467)
LearningXCustomer				.018		.025
				(.927)		(.918)
LearningXFlexibility				.009		.115
				(.958)		(.567)
LearningXInnovation				-.164		-.033
				(.230)		(.848)
LearningXOp.Efficiency				.092		.103
				(.535)		(.589)
LearningXSupply				-.129		-.085
				(.261)		(.570)
InformationXCustomer					.023	.003
					(.879)	(.987)
InformationXFlexibility					-.090	-.147
					(.398)	(.293)
InformationXInnovation					-.146†	-.139
					(.098)	(.227)
InformationXOp.Efficiency					.062	.000
					(.537)	(.999)
InformationXSupply					-.132	-.082
					(.219)	(.563)
R2 Square	0.010	0.173	0.188	0.203	0.225	0.228
Adjusted R2 Square	-0.010	0.135	0.142	0.136	0.159	0.140
F	0.514	4.541	4.087	3.011	3.424	2.594
p-value	0.726	0.000	0.000	0.000	0.000	0.000
Change R^2		0.145	0.007	-0.006	-0.023	-0.019
Change in F		3.815	-0.454	-1.076	0.413	-0.830
p-value (change)		-0.726	0.000	0.000	0.000	0.000

p-values for each unstandardized parameter estimate are in parentheses. †*p*<0.10, ** p<0.05; ***p<0.01

Table 42 - Across-the-Board Capabilities moderation between Standalone Capabilities and Flexibility

Independent variable	Dependent variable: Operational Performance – Flexibility (OP4)					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
(Constant)	4.380	4.304	4.087	4.041	4.161	4.106
Size	-.082	-.053	.014	.018	.003	.008
	(.300)	(.470)	(.851)	(.816)	(.966)	(.918)
Metal	-.283	-.287	-.277	-.330	-.321	-.305
	(.210)	(.170)	(.176)	(.111)	(.117)	(.143)
Paper	-.256	-.245†	-.204	-.246†	-.252†	-.264†
	(.105)	(.093)	(.154)	(.088)	(.079)	(.067)
Plastic	-.296†	**-.330****	**-.319****	**-.294****	**-.322****	**-.304****
	(.059)	(.026)	(.028)	(.042)	(.025)	(.037)
Customer Support		**.233****	**.317****	**.298****	**.232****	**.233****
		(.033)	(.004)	(.009)	(.048)	(.049)
Flexibility		-.034	-.007	.016	.023	.024
		(.692)	(.932)	(.853)	(.794)	(.786)
Innovation		-.041	.020	.050	.055	.068
		(.578)	(.789)	(.513)	(.468)	(.380)
Operational Efficiency		**.449*****	**.499*****	**.505*****	**.454*****	**.460*****
		(.000)	(.000)	(.000)	(.000)	(.000)
Supply Management		-.123†	-.056	-.067	-.086	-.080
		(.093)	(.468)	(.401)	(.266)	(.314)
Continuous Learning			-.087	-.072	-.078	-.034
			(.409)	(.509)	(.467)	(.761)
Information Management			**-.227****	**-.204****	**-.175****	**-.206****
			(.007)	(.017)	(.047)	(.022)
LearningXCustomer				-.086		-.057
				(.601)		(.772)
LearningXFlexibility				-.005		.110
				(.973)		(.503)
LearningXInnovation				**.258****		.130
				(.022)		(.361)
LearningXOp.Efficiency				-.006		.091
				(.958)		(.557)
LearningXSupply				-.014		.066
				(.881)		(.592)
InformationXCustomer					-.153	-.081
					(.216)	(.597)
InformationXFlexibility					-.012	-.100
					(.888)	(.381)
InformationXInnovation					**.205****	.149
					(.005)	(.112)
InformationXOp.Efficiency					-.041	-.101
					(.617)	(.359)
InformationXSupply					-.093	-.147
					(.294)	(.205)
R2 Square	0.024	0.204	0.249	0.276	0.290	0.310
Adjusted R2 Square	0.005	0.167	0.206	0.215	0.230	0.232
F	1.244	5.581	5.836	4.505	4.832	3.942
p-value	0.293	0.000	0.000	0.000	0.000	0.000
Change R^2		0.162	0.039	0.009	0.015	0.002
Change in F		4.337	0.255	-1.331	0.327	-0.890
p-value (change)		-0.293	0.000	0.000	0.000	0.000

p-values for each unstandardized parameter estimate are in parentheses. †*p*<0.10, ** p<0.05; ***p<0.01

Table 43 - Across-the-Board Capabilities moderation between Standalone Capabilities and Innovation

Independent variable	Dependent variable: Operational Performance – Innovation (OP5)					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
(Constant)	3.662	3.612	3.535	3.460	3.459	3.375
Size	.127	.129	.153†	**.184****	**.179****	**.203****
	(.152)	(.129)	(.082)	(.043)	(.048)	(.027)
Metal	**-.532****	**-.573****	**-.574****	**-.531****	**-.507****	**-.500****
	(.036)	(.017)	(.017)	(.031)	(.038)	(.046)
Paper	**-.775*****	**-.679*****	**-.665*****	**-.649*****	**-.622*****	**-.619*****
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Plastic	**-.362****	-.311†	-.309†	-.328†	-.306†	-.336†
	(.040)	(.066)	(.068)	(.056)	(.073)	(.054)
Customer Support		**.276****	**.300****	.260†	**.328****	**.310****
		(.027)	(.021)	(.053)	(.019)	(.029)
Flexibility		-.008	.008	.009	.001	.018
		(.936)	(.935)	(.928)	(.989)	(.864)
Innovation		**.296*****	**.323*****	**.316*****	**.298*****	**.290****
		(.001)	(.000)	(.001)	(.001)	(.002)
Operational Efficiency		.097	.113	.125	.146	.149
		(.352)	(.286)	(.245)	(.179)	(.173)
Supply Management		-.086	-.052	-.031	-.043	-.018
		(.300)	(.569)	(.746)	(.639)	(.847)
Continuous Learning			-.076	-.092	-.092	-.092
			(.542)	(.477)	(.472)	(.491)
Information Management			-.060	-.063	-.109	-.106
			(.541)	(.531)	(.295)	(.325)
LearningXCustomer				-.279		-.440†
				(.154)		(.062)
LearningXFlexibility				-.039		-.101
				(.804)		(.606)
LearningXInnovation				-.057		.153
				(.671)		(.371)
LearningXOp.Efficiency				.176		.151
				(.226)		(.415)
LearningXSupply				.045		.158
				(.687)		(.280)
InformationXCustomer					.052	.277
					(.723)	(.133)
InformationXFlexibility					-.055	-.004
					(.598)	(.978)
InformationXInnovation					-.125	-.211†
					(.150)	(.061)
InformationXOp.Efficiency					.124	.048
					(.212)	(.713)
InformationXSupply					-.070	-.158
					(.507)	(.255)
R2 Square	0.102	0.238	0.243	0.254	0.260	0.277
Adjusted R2 Square	0.084	0.203	0.200	0.191	0.197	0.194
F	5.693	6.810	5.661	4.032	4.148	3.355
p-value	0.000	0.000	0.000	0.000	0.000	0.000
Change R^2		0.119	-0.003	-0.009	0.006	-0.003
Change in F		1.117	-1.149	-1.629	0.116	-0.793
p-value (change)		0.000	0.000	0.000	0.000	0.000

p-values for each unstandardized parameter estimate are in parentheses. †*p*<0.10, ** p<0.05; ***p<0.01

Hypotheses H 3a - Across-the-Board Capabilities moderate the relationship between Standalone Capabilities and Unit Cost, H 3b - Across-the-Board Capabilities moderate the relationship between Standalone Capabilities and Quality, H 3c - Across-the-Board Capabilities moderate the relationship between Standalone Capabilities and Delivery, H3d - Across-the-Board Capabilities moderate the relationship between Standalone Capabilities and Flexibility, and H3e - Across-the-Board Capabilities moderate the relationship between Standalone Capabilities and Innovation were not supported in this study. Across-the-Board Capabilities moderation was not observed in the relationship among Standalone Capabilities and Unit Cost, Quality, Delivery, Flexibility, or Innovation (see Model 6 in Table 39, Table 40, Table 41, Table 42, and Table 43).

Results indicated that just like the dynamic capabilities, Across-the-Board Capabilities per se do not lead to superior performance (Eisenhardt & Martin, 2000; Zahra et al., 2006). They are necessary, but not sufficient to create superior operational performance (see Model 3 in Table 39, Table 40, Table 41, Table 42, and Table 43). The role of Across-the-Board Capabilities (Continuous Learning and Information Management) is to support in the development of Standalone Capabilities. For Zahra et al. (2006, pp. 943) "the effects of dynamic capabilities on organizational performance work through substantive capabilities ('what the firm can do') and depend on the quality of the organization's knowledge base ('what the firm knows')".

Information System also rarely contributes for a direct influence to sustain competitive advantage; its relationship is indirect through a complex chain of assets and capabilities that may lead to superior performance (Bharadwaj et al., 2007; Wade & Hulland, 2004). As well as Information Management, Continuous Learning does not directly improve performance, but works indirectly by embedding zero order capabilities (Schilke, 2014). A possible explanation is the nature of the Across-the-Board Capabilities that involves learning and construction of knowledge through the social relations. Internal learning is acquired by experience, errors, successes; and external learning is associated with new hires, acquisitions, partnerships, and so on (Patel et al., 2012; Setia & Patel, 2013). All this can be seen as a long-term investment by managers who answered the survey. In contrast to the Standalone Capabilities in which focus is short-term return. Hypothesis 3 as a whole was not supported. Summary of the results of the hypotheses are shown in Table 44.

Table 44 – Resume of Hypotheses

H 1– Standalone Capabilities have a positive relationship with Operational Performance	Partial support
H 1a – Customer Support Capability has a positive relationship with Operational Performance	Support
H 2b – Flexibility Capability has a positive relationship with Operational Performance	No support
H 3c – Innovation Capability has a positive relationship with Operational Performance	Partial support
H 4d – Operational Efficiency Capability has a positive relationship with Operational Performance	Partial support
H 5e – Supply Management Capability has a positive relationship with Operational Performance	No support
H 2– Across-the-Board Capabilities have a positive relationship with Standalone Capabilities	Support
H 2a – Continuous Learning Capability has a positive relationship with Standalone Capabilities	Support
H 2b – Information Management Capability has a positive relationship with Standalone Capabilities	Support
H3 - Across-the-Board Capabilities moderate the relationship between Standalone Capabilities and Operational Performance	No support
H 3a – Across-the-Board Capabilities moderate the relationship between Standalone Capabilities and Unit Cost	No support
H 3b – Across-the-Board Capabilities moderate the relationship between Standalone Capabilities and Quality	No support
H 3c – Across-the-Board Capabilities moderate the relationship between Standalone Capabilities and Delivery	No support
H 3d – Across-the-Board Capabilities moderate the relationship between Standalone Capabilities and Flexibility	No support
H 3e – Across-the-Board Capabilities moderate the relationship between Standalone Capabilities and Innovation	No support

5 CONCLUSION

Understanding practices and operational capabilities requires both qualitative and quantitative analysis. In qualitative phase, we analyzed nature and types of operational capabilities from the operational practices, creating a typology. However, strictly qualitative research has a limited ability to generalize and to identify the impact construct over the other, thus we adds the need for quantitative work as well. In the quantitative phase, we validate scales of typology and relate operational capabilities with operational performance.

In this dissertation, we proposed to answer four main questions: 1) what is the nature of operational capability? 2) what is the relationship between operational practices and operational capabilities? 3) what are types of operational capabilities characterized in the firm's internal environment? 4) what is the impact of the operational capabilities on operational performance?

First, we answered two questions: 1) what is the nature of operational capability? and 2) what is the relationship between operational practices and operational capabilities?

Operational capabilities are developed over time through the interaction bundles of operational practices. Operational practices are operational capabilities' antecedents. However, though we know that the development of a capability involves different paths, it is equifinal. We do not ignore the need to use different resources in this process, tangible and intangible, such as leadership and organizational culture. Yet, we believe that operational practices can be a key resource for the development of operational capabilities.

This logical relationship between practices and operational capabilities only began to be discussed from the studies of Wu et al. (2010) and Wu et al. (2012). Operational practices are mechanisms that aid the development of operational capabilities. But for that, operational practices need to be inter-linked. A practice alone will not lead to the development of a capability. For example, the implementation of 5S practice does not indicate that the firm has a TQM practice. In the same manner, a TQM practice alone does not lead to the development of an Operational Efficiency Capability. To be developed this capability requires the involvement of other practices such as Lead time, JIT, TPM, and EHS.

Like Wu et al. (2012), we believe that operational practices are additive. When an operational practice is implemented, other practices can be included to complement it. Over time, they are embedded in the social context of the firm; they develop idiosyncratic aspects and a capability may emerge.

To illustrate the development of an operational capability from daily routines, we use an excerpt from the interview of the Quality Manager of Flexi_Case. Using a similar metaphor to Wu et al. (2010) about the preparation of a meal to explain differences between resources, practices, and operational capabilities, the Quality Manager translates the complexity of developing a capability into simple words:

"Let's talk about a cake recipe. His mother makes cake. Certainly, her cake tastes better than yours most of the time. But, you have the recipe and know how to make the cake. So, why is your cake not as tasty as mother’s cake? Because we should consider the “hand that makes it”. His mother has experience. She gives a personal touch to the recipe, more salt, less salt, little this, that [...]. "

For the manager, the “hand” that makes the recipe is very important. In drawing a parallel, we can say that recipes are operational practices, and the means of preparing the meals are operational capabilities. A firm's experience over time will provide a touch of “who-knows-what” to create operational practices, leading to the development of operational capabilities. As a consequence, the final product will not be the same as the competitors’ because we need to consider 'the hand that makes it'. The Quality Manager emphasized that "experience is what makes us different."

If we use the analogy of a run, we can say that the finish line is performance. To reach the finish line, athletes must complete the path. This process involves foundation training to develop strength and stamina, and functional training to increase the runner's speed. In addition, athletes engage in activities concerned with diet, training, and health care. This set of actions represents operational practices, which, in an inter-related fashion, lead to the development of a capability for running (operational capability), allowing the athlete to complete its path (performance).

We can say that operational capabilities are *idiosyncratic resources developed over time, from bundles of inter-linked operational practices, based on the unique history and experiences of the firm, and problems that decision makers have had to face in the day-to-day operations*. Operational practices are embedded in the social and environmental context of the firm.

Next, another question to be answered is: 3) what are the types of operational capabilities characterized in the firm's internal environment?

In our theoretical research, we found eight different operational capabilities:1) Integrative Information Systems; 2) Continuous Improvement; 3) Innovation; 4) Flexible Processes; 5) Mass Customization; 6) Quality Management; 7) Supply Chain Management; and 8) Learning. These capabilities emerged repeatedly throughout the literature review. However, Quality Management was not observed, and two new capabilities were identified, being Operational Efficiency and Customer Support.

Although Quality Management is considered a capability in some studies (White, 1996), in this research, it was classified as an operational practice. In the four cases analyzed, we observed quality management through standardized procedures that were transferred easily. For this reason, Quality Management was not deemed a capability.

The Operational Efficiency Capability was found through analysis of qualitative data. It consists of a set of inter-linked operational practices (Lead time, JIT, TPM, and EHS), all of which seek to achieve robust operational results. An Operational Efficiency Capability is not performance; it is a capability developed over time, through the implementation and control of daily operational practices. It can impact operational performance, such as cost, quality, flexibility, delivery, or innovation. Thus, the Operational Efficiency Capability is the means to an end.

The Customer Support Capability was an interesting finding of the qualitative phase. A number of studies use customer satisfaction as a set of operational practices (Li et al., 2005), others like performance (Yeung, 2008), but, we concluded that it is a capability. Firms want to satisfy their customers, but not all are able to implement an adequate set of operational practices that, over time, can become a capability. In our study, the Customer Support Capability was supported in the qualitative and quantitative phase. Our regressions showed a positive and significant relationship with all the variables of operational performance. The Customer Support Capability is considered the most important in the packaging industry.

Nine operational capabilities were observed, creating our typology. However, they have been classified into two different constructs. We called the first construct “Standalone Capabilities”. They consist of zero order capabilities, and serve to achieve operational results (Wu et al., 2010; Zahra et al., 2006). It is composed of: 1) Customer Support; 2) Innovation; 3) Operational Efficiency; 4) Flexibility; 5) Customization; and 6) Supply Management. The second construct is “called Across-the-Board Capabilities” and provide support in developing other operational capabilities. They can build, change and/or reconfigure Standalone Capabilities (Teece et al., 1997). Across-the-Board Capabilities are considered first order capabilities, and are composed of: Learning, Continuous Improvement, and Information Management (Collis, 1994; Zollo & Winter, 2002).Figure 16shows the complete typology.

In order to confirm the typology of the qualitative phase, we conducted a survey. At this stage, some operational capabilities were grouped. In the Across-the-Board Capabilities were grouped into Learning and Continuous Improvement. The Standalone Capabilities were grouped into Flexibility and Customization. The grouping of these variables has theoretical and practical support. Before customizing products, the firm needs to be flexible, and learning precedes continuous improvement practices (Swink & Hegarty, 1998; Vickery et al., 1997; Zhang et al., 2003). Furthermore, they demonstrated no discriminant validity in the confirmatory analysis of the data. In total, seven capabilities were operationalized in the quantitative phase. Across-the-Board Capabilities were represented by Continuous Learning and Information Management, and Standalone Capabilities were represented by Customer Support, Innovation, Operational Efficiency, Flexibility, and Supply Management.

In addition to typology, we have noticed that not all firms have the same operational capabilities. The market in which the firm operates will define the type of operational capabilities necessary for it to compete with its competitors. Even within the firm, operational capabilities can be at different stages of development. Capabilities are not finished resources - they are developed according to the needs of the firm and, therefore, they can be at various levels of maturity. A capability does not last forever; it may cease to exist or be replaced by another that best meets the firm's needs (Collis, 1994).

Finally, we answer the fourth question: 4) what is the impact of operational capabilities on operational performance?

A sustainable competitive advantage is the capability of a firm to develop other capabilities (Collis, 1994). When we divided operational capabilities in the two aforementioned groups, Across-the-Board Capabilities and Standalone Capabilities, we were able to identify the role of each of them. Standalone capabilities have a direct relationship with operational performance, though the same does not hold true with

Across-the-Board Capabilities. Rather, these capabilities have a role creating a foundation for the development of Standalone Capabilities.

The existence of the two groups allows us to understand how the firm generates sustainable competitive advantages from its operational capabilities. This new typology characterizes capabilities which impact performance, and how they can be enhanced constantly. Across-the-Board Capabilities permit differentiated Standalone Capabilities among firms.

Intensive use of Across-the-Board Capabilities renders Standalone Capabilities into a constant process of transformation. This inhibits imitation and further provides sources of sustainable competitive advantage. Thus, although Standalone Capabilities have a direct impact on performance, they alone are not sources of competitive advantage as, over time, competitors can achieve the same level of development. In this sense, Across-the-Board Capabilities create a distance from competitors while developing Standalone Capabilities, which can lead to sustainable competitive advantages for the firm.

The nature of Across-the-Board Capabilities implies that they do not need to have a direct relationship with operational performance. Our qualitative results suggested that Across-the-Board Capabilities moderate the relationship between Standalone Capabilities and operational performance. However, the results of our quantitative study did not confirm this hypothesis. Across-the-Board Capabilities were not related to operational performance, neither directly nor indirectly. What we found was Across-the-Board Capabilities function as an antecedent of Standalone Capabilities. Across-the-Board Capabilities improve, modify, or even form novel Standalone Capabilities.

In general, Standalone Capabilities were expected to be related to a superior operational performance. Operational performance is a multidimensional construct, and was represented by its dimensions (unit cost, quality, delivery, flexibility and innovation). Although several studies have used a composite measure of operational performance, averaging items related to each dimension, our confirmatory data analysis has not yielded convergent validity. Individual items representing cost, quality, delivery, flexibility and innovation were then employed to represent the different dimensions of operational performance.

Three main findings resulted from the regression analysis between Standalone Capabilities and operational performance. First, the Operational Efficiency capability has a positive relationship with Flexibility and Delivery performance dimensions. It was an important result because it can improve operational performance by substituting other capabilities that had no relationship to performance. For example, the Flexibility Capability was not related to the Flexibility performance dimension. Flexible systems that focus on creating internal capabilities may not enhance performance (Zhang et al., 2003). The Flexibility Capability can give rise to additional costs for the firm and may be difficult to implement into the production process. However, if a firm develops an Operational Efficiency Capability, it can reach Flexibility in performance through the delivery of different products in different quantities without excessive cost, time, organizational disruptions or performance losses (Zhang et al., 2003). Second, we demonstrated by discriminant validity that the Flexibility Capability and Flexibility as a performance dimension are two different constructs. The Flexibility Capability is composed of resources available in the internal environment of the firm, such as processes, machinery, equipment and people. It targets a flexible operational process. On the other hand, Flexibility as a performance dimension is related to the mix/volume of available products in the market. These two constructs are different, should not be operated with the same items and are not necessarily related. Third, we noted a negative relationship between Supply Management and Cost. This finding leads us to think upon the role of operational capabilities beyond operational performance. Could an operational capability only have value if it has a positive relationship with the operational performance? The development of a capability may be related to a contingent strategy or benefits that it can provide to other operational capabilities.

The primary theoretical contribution of the current dissertation is the creation of an operational capabilities typology based on firms' internal environments. We found two groups of operational capabilities - Standalone Capabilities and Across-the-Board Capabilities. Each one has a specific function in the operational process. Standalone Capabilities improve operational performance and Across-the-Board Capabilities can build or reconfigure Standalone Capabilities. These two groupings provide insights into the role of zero order and first order capabilities in operations management.

A second contribution is that operational capabilities are not an off-the-shelf resource. They are developed over time through the implementation of operational practices. The relationship between practices and operational capabilities puts forward the idea of operational practices as antecedents of operational capabilities. Moreover, we further differentiated between the constructs of operational practices and operational capabilities and showed the origin of operational capabilities from the internal environment of the firm. Another point to consider is that the operational capabilities have different levels of maturity and can account for at least part of the heterogeneity in performance among firms, this point having not been exploited in operations.

Our model provides a simple but informative tool for managers to gauge progress and determine the impact of improvement efforts on performance. Operational capabilities can be sources of competitive advantage, but the question is how managers can build them in a firm's internal environment. In this study, we have identified bundles of operational practices as antecedents of operational capabilities, and we have shown the path that leads to the development of operational capabilities.

Although operational capabilities can potentially lead to sustainable competitive advantage, not all operational capabilities need to exist at the same time. Managers must take into account the type of industry and market in which their firms operate. Furthermore, operational capabilities are not permanent; they may lessen their importance at certain periods of time or even cease to exist altogether. Operational capabilities are not generically valuable in all industries at all periods of time (Collis, 1994). Context in which the firm functions should be considered when developing an operational capability. We suggest that firms invest in their operational capabilities based on their own unique context instead of using off-the-shelf templates of capabilities seen as competitive advantages. Managers need to know the internal resources of the firm.

This study has four main limitations. The first, from the qualitative phase, is that we have identified and selected operational practices that were more evident in the interviews, but we know that other practices were left out because they were not mentioned by interviewees or they had not been observed by researchers. The second limitation is that we found evidence, both in literature and case studies, that operational practices are inter-linked; hence when we separate them into categories, we simplify a reality that is actually complex and dynamic. Third, the typology presented here is restricted to the packaging industry located in Brazil. We cannot guarantee that all operational capabilities of this study are found in other industries. However, we do indeed believe that our model of Across-the-Board Capabilities and Standalone Capabilities can be applied in different industries. Finally, in the quantitative phase of this study, only the packaging industry was investigated. As such, the research is limited by the cross-sectional nature of the data. This approach allows relating operational capabilities with operational performance, but does not explain why certain operational capabilities do not have a positive relationship with operational performance. The use of a single industry can be a limitation, but does help decrease the variability of the data.

For future studies, we suggest that other researchers explore how organizational culture affects the development of operational capabilities. The social context is an important aspect to be considered because it permits a process of mutual learning between the organization and the individuals in it. Firms stock knowledge in their procedures, practices, standards and rules. Over time, the accumulation of knowledge generates learning for their employees and, at the same time, employees are socialized with the beliefs of the organization (March, 1991).

For example, when analyze the two American multinationals in this research, both with best practices, it was realized that each has its own way of functioning. In the case of Label_Case, the firm has the corporate motto "One way", meaning that the work of all employees should become the result of the company, and not simply a department or a plant. They believe in a unique way of conducting business activities, and this organizationally spans from President to an Operator. Conversely, Flexi_Case has a departmentalized structure, where each department works to achieve its goals and at a certain point, these goals are shared. Both firms have similar operational capabilities, but a completely different organizational culture. We believe this is an issue to be explored in further research.

Leadership was another aspect that emerged from the data analysis. When Flexi_Case implemented its management system - WCOM -a number of plants were successful while others were not. WCOM system was effectively put in place by all plants when the Director of the firm took over the project and established a plan of action monitored by the board. Leadership influences on the development of operational capabilities is a point to be investigated, but not only leadership related to the board. We believe that individual leadership can positively impact the development of new operational capabilities. According to the Quality Manager of Paper_Case "[...] working procedures and manuals are not enough. [...] it is necessary to change people's behavior".

We also suggest that future research be performed in other industries so that the findings can be compared. Additionally, we believe it is of interest to investigate further the negative relationship between Supply Management and Unit Cost, potentially exploring what the reasons behind investing in a capability are even if it negative impacts the operational performance of the firm. Ultimately, we hope that studies in the future can complement and advance the issue of operational capabilities, contribute to the literature on operations and help production managers achieve sustainable competitive advantages for their firms.

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APPENDICES

Appendix 1–Operational practice and inter-item

OPERATIONAL PRACTICE	INTER-ITEM	QUESTION	AUTHORS
TQM Power (1995)	**Strategic Planning**	Como são organizadas as ações ou estratégias que a empresa irá desenvolver nos próximos meses? Como as ações ou estratégias se relacionam com a produção? Como as ações ou estratégias (previstas) são executadas?	Sila (2007) Wilson & Collier (2000) Samson & Terziovski (1999) Choi & Eboch (1998)
	People Management (training)	Descreva como um funcionário aprende a desenvolver uma função na empresa? Como funcionam os treinamentos na empresa? Qual foi o último? Como “esse último” treinamento ajudou no seu trabalho?	Kaynak & Hartley (2008) Sila (2007) Nair (2006) Kaynak (2003) Das et al. (2000) Wilson & Collier (2000) Samson & Terziovski (1999) Choi & Eboch (1998)
		O que acha que mudou (na sua atividade) de quando começou para hoje? Como a empresa te preparou para essas mudanças?	
	Leadership	Como os problemas da produção são resolvidos? Exemplo quebrou uma máquina/funcionário faltou.	Kaynak & Hartley (2008) Sila (2007) Nair (2006) Kaynak (2003) Wilson & Collier (2000) Samson & Terziovski (1999)
		Quando você precisa de algo. A quem você recorre?Exemplo Como seu gerente/supervisor acompanha sua atividade?	
	Measuring / Information / Analysis	Como você acompanha as metas da produção?Como isso ajuda em sua atividade?	Kaynak & Hartley (2008) Sila (2007) Nair (2006) Kaynak (2003) Daset al. (2000) Wilson & Collier (2000) Samson & Terziovski (1999) Choi & Eboch (1998)
		Que tipo de relatório vocês possuem na produção? Como e quando os relatórios são analisados?	
	Product Design	Como são criados os novos produtos? Quantos produtos foram criados nos últimos tempos?	Kaynak & Hartley (2008) Nair (2006) Kaynak (2003)
		Como os novos produtos são inseridos na linha de produção? Quais dificuldades vocês enfrentam? Explique	
		Como funciona a personalização de um produto para o cliente?	
	Management processes	Como funciona o fluxo de entrada e saída de produtos?Quanto tempo ele funciona desta maneira? O que mudou ao longo do tempo?	Kaynak & Hartley (2008) Sila (2007) Nair (2006)
		Como o fluxo atual da produção ajuda no atendimento ao cliente?	

		Em que momento do processo vocês conseguem identificar um problema na execução de um produto? Exemplo	Kaynak (2003) Wilson & Collier (2000) Samson & Terziovski (1999) Choi & Eboch (1998)
	Client focus	Como os clientes ajudam vocês a melhorar o seu trabalho (desempenho)? Quais os feedbacks dos clientes vocês tem recebido referente aos produtos? Se o cliente reclamar de alguma coisa referente ao produto acabado, qual é o procedimento?Exemplo	Kaynak & Hartley (2008) Sila (2007) Nair (2006) Daset al. (2000) Samson & Terziovski (1999)
JIT	**Adherence in daily schedule**	Como a programação diária é comunicada? Como você sabe o que vai ser produzido no dia? Formal/ Informal. Como a programação diária da produção é executada? Quando a programação é interrompida? Como isso afeta o trabalho de vocês?	Mackelprang & Nair (2010) Matsui (2007) Ward & Zhou (2006) Ketokivi & Schroeder (2004) Callen et al. (2000)
	Cell arrangement	Como os funcionários são alocados em cada posto de trabalho? Existe troca? Se algum funcionário faltar, como funciona?	Ward & Zhou (2006) Swink et al. (2005) Fullerton et al, (2003) Fullerton & McWatters (2001) Callen et al. (2000)
	Reduction cycles / configuration	Quantos tipos de produtos uma máquina produz? Como funcionam os ciclos das máquinas? Como e quanto ela é configurada?	Mackelprang & Nair (2010) Matsui (2007) Ward&Zhou (2006) Ketokivi & Schroeder (2004) Fullerton et al, (2003) Fullerton & McWatters (2001) Callen et al. (2000)
	Small lots	Como é feita a programação de pedidos (pequenos/grandes)? Por quê?	Mackelprang & Nair (2010) Matsui (2007) Ward & Zhou (2006) Swink et al. (2005)
	Quick production change	Se um cliente faz um pedido "pra ontem". Como funciona a mudança de programação? Como isso afeta a produção?	Ward& Zhou (2006)
	Preventive maintenance	Se uma máquina parar de funcionar, como o problema é resolvido? Exemplo. Como são programadas as manutenções das máquinas?	Mackelprang & Nair (2010) Fullerton et al, (2003) Fullerton & McWatters (2001) Callen et al. (2000)
	Layout	Como é disposto o layout dos equipamentos (células)?	Mackelprang & Nair (2010)

	equipment		Matsui (2007)
	Client	Em quanto tempo vocês conseguem entregar um pedido a um cliente? Exemplo.	Mackelprang & Nair (2010) Matsui (2007) Ketokivi & Schroeder (2004) Fullerton et al, (2003) Fullerton & McWatters (2001)
		Como os clientes acompanham o pedido?	
	Bottlenecks	Qual o maior gargalo (dificuldade) que você encontra hoje na produção?	Ward& Zhou (2006)
	Kanban	Como vocês controlam o fluxo de produção?	Mackelprang & Nair (2010) Matsui (2007) Swink et al. (2005) Fullerton et al, (2003) Fullerton & McWatters (2001) Callen et al. (2000)
SCM	**Selection process**	Quanto tempo em média os fornecedores trabalham com vocês? Como isso ajuda vocês na produção?	Ou, Liu, Hung, & Yen (2010) Yeung (2008) Droge et al. (2004) Tan et al. (2002) Tan et al. (1999)
		Em média quantos fornecedores (principais) vocês tem por tipo de insumo?	
		A proximidade geográficados fornecedores é importante para vocês? Sim, Não, por quê?	
		Quais as características importantes para uma empresa ser uma fornecedora?	
	Integration	Existe troca de ideias entre vocês e os fornecedores sobre como melhorarar o processo produtivo? Como isso funciona? Me de um exemplo.	
		Como é feita a integração do design do produto com os fornecedores? Como vocês acompanham os pedidos feitos aos fornecedores? Como os fornecedores são integrados na estratégia da empresa?	
	Evaluation	Como vocês avaliam se os fornecedores estão atendendo vocês de forma adequada?	
		Como os fornecedores garantem a vocês a qualidade, capacidade produtiva e entrega da matéria-prima/produtos?	
		Os fornecedores possuem algum tipo de certificação? Como isso ajuda vocês?	
		Como a empresa acompanha os fornecedores com relação às questões éticas?	
		Quais são os procedimentos quando o pedido chega com algum tipo do fornecedor com problemas? Me de um exemplo	

Appendix 2– Summary of data collection protocol

Firm:	City:
Date:	Start time:
Interviewee:	Position:
Experience time:	Time experience in the packaging industry:
Number of employees:	
Does firm exports? If yes What is% of production exported?	How many% the firm has owned the national market?

Make X	Classification	Annual gross operating revenue
	Microenterprise	< or =R$ 2,4 milhões
	Small	> R$ 2,4 milhões and <or =R$ 16 milhões
	Medium	>R$ 16 milhões and < or = R$ 90 milhões
	Medium-large	>R$ 90 milhões and < or = R$ 300 milhões
	Large	> R$ 300 milhões

http://www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Institucional/Apoio_Financeiro/porte.html

Hours:
EMAIL:

Practices	Topics indicative questions	Sources of information
TQM	Operational management Quality Process People Management and Leadership Measuring and Analysis Design of products Customization Client focus	Interviews Documents Observation Visits
JIT	Adherence in daily program Small Lots Reduction cycles andSetup Cell Arrangement Layout equipment Preventive Maintenance Client focus	Interviews Documents Observation Visits
SCM	Selection Integration Relationship Evaluated	Interviews Documents Observation Visits

Appendix 3–Select of the operational practices (Q-Sort)

	Select one of the operational practices and a measuring factors	Practices	Measuring factors	
				OBS.:
1	Como funciona a personalização de um produto para o cliente?			
2	Como funciona o fluxo de entrada e saída de produtos?Quanto tempo ele funciona desta maneira? O que mudou ao longo do tempo?			
3	Como o fluxo atual da produção ajuda no atendimento ao cliente?			
4	Quantos tipos de produtos uma máquina produz? Como funcionam os ciclos das máquinas? Como e quanto ela é configurada?			
5	Como é feita a programação de pedidos (pequenos/grandes)? Por quê?			
6	Se um cliente faz um pedido "pra ontem". Como funciona a mudança de programação? Como isso afeta a produção?			
7	A proximidade geográfica dos fornecedores é importante para vocês? Sim, Não, por quê?			
8	Quais as características importantes para uma empresa ser uma fornecedora?			
9	Se o cliente reclamar de alguma coisa referente ao produto acabado, qual é o procedimento?Exemplo			
10	Como a programação diária é comunicada? Como você sabe o que vai ser produzido no dia? Formal/ Informal.			
11	Como você acompanha as metas da produção?Como isso ajuda em sua atividade?			
12	Que tipo de relatório vocês possuem na produção?			
13	Como e quando os relatórios são analisados?			
14	Como são criados os novos produtos? Quantos produtos foram criados nos últimos tempos?			

Planejamento Estratégico
Gestão de Pessoas (treinamento)
Liderança
Medição/Informação/Análise
Design de produtos
Gestão de processos
Foco no cliente
Aderência na programação diária
Arranjo celular
Redução de ciclos/configuração
Pequenos lotes
Mudança rápida da produção
Manutenção preventiva
Layout equipamentos
Gargalos
Kanban
Escolha Fornecedor
Integração do fornecedor
Avaliação do Fornecedor

Appendix 4 – Evidence of the relationship between practices and operational capabilities

Practice	Topic	Question	Inter-item	Operational Capabilities
TQM	Operational management Quality	How is production planning?	Actions or strategies that the firm will develop in the coming months. Time. Execution. Accompanied. Input and output flow. Bottleneck in production.	Continuous improvement Innovation Learning Quality management Supplier
	People Management	How are made training and development of production employees' policies? How do employees influence the production process improvement? How is communication conducted of the cross-functional teams?	Preparation for the changes over time – Training. Monitoring of new employees – Training. Training of employees for different functions. In the case of a transfer function, the yield is the same. Formalization ideas, suggestions. Implementation (ie.) Rewards (ie.). Time for development. How are managed the errors and failures of a product / process.	Continuous improvement Flexibility Integration information system Learning Quality management
	Leadership	What is the role of the management in the development of activities day to day?	Solving Problems - Paper supervisor. Monitoring the activity by the supervisor Supervisor participation in the improvement of their activity?	Continuous improvement Flexibility Integration information system Learning Quality management
	Measuring and Analysis	What type of report do you have in this function? Who issues? And, as it (s) helps in the development of your activities?	Monitoring goals. Reports Analysis - (feedback)	Continuous improvement Innovation Learning Quality management Supplier
	Design of products Customization	How are created and inserted the new products on the production line? In what level do you can customize	Existence of patents. Protection in the creation/development of new products, business or clients. Insert a variety of products without increasing the cost.	Continuous improvement Flexibility Innovation Learning

		the product to a customer. example.	Personalization products on a large scale. Respond quickly to customization.	Mass Customization
TQMand JIT	Technologies	How do the new technologies influence the production?	Types of technologies acquired in recent times (machinery, processes or information systems). How were acquired and how changed the operating process? Introduction of new technologies to market How do innovations reinforce the expertise (experience / knowledge) of the firm (processes / products).	Continuous improvement Flexibility Integration information system Innovation Learning Mass Customization Quality management Supplier
	Client focus	How do customers influence the production?	Feedback from customers relating to products Ideas generated by customers. Customer role in the acquisition of new technologies. Customer complaints (product, process, delivery). Delivery time. Monitoring of the request by the customer.	Continuous improvement Flexibility Innovation Learning Mass Customization Quality management
JIT	Adherence in daily program Small Lots Reduction cycles - Setup	How are planned and implemented daily activities of production?	Communication daily program (formal / informal). Control of the production flow. (Ex .: Kanban) Monitoring each process as to the accuracy and quality. Identification and resolution of operational problems. Present capacity of the machines for different volume and product mix. Interrupt / change the daily programming. When and why. Order off schedule. Reduction of cycles of the machines (SETUP). Decision of the quantities to be produced (small / large lots). How inputs are managed? Diversification.	Continuous improvement Flexibility Integration information system Innovation Learning Mass Customization Quality management
	Cell Arrangement Layout equipment	How is organized the production flow? (people and layout of the machines)	Existence or not working cell. Lack of employees; transfer of staff. Break machines. Purchase of new machinery.	Continuous improvement Flexibility Integration information system Innovation
	Preventive Maintenance	How does the maintenance of the machines?	What is the frequency concerts during production Difficulties in maintaining	

				Continuous improvement Integration information system Innovation Learning Quality management
SCM	Selection	How is the process of selecting suppliers?	How contracts are conducted? (Formal / informal / aspects required) Characteristics that suppliers must possess Certification. Code of ethics. Number of suppliers pot type of input. Geographical proximity of suppliers.	Supplier
	Integrationand Relationship	How do suppliers are integrated into the production planning? How do the relationship with suppliers helps improve the production process? Example. How dosuppliers help in the acquisition of new technologies? Example.	Average time that suppliers work with the firm. Integrationproduct design with suppliers Integration Information System (Buyer/supplier) Tracking What are the strengths of your relationship with suppliers? What needs to improve?	Continuous improvement Integration information system Innovation Learning Quality management Supplier
	Evaluated	11. How do suppliers are evaluated?	Quality. Productive capacity. Delivery. Flexibiidade Monitoring of suppliers (financial / technological / ethical issues) Formal / Informal Punishments	Continuous improvement Learning Quality management Supplier

Appendix 5 – Interview script

<table>
<tr><td colspan="3">The information collected is completely confidential. Names will be kept confidential. The research will be recorded for later analysis.</td></tr>
<tr><td colspan="2">Firm:</td><td>City:</td></tr>
<tr><td>Date:</td><td colspan="2">Start time:</td></tr>
<tr><td>Interviewee:</td><td colspan="2">Position:</td></tr>
<tr><td>Experience time:</td><td colspan="2">Experience time in the packaging industry:</td></tr>
<tr><td colspan="2">Part 1: Questions for managers of area (managers that relate to the production will be selected according the firm's organogram).</td><td>Observations:</td></tr>
<tr><td colspan="2">1. How your area doesrelate to the production area? (marketing, logistics, purchasing, etc.).
2. How do you work for the development of this activity? (ex .: purchases of inputs, design prototypes, marketing campaigns, etc.).
• Employees (ideas / suggestions. Communication channel. Meetings / site)
• Customers (requests)
• Suppliers (Relationship (long / short). Certifications. Evaluation. Information System)
• New technologies
• New products and services
• Competitors (benchmarking)
• Market / Government (regulation, policies, rules).
3. Can you describe me any situation in which the two areas worked together to solve particular situation (problem).
• When it happened
• Who was involved
• How is resolved
• How is currently
4. In what point do you think firm performance better than the competition? (customers, suppliers, production, introduction of new products on the market).
5. In what point do you think that the firm should invest in coming years?</td><td>• Basic information about the firm.
• Market positioning.
• Product mix

Try to capture these questions:
Operational ambidexterity: exploration and exploitation:

a) Ability to explore new operational technologies.
b) Ability to create products / new services for the firm.
c) Ability to develop creative ways to customer satisfaction.
d) Aggression in introducing new products to market
e) Seek constantly new technologies and operating systems.
f) Commitment with best quality and low cost.</td></tr>
</table>

Part 2: Specific questions to the productive process. Tell me a little about your function in firm?		Insert: What? How? When? Why this? Identify what's different from competitor	Operational Capabilites
TQM	**Operational management / Quality**	Kaynak & Hartley (2008); Sila (2007); Nair (2006); Kaynak (2003); Wilson & Collier (2000); Samson & Terziovski (1999); Choi & Eboch (1998)	Quality management
1. How is production planning?		▪ actions or strategies that the firm will develop in the coming months. ▪ Time. Execution. Accompanied. ▪ Input and output flow. ▪ Bottleneck in production.	
JIT	**Adherence in daily program / Small Lots / reduction cycles - Setup**	Mackelprang & Nair (2010); Matsui (2007); Ward& Zhou (2006); Ketokivi & Schroeder (2004); Fullerton et al. (2003); Fullerton & Mcwatters (2001);Callen et al. (2000); Swink et al. (2005)	Integration Information System; Quality Management Flexibility
2. How are planned and implemented daily activities of production?		• Communication daily program (formal / informal). • Control of the production flow. (Ex .: Kanban) • Monitoring each process as to the accuracy and quality. • Identification and resolution of operational problems. • Present capacity of the machines for different volume and product mix. • Interrupt / change the daily programming. When and why. • Order off schedule. • Reduction of cycles of the machines (SETUP). • Decision of the quantities to be produced (small / large lots). • How inputs are managed? Diversification.	
JIT	**Cell Arrangement / Layout equipment**	Mackelprang & Nair (2010); Matsui (2007); Ward & Zhou (2006); Ketokivi & Schroeder (2004); Callen et al. (2000)	Flexibility
1. How is organized the production flow? (people and layout of the machines)		• Existence or not working cell. Lack of employees; transfer of staff. Break machines. Purchase of new machinery.	
JIT	**Preventive Maintenance**	Mackelprang & Nair (2010); Fullerton et al. (2003); Fullerton & Mcwatters (2001); Callen et al. (2000)	Quality Management
1. How does the maintenance of the machines?		▪ What is the frequency concerts during production ▪ Difficulties in maintaining	
TQM	**People Management**	Kaynak & Hartley (2008); Sila (2007); Nair (2006); Kaynak (2003); Das et	

		al. (2000); Wilson & Collier (2000); Samson & Terziovski (1999); Choi &Eboch (1998)	Quality Management Continuous improvement. flexibility Continuous improvement. Integration of the information system
3. How are made training and development of production employees' policies? 4. How do employees influence the production process improvement? 5. How is communication conducted of the cross-functional teams?		▪ Preparation for the changes over time – Training. ▪ Monitoring of new employees – Training. ▪ Training of employees for different functions. ▪ In the case of a transfer function, the yield is the same. ▪ Formalization ideas, suggestions. Implementation (ie.) Rewards (ie.). Time for development. ▪ How are managed the errors and failures of a product / process.	
TQM	**Leadership**	Kaynak & Hartley (2008); Sila (2007); Nair (2006); Kaynak (2003); Wilson & Collier (2000); Samson & Terziovski (1999)	Quality Management
6. What is the role of the management in the development of activities day to day?		▪ Solving Problems - Paper supervisor. ▪ Monitoring the activity by the supervisor ▪ Supervisor participation in the improvement of their activity?	
TQM	**Measuring / Analysis**	Kaynak & Hartley (2008); Sila (2007) Nair (2006); Kaynak (2003); Das et al. (2000) Wilson & Collier (2000); Samson & Terziovski (1999); Choi & Eboch (1998)	Quality Management
7. What type of report do you have in this function? Who issues? And, as it (s) helps in the development of your activities?		▪ Monitoring goals. ▪ Reports Analysis - (feedback)	
TQM	**Design of products / Customization**	Kaynak & Hartley (2008); Nair (2006) Kaynak (2003)	Innovation Customization
8. How are created and inserted the new products on the production line? 9. In what level do you can customize the product to a customer. example.		▪ Existence of patents. ▪ Protection in the creation/development of new products, business or clients. ▪ Insert a variety of products without increasing the cost. ▪ Personalization products on a large scale. ▪ Respond quickly to customization.	
JIT/ TQM	**Client focus / technologies**	Kaynak & Hartley (2008); Sila (2007); Nair (2006); Das et al. (2000); Samson & Terziovski (1999); Mackelprang & Nair (2010); Matsui (2007);	

		Ketokivi & Schroeder (2004); Fullerton et al. (2003); Fullerton & Mcwatters (2001)	Continuous Improvement Innovation Quality Management
	10. How do customers influence the production?	▪ Feedback from customers relating to products ▪ Ideas generated by customers. ▪ Customer role in the acquisition of new technologies. ▪ Customer complaints (product, process, delivery). ▪ Delivery time. ▪ Monitoring of the request by the customer.	
	11. How do the new technologies influence the production?	▪ Types of technologies acquired in recent times (machinery, processes or information systems). How were acquired and how changed the operating process? ▪ Introduction of new technologies to market ▪ How do innovations reinforce the expertise (experience / knowledge) of the firm (processes / products).	Innovation
SCM	**Selection process**	Ou et al. (2010); Yeung (2008); Droge et al. (2004); Tan et al (2002); Tan et al. (1999)	Management of suppliers
	11. How is the process of selecting suppliers?	▪ How contracts are conducted? (Formal / informal / aspects required) ▪ Characteristics that suppliers must possess ▪ Certification. Code of ethics. ▪ Number of suppliers pot type of input. ▪ Geographical proximity of suppliers.	
SCM	**Integration /Relationship**	Ou et al. (2010); Yeung (2008); Droge et al. (2004); Tan et al. (2002); Tan et al. (1999)	Management of suppliers Integration Information System
	12. How do suppliers are integrated into the production planning? 13. How do the relationship with suppliers helps improve the production process? Example. 14. How dosuppliers help in the acquisition of new technologies? Example.	▪ Average time that suppliers work with the firm. ▪ Integrationproduct design with suppliers ▪ Integration Information System (Buyer/supplier) ▪ Tracking ▪ What are the strengths of your relationship with suppliers? What needs to improve?	
SCM	**Evaluated**		
		Ou et al. (2010); Yeung (2008); Droge et al. (2004); Tan et. al (2002; Tan et al. (1999)	Management of suppliers
	15. How do suppliers are evaluated?	▪ Quality. Productive capacity. Delivery. Flexibiidade ▪ Monitoring of suppliers (financial / technological / ethical issues) ▪ Formal / Informal	

	▪ Punishments	

Part 3: Questions about the firm	
Number of employees:	
Does firm exports? If yes What is% of production exported?	How many% the firm has owned the national market?

Make X	Classification	Annual gross operating revenue
	Microenterprise	< or =R$ 2,4 milhões
	Small	> R$ 2,4 milhões and <or =R$ 16 milhões
	Medium	>R$ 16 milhões and < or = R$ 90 milhões
	Medium-large	>R$ 90 milhões and < or = R$ 300 milhões
	Large	> R$ 300 milhões

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Questions to staff

1. What is your biggest concern today in the packaging market?
   What is the trend of the packaging market for years to come?

Hours:
EMAIL:

FUNDAÇÃO GETULIO VARGAS

Escola de Administração de Empresas de São Paulo

Appendix 6–Invitation Letter

São Paulo, 20 de Agosto de 2014.

Prezado,

Inicialmente, gostaria de agradecer sua disponibilidade em conhecer esta pesquisa.

A partir de um levantamento prévio na indústria de embalagens, sua empresa foi qualificada como pertencente a um restrito grupo que desenvolvem práticas de gestão de alto nível. Aproveitando toda sua experiência no setor, gostaria de convidá-lo a participar da pesquisa que está sendo desenvolvida pela Fundação Getúlio Vargas - FGV/São Paulo, e conduzida pelo Prof. Dr. Luiz Arthur Ledur Brito.

A pesquisa tem como objetivo analisar como as práticas operacionais levam a um maior desempenho operacional. Para tanto, a metodologia utilizada será o Estudo de Caso.

O caso consiste no estudo aprofundado de uma empresa, e visa entender na íntegra a complexa realidade do dia a dia organizacional.

O processo produtivo será foco deste estudo, desta forma, múltiplas entrevistas serão realizadas no setor. Operários, líderes de linha, supervisores, gerentes, entre outros, serão ouvidos. Cada entrevista terá duração aproximada de 50 minutos. Também serão agendas visitas de acompanhamento das atividades dos funcionários e observação dos processos produtivos.

Gestores de outras áreas como marketing, comercial, compras, recursos humanos, administrativo, diretoria, entre outras, também poderão ser entrevistados, uma vez que estão inter-relacionados com a produção.

Para que o trabalho seja desenvolvido é imprescindível que a empresa indique um responsável, que será o contato da pesquisadora. A este caberá o agendamento prévio das entrevistas, das visitas operacionais e de outras solicitações inerentes à pesquisa.

Não serão necessárias informações financeiras ou estratégicas da empresa**.** Todas as respostas **são totalmente confidenciais,** preservando os nomes dos entrevistados e da empresa**.A FGV é rigorosa quanto aos procedimentos de confidencialidade no processo de pesquisa.**

Como retorno, pretende-se fornecer às empresas participantes um relatório indicando quais os mecanismos que levam as empresas obterem melhores desempenhos com suas práticas operacionais.

Mais uma vez agradeço sua atenção, ficando à disposição para maiores dúvidas e aguardando um breve retorno.

Atenciosamente,

Prof. Dr. Luiz Arthur Ledur Brito [2]

Professor da EAESP/FGV-SP

Marcia Regina Santiago Scarpin

Pesquisadora EAESP/FGV-SP

mrs.scarpin@gmail.com.br

Celular: (47) 91960266

[2] Tel.: (5511) 3799-7780.

Appendix 7 – Pre-test firms

Razão social	Indústria	Informações	Respondente	Tipo de entrevista	Cidade	Data
Alfa Embalagens Ltda	Papelão micro-ondulado, onda simples, dupla e tripla.	Atuando na fabricação de caixas e acessórios de papelão ondulado, logo se tornou referência em seu mercado.Atendendo empresas de grande porte.	Gerente industriale supervisor da produção	Pessoalmente	São Bento do Sul	18/04
Beta SA Gráfica e Editora	Desenvolvimento de projetos de embalagens, pré-impressão para o tratamento de imagens. Setor de protótipo, aonde são desenvolvidos o formato e tipo de embalagem para o produto, contamos também com o setor de corte e vinco que define o formato da embalagem e em seguida a colagem que aplica o adesivo nos pontos específicos necessários para cada tipo de embalagem. No seguimento de rótulos de papel temos o setor de corte final que da o formato ao rótulo e que em seguida são embalados para envio ao cliente.	Pioneira na fabricação de embalagens e rótulos no estado de Santa Catarina, de pequena fornecedora local, logo passou a atender o mercado nacional. Em 2006/2007, com um grande investimento, o parque gráfico foi ampliado novamente, que passou de 13.000M2 para 16.000M2 e iniciou-se o desenvolvimento de dois novos tipos de produtos para atender um mercado diferenciado, os rótulos termo_encolhíveis e autoadesivos.	Gerente industrial e supervisor da produção	Pessoalmente	Blumenau	22/04
Zeta Indústria de Plásticos do Vale	Fabricação de produtos injetados, soprados e extrusados de alta qualidade. Linhas amplas e modernas para mesa, cozinha, limpeza, organização, acessórios, pet, jardim, bebe e infantil.	Situada em Gaspar/SC, a Zeta é uma das maiores e mais importantes empresas de utilidades domésticas em plástico do país. Há mais de 30 anos no mercado, conquistou clientes e consumidores em todo Brasil e, atualmente, exporta para mais de 40 países. Em uma área construída de 12.000m2, são desenvolvidos e produzidos produtos de alta qualidade, dentro dos mais atuais conceitos de design, ergonomia e funcionalidade.	Gerente de finalização e Gerente de compras	Pessoalmente	Gaspar	23/04
Dela Fabricante de	Empresa fabricante de embalagens flexíveis atuante em mercados higiênicos,	A empresa possui equipamentos de alta tecnologia, tais como extrusoras, plana e blow, impressoras	Gerente industrial e	Pessoalmente	São Paulo	29/04

embalagens flexíveis	alimentícios, pneumáticos e têxteis.	flexográficas gear less de última geração, impressoras rotográficas. Possui ainda Certificação ISO 9001, e atende grandes clientes no Brasil.	supervisor da produção			

Appendix 8 – Integrative information systems capability

Author	Term applied	Construct variables - Inter-item	**Operationalization:** **type of analysis;** **sample size; industry and country**
Narasimhan & Jayaram (1998)	Integrative information systems capability	Competência na integração do sistema de informação (uso de computadores para funções diversas. Ex.: previsão de vendas, planejamento da produção, etc)	Modelagem de Equação Estrutural Grupo: Global Manufacturing Research Group _GMRG. A amostra é composta por 576 empresas: 215 - América do Norte 216 – Europa 145-Pan Pacifico Industrial *América do Norte*: México e Estados Unidos *Europa*: Bulgária, Alemanha, Polônia, Rússia, Espanha, Suécia *Pan Pacifico*: Hong Kong, China, Japão, Nova Zelandia
Swink & Hegarty (1998)	Integration	-	Proposições teóricas
B. B. Flynn & Flynn (1999)	Information-processing capability	-Redução da diversidade de produção. -Redução na diversidade de objetivos. -Redução na diversidade de fornecedores. -Redução na diversidade de clientes. -Redução na diversidade de empregados- -Investimento em sistemas de informação. -Relacionamento e comunicação.	Regressão moderada e múltipla/Analise discriminante 164 unidades de produção Eletrônicos Maquinas Transporte Componentes Estados Unidos
Wu et al. (2010)	Operational cooperation	-O sistema de informação facilita a cooperação entre as funções. -Procedimentos formais facilitam o trabalho em equipe interfuncional. -O bom relacionamento entre funcionários é incentivado a fim de identificar e resolver possíveis problemas. -O bom relacionamento entre fornecedores e clientes é incentivado a fim de desenvolver soluções de melhorias.	Grupo Focal Análise Fatorial Confirmatória (desenvolvimento e validação da escala) 222 respondentes Alimentos. Bebidas. Máquinas. Computador. Produtos eletrônicos. Produtos químicos. Produtos farmacêuticos. Equipamentos eletrônicos e de transporte Estados Unidos
Zhao et al.	Internal integration	-Integração de informações entre funções.	Analise Fatorial Confirmatória/Modelagem de equação estrutural

(2011)	capability	-Integração da gestão de estoques. -Integração da operação logística. -Uso de times entre funções Integração entre funções internas e gerenciamento de materiais passando pela produção, transporte e vendas.	Amostra: 587 empresas Artesanato. Materiais de construção.Indústria Química e Farmacêutica. Eletrônicos e companhias elétricas Comida, bebida e álcool. Indústria de joias. Metal, mecânica e industria de engenharia. Farmacêutica e medicamentos. Edição e Impressão. Borracha e plástico. Têxtil e vestuário. Brinquedos Moveis e madeira China: Chongqing, Tianjin, Guangzhou, Shanghai, and Hong Kong.
Wu et al. (2012)	Operational cooperation	-Procedimentos formais facilitam o trabalho em equipe interfuncional. -O bom relacionamento entre funcionários é incentivado a fim de identificar e resolver possíveis problemas. -O bom relacionamento entre fornecedores e clientes é incentivado a fim de desenvolver soluções de melhorias.	Análise Fatorial Confirmatória Regressão 140 respondentes Alimentos. Bebida. Tabaco. Têxtil e vestuário. Couro. Papel. Impressão. Petróleo e produtos de carvão. Química. Plásticos e produtos de borracha.Produtos minerais não-metálicos. Metal. Produtos elétricos e eletrônicos. Equipamentos para transporte. Equipamentos produtos médicos
Setia & Patel (2013)	Integrated IS capability	-Competência na integração do sistema de informação. -Planejamento e coordenação.	Analise Fatorial Confirmatória 153 empresas industriais Equipamentos automotivo Empresas Químicas Equipamentos eletrônicos Equipamentos industriais Estados Unidos
Weigelt (2013)	Supplier IT capabilities	-Sistema de arquitetura, ou seja, o design técnico usado pelos fornecedores. -Confiabilidade do sistema, ou seja, funcionamento, previsão e velocidade de transmissão. -Treinamento e consultoria para usuários. -Qualidade na coordenação de serviços e gerenciamento de projetos -Gestão de gerenciamento, ou seja, comunicação e capacidade de resposta na gestão de contas do cliente.	Regressão 22 fornecedores de soluções tecnológicas Fornecedores de solução tecnologica Estados Unidos

Appendix 9 – Continuous improvement capability

Author	Term applied	Construct variables - Inter-item	Operationalization: type of analysis; sample size; industry and country
Swink & Hegarty (1998)	Improvement	-	Proposições teóricas
Narasimhan & Jayaram (1998)	Manufacturing process improvement	-Programas que enfatizam a melhoria do processo produtivo e o gerenciamento da qualidade total.	Modelagem de Equação Estrutural Grupo: Global Manufacturing Research Group _GMRG. A amostra é composta por 576 empresas: 215 - América do Norte 216 – Europa 145-Pan Pacifico Industrial *América do Norte*: México e Estados Unidos *Europa*: Bulgária, Alemanha, Polônia, Rússia, Espanha, Suécia *Pan Pacifico*: Hong Kong, China, Japão, Nova Zelandia
Bessant & Francis (1999)	Continuous improvement capability	-Políticas de treinamentos Medidas de mensuração. -Gerenciamento de ideias. -Sistema de recompensa e reconhecimento. -Tempo para criação de novas ideias; codificar o pensamento para capturar conhecimento e a aprendizagem; desenvolvimento de rotinas inovadoras.	Estudo de caso único. Foram realizadas entrevistas e observação do processo produtivo. O artigo não possui metodologia. AB indstria. Maior conglomerado de produção de peças aeroespaciais e motor de veículos
Peng et al. (2008)	Improvement capability	-Melhoramento contínuo de produtos e processos, a práticas de abordagens estáticas. -Aprendizagem e aperfeiçoamento contínuo, após a instalação de novos equipamentos. -A melhoria contínua faz com que nosso desempenho seja algo dinâmico, dificultando a ação da concorrência. -Acreditamos que o processo de melhoria nunca está completo; sempre há caminhos de melhoramento incremental.	Analise Fatorial Confirmatória Regressão Grupo: High Performance Manufacturing (HPM) 189 empresas Máquinas eletrônicas Fornecedores de empresas de automóveis Unidades de produção: Finlândia, Suécia, Alemanha, Japão, Korea, Estados Unidos

		-Nossa organização está sempre mudando a fim de melhor atender nosso cliente.	
Wu et al. (2010)	Operational improvement	-Continuamente padronizamos processo produtivo. -Continuamente simplificamos o processo produtivo. -Continuamente reduzimos as variações e os desperdícios. -Aprendemos com falhas e sucessos do passado para melhorar os processos continuamente.	Grupo Focal Análise Fatorial Confirmatória (desenvolvimento e validação da escala) 222 respondentes Alimentos. Bebidas. Máquinas. Computador. Produtos eletrônicos. Produtos químicos. Produtos farmacêuticos. Equipamentos eletrônicos e de transporte Estados Unidos
Li et al. (2010)	Capability enhancement	Nossa empresa tem melhorado sua capacidade interna durante os últimos três anos, nas seguintes áreas: -P&D -Introdução de novos produtos -Qualidade de produtos - *Lean Manufacturing*	Analise Fatorial Confirmatória Regressão 140 empresas Compradores: americanos e europeus Fornecedores: Sete províncias da China - Guangdong, Henan, Liaoning, Shandong, Shanxi, Shaanxi, and Sichuan
Wu et al. (2012)	Operational improvement	-Continuamente padronizamos processo produtivo. -Continuamente simplificamos o processo produtivo. -Continuamente reduzimos as variações e os desperdícios. -Aprendemos com falhas e sucessos do passado para melhorar os processos continuamente.	Análise Fatorial Confirmatória Regressão 140 respondentes Alimentos. Bebida. Tabaco. Têxtil e vestuário. Couro. Papel. Impressão. Petróleo e produtos de carvão. Química. Plásticos e produtos de borracha.Produtos minerais não-metálicos. Metal. Produtos elétricos e eletrônicos. Equipamentos para transporte. Equipamentos produtos médicos
Kim et al. (2012)	Incremental process innovation	-Nossa organização introduz pequenos melhoramentos em máquinas e equipamentos para produção de produtos ou serviços. -Nossa organização introduz pequenos melhoramentos no processo produtivo para produção de produtos ou serviços. -Nossa organização introduz pequenos melhoramentos tecnológicos para produção de produtos ou serviços.	Análise Fatorial Confirmatória Modelagem de equação estrutural 233 empresas industriais e/ou serviços certificadas pela ISSO 9001 Empresas de services (9,9%) Industrisl (90,1%): Metal; Máquinas; Equipamentos de transporte; Química; Produtos eletrônicos e para computadores; Equipamentos elétricos; Construção **Embalagem para alimentos** (40%)

Appendix 10 – Innovation capability

Author	Term applied	Construct variables - Inter-item	Operationalization: type of analysis; sample size; industry and country
Swink & Hegarty (1998)	Innovation	-	Proposições teóricas
Narasimhan & Jayaram (1998)	Technology and Innovation.	-	Modelagem de Equação Estrutural Grupo: Global Manufacturing Research Group _GMRG. A amostra é composta por 576 empresas: 215 - América do Norte 216 – Europa 145-Pan Pacifico Industrial *América do Norte*: México e Estados Unidos *Europa*: Bulgária, Alemanha, Polônia, Rússia, Espanha, Suécia *Pan Pacifico*: Hong Kong, China, Japão, Nova Zelandia
Peng et al. (2008)	Innovation capability	-Investimos em equipamentos e programas que antecipe nossa necessidade quanto à capacidade de produção. -Esforçamos para antecipar novas tecnologias e práticas operacionais. -Em nosso ramo, nossa unidade é líder em novas tecnologias. -Constantemente estamos pensando na próxima geração de tecnologias operacionais.	Analise Fatorial Confirmatória Regressão Grupo: High Performance Manufacturing (HPM) 189 empresas Máquinas eletrônicas Fornecedores de empresas de automóveis Unidades de produção:Finlândia; Suécia; Alemanha; Japão; Korea; Estados Unidos
Wu et al. (2010)	Operational innovation	-Criamos inovações que prevalecem aos nossos processos obsoletos. -Criamos inovações que mudam nossos processos. -Criamos inovações que fazem nossa expertise prevalecer aos processos obsoletos.	Grupo Focal Análise Fatorial Confirmatória (desenvolvimento e validação da escala) 222 respondentes Alimentos. Bebidas. Máquinas. Computador. Produtos eletrônicos. Produtos químicos. Produtos farmacêuticos. Equipamentos eletrônicos e de transporte Estados Unidos
Biedenbach	Innovative capabilities	Mensuradas através das dimensões de inovação	Parte qualitative:

&Müller (2012)		incremental e radical (Subramaniam & Youndt, 2005) -Nossas inovações reforçam as linhas de produtos existência Nossas inovações reforçam a experiência existente em produtos vigentes. -Nossas inovações reforçam como nossa empresa compete atualmente. -Nossas inovações reforça a expertise existente em produtos predominantes. -Nossas inovações tornam nossas antigas linhas de produtos obsoletas .	Realismo crítico. Estudo de caso único exploratório Parte quantitativa: Regressão mútipla Correlaçao canonica 64 respondentes Empresas farmacêuticas e de biotecnologia
Kim et al. (2012)	Radical process innovation	-Nossa organização introduz novas e significantes melhorias em máquinas e/ou equipamentos para produção de produtos ou serviços. -Nossa organização introduz novas e significantes modificações no processo produtivo para produção de produtos ou serviços. -Nossa organização introduz novas ou significantes melhorias tecnológicas para produção de produtos ou serviços.	Análise Fatorial Confirmatória Modelagem de equação estrutural 233 empresas industriais e/ou serviços certificadas pela ISSO 9001 Empresas de services (9,9%) Industrisl (90,1%): Metal; Máquinas; Equipamentos de transporte Química; Produtos eletrônicos e para computadores; Equipamentos elétricos; Construção **Embalagem para alimentos** (40%)
Wu et al. (2012)	Operational innovation	-Criamos inovações que prevalecem aos nossos processos obsoletos. -Criamos inovações que mudam nossos processos. -Criamos inovações que fazem nossa expertise prevalecer aos processos obsoletos.	Análise Fatorial Confirmatória Regressão 140 respondentes Alimentos. Bebida. Tabaco. Têxtil e vestuário. Couro. Papel. Impressão. Petróleo e produtos de carvão. Química. Plásticos e produtos de borracha.Produtos minerais não-metálicos. Metal. Produtos elétricos e eletrônicos. Equipamentos para transporte. Equipamentos produtos médicos

Appendix 11 – Flexible process capability

Author	Term applied	Construct variables - Inter-item	Operationalization: type of analysis; sample size; industry and country
Swink & Hegarty (1998)	Responsiveness Acuity Agility	-	Proposições teóricas
Zhang et al. (2003)	Flexible competence	Flexibilidade do maquinário: -Set-up das máquinas pode ser feito rapidamente. -Nossas máquinas podem fazer mais de um tipo de operação. -Nossas máquinas podem utilizar diversas ferramentas. -Máquinas muitas vezes se tornam obsoletas quando novas operações são necessárias. -Máquinas podem ser rapidamente alteradas Set-ups podem ser facilmente realizados. Flexibilidade dos trabalhadores: -Os trabalhadores podem realizar vários tipos de operações de forma eficaz. -Os trabalhadores podem utilizar diferentes ferramentas de forma eficaz. -Trabalhadores treinados podem desenvolver diversas tarefas de forma eficaz na organização. -Trabalhadores podem operar diferentes tipos de máquinas. -Trabalhadores podem ser facilmente transferidos entre as unidades da organização. Flexibilidade no uso de insumos: -Os insumos podem ser utilizados de formas diferentes. -Diferentes insumos podem ser utilizados de forma conjunta. -Insumos podem ser utilizados em diferentes tipos de operações. -Trocas de insumos podem ocorrer rapidamente na produção.	Analise Fatorial Confirmatória Modelagem de Equação Estrutural 273 empresas Metal Máquinas Equipamentos e components elétricos e eletronicos Equipamentos para transporte Equipamentos para instrumentos e mensurações

		-Ferramentas para insumos podem ser trocadas rapidamente. Flexibilidade de Rotinas: -Parte da operação pode ser realizada em diferentes máquinas. -Parte da operação pode utilizar diferentes caminhos operacionais. -O sistema fornece caminhos alternativos em caso de quebra de máquinas. -Parte do fluxo da sequencia operacional pode ser alterada. -A sequencia das maquinas podem ser alteradas ou substituídas rapidamente. -Rotinas são facilmente alteradas.	
Wu et al. (2010)	Operational responsiveness	-Reduzimos a incerteza da disponibilidade de equipamentos, mudando de forma e rápida e fácil a rota do fluxo de trabalho. -Ajustamos as variações inesperadas dos componentes e insumos materiais com facilidade e rapidez. -Ajustamos as variações inesperadas das exigências de trabalho com facilidade e rapidez. -Ajustamos as mudanças inesperadas nas exigências remessa com facilidade e rapidez-	Grupo Focal Análise Fatorial Confirmatória (desenvolvimento e validação da escala) 222 respondentes Alimentos. Bebidas. Máquinas. Computador. Produtos eletrônicos. Produtos químicos. Produtos farmacêuticos. Equipamentos eletrônicos e de transporte Estados Unidos
Patel et al. 2012)	Flexible manufacturing capability	Em comparação aos concorrentes: Flexibilidade do maquinário: -Número de diferentes operações que a máquina pode desempenhar. -As máquinas executam bem diferentes operações. -Set-up das máquinas pode ser feito rapidamente. -As máquinas são igualmente eficazes, em termos de produtividade, para todas as operações. Flexibilidade dos trabalhadores: -Trabalhadores são treinados para executarem múltiplas tarefas. -Os trabalhadores podem realizar vários tipos de tarefas	Analise Fatorial Confirmatória Modelagem de Equação Estrutural 852 empresa Indústria de tecnologia Estados Unidos

		de forma eficaz. -Um pequeno custo é incidido (em termos de perda de produtividade), quando os trabalhadores são movidos para diferentes tarefas. -Em termos de qualidade, os trabalhadores são igualmente eficientes para todas as tarefas. Flexibilidade no uso de materiais: -Existem diferentes caminhos de manuseio de materiais entre os centos de processamento. -O sistema de manuseio de materiais pode transportar diferentes tamanhos de insumos. -A rota de materiais pode mudar rapidamente. -A escolha da rota de materiais não afeta a eficiência de sua transferência.	
Wu et al. (2012)	Operational responsiveness	-Reduzimos a incerteza da disponibilidade de equipamentos, mudando de forma e rápida e fácil a rota do fluxo de trabalho. -Ajustamos as variações inesperadas dos componentes e insumos materiais com facilidade e rapidez. -Ajustamos as variações inesperadas das exigências de trabalho com facilidade e rapidez. -Ajustamos as mudanças inesperadas nas exigências remessa com facilidade e rapidez.	Análise Fatorial Confirmatória Regressão 140 respondentes Alimentos. Bebida. Tabaco. Têxtil e vestuário. Couro. Papel. Impressão. Petróleo e produtos de carvão. Química. Plásticos e produtos de borracha.Produtos minerais não-metálicos. Metal. Produtos elétricos e eletrônicos. Equipamentos para transporte. Equipamentos produtos médicos

Appendix 12 – Mass customization capability

Author	Term applied	Construct variables - Inter-item	Operationalization: type of analysis; sample size; industry and country
Tu et al. (2004)	Mass customization capability	-Capacidade de customização de produtos em grande escala. -Capacidade de produzir variedades de produtos diferentes sem aumentar o custo de produção. -Capacidade de customizar produtos em grande volume. -Capacidade de setting up para diferentes produtos a um baixo custo. -Capacidade de responder rapidamente a customização. -Capacidade de adicionar variedade de produtos sem sacrificar o volume de produção.	Analise Fatorial Confirmatória Modelagem de Equação Estrutural 303 empresas Automotivo Metal Equipamentos elétricos e eletrônicos Móveis e utensílios Borracha e produtos plásticos Máquina e equipamento Equipamentos de transporte Equipamentos para instrumentos e mensurações Estados Unidos
Huang et al. (2008, 2010)	Mass customization capability	-Capacidade de customização de produtos em grande escala. -Capacidade de produzir variedades de produtos diferentes sem aumentar o custo de produção. -Capacidade de customizar produtos em grande volume. -Capacidade de adicionar variedade de produtos sem sacrificar a qualidade. -Capacidade de responder rapidamente a customização.	Analise Fatorial Confirmatória Modelagem de Equação Estrutural Grupo: High Performance Manufacturing 167 unidades de produção Eletrônico Maquinários Fornecedores da indústria automobilística Países: Japão. Korea. Áustria .Finlândia. Itália. Alemanha. Suíça. Estados Unidos
Wu et al. (2010)	Operational customization	-Os equipamentos são utilizados de forma única, o que nos diferenciam dos nossos concorrentes. -O processo de design do produto tem sido modificado e ampliado para melhor atender as necessidades de nossos clientes. -O sistema de planejamento tem sido modificado e ampliado para melhor atender as necessidades dos clientes. -O processo de produção tem sido modificado e ampliado para ganhar posições únicas no mercado.	Grupo Focal Análise Fatorial Confirmatória (desenvolvimento e validação da escala) 222 respondentes Alimentos. Bebidas. Máquinas. Computador. Produtos eletrônicos. Produtos químicos. Produtos farmacêuticos. Equipamentos eletrônicos e de transporte Estados Unidos

		-Introduzimos novos materiais, desenvolvidos internamente em nossos programas de treinamento. -Estimulamos o trabalho em equipe para facilitar o compartilhamento de conhecimento individual em toda a organização.	
Wu et al. (2012)	Operational customization	-Os equipamentos são utilizado de forma única, o que nos diferenciam dos nossos concorrentes. -O processo de design do produto é modificado e ampliado para melhor atender as necessidades de nossos clientes. -O sistema de planejamento tem sido modificado e ampliado para melhor atender as necessidades de nossos clientes. -O processo de produção tem sido modificado e ampliado para ganhar posições únicas no mercado.	Análise Fatorial Confirmatória Regressão 140 respondentes Alimentos. Bebida. Tabaco. Têxtil e vestuário. Couro. Papel. Impressão. Petróleo e produtos de carvão. Química. Plásticos e produtos de borracha.Produtos minerais não-metálicos. Metal. Produtos elétricos e eletrônicos. Equipamentos para transporte. Equipamentos produtos médicos

Appendix 13 – Quality management capability

Author	Term applied	Construct variables - Inter-item	Operationalization: type of analysis; sample size; industry and country
Choo et al. (2007)	Quality management	-	Ensaio teórico
Kim et al. (2012)	Quality management practices	-Liderança gerencial. -Treinamento. -Relacionamento com os empregados. -Gerenciamento na qualidade dos fornecedores. -Relacionamento com os clientes. -Relatórios e informações sobre a qualidade. -Designer de produtos/serviços. -Gerenciamento de processos.	Análise Fatorial Confirmatória Modelagem de equação estrutural 233 empresas industriais e/ou serviços certificadas pela ISSO 9001 Empresas de serviços (9,9%) Industrial (90,1%): Metal; Máquinas;Equipamentos de transporte Química; Produtos eletrônicos e para computadores; Equipamentos elétricos; Construção **Embalagem para alimentos** (40%)
B. Flynn et al. (1994)	Quality management	Suporte da direção: -Liderança. - Recompensas. Informação de qualidade: -Controle de processos. -Feedback. Gerenciamento de processos. Designer de produtos. Gerenciamento dos empregados. -Envolvimento dos fornecedores. -Envolvimento dos clientes	Cronbach's alpha Canonical correlation analysis 45 empresas World Class Manufacturing Eletrônico Maquinários Fornecedores da indústria automobilística Estados Unidos

Appendix 14 – Supply chain management capability

Author	Term applied	Construct variables - Inter-item	**Operationalization:** **type of analysis;** **sample size; industry and country**
Narasimhan & Jayaram (1998)	Supplier capability	-Competência dos fornecedores (evolução dos fornecedores com base na qualidade e confiabilidade na entrega)	Modelagem de Equação Estrutural Grupo: Global Manufacturing Research Group _GMRG. A amostra é composta por 576 empresas: 215 - América do Norte 216 – Europa 145-Pan Pacifico Industrial *América do Norte*: México e Estados Unidos *Europa*: Bulgária, Alemanha, Polônia, Rússia, Espanha, Suécia *Pan Pacifico*: Hong Kong, China, Japão, Nova Zelândia
Yeung (2008)	Strategic supply management	-Relação de longo prazo comprador-fornecedor. -Redução da base de fornecedores, com foco em alguns principais fornecedores Sistema formal de avaliação de fornecedores. -Gerenciamento dos fornecedores como parte do processo de planejamento estratégico.	Análise Fatorial Confirmatória Modelo de Equação Estrutural 225 empresas respondentes Um total de 16 empresas foram estrategicamente selecionadas de acordo com seu avançado sistema de qualidade para entrevistas em profundidade na fase final deste estudo Indústria eletrônica Hong Kong
Jiang (2009)	Supplier'sconduct	Governança fornecedor-comprador: -Fornecemos o código de conduta de fornecedores e acompanhamos sua evolução. -O comprador raramente trabalha conosco na implementação do código de conduta de fornecedores. -Se forçamos a implementação do código de conduta de fornecedores, o comprador simplesmente mudam para outros fornecedores, sem buscar uma solução conosco. Governança dos pares:	Análise Fatorial Confirmatória Modelagem de Equação Estrutural 223 empresas fornecedoras Têxtil China

		-O comprador permite um diálogo aberto sobre questões do código de conduta de fornecedores, de modo que as metas sejam estabelecidas em conjunto. -O comprador trabalha conosco na implementação do código de conduta de fornecedores (por exemplo, visita nossas instalações de produção, oferecendo programas de formação contínua, etc.). -Se seguirmos o código de conduta de fornecedores, obtemosincentivos do comprador (por exemplo, extensão ou renovação de contratos; aumento dos volumes de pedidos, recompensas financeiras, etc.). -Se nos esforçamos na implementação do código de conduta de fornecedores, o comprador buscaraencontrar soluções conosco em vez de simplesmente mudar para outros fornecedores. -O comprador investe recursos na capacitação da implementação do código de conduta de fornecedores. -O comprador nos vê como um parceiro e compartilha informações conosco.	
Pagell & Wu (2009)	Supply chain management	-Transparência. -Rastreabilidade. -Certificação de Fornecedor. -Descomoditização.	Estudo de multiplos casos Foram 10 casos. Com 4 a 13 entrevistas por caso. Produtos de limpeza. Madeira. Eletrônicos. Restaurante. Equipamentos TI. Produtos para iluminação.Alimentos. Bebidas. Papel. Construção. Estados Unidos
Kristal et al. (2010)	Ambidextrous supply chain strategy	Supply chain Exploitation Practices: -Para nos mantermos competitivo, nossos gerentes focam na redução deprocessos operacionais existentes na cadeia de suprimento. -O aproveitamento da tecnologia em nossa cadeia de suprimentos é importante para a estratégia de nossa empresa. -Para nos mantermos competitivos, nossos gerentes da cadeia de suprimentos se concentram nas melhores tecnologias existentes.	Análise Fatorial Confirmatória Cluster Modelagem de Equação Estrutural 174 empresas Automotivo. Tecnologia. Químico. Aeroespacial. Farmacêutico. Bens de consumo. Alimentos. Planos de Saúde. Outros Estados Unidos

		-Nossos gerentes focam no desenvolvimento de fortes competências no processo de nossa cadeia de suprimentos. Supply chain Exploration Practices: -Buscamos proatividade no desenvolvimento de novas soluções na cadeia de suprimentos. -Buscamos continuamente experimentar novas soluções a fim de melhorar a nossa cadeia de fornecimento. -Buscamos continuamente explorar novas oportunidades a fim de melhorar nossa cadeia de fornecimento. -Buscamos constantemente buscando novas abordagens a fim de resolver nossos problemas da cadeia de suprimentos.	
Zhao et al. (2011)	SCM capabilities	-Integração de Fornecedores Troca de informações com a maioria dos fornecedores por meio de network. -Sistemas de ordem de pedidos. -Nível estratégico de parcerias. -Processo de aquisição estável. -Participação do fornecedor no estágio de design. -Compartilhamento de esquemas de produção. -Compartilhamento de estoques. -Ajuda aos maiores fornecedores para melhoria de seus processos.	Analise Fatorial Confirmatória Modelagem de equação estrutural Amostra: 587 empresas Artesanato. Materiais de construção. Indústria Química e Farmacêutica. Eletrônicos e companhias elétricas. Comida, bebida e álcool. Indústria de joias. Metal, mecânica e industria de engenharia. Farmacêutica e medicamentos. Edição e Impressão. Borracha e plástico. Têxtil e vestuário. Brinquedos Moveis e Madeira. China: Chongqing, Tianjin, Guangzhou, Shanghai, and Hong Kong.

Appendix 15 – Learning capability

Author	Term applied	Construct variables - Inter-item	Operationalization: type of analysis; sample size; industry and country
Kogut & Zander (1992)	Combinative Capabilities	-	Ensaio teórico
Tu et al. (2006)	Learning capability	Capacidade absortiva: -Conhecimento dos empregados. -Conhecimento dos gerentes. -Rede de comunicação. -Clima organizacional. -Digitalização do Conhecimento.	Análise Fatorial Confirmatória Modelo de Equação Estrutural Análise de Regressão 303 respondentes Móveis e utensilios Produtos de borracha e plástico Fabricação de produtos de metal Equipamentos e máquinas industrial Equipamentos elétricos e eletrônicos Equipamentos de transporte Produtos médicos Estados Unidos
Li et al. (2010)	Learning intent	Nossa empresa busca aprender sobre a habilidade e o conhecimento de nossos compradores estrangeiros nas seguintes áreas: -Sistema de informação. -Gerenciamento gerencial P&D. -Marketing. -Processos operacionais e produtivos.	Analise Fatorial Confirmatória Regressão 140 empresas Compradores: americanos e europeus Fornecedores: Sete províncias da China - Guangdong, Henan, Liaoning, Shandong, Shanxi, Shaanxi, and Sichuan
Biedenbach & Müller (2012)	Absorptive capability Adaptive capability	Capacidade absortiva: Mensurada através da transformação, exploration e explotation da aprendizagem (Lichtenthaler, 2009) - Reconhecimento do conhecimento. -Assimilação do conhecimento. - Manutenção do Conhecimento. -Reativação do conhecimento. -Transformação do conhecimento . - Aplicação do Conhecimento	Parte qualitativa: **Realismo crítico**. Estudo de caso único exploratório Parte quantitativa: Regressão múltipla Correlação canônica 64 respondentes Empresas farmacêuticas e de biotecnologia

		Capacidade adaptativa: Escala adaptada de (Tuominen, Rajala, & Möller, 2004) -Conhecemos as atividades de P&D de nossos concorrentes. -Conhecemos os movimentos estratégicos de nossos concorrentes. -Conhecemos as necessidades de produtos de nossos clientes Nossos produtos são baseados em soluções. -A gestão de marketing e colaboração pessoal possui estreita colaboração com P&D. -A disseminação de informação sobre o mercado aumenta a cooperação entre marketing e P&D.	
Patel et al. (2012)	Learning capabilities	Potential operational absorptive capacity (POAC): aquisição e assimilação do conhecimento externo (escala ver Setia e Patel, 2013). Realized operational absorptive capacity (ROAC): transformação e exploração do conhecimento externo (escala ver Setia e Patel, 2013).. Operational ambidexterity: exploration e exploitation. -Habilidade de explorar novas tecnologias operacionais. -Habilidade para criar produtos/serviços novos para a empresa. -Habilidade desenvolver formas criativa para satisfação do cliente. -Agressividade em introduzir novos produtos. -Buscar constantemente novas tecnologias e sistemas operacionais. -Compromisso com melhor qualidade e custo baixo. Obs.: A escala usada foi uma só para os dois conceitos.	Analise Fatorial Confirmatória Modelagem de Equação Estrutural 852 empresa Industria de tecnologia Estados Unidos
Setia & Patel (2013)	Potential operational absorptive capacity (POAC)	POAC: *Aquisição*: - Interação com outros departamentos. -Trabalho entre funções.	Analise Fatorial Confirmatória 153 empresas industriais Equipamentos automotivo Empresas Químicas

	Realized operational absorptive capacity (ROAC).	-Informação relacionadas a operações. -Reuniões com clientes, fornecedores, e outros pares para trocas de conhecimento. *Assimilação*: -Reconhecimento de mudanças no ambiente operacional. -Identificação rápida de inovações que atendam os clientes. -Analisar e interpretar as mudanças de mercado para as demandas operacionais ROAC: *Transformação*: -Considerar as mudanças de mercado e demandas operacionais em termos de produtos, processos, distribuição e logística. -Funcionários armazenam conhecimento para futuras referencias. -Reconhecimento e uso do conhecimento operacional externo no setor operacional existente. -Compartilhamento de experiências práticas. -São aproveitadas as oportunidades de novos conhecimentos externos -Reuniões periódicas são realizadas para discutir novos produtos, processos e desenvolvimento logístico. *Exploração:* -Sabemos como as atividades dentro da unidade devem ser realizadas. -Resposta a reclamações dos clientes. -Divisão de funções e responsabilidade. -Consideramos como explorar melhorar nosso conhecimento operacional. -Dificuldade em implementar novos produtos e processos. -Empregados falam a mesma língua sobre nossos produtos, processos e logística.	Equipamentos eletrônicos Equipamentos industriais Estados Unidos
Paiva et al. (2008)	Organizational learning	-Conhecimento organizacional externo. -Conhecimento organizacional interno.	Analise Fatorial Confirmatória Modelagem de Equação Estrutural

		-Orientação cross-functional. -Fontes de informação. Obs.: (o questionário não está divido por construto)	104 empresas Indústria de plásticos e máquinas Brasil

Appendix 16 – Firms with requirements for research

Nome_empresa	Segmento	Estado	quant_ funcionários	Controle_societário	CEO_família	Perc_exportação
O-I Brasil	Embalagens de vidro	SP	4.000	Multinacional americana	Não	3,00
Dixie Toga Ltda.	Embalagens de plástico flexível, rígido e semi-rígido; Embalagens de papel, papel-cartão e papelão ondulado	SP	4.000	Multinacional americana	Não	5,00
Celulose Irani S/A	Embalagens de papel, papel-cartão e papelão ondulado; Embalagens cartonadas	RS	2.500	Gestores profissionais	Sim	10,00
Brasilata S/A Embalagens Metálicas	Embalagens Metálicas	SP	1.000	Fundador	Não	3,00
Klabin / Divisão de Papel-Cartão	Embalagens de papel, papel-cartão e papelão ondulado	SP	1.200	Família (segunda geração em diante)	Não	40,00
Siegwerk Brasil Industria de Tintas Ltda	Tintas para Indústria Gráfica de Embalagens	SP	120	Outra multinacional	Não	0,00
Tetra Pak Ltda.	Embalagens de papel, papel-cartão e papelão ondulado	SP	1.800	Multinacional européia	Não	15,00
Braskem	Petroquímica	SP	8.000	Multinacional brasileira	Não	25,00
Klabin / Sacolas de papel	Embalagens de papel, papel-cartão e papelão ondulado	SC	1.000	Família (segunda geração em diante)	Não	15,00
C-Pack Creative Packaging S.A.	Embalagens de plástico flexível, rígido e semi-rígido	SC	530	Multinacional européia	Não	7,00
ZARAPLAST S/A	Embalagens de plástico flexível, rígido e semi-rígido	SP	3.000	Família (segunda geração em diante)	Sim	5,00
Grupo Artecola	Fabricantes de rótulos	RS	2.900	Família (segunda geração em diante)	Sim	30,00
CANGURU EMBALAGENS CRICIÚMA LTDA	Embalagens de plástico flexível, rígido e semi-rígido	SC	1.300	Família (segunda geração em diante)	Não	17,50
Novelis	Metalurgia	SP	1.800	Outra multinacional	Não	3,00
Polo Indústria e Comércio S.A	Embalagens de plástico flexível, rígido e semi-rígido	SP	325	Multinacional americana	Não	17,50

Raft Embalagens Ltda.	Embalagens Metálicas	SP	180	Fundador	Sim	5,00
Silgan White Cap do Brasil Ltda.	Fabricantes de tampas	SP	60	Multinacional americana	Não	22,50
MD Papéis Ltda	Embalagens de papel, papel-cartão e papelão ondulado	SP	600	Gestores profissionais	Não	30,00
SR Embalagens Plásticas Ltda	Embalagens de plástico flexível, rígido e semi-rígido	SP	400	Fundador	Sim	0,00
Tradepack	Embalagens de plástico flexível, rígido e semi-rígido	SP	3.000	Fundador	Sim	32,00
Rigesa Celulose Papel e Embalagens Ltda.	Embalagens de papel, papel-cartão e papelão ondulado	SP	2.500	Multinacional Americana	Não	5,00
SBDE - SOCIEDADE BRAS. DE EMBALAGENS DESC (INCOPLAST)	Embalagens de plástico flexível, rígido e semi-rígido	SC	3.350	Família (segunda geração em diante)	Sim	5,00
EXTRUSA PACK IND. E COM. DE EMBALAGENS LTDA.	Embalagens de plástico flexível, rígido e semi-rígido	SP	250	Fundador	Não	0,00
Wheaton Brasil Vidros Ltda.	Embalagens de vidro	SP	2.800	Gestores profissionais	Não	9,00
Cartonagem Jauense Ltda	Embalagens de papel, papel-cartão e papelão ondulado	SP	640	Outra pessoa física	Não	0,00
Bispharma Packaging	Embalagens Metálicas	SP	320	Família (segunda geração em diante)	Sim	0,00
Plasc Embalagens	Embalagens de plástico flexível, rígido e semi-rígido	SC	300	Fundador	Não	3,00
Peeqflex Indústria e Comércio Ltda.	Embalagens de plástico flexível, rígido e semi-rígido	SP	400	Família (segunda geração em diante)	Sim	5,00

Appendix 17 – Analytical Categories Label_Case

Name	Sources	References	Created On	Modified On
Continuos Improvement Capability	**13**	**65**	**02/02/2015 20:20**	**09/06/2015 14:19**
Kaizen	5	19	05/02/2015 16:27	09/06/2015 14:19
SEMED - Single - minute exchange of die	1	1	05/02/2015 19:06	08/02/2015 21:09
Loop	1	1	09/04/2015 10:40	09/06/2015 14:19
Root cause of the problem	7	19	05/02/2015 22:36	09/06/2015 14:19
Tkan you	4	12	01/06/2015 16:54	09/06/2015 14:19
Reward	3	8	05/03/2015 16:22	09/04/2015 11:46
Customer Support Capability	**16**	**87**	**03/02/2015 18:31**	**09/06/2015 14:18**
Customer Relationship	6	14	14/02/2015 18:47	28/06/2015 22:19
Partnership Buyer-Firm	3	5	15/04/2015 18:23	15/04/2015 19:52
Relationship with End User	4	6	26/03/2015 18:43	02/06/2015 14:43
Strategic Buyers	1	3	26/03/2015 18:16	15/04/2015 18:29
Responsiveness	12	40	15/04/2015 18:22	09/06/2015 15:42
Customer Service - Quality	5	6	03/02/2015 21:13	26/03/2015 15:59
Complaint Handling - Quality	1	3	19/03/2015 18:34	20/03/2015 12:36
Cross-Functional Teams	1	1	14/02/2015 23:34	14/02/2015 23:34
Customer's Request	2	3	19/02/2015 18:52	05/03/2015 22:07
Quality Response	2	2	03/02/2015 21:15	20/03/2015 14:15
Satisfaction Survey	1	1	11/03/2015 15:08	11/03/2015 15:08
Time Response	6	8	03/02/2015 21:12	30/04/2015 14:52
Customers Requirements	9	25	03/02/2015 21:27	03/09/2015 18:07
Delivery on Time -24h 48h 72h- Just in Time	6	9	03/02/2015 21:14	15/04/2015 18:28
Service Level Agreement	8	27	06/02/2015 18:22	29/09/2015 15:12
Investment Production Process Buyer	0	0	13/04/2015 17:26	09/06/2015 15:42
Operational Efficiency Project Buyer	6	19	06/02/2015 18:05	09/06/2015 15:42
Technical Support Service	2	3	20/03/2015 11:34	26/03/2015 15:59
Client Complaints	1	13	25/03/2015 20:02	25/03/2015 20:32
Monitoring of Indicators	1	11	25/03/2015 19:39	25/03/2015 20:32
Problem Solving	2	9	25/03/2015 19:07	15/04/2015 18:20
Flexibility Capability	**9**	**52**	**26/03/2015 16:31**	**09/06/2015 14:11**
Customization	7	22	26/02/2015 17:02	09/06/2015 14:11
Customization of the Finished Product	3	7	26/02/2015 17:03	11/03/2015 15:16
Customization of the Product	4	11	26/03/2015 17:51	09/06/2015 15:43
Customization Process and Machines	2	2	16/04/2015 10:19	27/03/2015 12:41
Scheduling by Product Category	5	19	25/02/2015 16:57	09/06/2015 14:11
Small Batches Delivery	3	11	07/02/2015 00:12	09/06/2015 14:11
Delivery of Small Lots	1	2	07/02/2015 00:14	30/04/2015 14:52
Product Finishing	1	1	07/02/2015 11:38	30/04/2015 14:52
Service Order Buyer	2	6	07/02/2015 11:36	30/04/2015 14:52

Unscheduled Delivery	1	2	05/03/2015 15:18	05/03/2015 15:22
Information Management Capability	**21**	**231**	**17/02/2015 19:06**	**09/06/2015 14:17**
A3	2	4	12/03/2015 17:09	09/06/2015 14:16
Forquest	10	18	26/03/2015 17:36	09/06/2015 14:17
Key Performance Indicators (KPI)	10	99	06/02/2015 13:12	03/10/2015 12:14
Impact Effort Matrix	1	2	08/02/2015 23:07	08/02/2015 23:13
Monitoring of Performance Indicators	8	84	28/01/2015 21:28	09/06/2015 15:44
Projects Management	2	4	03/02/2015 17:06	01/06/2015 20:44
Objectives, Goals, Strategies and Measures (OGSM)	1	1	08/02/2015 21:08	03/10/2015 12:14
Visible Management Systems (VMS)	17	85	03/02/2015 18:58	03/10/2015 12:15
Display of Information	1	1	07/04/2015 16:00	07/04/2015 16:00
Encoding Information	3	3	03/02/2015 19:05	27/02/2015 16:28
Integration Information	5	11	03/02/2015 18:59	07/04/2015 16:02
Share Information among sectors	17	70	06/02/2015 12:53	09/06/2015 15:46
Innovation Capability	**9**	**52**	**09/02/2015 16:13**	**09/06/2015 14:17**
Development and Implementation of New Machinery and Equipment	7	26	27/02/2015 13:07	10/06/2015 11:36
Development of New Technologies	1	4	06/02/2015 22:29	30/04/2015 14:52
Return on Investment	1	1	05/03/2015 17:25	16/04/2015 10:24
Technology Transfer (sites, clients, market)	2	5	06/02/2015 22:52	30/04/2015 14:52
Development of New Processes	3	24	11/02/2015 22:15	09/06/2015 14:17
Cost out	0	0	13/04/2015 15:53	02/06/2015 14:43
Development of New Products (diversification)	3	14	06/02/2015 22:39	30/04/2015 14:52
Improve Existing Products	2	5	07/02/2015 12:12	09/06/2015 15:46
Qualification of Raw Material	1	4	10/02/2015 20:11	09/06/2015 15:46
Learning Capability	**19**	**251**	**02/02/2015 20:19**	**09/06/2015 14:20**
Action Plan	1	3	09/04/2015 10:33	09/06/2015 14:19
Monitoring	1	1	09/04/2015 11:06	09/04/2015 11:06
Leadership Principle	8	16	05/02/2015 18:17	09/06/2015 14:19
Help Chain	2	4	27/02/2015 12:16	07/04/2015 15:31
Management of Change (MOC)	3	3	05/03/2015 14:52	03/10/2015 12:15
Managing for Daily Improvement (MDI)	15	78	05/02/2015 22:28	03/10/2015 12:15
Decision-Making Group	3	5	11/03/2015 18:58	01/06/2015 15:52
Demand for Problems	1	1	06/02/2015 13:03	30/04/2015 14:52
MDI 1 Machines	7	11	11/03/2015 19:33	01/06/2015 17:17
MDI 2 Management of Production	5	8	11/03/2015 19:37	01/06/2015 17:18
MDI 3 Management with all Areas	7	7	11/03/2015 19:45	01/06/2015 17:18
Solving Problems Quickly	6	31	02/02/2015 19:52	09/06/2015 15:47
Training & Development (Human Resources)	16	142	02/02/2015 20:39	09/06/2015 14:19
Based on Complaints	1	1	21/03/2015 13:48	27/03/2015 15:58
Competence	2	5	22/02/2015 11:01	27/03/2015 16:46
Facilitators	1	3	18/03/2015 22:08	18/03/2015 22:09

Impact and Return on efficiency	1	6	17/03/2015 22:59	18/03/2015 21:37
Integration among sectors	2	5	12/03/2015 16:47	18/03/2015 21:46
Learn by doing	4	6	12/03/2015 16:34	09/04/2015 19:15
Management Support - Prioritization	2	2	26/02/2015 16:13	17/03/2015 23:04
Mandatory	2	3	27/03/2015 16:02	07/04/2015 15:40
Monitoring	1	5	17/03/2015 23:15	17/03/2015 23:22
Standardization Tasks and Post	5	14	26/02/2015 15:56	09/06/2015 15:47
Target	1	4	17/03/2015 23:11	17/03/2015 23:20
Training & Development	7	32	04/03/2015 19:47	09/06/2015 15:48
Operational Efficiency Capability	**20**	**509**	**04/02/2015 19:28**	**09/06/2015 14:18**
Environmental, Health, and Safety (EHS)	8	55	05/02/2015 22:56	03/10/2015 12:16
Accident	2	4	06/04/2015 17:53	09/06/2015 15:48
Efficiency	4	8	05/02/2015 23:08	16/04/2015 11:21
Feel Safe	2	2	05/02/2015 22:59	04/03/2015 17:41
Investment versus Return	1	2	06/04/2015 18:05	16/04/2015 11:21
Monitoring of Indicators	1	8	06/04/2015 17:57	16/04/2015 11:21
Norm Standardization e Procedure	6	8	05/02/2015 23:05	16/04/2015 11:21
Practices of Safety at Work	2	12	13/03/2015 14:25	09/06/2015 15:48
Just in Time (JIT)	11	73	07/02/2015 00:04	03/10/2015 12:16
Action Plan	1	2	07/04/2015 15:55	07/04/2015 15:55
Adherence in daily program	4	10	11/03/2015 17:19	01/06/2015 21:14
Flexible Functions	1	3	07/04/2015 15:36	07/04/2015 15:37
Internal Flow	3	8	19/02/2015 19:16	07/04/2015 16:01
Inventory management	1	3	07/04/2015 15:27	11/06/2015 14:19
Monitoring of Indicators	1	9	07/04/2015 15:21	07/04/2015 16:23
Outsourced Carrier	4	13	19/02/2015 19:20	09/06/2015 15:49
Receive Raw Material	1	1	07/04/2015 16:20	07/04/2015 16:20
Setup	5	20	05/02/2015 17:55	09/06/2015 15:49
Time Delivery to Buyer	1	2	19/02/2015 17:53	09/06/2015 15:49
Lead Time	8	42	22/02/2015 10:40	09/06/2015 14:18
Finishing	2	4	11/03/2015 15:49	26/03/2015 16:09
Large Lots	1	1	09/04/2015 11:42	01/06/2015 20:52
PCP	2	2	26/03/2015 16:03	01/06/2015 17:48
Production	7	14	11/03/2015 15:49	09/06/2015 15:50
Total Productive Maintenance (TPM)	8	140	09/04/2015 10:38	03/10/2015 12:16
Maintenance	8	136	28/01/2015 20:01	11/03/2015 18:39
Autonomous maintenance	3	3	02/02/2015 20:35	27/03/2015 15:54
Building Maintenance	3	6	27/03/2015 12:29	09/04/2015 19:01
Corrective Maintenance	5	13	28/01/2015 20:10	09/04/2015 19:16
Maintenance Planning	3	12	27/03/2015 12:31	09/06/2015 15:51
Maintenance Practices	2	7	05/02/2015 17:52	09/06/2015 15:51

Monitoring of PerformanceIndicators	2	16	27/03/2015 15:52	10/04/2015 14:20
Performance Maintenance Indicators	4	16	28/01/2015 20:13	09/04/2015 19:21
Predictive Maintenance	6	15	28/01/2015 20:08	09/04/2015 19:06
Preventive Maintenance	7	36	28/01/2015 20:02	09/04/2015 19:21
To Defer Maintenance Actions	2	9	27/03/2015 12:37	27/03/2015 16:49
Maintenance Practices	1	1	05/02/2015 17:51	09/06/2015 15:51
Total Quality Management (TQM)	13	177	19/03/2015 18:32	03/10/2015 12:16
5 S	3	3	05/02/2015 19:06	09/06/2015 15:56
Control and Tracking of the Quality	5	20	20/03/2015 12:32	16/04/2015 11:02
House of Quality Practice	1	1	16/04/2015 10:25	16/04/2015 10:26
Monitoring of Buyer Satisfaction	3	12	20/03/2015 12:42	09/06/2015 15:57
Process Management	5	19	03/02/2015 20:19	09/06/2015 15:56
Product Management	8	41	07/02/2015 11:45	09/06/2015 15:55
QFD - Quality Function Deployment -	1	3	06/02/2015 22:56	30/04/2015 14:52
Quality Culture	2	2	25/02/2015 15:52	16/04/2015 12:03
Quality Practices	2	8	20/03/2015 12:19	09/06/2015 15:54
Quality Response to Buyer	7	45	20/03/2015 15:29	09/06/2015 15:54
Raw Material Quality	6	17	20/03/2015 16:19	09/06/2015 15:52
Supplier ManagementCapability	**15**	**234**	**09/02/2015 15:37**	**09/06/2015 14:17**
Supplier Evaluation	6	41	14/02/2015 15:28	09/06/2015 14:17
Award Ceremony	1	1	20/03/2015 18:16	02/06/2015 14:43
Delivery reability, quality, quantity and on time	2	7	19/02/2015 17:32	08/04/2015 19:18
Global	3	7	19/02/2015 17:39	08/04/2015 18:45
Importance of Supplier	3	3	19/02/2015 18:50	08/04/2015 18:46
Level of Service	3	9	17/02/2015 19:41	09/06/2015 15:58
Period	2	2	19/02/2015 17:37	08/04/2015 19:12
Supplier Disqualification.	3	5	20/03/2015 18:11	09/06/2015 15:58
Supplier Relationship	14	168	03/02/2015 18:36	09/06/2015 14:17
Benefit	1	2	08/04/2015 17:22	02/06/2015 14:43
Development of new products and technological	3	7	11/02/2015 22:23	02/06/2015 14:43
Equality Policy	2	2	20/03/2015 17:57	07/04/2015 16:20
Internal Integration with other Areas	2	8	17/02/2015 19:14	09/06/2015 15:59
International Suppliers	5	17	17/02/2015 19:34	09/06/2015 15:59
Local Suppliers	6	18	13/02/2015 18:19	09/06/2015 15:59
Long-term	5	12	14/02/2015 15:25	09/06/2015 16:00
Multiple Suppliers	4	10	13/02/2015 11:36	09/06/2015 16:00
Partnership	4	14	03/02/2015 18:38	09/06/2015 16:00
Problem Solving	2	3	13/02/2015 20:51	08/04/2015 18:48
Production Planning	2	19	17/02/2015 18:14	09/06/2015 16:01
Raw Materials	7	20	07/02/2015 12:05	09/06/2015 16:02
Share and Aling Information	2	11	17/02/2015 19:53	09/06/2015 16:02

Supplier Intercompany	5	21	13/02/2015 18:18	09/06/2015 16:02
Trainings	1	1	14/02/2015 23:09	14/02/2015 23:09
Supplier Selection	4	14	08/04/2015 17:58	09/06/2015 14:17
Approve Suppliers	4	13	14/02/2015 16:06	09/06/2015 16:02

Appendix 18 – Analytical Categories Flexi_Case

Name	Sources	References	Created On	Modified On
Continuos Improvement Capability	**15**	**76**	**09/06/2015 16:12**	**27/06/2015 16:02**
Kaizen	6	10	09/06/2015 16:12	27/06/2015 15:36
Brainstorming	2	2	09/06/2015 18:05	27/06/2015 15:36
Loop	1	1	09/06/2015 16:12	27/06/2015 15:36
Product Structure	1	4	24/06/2015 13:01	27/06/2015 15:36
Return on Investment	1	1	10/06/2015 16:47	27/06/2015 15:36
MatrixCost-Cutting Processes	5	16	09/06/2015 17:50	27/06/2015 16:05
Cost-Cutting	4	11	10/06/2015 16:17	27/06/2015 15:36
Process	1	2	09/06/2015 17:42	27/06/2015 15:36
Product	1	1	09/06/2015 17:43	27/06/2015 15:36
Raw Material	1	1	09/06/2015 17:43	27/06/2015 15:36
Root cause of the problem	3	3	09/06/2015 16:12	27/06/2015 16:05
Customer Support Capability	**15**	**132**	**09/06/2015 16:12**	**26/06/2015 18:37**
Customer Relationship	8	27	09/06/2015 16:12	28/06/2015 22:19
Classification Key Customers	5	13	10/06/2015 16:12	27/06/2015 15:35
Product Development	5	5	10/06/2015 16:08	27/06/2015 15:35
Pull-Production	2	3	23/06/2015 16:16	27/06/2015 15:35
Responsiveness	15	83	09/06/2015 16:58	27/06/2015 15:35
Customers Complaints	10	14	10/06/2015 18:11	27/06/2015 15:35
Customers Requirements	14	43	10/06/2015 22:57	03/09/2015 18:07
Lead Time	2	5	24/06/2015 16:58	27/06/2015 15:35
Monitoring of Indicators of Customer	2	2	10/06/2015 18:14	27/06/2015 15:35
Quality Assured	2	14	26/06/2015 16:43	27/06/2015 15:35
Service Level Agreement	9	19	09/06/2015 16:12	29/09/2015 15:12
Cusromer to firm	1	2	25/06/2015 10:19	27/06/2015 15:35
Customization Capability	**9**	**47**	**09/06/2015 16:12**	**30/06/2015 10:52**
Process Modularity	9	25	10/06/2015 12:13	27/06/2015 15:35
Product Modularity	9	22	10/06/2015 12:13	27/06/2015 15:35
Flexibility Capability	**12**	**42**	**09/06/2015 16:12**	**27/06/2015 15:34**
Flexibility Machines	7	9	10/06/2015 23:24	27/06/2015 15:34
Flexible-Manufacturing-Cell	2	2	09/06/2015 18:22	27/06/2015 15:34
Flexibility of Delivery	5	12	11/06/2015 14:36	27/06/2015 15:34
Flexibility of Raw Material	2	3	11/06/2015 16:49	27/06/2015 15:34
Small Batches	7	17	09/06/2015 16:12	27/06/2015 15:34
Scheduling by Product Category	5	12	09/06/2015 16:12	27/06/2015 15:34
Information Management Capability	**18**	**187**	**09/06/2015 16:12**	**23/06/2015 17:12**
Forquest	5	22	09/06/2015 16:12	27/06/2015 15:31
Key Performance Indicators (KPI)	17	108	09/06/2015 16:12	03/10/2015 12:18
Costs and Savings	1	2	09/06/2015 17:22	27/06/2015 15:34

Operational Performance Indicators	8	28	09/06/2015 17:28	27/06/2015 15:34
UPI - Universal Performance Indicators	1	1	24/06/2015 15:03	27/06/2015 15:33
Material Requirements Planning (MRP)	1	4	11/06/2015 22:58	03/10/2015 12:18
Production Order	1	2	24/06/2015 13:14	27/06/2015 15:33
Sales and Operational Planning (S&OP)	4	24	10/06/2015 14:31	03/10/2015 12:18
Annual Budget	1	2	10/06/2015 14:27	27/06/2015 15:33
Visible Management Systems (VMS)	8	26	09/06/2015 16:12	03/10/2015 12:18
Innovation Capability	**14**	**62**	**09/06/2015 16:12**	**24/06/2015 21:08**
Development and Implementation of New Machinery and Equipment	12	40	09/06/2015 16:12	27/06/2015 15:33
Development of New Processes	12	21	09/06/2015 16:12	27/06/2015 15:33
Implementation of Software acho que posso incluir sistema nos de cima	1	2	21/06/2015 14:07	27/06/2015 15:33
Learning Capability	**16**	**152**	**09/06/2015 16:12**	**27/06/2015 15:32**
Daily Management System	14	65	10/06/2015 18:07	27/06/2015 18:23
Leadership Principle	4	11	09/06/2015 16:12	27/06/2015 15:32
Meeting Groups	2	11	09/06/2015 16:12	27/06/2015 17:37
Eight Disciplines of Problem Solving (8D)	5	7	25/06/2015 11:41	03/10/2015 12:18
MOC - Management of Change	1	1	09/06/2015 16:12	27/06/2015 15:32
Integrative Action Plan	11	32	09/06/2015 16:12	27/06/2015 15:32
Training & Development (Human Resources)	12	46	09/06/2015 16:12	27/06/2015 15:31
On the Job	5	5	10/06/2015 18:42	27/06/2015 15:31
Recruitment and trainingby Competence	7	13	09/06/2015 22:07	27/06/2015 15:31
Training Audit	3	3	09/06/2015 22:08	27/06/2015 15:31
Visual Training (Loops)	1	2	10/06/2015 18:38	27/06/2015 15:31
Operational Efficiency Capability	**17**	**363**	**09/06/2015 16:12**	**27/06/2015 15:31**
Environmental, Health, and Safety (EHS)	9	37	09/06/2015 16:12	03/10/2015 12:19
Environmental Sustainability	4	8	25/06/2015 13:37	27/06/2015 15:31
Just in Time (JIT)	12	78	09/06/2015 16:12	03/10/2015 12:19
Buffer	1	1	09/06/2015 16:50	27/06/2015 15:30
Capacity of Machines	5	10	21/06/2015 14:34	27/06/2015 15:30
Inventory Management	8	43	11/06/2015 14:18	27/06/2015 15:30
Kanban	1	1	24/06/2015 15:18	27/06/2015 15:30
Load Combination	1	2	26/06/2015 20:02	27/06/2015 15:30
Product Management	3	3	10/06/2015 15:56	27/06/2015 15:30
Pull-Production	1	1	24/06/2015 14:14	27/06/2015 15:30
Setup	5	11	13/06/2015 19:15	27/06/2015 15:30
Time Delivery to Buyer	3	3	10/06/2015 15:02	27/06/2015 15:30
Lead Time	10	59	09/06/2015 16:12	27/06/2015 15:30
Machine Load	1	1	09/06/2015 16:43	27/06/2015 15:30
Master Production Scheduling	6	17	09/06/2015 16:48	27/06/2015 15:30
PCP	8	31	11/06/2015 14:32	27/06/2015 15:30

Weekly Meeting	1	1	24/06/2015 22:20	27/06/2015 15:29
Total Productive Maintenance (TPM)	8	64	09/06/2015 16:12	03/10/2015 12:20
Autonomous Management	5	14	24/06/2015 20:37	27/06/2015 15:08
Corrective Maintenance	3	9	11/06/2015 23:28	27/06/2015 15:08
Facility Maintenance	1	2	27/06/2015 10:55	27/06/2015 15:08
Predictive Maintenance	3	9	10/06/2015 18:50	27/06/2015 15:08
Preventive Maintenance	5	18	10/06/2015 18:49	27/06/2015 15:08
Total Quality Management (TQM)	14	117	09/06/2015 16:12	03/10/2015 12:20
Certifications	1	6	27/06/2015 11:23	27/06/2015 15:08
Committee Product Quality Problems	1	5	26/06/2015 16:59	27/06/2015 15:08
Machine Warning Mechanisms	1	3	24/06/2015 18:26	27/06/2015 15:08
Non-Compliance Report	3	5	24/06/2015 17:23	27/06/2015 15:08
Process Management	3	8	26/06/2015 15:02	27/06/2015 15:08
Product Management	10	17	11/06/2015 17:47	27/06/2015 15:07
Product Quality	9	42	10/06/2015 12:20	27/06/2015 15:07
Quality Test	1	5	27/06/2015 12:11	27/06/2015 15:07
Raw Material Quality	2	5	09/06/2015 17:16	27/06/2015 15:07
Traceability	2	4	24/06/2015 18:31	27/06/2015 15:07
Visual Control of Worker	3	5	24/06/2015 19:17	27/06/2015 15:07
Supplier ManagementCapability	**13**	**143**	**09/06/2015 16:12**	**27/06/2015 15:06**
Supplier Evaluation	4	8	09/06/2015 16:12	27/06/2015 15:05
Meetings with Suppliers	1	1	11/06/2015 15:47	27/06/2015 15:05
OTIF - On-Time In-Full	3	4	11/06/2015 15:19	27/06/2015 15:05
Supplier Relationship	13	122	09/06/2015 16:12	27/06/2015 15:05
Development of new products, processes, and technological	4	11	10/06/2015 12:26	27/06/2015 15:05
Formal Agreements	2	5	11/06/2015 15:21	27/06/2015 15:04
Forquest	2	2	09/06/2015 16:45	27/06/2015 15:04
International Suppliers	6	14	09/06/2015 16:29	27/06/2015 15:04
Level Service	2	6	25/06/2015 20:27	27/06/2015 15:04
Local Suppliers	5	10	11/06/2015 16:10	27/06/2015 15:04
Long Term	1	1	25/06/2015 20:16	27/06/2015 15:04
Monitoring Indicators and others	3	3	24/06/2015 15:53	27/06/2015 15:04
Monopoly	1	1	25/06/2015 20:20	27/06/2015 15:04
Multiple Suppliers	5	7	11/06/2015 16:53	27/06/2015 15:04
Raw Material	9	52	10/06/2015 11:14	27/06/2015 15:04
Reliability	3	6	10/06/2015 11:15	27/06/2015 15:03
Supply Among Plants	1	1	26/06/2015 21:30	27/06/2015 15:03
Time of Supply	1	2	11/06/2015 15:59	27/06/2015 15:03
Supplier Selection	5	13	09/06/2015 16:12	27/06/2015 15:02
Approve Suppliers Process	5	10	11/06/2015 15:56	27/06/2015 15:02
Bid	2	3	11/06/2015 15:38	25/06/2015 21:00

Appendix 19 – Analytical Categories Paper_Case

Name	Sources	References	Created On	Modified On
Continuos Improvement Capability	**5**	**17**	**17/08/2015 22:57**	**25/08/2015 22:19**
Cost Out	3	5	23/08/2015 21:33	27/08/2015 14:25
LPP - Linked Personnel Panel	2	4	21/08/2015 19:14	27/08/2015 14:22
RAP - Risk Analysis for Prevention	1	5	21/08/2015 19:07	26/08/2015 19:33
Tree Diagram	2	5	17/08/2015 22:57	26/08/2015 19:33
Customer Support Capability	**15**	**233**	**17/08/2015 22:57**	**09/06/2015 16:10**
Customer Relationship	11	41	17/08/2015 22:57	26/08/2015 19:31
Contract of Exclusivity	1	4	24/08/2015 17:57	26/08/2015 19:32
Customer Classification	1	1	21/08/2015 14:49	26/08/2015 19:32
Customer Visits	2	17	23/08/2015 15:47	26/08/2015 19:32
Reliable Product	2	4	18/08/2015 19:23	26/08/2015 19:32
Reuse Scrap	2	5	26/08/2015 15:05	26/08/2015 19:32
Stock for the Customer	2	2	21/08/2015 14:54	26/08/2015 19:32
Trade Agreement.	1	1	25/08/2015 21:41	26/08/2015 19:32
Responsiveness	15	161	17/08/2015 22:57	24/08/2015 17:13
Customers Complaints	9	53	18/08/2015 19:59	03/09/2015 18:08
Customers Requirements	15	94	18/08/2015 14:26	03/09/2015 18:08
Service Level Agreement	8	31	17/08/2015 22:57	29/09/2015 15:13
Technical Support	8	26	21/08/2015 15:27	26/08/2015 19:33
Customization Capability	**11**	**89**	**18/08/2015 12:09**	**26/08/2015 19:34**
Customization on a Large Scale	8	24	18/08/2015 12:14	26/08/2015 19:34
Product Variety	11	54	18/08/2015 12:14	26/08/2015 19:34
Quick Response for Customization	5	9	18/08/2015 12:16	27/08/2015 14:14
Flexibility Capability	**11**	**117**	**17/08/2015 22:57**	**23/08/2015 17:48**
Flexibility Machines	6	11	18/08/2015 18:00	26/08/2015 19:34
Flexibility of Raw Material	7	23	18/08/2015 12:00	26/08/2015 19:34
Production Scheduling	8	22	18/08/2015 13:24	06/09/2015 20:11
Scheduling by Product Category	6	23	17/08/2015 22:57	25/08/2015 19:32
Small Batches	7	32	17/08/2015 22:57	26/08/2015 17:42
Information Management Capability	**14**	**113**	**17/08/2015 22:57**	**26/08/2015 18:40**
Forquest	4	27	17/08/2015 22:57	26/08/2015 19:46
Key Performance Indicators (KPI)	12	73	17/08/2015 22:57	03/10/2015 12:21
Efficiency Indicator	5	32	18/08/2015 15:47	26/08/2015 19:35
Maintenance Indicators	1	5	23/08/2015 20:23	26/08/2015 19:35
Quality Indicator	1	1	19/08/2015 20:50	26/08/2015 19:35
Safety Indicators	1	2	18/08/2015 21:56	26/08/2015 19:35
Manual Control of Information (Logbook)	1	3	21/08/2015 18:01	27/08/2015 14:18
Visible Management Systems (VMS)	4	8	17/08/2015 22:57	03/10/2015 12:21
Check List of Machine Condition	1	2	25/08/2015 16:42	27/08/2015 14:03

Label Product Specification	1	2	21/08/2015 17:21	27/08/2015 14:03
Innovation Capability	**9**	**34**	**17/08/2015 22:57**	**26/08/2015 18:56**
Development and Implementation of New Machinery and Equipment	8	28	17/08/2015 22:57	25/08/2015 19:38
Development of New Processes	5	5	17/08/2015 22:57	26/08/2015 19:36
Learning Capability	**14**	**146**	**17/08/2015 22:57**	**26/08/2015 19:37**
EmergencyAction Plan	8	17	17/08/2015 22:57	27/08/2015 14:28
Multidisciplinary Meetings Daily	11	48	18/08/2015 13:22	01/09/2015 21:12
Plan-do-check-act (PDCA)	6	19	18/08/2015 17:16	03/10/2015 12:22
Training & Development (Human Resources)	9	62	17/08/2015 22:57	26/08/2015 19:36
Operational Efficiency Capability	**17**	**432**	**17/08/2015 22:57**	**09/06/2015 16:10**
Environmental, Health, and Safety (EHS)	8	27	17/08/2015 22:57	03/10/2015 12:22
Integration	1	2	18/08/2015 21:40	26/08/2015 19:46
Security Dialogue	1	2	18/08/2015 21:43	26/08/2015 19:46
Worker Behavior	1	1	20/08/2015 16:17	26/08/2015 19:46
Just in Time (JIT)	11	79	17/08/2015 22:57	03/10/2015 12:22
Capacity of Machines	3	12	18/08/2015 19:00	26/08/2015 19:46
Inventory Management	8	40	20/08/2015 17:17	26/08/2015 19:46
Pushed Production	2	5	20/08/2015 19:34	26/08/2015 19:46
Setup	5	22	18/08/2015 15:59	26/08/2015 19:46
Lead Time	10	52	17/08/2015 22:57	26/08/2015 19:46
Master Production Schedulin	6	13	20/08/2015 17:15	26/08/2015 19:45
Total Productive Maintenance (TPM)	10	83	17/08/2015 22:57	03/10/2015 12:22
Corrective Maintenance	8	29	18/08/2015 19:05	26/08/2015 19:45
Outsourced Maintenance	4	8	18/08/2015 19:07	26/08/2015 19:45
Predictive Maintenance	3	6	23/08/2015 20:27	26/08/2015 19:45
Preventive Maintenance	6	24	18/08/2015 19:02	26/08/2015 19:45
Total Quality Management (TQM)	13	191	17/08/2015 22:57	03/10/2015 12:22
Certifications	5	43	19/08/2015 17:54	26/08/2015 19:39
Environmental Management	1	2	19/08/2015 19:02	26/08/2015 19:39
HACCP - Hazard Analysis and Critical Control Points	1	2	22/08/2015 12:00	26/08/2015 19:39
House Keeping and 5S	4	8	19/08/2015 18:40	26/08/2015 19:39
Measuring Equipment	2	4	18/08/2015 19:19	26/08/2015 19:39
Process Management	5	27	19/08/2015 19:04	26/08/2015 19:38
Product Management	11	72	18/08/2015 20:02	26/08/2015 19:38
Quality Analysis of Raw Materials	1	4	24/08/2015 20:22	26/08/2015 19:38
Raw Material Management	1	1	26/08/2015 14:17	26/08/2015 19:38
Reuse Scrap	3	6	25/08/2015 21:36	26/08/2015 19:45
Test Sample	4	7	18/08/2015 19:51	26/08/2015 19:38
Supplier Management Capability	**12**	**242**	**17/08/2015 22:57**	**09/06/2015 16:11**
Supplier Evaluation	5	33	17/08/2015 22:57	26/08/2015 19:45
Audit Plan	2	6	22/08/2015 12:28	26/08/2015 19:44

Formal	1	8	26/08/2015 13:33	26/08/2015 19:44
Reliability	1	4	26/08/2015 13:31	26/08/2015 19:44
Supplier Evaluation	2	6	19/08/2015 19:39	26/08/2015 19:44
Supplier Relationship	12	160	17/08/2015 22:57	26/08/2015 19:44
Audit Plan	2	8	26/08/2015 14:56	26/08/2015 19:43
BID	1	2	26/08/2015 13:16	26/08/2015 19:43
Comply with Legislation	2	2	20/08/2015 16:22	26/08/2015 19:43
Development product and process	1	2	24/08/2015 15:07	26/08/2015 19:43
Diversification of Suppliers	1	4	26/08/2015 13:07	26/08/2015 19:43
Formal Purchase Agreement	2	12	26/08/2015 13:01	26/08/2015 19:43
Investment Technology and Finance	1	3	21/08/2015 15:18	26/08/2015 19:42
Long Term Relationship	2	6	21/08/2015 14:56	26/08/2015 19:42
New Technologies	2	8	24/08/2015 16:06	26/08/2015 19:42
Product-presentation Approach	1	2	23/08/2015 21:38	26/08/2015 19:42
QuickReply	1	2	18/08/2015 20:38	26/08/2015 19:42
Raw Material	11	83	18/08/2015 18:19	26/08/2015 19:42
Report Supplier Service	1	6	26/08/2015 16:06	26/08/2015 19:41
Strategic Supplier	2	8	26/08/2015 16:09	26/08/2015 19:41
Technical Support	4	7	18/08/2015 20:36	26/08/2015 19:41
Training	1	4	23/08/2015 21:08	26/08/2015 19:41
Supplier Selection	7	49	17/08/2015 22:57	26/08/2015 19:40
Approve Suppliers Process	3	11	18/08/2015 20:45	26/08/2015 19:40
Audit Plan	2	7	26/08/2015 14:55	26/08/2015 19:40
Certifications	4	11	26/08/2015 12:50	26/08/2015 19:40
Cost	3	9	26/08/2015 12:55	26/08/2015 19:40
Formal Purchase Agreement	1	3	26/08/2015 13:22	26/08/2015 19:40
Specification of Raw Material	1	5	26/08/2015 12:50	26/08/2015 19:40

Appendix 20 – Analytical Categories Metal_Case

Name	Sources	References	Created On	Modified On
Continuos Improvement Capability	**8**	**63**	**01/09/2015 20:47**	**30/09/2015 19:41**
Root cause of the problem	1	1	01/09/2015 20:47	03/10/2015 11:52
Simplification Project	6	36	01/09/2015 21:46	03/10/2015 11:51
Waste Management Teams	2	22	21/09/2015 19:12	03/10/2015 11:51
Customer Support Capability	**15**	**200**	**01/09/2015 20:47**	**24/09/2015 19:52**
Customer Relationship	13	60	01/09/2015 20:47	03/10/2015 11:51
Formalization	1	2	02/09/2015 16:36	03/10/2015 11:51
Kanban	5	9	03/09/2015 18:13	03/10/2015 11:51
Launching of Innovative Products	5	20	24/09/2015 19:12	03/10/2015 11:51
Pull Production	1	3	29/09/2015 15:21	03/10/2015 11:51
Reciprocity	3	6	08/09/2015 18:20	03/10/2015 11:51
Responsiveness	14	117	01/09/2015 20:47	30/09/2015 17:08
Customers Complaints	7	25	02/09/2015 21:25	03/10/2015 11:51
Customers Requirements	11	49	03/09/2015 18:06	03/10/2015 11:51
New Trends	4	13	04/09/2015 15:57	03/10/2015 11:51
Service Level Agreement	9	16	01/09/2015 20:47	03/10/2015 11:51
Financial Investment	1	1	24/09/2015 19:23	03/10/2015 11:51
Storing the Customer's Stock	5	6	03/09/2015 18:14	03/10/2015 11:51
Technical Assistance	4	7	02/09/2015 13:11	03/10/2015 11:50
Flexibility Capability	**7**	**76**	**01/09/2015 20:47**	**09/06/2015 16:10**
Customization Lithography	6	22	01/09/2015 20:47	29/09/2015 18:12
Deadline for Delivery	2	4	01/09/2015 20:47	29/09/2015 16:10
Manufacturing Cell	4	36	03/09/2015 21:41	03/10/2015 11:50
Production Scheduling	5	14	02/09/2015 16:48	03/10/2015 11:50
Information Management Capability	**11**	**129**	**01/09/2015 20:47**	**08/09/2015 14:30**
Forquest	1	7	01/09/2015 20:47	03/10/2015 11:50
Key Performance Indicators (KPI)	11	113	01/09/2015 20:47	03/10/2015 12:12
Operational Manager Report	1	7	08/09/2015 14:33	03/10/2015 11:50
Innovation Capability	**13**	**86**	**01/09/2015 20:47**	**30/09/2015 19:21**
Development and Implementation of New Machinery and Equipment	12	56	01/09/2015 20:47	30/09/2015 19:39
Development of New Processes	9	24	01/09/2015 20:47	03/10/2015 11:49
Learning Capability	**15**	**164**	**01/09/2015 20:47**	**09/06/2015 16:10**
Action Plan	7	27	01/09/2015 20:47	03/10/2015 11:49
5W 2H	1	1	21/09/2015 19:21	03/10/2015 11:49
Leadership Principle	10	30	01/09/2015 20:47	03/10/2015 11:49
Multidisciplinary Meetings Daily	7	33	01/09/2015 21:11	03/10/2015 11:49
MDI - Managing for Daily Improvement	1	2	01/09/2015 20:47	03/10/2015 11:49
Training & Development (Human Resources)	11	74	01/09/2015 20:47	03/10/2015 11:49

Internal	4	10	02/09/2015 20:57	03/10/2015 11:49
Older Worker Trains Newest (on the job)	4	8	01/09/2015 21:51	03/10/2015 11:49
On Job	2	2	02/09/2015 20:45	03/10/2015 11:49
Operational Efficiency Capability	**17**	**449**	**01/09/2015 20:47**	**30/09/2015 17:11**
Environmental, Health, and Safety (EHS)	7	26	01/09/2015 20:47	03/10/2015 12:10
Environmental Sustainability	2	10	29/09/2015 19:47	03/10/2015 11:49
JIT - Just in Time	13	124	01/09/2015 20:47	03/10/2015 11:49
Capacity of Machines	5	7	02/09/2015 16:40	03/10/2015 11:48
Inventory Management	8	36	02/09/2015 16:18	03/10/2015 11:48
Kanban	8	33	01/09/2015 21:25	03/10/2015 11:48
Large Batches	6	18	02/09/2015 18:09	03/10/2015 11:48
Setup	4	29	02/09/2015 16:44	03/10/2015 11:48
Lead Time	7	74	01/09/2015 20:47	03/10/2015 11:48
Master Production Scheduling	2	4	02/09/2015 16:33	03/10/2015 11:48
Production Scheduling	7	69	02/09/2015 16:16	03/10/2015 11:48
Total Productive Maintenance (TPM)	10	103	01/09/2015 20:47	03/10/2015 12:11
Corrective Maintenance	9	38	01/09/2015 20:59	03/10/2015 11:48
Maintenance Inspections	1	1	02/09/2015 13:29	03/10/2015 11:48
Predictive Maintenance	1	3	27/09/2015 11:32	03/10/2015 11:47
Preventive Maintenance	7	50	01/09/2015 21:02	03/10/2015 11:47
Total Quality Management (TQM)	11	118	01/09/2015 20:47	03/10/2015 12:10
Audit	2	4	11/09/2015 17:00	03/10/2015 11:47
Certifications	3	12	10/09/2015 21:43	03/10/2015 11:47
Product Traceability	1	5	14/09/2015 14:34	03/10/2015 11:47
Quality Assurance	3	4	10/09/2015 21:50	03/10/2015 11:47
Quality Control	4	15	02/09/2015 13:43	03/10/2015 11:47
Quality of Raw Material	2	7	24/09/2015 14:20	03/10/2015 11:47
Quality Process	4	26	11/09/2015 15:35	03/10/2015 11:47
Quality Product	7	25	03/09/2015 18:03	03/10/2015 11:47
Quality Service	2	5	11/09/2015 16:27	03/10/2015 11:47
Reliability	2	2	03/09/2015 18:16	03/10/2015 11:47
Supplier ManagementCapability	**14**	**301**	**01/09/2015 20:47**	**24/09/2015 15:00**
Supplier Evaluation	3	15	01/09/2015 20:47	03/10/2015 11:47
Corrective Actions	1	1	24/09/2015 21:27	03/10/2015 11:47
Formal	3	10	02/09/2015 21:47	03/10/2015 11:47
Non-Compliance	1	1	24/09/2015 21:31	03/10/2015 11:46
Trade Agreement	1	1	08/09/2015 17:55	03/10/2015 11:46
Supplier Relationship	13	238	01/09/2015 20:47	03/10/2015 11:46
Agreement	3	13	08/09/2015 18:47	03/10/2015 11:46
Bid	2	11	02/09/2015 12:17	03/10/2015 11:46
Certification	1	2	05/09/2015 15:57	03/10/2015 11:46

Compensation for Losses	1	3	14/09/2015 17:07	03/10/2015 11:46
Improved Production Process	1	3	28/09/2015 10:24	03/10/2015 11:46
Long Term	7	15	02/09/2015 12:14	03/10/2015 11:46
Multiple Suppliers	6	24	02/09/2015 12:16	03/10/2015 11:46
Problem Solving	5	21	05/09/2015 16:20	03/10/2015 11:46
Product Development	2	3	14/09/2015 13:55	03/10/2015 11:46
Raw Material	12	73	02/09/2015 13:48	03/10/2015 11:46
Reciprocity	2	4	08/09/2015 18:26	03/10/2015 11:45
Regular Meetings	3	6	03/09/2015 17:15	03/10/2015 11:45
Single Supplier	11	33	02/09/2015 13:40	03/10/2015 11:44
Solutions New technologies	6	24	02/09/2015 12:28	03/10/2015 11:44
Supplier Selection	6	47	01/09/2015 20:47	15/09/2015 09:18
Bid	2	11	09/09/2015 17:01	15/09/2015 09:18
Development of New Suppliers	2	15	02/09/2015 20:12	15/09/2015 09:18
Document Approval	2	10	11/09/2015 11:57	24/09/2015 21:25
Emergency	1	3	08/09/2015 18:00	15/09/2015 09:18
Technical Approval	3	6	09/09/2015 16:59	24/09/2015 14:06

Appendix 21 –Scale Operational Capabilities

Items of the original scale	Operational Capability	Author (s)
Managers are rewarded for improvements in operational effectiveness All employees believe that it is their responsibility to improve operational effectiveness in the plant Continuous improvement of operational effectiveness is stressed in all work processes throughout the plant Workers are rewarded for improvements in operational effectiveness We use programs/methodologies to strengthen the process of continuous improvement	Continuos Improvement	Pagell, Klassen, Johnston, Shevchenko, & Sharma (2015)
We frequently evaluate the formal and informal complaints of our customers We frequently interact with customers to set reliability, responsiveness, and other standards for us We have frequent follow-up with our customers for quality /service feedback We frequently measure and evaluate customer satisfaction We frenquently determine future customer expectations We facilitate customers' ability to seek assistance from us We share a sense of fair play with our customers We periodically evaluate the importance of our relationship with our customers We provide support to improve the production process of our client	Customer Support	S. Li, Rao, Ragu-Nathan, & Ragu-Nathan (2005)
Our capacity of customizing products on a large scale is high Our capacity of adding product variety without increasing cost is high Our capability of customizing products while maintaining a large volume is high Our capability of setting up for a different product at low cost is high Our capability of responding to customization requirements quickly is high Our capability of adding product variety without sacrificing overall production volume is high	Customization	Tu et al. (2004) Quiang Tu, Vonderembse, & Ragu-Nathan (2001)
A typical part can use many different routes Workers can operate various types of machines A typical material handling system can link different processing centers The operating sequence through which the parts flow can be changed We can quickly change the quantities for our products produced We can produce a wide variety of products in our plants	Flexibility	Zhang et al. (2003)
Charts showing defect rates are posted on the shop floor Charts showing schedule compliance are posted on the shop floor Charts plotting the frequency of machine breakdowns are posted on the shop floor Information on quality performance is readily available to employees Information on productivity is readily available to employees	Information Management	Cua et al. (2001)

Rapid new product introductions Frequency of new product introduction We pursue long-range programs, in order to acquire manufacturing capabilities in advance of our needs We make an effort to anticipate the potential of new manufacturing practices and technologies Our plant stays on the leading edge of new technology in our industry We are constantly thinking of the next generation of manufacturing technology	Innovation	Schroeder et al. (2010)
Work process have been designed in such a way tha they are capable of developing standards of conduct at all levels of the firm Employees are capable of taking the initiative and assimilating better ways of doing their job There is an important spirit of dialogue and acceptance of diverse opinions in all areas of the firm Any one person's knowledge is transmitted and made readily available to the employees Plant employees receive training and development in workplace skills on a regular basis	Learning	Escrig-Tena & Bou-Llusar (2005)
Our firm reduces setup time Our firm has continuous quality improvement program Our firm uses a "Pull" production system Our firm pushes suppliers for shorter lead times Our firm uses forecast system in production Our firm has total productive maintenance (TPM) program Our firm has health and Safety at work program Our firm has environmental sustainabilbity program	Operational Efficiency	Nahm, Vonderembse, & Koufteros (2004); Shah & Ward (2003); S. Li et al. (2005); R. Fullerton, Kennedy, & Widener (2014)
Periodic audits Hold meetings with suppliers on regular basis to solve problem Require certification of suppliers on key materials Providing training on quality requirements to suppliers Formal, periodic written evaluation suppliers Involve key suppliers in design stage of new products Operate in a JIT purchasing environment Contact with one or two suppliers on key materials We have a formal process for selecting suppliers	Supply Management	Stanley & Wisner (2001)

Appendix 22 –Q-Sort Operational Capabilities

Operational Capabilities		Score	Right	Cont Imp	Cust Sup	Custom	Flex	Inf Man	Innov	Learn	Op Effic	Sup Man	None
Continuos Improvement	Enfatizamos o melhoramento continuo para aumentar nossa eficiência operacional *Continuous improvement of operational effectiveness is stressed in all work processes throughout the plant*	4,75	83,33%		0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	16,67%	0,00%	0,00%
	Os funcionários do chão de fábrica são recompensados por melhoriasque resultem em eficiência operacional *Workers are rewarded for improvements in operational effectiveness*	3,91	33,33%		0,00%	0,00%	0,00%	0,00%	0,00%	8,33%	50,00%	0,00%	8,33%
	Os funcionários acreditam que é sua responsabilidade melhorar a eficiência operacional da produção *All employees believe that it is their responsibility to improve operational effectiveness in the plant*	3,92	33,33%		0,00%	0,00%	0,00%	0,00%	0,00%	8,33%	58,33%	0,00%	0,00%
	Os gerentes são recompensados por melhorias que resultem em eficiência operacional *Managers are rewarded for improvements in operational effectiveness*	3,92	33,33%		0,00%	0,00%	0,00%	0,00%	0,00%	8,33%	58,33%	0,00%	0,00%
	Usamos programas/metodologias para reforçar nosso processo de melhoria continua *We use programs/methodologies to strengthen the process of continuous improvement*	4,75	100,00%		0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Customer Support	Avaliamos as reclamações formais e informais de nossos clientes *We frequently evaluate the formal and informal complaints of our customers*	4,58	83,33%	8,33%		0,00%	0,00%	0,00%	0,00%	8,33%	0,00%	0,00%	0,00%
	Detectamos as futuras expectativas de nossos clientes *We frenquently determine future customer expectations*	3,42	83,33%	0,00%		0,00%	0,00%	8,33%	8,33%	0,00%	0,00%	0,00%	0,00%
	Fazemos follow-up com nossos clientes para termos feedback sobre nossa qualidade/serviço *We have frequent follow-up with our customers for quality /service feedback*	4,33	83,33%	8,33%		0,00%	0,00%	0,00%	0,00%	0,00%	8,33%	0,00%	0,00%

	Frequentemente avaliamos nossa relação com os nossos principais clientes *We periodically evaluate the importance of our relationship with our customers*	4,17	100,00%	0,00%		0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
	Interagimos com nossos clientes para estabelecer padrões de confiabilidade e capacidade de resposta *We frequently interact with customers to set reliability, responsiveness, and other standards for us*	4,00	75,00%	8,33%		0,00%	8,33%	0,00%	0,00%	0,00%	8,33%	0,00%	0,00%
	Mantemos uma conduta de "jogo limpo" com os nossos clientes *We share a sense of fair play with our customers*	3,33	91,67%	0,00%		0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	8,33%
	Mensuramos e avaliamos a satisfação de nossos clientes *We frequently measure and evaluate customer satisfaction*	4,17	83,33%	8,33%		0,00%	0,00%	0,00%	0,00%	8,33%	0,00%	0,00%	0,00%
	Oferecemos suporte (treinamento/financeiro) paraclientes estratégicosmelhorarem seu o processo produtivo *We provide support to improve the production process of our client*	4,73	91,67%	8,33%		0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
	Os clientes conseguem facilmente assistência técnica *We facilitate customers' ability to seek assistance from us*	4,82	91,67%	0,00%		8,33%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Customization	Conseguimos diversificar nossa linha de produção sem sacrificar o volume *Our capability of adding product variety without sacrificing overall production volume is high*	4,50	25,00%	0,00%	0,00%		75,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
	Incluímos diferentes produtos na linha de produção sem aumentar nosso custo *Our capacity of adding product variety without increasing cost is high*	3,67	33,33%	0,00%	0,00%		25,00%	0,00%	0,00%	0,00%	41,67%	0,00%	0,00%
	Personalizamos produtos em larga escala *Our capacity of customizing products on a large scale is high*	4,82	91,67%	0,00%	0,00%		8,33%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
	Temos capacidade de personalizar produtos mantendo um grande volume	4,75	83,33%	0,00%	0,00%		16,67%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%

	Our capability of customizing products while maintaining a large volume is high												
	Temos capacidade de responder rapidamente às necessidades de personalização de produtos *Our capability of responding to customization requirements quickly is high*	4,58	66,67%	0,00%	0,00%		33,33%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
	Temos capacidade de trocar rapidamente a produção mantendo baixo custo *Our capability of setting up for a different product at low cost is high*	4,08	25,00%	0,00%	0,00%		58,33%	0,00%	0,00%	0,00%	16,67%	0,00%	0,00%
Flexibility	Conseguimos mudar rapidamente a quantidade de produtos produzidos *We can quickly change the quantities for our products produced*	4,75	91,67%	0,00%	0,00%	0,00%		0,00%	0,00%	0,00%	8,33%	0,00%	0,00%
	Conseguimos facilmente alterar partes do fluxo da sequência operacional *The operating sequence through which the parts flow can be changed*	4,33	91,67%	0,00%	0,00%	8,33%		0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
	Nosso sistema de transporte de materialliga diferentes centros de processamento *A typical material handling system can link different processing centers*	3,50	8,33%	0,00%	0,00%	0,00%		16,67%	0,00%	0,00%	25,00%	25,00%	25,00%
	Os funcionários conseguem operar diferentes tipos de máquinas *Workers can operate various types of machines*	3,58	66,67%	0,00%	0,00%	0,00%		0,00%	0,00%	25,00%	8,33%	0,00%	0,00%
	Partes específicas das máquinas podem ser utilizadas em diferentes rotinas operacionais *A typical part can use many different routes*	3,36	75,00%	0,00%	0,00%	8,33%		0,00%	0,00%	0,00%	8,33%	0,00%	8,33%
	Podemos produzir diferentes produtos *We can produce a wide variety of products in our plants*	4,00	100,00%	0,00%	0,00%	0,00%		0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Informa tion	As informações sobre produtividade são disponível para os funcionários *Information on productivity is readily available to employees*	4,42	75,00%	8,33%	0,00%	0,00%	0,00%		0,00%	8,33%	8,33%	0,00%	0,00%

	Disponibilizamos informações sobre o desempenho de qualidade para os funcionários do chão de fábrica *Information on quality performance is readily available to employees*	4,33	66,67%	16,67%	0,00%	0,00%	0,00%		0,00%	8,33%	8,33%	0,00%	0,00%
	Possuímos gráficos com as frequências de quebras de máquina no chão de fábrica *Charts plotting the frequency of machine breakdowns are posted on the shop floor*	4,17	58,33%	8,33%	0,00%	0,00%	0,00%		0,00%	0,00%	33,33%	0,00%	0,00%
	Possuímos gráficos mostrando as quantidades de defeitos no chão de fábrica *Charts showing defect rates are posted on the shop floor*	4,17	50,00%	25,00%	0,00%	0,00%	0,00%		0,00%	0,00%	25,00%	0,00%	0,00%
	Temos gráficos com as metas de produção no chão de fábrica *Charts showing schedule compliance are posted on the shop floor*	4,09	66,67%	8,33%	0,00%	0,00%	0,00%		0,00%	0,00%	25,00%	0,00%	0,00%
Innovation	Buscamos antecipar novas práticas e tecnologias de manufatura *We make an effort to anticipate the potential of new manufacturing practices and technologies*	4,58	75,00%	16,67%	0,00%	0,00%	0,00%	0,00%		0,00%	8,33%	0,00%	0,00%
	Buscamos programas de longo alcance, afim de aumentar nossa capacidade de produção eantecipar futuras necessidades da firma *We pursue long-range programs, in order to acquire manufacturing capabilities in advance of our needs*	3,25	25,00%	50,00%	0,00%	0,00%	0,00%	0,00%		0,00%	25,00%	0,00%	0,00%
	Constantemente pensamos na próxima geração de tecnologias em manufatura *We are constantly thinking of the next generation of manufacturing technology*	4,33	100,00%	0,00%	0,00%	0,00%	0,00%	0,00%		0,00%	0,00%	0,00%	0,00%
	Frequentemente introduzimos novos produtos na produção *Frequency of new product introduction*	3,50	91,67%	0,00%	0,00%	0,00%	0,00%	0,00%		0,00%	0,00%	0,00%	8,33%
	Somos líderes em novas tecnologias *Our plant stays on the leading edge of new technology in our industry*	4,92	91,67%	0,00%	0,00%	0,00%	0,00%	0,00%		0,00%	8,33%	0,00%	0,00%

	Temos uma rápida introdução de novos produtos *Rapid new product introductions*	4,00	41,67%	0,00%	0,00%	0,00%	33,33%	0,00%		0,00%	8,33%	0,00%	16,67%
Learning	Buscamos um espírito de diálogo e aceitação para opiniões diferentes *There is an important spirit of dialogue and acceptance of diverse opinions in all areas of the firm*	3,56	58,33%	0,00%	0,00%	0,00%	0,00%	16,67%	0,00%		0,00%	0,00%	25,00%
	O conhecimento (de uma forma geral) é facilmente transmitido e disponível para qualquer funcionário *Any one person's knowledge is transmitted and made readily available to the employees*	3,92	83,33%	0,00%	0,00%	0,00%	0,00%	16,67%	0,00%		0,00%	0,00%	0,00%
	Os funcionários são treinados para que possam desenvolver suas atividades diárias *Plant employees receive training and development in workplace skills on a regular basis*	4,45	75,00%	16,67%	0,00%	0,00%	0,00%	0,00%	0,00%		8,33%	0,00%	0,00%
	Os funcionários tem iniciativa para melhorar a seu trabalho *Employees are capable of taking the initiative and assimilating better ways of doing their job*	4,25	58,33%	41,67%	0,00%	0,00%	0,00%	0,00%	0,00%		0,00%	0,00%	0,00%
	Os processos de trabalho são elaborados para criar padrões de trabalho em todos os níveis da fábrica *Work process have been designed in such a way tha they are capable of developing standards of conduct at all levels of the firm*	3,33	16,67%	25,00%	0,00%	0,00%	0,00%	8,33%	0,00%		41,67%	0,00%	8,33%
Operational Efficiency	Acreditamos que segurança do trabalho é uma prioridade *Our firm has health and Safety at work program*	3,38	33,33%	16,67%	0,00%	0,00%	0,00%	0,00%	0,00%	8,33%		0,00%	41,67%
	Buscamos reduzir o nosso tempo de setup *Our firm reduces setup time*	4,17	75,00%	8,33%	0,00%	0,00%	16,67%	0,00%	0,00%	0,00%		0,00%	0,00%
	É utilizado um sistema de previsão para direcionar a produção *Our firm uses forecast system in production*	3,91	41,67%	0,00%	0,00%	0,00%	0,00%	50,00%	0,00%	0,00%		0,00%	8,33%
	Possuímos um programa de melhoria contínua da qualidade *Our firm has continuous quality improvement program*	4,75	0,00%	100,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%		0,00%	0,00%

	Possuímos um programa de sustentabilidade ambiental *Our firm has environmental sustainability program*	2,29	8,33%	25,00%	8,33%	0,00%	0,00%	0,00%	0,00%	8,33%		0,00%	50,00%
	Pressionamos nossos fornecedores para redução do tempo de entrega *Our firm pushes suppliers for shorter lead times*	3,55	41,67%	0,00%	0,00%	0,00%	0,00%	8,33%	0,00%	0,00%		50,00%	0,00%
	Trabalhamos como um programa de manutenção produtiva total (TPM) *Our firm has total productive maintenance (TPM) program*	3,82	66,67%	25,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%		0,00%	8,33%
	Usamos um sistema de produção puxada *Our firm uses a "Pull" production system*	3,64	66,67%	0,00%	0,00%	16,67%	0,00%	0,00%	0,00%	0,00%		0,00%	16,67%
Supply Management	Cultivamos relações próximas com nossos principais fornecedores de matéria-prima *Contact with one or two suppliers on key materials*	4,50	100,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%		0,00%
	Fazemos avaliações formais com nossos fornecedores *We have a formal process for selecting suppliers*	4,58	91,67%	8,33%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%		0,00%
	Fornecemos treinamento sobre qualidade para nossos fornecedores *Providing training on quality requirements to suppliers*	4,42	75,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	25,00%	0,00%		0,00%
	Operamos em um sistema de just-in-time com nossos fornecedores *Operate in a JIT purchasing environment*	3,92	58,33%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	41,67%		0,00%
	Os principais fornecedores são envolvidos no estágio de desenvolvimento de novos produtos *Involve key suppliers in design stage of new products*	4,00	75,00%	0,00%	0,00%	0,00%	0,00%	0,00%	25,00%	0,00%	0,00%		0,00%
	Pedimos certificações (ex.: ISO 9000) para nossos principais fornecedores de matérias-primas *Require certification of suppliers on key materials*	4,58	83,33%	16,67%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%		0,00%
	Realizamos auditorias periódicas em nossos fornecedores *Periodic audits*	4,42	91,67%	8,33%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%		0,00%
	Realizamos reuniões frequentes com nossos fornecedores para resolução de problemas *Hold meetings with suppliers on regular basis to solve*	4,50	91,67%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	8,33%	0,00%		0,00%

	problem												
	Temos um processo formal para seleção de fornecedores *Formal, periodic written evaluation suppliers*	4,67	100,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%		0,00%
	Medium	**4,12**	**67,09%**	**8,64%**	**0,17%**	**0,79%**	**5,19%**	**2,31%**	**0,63%**	**2,47%**	**10,78%**	**1,50%**	**3,95%**

Appendix 23–Q-Sort Operational Capabilities (second round)

Operational Capabilities				
	Original Scale	**Translated Scale**	**New Score**	**Referencia**
Continuous Improvement	People use appropriate tools and techniques to support CI sustained involvement in CI	Usamos programas e metodologias apropriadas para dar suporte ao nosso processo de melhoria contínua	1.0	Bessant, Caffyn, & Gallagher (2001)
	People (as individuals and/or groups) initiate and carry through CI activities - they participate in the process	Nossos funcionários (individualmente e em grupos) participam e colaboram com atividades que favorecem nosso processo de melhoria contínua	.83	
	Ideas are responded to in a clearly defined and timely fashion - either implemented or otherwise dealt with	Em nossa fábrica todas as idéias geradas pelos funcionários (implementadas ou não) são respondidas	.80	
	Our firm has continuous quality improvement program	Nossa fábrica possui um programa melhoramento continuo da qualidade	1.0	
	Our firm has continuous occupational health and safety improvement program	Em nossa fábrica melhoramos continuamente nossos programas saúde e segurança do trabalho	.75	
Customer Support	We frenquently determine future customer expectations	Procuramos constantemente detectar futuras expectativas dos nossos clientes	.91	S. Li et al. (2005)
	We facilitate customers' ability to seek assistance from us	Nossos clientes são rapidamente atendidos por nossa assistência técnica	.91	
	We frequently evaluate the formal and informal complaints of our customers	Frequentemente avaliamos e respondemos as reclamações formais e informais de nossos clientes	.83	
	We periodically evaluate the importance of our relationship with our customers	Frequentemente mensuramos e avaliamos o relacionamento com os nossos clientes	1.0	
Customization	Our capability of customizing products while maintaining a large volume is high	É alta nossa capacidade de customizar produtos mantendo um grande volume	.83	Qiang Tu et al. (2004)
	Our product process is designed as adjustable modules	Nosso processo produtivo está estruturado em processos modulares ajustáveis	.75	
	Our production process can be adjusted by adding new process modules	Nosso processo produtivo pode ser facilmente ajustado para incluir novos processos modulares	.70	
	Production process modules can be adjusted for changing production needs	Nosso processo produtivo é facilmente ajustado para atender a necessidades de alterações na produção	1.0	
	Production process modules can be rearranged so that customization subprocesses occur last	Nossos processos modulares podem ser facilmente reorganizados permitindo que os subprocessos de customização ocorram por último	.80	

Flexibility	Machine tools can be changed quickly	Conseguimos trocar rapidamente as ferramentas de nossas máquinas	.75	Zhang et al. (2003)
	We can quickly change the quantities for our products produced	Conseguimos mudar rapidamente a quantidade de produtos produzidos	.91	
	The operating sequence through which the parts flow can be changed	Conseguimos facilmente alterar a sequencia do nosso fluxo operacional	.91	
	We can produce a wide variety of products in our plants	Conseguimosproduzir uma grande variedade de produtos em nossa fábrica	1.0	
	The ability to effectively respond to changes in planned delivery dates	Temos capacidade de responder rapidamente às mudanças de programação de datas de entrega	.80	
Information Manag.	Information on quality performance is readily available to employees	Disponibilizamos informações atualizadas sobre o desempenho da qualidade aos funcionários do chão de fábrica	.90	Cua et al. (2001)
	Our firm uses forecast system in production	Utilizamos informações de previsão de demanda para planejar a produção	.90	
	Information on productivity is readily available to employees	Informações atualizadas sobre produtividade são disponibilizadas para nossos funcionários	.90	
	Charts plotting the frequency of machine breakdowns are posted on the shop floor	Possuímos quadrosno chão de fábrica com dados de paradas de máquinas	1.0	
	Charts showing defect rates are posted on the shop floor	Possuímos quadros no chão de fábrica monstrando as quantidades defeitos	1.0	
Innovation	Frequency of new product introduction	Frequentemente introduzimos novos produtos na produção	.91	Peng et al. (2010)
	Our plant stays on the leading edge of new technology in our industry	Somos líderes em novas tecnologias em nossa indústria	.91	
	We are constantly thinking of the next generation of manufacturing technology	Constantemente pensamos na próxima geração de tecnologias em manufatura	1.0	
	We make an effort to anticipate the potential of new manufacturing practices and technologies	Procuramos nos antecipar a novas práticas e tecnologias de manufatura	.75	
Learning	Plant employees receive training and development in workplace skills on a regular basis	Nossos funcionários regularmente recebem treinamentos para que possam desenvolver suas atividades diárias	.75	Escrig-Tena & Bou-Llusar (2005)
	Any one person's knowledge is transmitted and made readily available to the employees	O conhecimento (de uma forma geral) em nossa empresa é facilmente transmitido e disponibilizado a qualquer funcionário	.83	

	There is an important spirit of dialogue and acceptance of diverse opinions in all areas of the firm	Em nossa fábrica existe um importante espírito de diálogo entre as áreas e diferentes opiniões são aceitas	.75	
	Work process have been designed in such a way tha they are capable of developing standards of conduct at all levels of the firm	Nossos processos de trabalho são definidos em equipe visando estabelecer mecanismos de aprendizagem em todos os níveis da fábrica	.90	
	Employees are capable of taking the initiative and assimilating better ways of doing their job	Nossos funcionários têm iniciativa e são capazes de apreender novas maneiras de fazer seu trabalho	.80	
Operational Efficiency	Our firm reduces setup time	Constantemente buscamos reduzir o nosso tempo de setup	.75	Yeung (2008)
	Our firm has total productive maintenance (TPM) program	Nosso programa de manutenção consegue manter as máquinas com alto índice de produtividade	.80	
	has very low unit costs of manufacturing	Nossa fábrica possui baixo custo unitário de produção	1.0	Kortmann, Gelhard, Zimmermann, & Piller (2014)
	Has a very short manufacturing lead time	Nossa fábrica regularmente trabalha com um curto tempo de lead time de produção	.90	
	Has an excellent production cycle time	Nossa fábrica tem um excelente tempo de ciclo de produção	.90	
Supply Management	Involve key suppliers in design stage of new products	Nossos principais fornecedores sempre são envolvidos no desenvolvimento de novos produtos	1.0	Stanley & Wisner (2001)
	We have a formal process for selecting suppliers	Seguimos um processo formal para seleção de fornecedores	1.0	
	Hold meetings with suppliers on regular basis to solve problem	Realizamos reuniões frequentes com nossos fornecedores visando a resolução de problemas	.91	
	Formal, periodic written evaluation suppliers	Periodicamente fazemos avaliações formaiscom nossos fornecedores	.91	

Appendix 24– Items removed from the questionnaire

Capabilities	Question
Continues Improvement	Todas as idéias geradas pelos funcionários (implementadas ou não) são respondidas *Ideas are responded to in a clearly defined and timely fashion - either implemented or otherwise dealt with*
Learning	Nossos funcionários regularmente recebem treinamentos para que possam desenvolver suas atividades diárias *Plant employees receive training and development in workplace skills on a regular basis*
Information Management	Utilizamos informações de previsão de demanda para planejar a produção *Our firm uses forecast system in production*
Customization	Nosso processo produtivo pode ser facilmente ajustado para incluir novos processos modulares *Our production process can be adjusted by adding new process modules*
Flexibility	Conseguimos facilmente alterar a sequencia do nosso programa de produção *The operating sequence through which the parts flow can be changed*
Operational Efficiency	Constantemente buscamos reduzir o nosso tempo de setup *Our firm reduces setup time*

Appendix 25–Descriptive statistics (pre-test)

Descriptive statistics

	N	Minimum	Maximum	Average.	Standard Deviation
Continuos Improvement	28	1.50	5.00	3.67	.96
Learning	28	1.25	4.75	3.48	.78
Customization	28	1.00	5.00	3.25	.88
Flexibility	28	1.00	5.00	3.29	.88
Information Management	28	1.00	5.00	3.49	1.14
Operational Efficiency	28	1.00	5.00	3.41	.94
Supply Management	28	1.25	5.00	3.77	.92
Innovation	28	1.50	5.00	3.17	1.01
Customer Support	28	2.00	5.00	3.58	.86
Environmental dynamism	28	1.66	5.00	3.75	.95
Media Performance	28	1.0	5.0	3.33	.95
N válido (de lista)	28				

Appendix 26– Correlations (pre-test)

Correlations

Correlação de Pearson	Continuos Improvement	Learning	Customization	Flexibility	Information Management	Operational Efficiency	Supply Management	Innovation	Customer Support	Environmental dynamism	Performance
Continuos Improvement	1	.635**	.672**	.500**	.860**	.492**	.600**	.643**	.590**	.291	-.033
Learning	.635**	1	.461*	.231	.565**	.502**	.592**	.413*	.578**	.363	.027
Customization	.672**	.461*	1	.802**	.756**	.774**	.740**	.688**	.477*	.331	-.119
Flexibility	.500**	.231	.802**	1	.653**	.654**	.724**	.523**	.433*	.148	-.041
Information Management	.860**	.565**	.756**	.653**	1	.630**	.672**	.635**	.529**	.202	-.023
Operational Efficiency	.492**	.502**	.774**	.654**	.630**	1	.749**	.604**	.311	.168	.047
Supply Management	.600**	.592**	.740**	.724**	.672**	.749**	1	.610**	.611**	.315	.026
Innovation	.643**	.413*	.688**	.523**	.635**	.604**	.610**	1	.490**	.392*	-.260
Customer Support	.590**	.578**	.477*	.433*	.529**	.311	.611**	.490**	1	.325	.219
Environmental dynamism	.291	.363	.331	.148	.202	.168	.315	.392*	.325	1	.022
Performance	-.033	.027	-.119	-.041	-.023	.047	.026	-.260	.219	.022	1

**. Correlation is significant at the level 0.01.

*. Correlation is significant at the level 0.05 .

Appendix 27– Inflation factor of variance (VIF)

Coefficients[a,b]

Modelo		Coefficients not standardized		Standardized Coefficients	t	Sig.	Estatísticas de colinearidade	
		B	Erro Padrão	Beta			Tolerância	VIF
1	(Constante)	3.702	1.152		3.213	.005		
	Continuos Improvement	.056	.411	.052	.137	.893	.228	4.389
	Learning	-.643	.380	-.483	-1.693	.108	.397	2.520
	Customization	-.518	.455	-.447	-1.138	.270	.210	4.771
	Flexibility	-.334	.410	-.297	-.815	.426	.244	4.099
	Information Management	.215	.335	.230	.640	.530	.251	3.983
	Operational Efficiency	.788	.380	.731	2.072	.053	.260	3.853
	Supply Management	-.088	.414	-.079	-.212	.834	.236	4.237
	Innovation	-.535	.288	-.568	-1.859	.080	.346	2.888
	Customer Support	.855	.309	.760	2.769	.013	.429	2.330

a. Dependent variable: Media Performance

Appendix 28– Questionnaire

QUESTIONÁRIO DE PESQUISA
(NÃO É NECESSÁRIO IDENTIFICAÇÃO)

Olá,

Este questionário faz parte de uma pesquisa para Fundação Getulio Vargas - FGV e visa obter dados para analisar a relação entre práticas operacionais, competências operacionais e desempenho. Maiores informações podem ser adquiridas pelo e-mail mrs.scarpin@gmail.com com Marcia Scarpin.

Caracterização

Setor de atuação da empresa: (Pegar o setor na planilha que eu enviei)

Tamanho da empresa (da fábrica que você trabalha)
☐ Micro: com até 19 empregados
☐ Pequena: de 20 a 99 empregados
☐ Média: 100 a 499 empregados
☐ Grande: mais de 500 empregados

Os resultados financeiros da empresa são publicados: ☐ sim☐ não☐ não sei
Aponte as características que melhor descrevem seu cargo:
☐ presidente ☐diretor ☐ gerente ☐ supervisor ☐ coordenador ☐ outros: ____________________
Em qual departamento:
☐ produção ☐logística☐ finanças ☐ Supply Chain Management ☐ RH ☐ outros: ________________

Tempo de empresa: ________
Tempo no cargo: _________
Tempo de atuação neste setor: _________

1 = Discordo totalmente	**2** = Discordo parcialmente	**3** = Não concordo e nem discordo	**4** = Concordo parcialmente	**5** = Concordo totalmente

Em nossa fábrica:

1	Usamos programas e metodologias específicas para dar suporte ao nosso processo de melhoria contínua	1	2	3	4	5
2	Nossos funcionários (individualmente ou em grupos) participam e colaboram intensamente com atividades do nosso processo de melhoria contínua	1	2	3	4	5
3	O conhecimento (de uma forma geral) é facilmente transmitido e disponibilizado a qualquer funcionário	1	2	3	4	5
4	Existe um importante espírito de diálogo entre as áreas e aceitamos diferentes opiniões	1	2	3	4	5
5	Possuímos um programa de melhoramento contínuo da qualidade					
6	Nossos processos de trabalho são definidos em equipe visando estabelecer mecanismos de aprendizagem em todos os níveis da fábrica	1	2	3	4	5
7	Melhoramos continuamente nossos programas de saúde e segurança do trabalho à frente da concorrência	1	2	3	4	5
8	Nossos funcionários têm facilidade de apreender novas maneiras de fazer seu trabalho	1	2	3	4	5
9	É alta nossa capacidade de customizar produtos mantendo um grande volume de produção	1	2	3	4	5
10	Conseguimos trocar rapidamente as ferramentas de nossas máquinas	1	2	3	4	5
11	Todo o nosso processo produtivo está estruturado em processos modulares ajustáveis	1	2	3	4	5
12	Conseguimos mudar rapidamente a quantidade de produtos produzidos	1	2	3	4	5
13	Nosso processo produtivo é facilmente ajustado para atender as necessidades de alterações na produção	1	2	3	4	5
14	Conseguimos produzir uma grande variedade de produtos	1	2	3	4	5
15	Nossos processos podem ser facilmente reorganizados permitindo que os subprocessos de customização ocorram por último	1	2	3	4	5
16	Temos capacidade de responder rapidamente às mudanças de programação de datas de entrega	1	2	3	4	5
17	Disponibilizamos informações atualizadas sobre o desempenho da qualidade para nossos funcionários do chão de fábrica	1	2	3	4	5
18	Nosso programa de manutenção consegue manter as máquinas com alto índice de produtividade	1	2	3	4	5
19	Disponibilizamos informações atualizadas sobre produtividade para nossos funcionários do chão de fábrica	1	2	3	4	5
20	Nossa fábrica possui baixo custo unitário de produção comparado aos nossos concorrentes	1	2	3	4	5
21	Possuímos quadros atualizados no chão de fábrica com dados de paradas de máquinas	1	2	3	4	5
22	Comparado aos nossos concorrentes, nossa fábrica regularmente trabalha com **tempo reduzido de lead time** na produção (o lead time é o intervalo de tempo necessário para que o material passe pela fabricação – do primeiro até o último processo e estar pronto para outra etapa.)	1	2	3	4	5

23	Possuímos quadros atualizados no chão de fábrica mostrando quantidade de estragos	1	2	3	4	5
24	Comparado aos nossos concorrentes, nossa fábrica regularmente trabalha com **tempo de ciclo de produção** reduzido(tempo necessário para a execução de uma peça, ou seja, o tempo transcorrido entre a repetição do início ao fim da operação)	1	2	3	4	5
25	Nossos principais fornecedores sempre são envolvidos no desenvolvimento de novos produtos	1	2	3	4	5
26	Regularmente reduzimos a quantidade de estragos da produção					
27	Seguimos um processo formal para seleção de fornecedores	1	2	3	4	5
28	Realizamos reuniões frequentes com nossos fornecedores visando a resolução de problemas	1	2	3	4	5
29	Periodicamente fazemos avaliações formais com nossos fornecedores	1	2	3	4	5
30	Frequentemente introduzimos novos produtos na produção	1	2	3	4	5
31	Somos líderes em novas tecnologias em nossa indústria	1	2	3	4	5
32	Constantemente pensamos na próxima geração de tecnologias em manufatura (produção)	1	2	3	4	5
33	Buscamos frequentemente implementar novas práticas/processos em nossa produção	1	2	3	4	5
34	Procuramos constantemente detectar futuras expectativas dos nossos clientes	1	2	3	4	5
35	Nossos clientes são rapidamente atendidos por nossa assistência técnica	1	2	3	4	5
36	Sempre avaliamos e respondemos as reclamações formais e informais de nossos clientes	1	2	3	4	5
37	Medimos e avaliamos o relacionamento com os nossos clientes	1	2	3	4	5

Considerando o mercado no qual sua fábrica atua, nos últimos três anos (2012, 2013 e 2014), você acredita que:						
38	Ocorreram grandes mudanças nos modos de produção e/ou prestação de serviços	1	2	3	4	5
39	Ocorreram mudanças frequentes e importantes nos regulamentos governamentais	1	2	3	4	5
40	Ocorreram mudanças frequentes e importantes no número de concorrentes	1	2	3	4	5

1 = muito inferior	2 = um pouco inferior	3 = equivalente	4 = um pouco superior	5 = muito superior		
Em relação aos seus concorrentes nos últimos três anos (2012, 2013 e 2014), como você avalia sua unidade referente ao:						
41	Custo unitário do produto	1	2	3	4	5
42	Conformidade com as especificações do produto (qualidade exigida)	1	2	3	4	5
43	Pontualidade na entrega do produto	1	2	3	4	5
44	Capacidade em mudar rapidamente o mix/volume do produto (tipo de produto / quantidade)	1	2	3	4	5
45	Introdução de novos produtos no mercado					

1 = muito inferior	2 = um pouco inferior	3 = equivalente	4 = um pouco superior	5 = muito superior		
Em relação aos seus concorrentes nos últimos três anos (2012, 2013 e 2014), como você avalia sua unidade referente ao:						
46	Crescimento de vendas	1	2	3	4	5
47	Lucratividade	1	2	3	4	5

As informações são todas confidenciais. O Sr. (a) deseja receber um relatório setorial, no qual sua empresa poderá ser comparado com a média do setor? Se sim deixe seu e-mail:

e-mail ___________________________

Obrigada por sua colaboração!

Appendix 29 - Exploratory factor analysis (EFA)

Across-the-Board Capabilities confirmatory model

	CMIN	DF	P	CMIN/DF	NFI	RFI	IFI	TLI	CFI	RMSEA
Original	142,666	53	0	2,692	0,817	0,772	0,876	0,843	0,874	0,091
Sem IM4	94,86	43	0	2,206	0,854	0,814	0,915	0,889	0,913	0,077
Sem CI1	61,985	34	0,002	1,823	0,89	0,854	0,947	0,928	0,946	0,063
Sem LE2	38,506	26	0,054	1,481	0,923	0,894	0,974	0,963	0,973	0,048
Sem LE4	23,186	19	0,229	1,22	0,949	0,925	0,99	0,986	0,99	0,033
Sem CI4	19,043	13	0,122	1,465	0,954	0,926	0,985	0,975	0,985	0,048
Sem LE1	15,17	8	0,056	1,896	0,958	0,922	0,98	0,962	0,98	0,066

Standalone Capabilities confirmatory model - Upstream/Downstream group

	CMIN	DF	P	CMIN/DF	NFI	RFI	IFI	TLI	CFI	RMSEA
Original	42,895	19	0,001	2,258	0,915	0,875	0,951	0,927	0,95	0,078
Sem CS1	23,482	13	0,036	1,806	0,945	0,912	0,975	0,959	0,974	0,063
Sem SM1	19,332	8	0,013	2,417	0,949	0,904	0,969	0,941	0,969	0,083

Standalone Capabilities confirmatory model - Operational group

	CMIN	DF	P	CMIN/DF	NFI	RFI	IFI	TLI	CFI	RMSEA
Original	253,095	116	0	2,182	0,76	0,719	0,854	0,825	0,851	0,076
Sem CT1	228,415	101	0	2,262	0,769	0,725	0,856	0,826	0,853	0,078
Sem OE1	178,832	87	0	2,056	0,801	0,76	0,887	0,86	0,884	0,072
Sem IN1	131,083	74	0	1,771	0,84	0,804	0,924	0,904	0,922	0,061
Sem FL4	103,977	62	0,001	1,677	0,865	0,83	0,941	0,924	0,939	0,057
Sem FL3	80,53	51	0,005	1,579	0,887	0,853	0,955	0,941	0,954	0.053
Sem CT4	55,444	41	0,065	1,352	0,914	0,884	0,976	0,967	0,975	0,041
Sem OE2	47,419	32	0,039	1,482	0,919	0,886	0,972	0,96	0,972	0,048
Sem CT2	40,017	24	0,021	1,667	0,924	0,885	0,968	0,951	0,967	0,057

Appendix 30 - Confirmatory data analysis

Across Rotated Component Matrix[a]

	Component	
	1	2
CI2	,109	,820
CI3	,310	,722
LE3	,448	,625
IM1	,766	,320
IM2	,854	,144
IM3	,696	,267

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 3 iterations.

Upstream/Downstream StandaloneRotated Component Matrix[a]

	Component	
	1	2
CS2	,154	,793
CS3	,136	,816
CS4	,351	,687
SM2	,796	,276
SM3	,795	,125
SM4	,838	,218

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 3 iterations.

Operational Standalone Rotated Component Matrixa

	Component		
	1	2	3
IN2	,747	,127	,170
IN3	,847	,165	,102
IN4	,726	,162	,051
OE3	,118	,845	,196
OE4	,135	,866	,125
OE5	,361	,593	,166
CT3	,049	,134	,792
FL1	,219	,208	,677
FL2	,080	,103	,832

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 4 iterations.

Performance - Matriz de componente rotativa[a]

	Componente	
	1	2
OP1	,017	,485
OP2	,009	,752
OP3	,358	,521
OP4	,189	,699
OP5	,682	,194
FP1	,843	-,085
FP2	,773	,207

Método de Extração: Análise de Componente Principal.
Método de Rotação: Varimax com Normalização de Kaiser.
a. Rotação convergida em 3 iterações.

Appendix 30 - Composite Reliability

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  /SCALE('ALL VARIABLES') ALL
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Reliability

Notes

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	Matrix Input	
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	Cases Used	Statistics are based on all cases with valid data for all variables in the procedure.
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Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.02

[DataSet0]

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	201	100.0
	Excluded[a]	0	.0
	Total	201	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.694	3

```
RELIABILITY
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  /MODEL=ALPHA.
```

Reliability

Notes

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Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data for all variables in the procedure.
Syntax		RELIABILITY /VARIABLES=IM1 IM2 IM3 /SCALE('ALL VARIABLES') ALL /MODEL=ALPHA.
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.00

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	201	100.0
	Excluded[a]	0	.0
	Total	201	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.709	3

```
RELIABILITY
  /VARIABLES=SM2 SM3 SM4
  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA.
```

Reliability

Notes

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	N of Rows in Working Data File	201
	Matrix Input	
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data for all variables in the procedure.
Syntax		RELIABILITY /VARIABLES=SM2 SM3 SM4 /SCALE('ALL VARIABLES') ALL /MODEL=ALPHA.
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.00

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	201	100.0
	Excluded[a]	0	.0
	Total	201	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.800	3

```
RELIABILITY
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 /SCALE('ALL VARIABLES') ALL
 /MODEL=ALPHA.
```

Reliability

Notes

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Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data for all variables in the procedure.
Syntax		RELIABILITY /VARIABLES=CS2 CS3 CS4 /SCALE('ALL VARIABLES') ALL /MODEL=ALPHA.
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.00

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	201	100.0
	Excluded[a]	0	.0
	Total	201	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.667	3

```
RELIABILITY
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  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA.
```

Reliability

Notes

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	N of Rows in Working Data File	201
	Matrix Input	
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data for all variables in the procedure.
Syntax		RELIABILITY /VARIABLES=IN2 IN3 IN4 /SCALE('ALL VARIABLES') ALL /MODEL=ALPHA.
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.00

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	201	100.0
	Excluded[a]	0	.0
	Total	201	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.738	3

```
RELIABILITY
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  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA.
```

Reliability

Notes

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Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data for all variables in the procedure.
Syntax		RELIABILITY /VARIABLES=FL1 FL2 CT3 /SCALE('ALL VARIABLES') ALL /MODEL=ALPHA.
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.00

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	201	100.0
	Excluded[a]	0	.0
	Total	201	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.703	3

```
RELIABILITY
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  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA.
```

Reliability

Notes

Output Created		02-JUN-2016 23:39:31
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	N of Rows in Working Data File	201
	Matrix Input	
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data for all variables in the procedure.
Syntax		RELIABILITY /VARIABLES=OE3 OE4 OE5 /SCALE('ALL VARIABLES') ALL /MODEL=ALPHA.
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.00

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	201	100.0
	Excluded[a]	0	.0
	Total	201	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.730	3

```
RELIABILITY
  /VARIABLES=OP1 OP2 OP3 OP4 OP5
  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA.
```

Reliability

Notes

Output Created		02-JUN-2016 23:40:38
Comments		
Input	Active Dataset	DataSet0
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	201
	Matrix Input	
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data for all variables in the procedure.
Syntax		RELIABILITY /VARIABLES=OP1 OP2 OP3 OP4 OP5 /SCALE('ALL VARIABLES') ALL /MODEL=ALPHA.
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.00

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	201	100.0
	Excluded[a]	0	.0
	Total	201	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.526	5