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FLÁVIO ROMERO MACAU

KNOWLEDGE EFFECT ON FIRM PERFORMANCE IN MANUFACTURING AND SERVICE FIRMS

SÃO PAULO
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Tese apresentada à Escola de Administração de Empresas de São Paulo da Fundação Getúlio Vargas, como requisito para a obtenção do título de Doutor em Administração de Empresas

Campo de conhecimento: Gestão de Operações e Competitividade

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“I promise nothing complete; because any human thing supposed to be complete, must for that very reason infallibly be faulty”

Herman Melville, Moby-Dick

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ABSTRACT

This thesis seeks to examine the difference between manufacturing and service firms with respect to the effects of knowledge on performance, and the influence of market turbulence in this relationship. Empirical data, resulting from a survey, was collected from more than 1,206 firms, involving several sectors. Two samples were analyzed, one with 334 manufacturing and other with 509 service firms. The findings indicate no significant difference in the importance of knowledge on performance between these sectors in the absence of market turbulence: knowledge development (KD) has a stronger effect than culture of competitiveness (CC) on firm performance. However, under market turbulence, manufacturers differ from service providers. The positive effect of KD is enhanced, while the positive effect of CC remains the same for manufacturing firms. On the other hand, the positive effect of KD is diminished, while the positive effect of CC is enhanced for service firms. This supports the argument concerning differences in the nature of manufacturing and service industries. From a managerial point of view, results confirm the importance of knowledge, irrespective of firm sector or market turbulence. However, while industrial firms should center efforts on KD, service firms must find a balance where knowledge development (e.g. norms, processes, routines) does not impair their culture of competitiveness (e.g. learning, innovation, action). The thesis contributes to existing literature by proposing that: (1) the positive effect of knowledge on performance is confirmed; (2) under turbulent markets manufacturing and service firms have different responses concerning the influence of knowledge on performance; (3) a multidimensional performance construct based on cost, profitability, and growth is an interesting way to evaluate firm sustained competitive advantage, rather than one-dimensional constructs; (4) the CC x KD interaction, found relevant for supply chains in previous studies, is not supported for firms; (5) differences in unit of analysis, e.g. from supply chains to firms, result in different effects of KD and CC on firm performance; (6) existing scales can be improved with the addition of more diverse indicators, capturing a wider range of concepts (e.g. information transfer measurement); and (7) results from previous studies are supported for Brazilian firms, contributing for theory generalization.

KEY-WORDS: Organizational knowledge, performance, market turbulence, industry, service, organizational culture.

SUMMARY

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1. INTRODUCTION

Research on competitive advantage is important to study how some firms outperform others. Increasingly the resource-based view (RBV) serve as a theoretical anchor to find out how firms develop strategic, non-tradable, hard to copy, and hard to substitute resources that gives them an edge over competitors (Barney, 1986, 1991, 1995; Conner, 1991; Dierickx & Cool, 1989; Wernerfelt, 1984). While some authors try to establish how firms develop advantageous positions through their internal resources (Rosenzweig & Roth, 2004; Schroeder, Bates, & Junttila, 2002), others extend the framework to groups of inter-related firms, e.g. exploring entire supply chains (Hult, Ketchen, & Arrfelt, 2007; Hult, Ketchen, & Slater, 2004).

A firm is not a clear cut entity, not an observable physical object, difficult to define except with reference to what it does or what is done within it (Penrose, 1959). In this thesis firms represented organized private systems responsible for product and or service delivery. Given all possible studies comprising firms, topics related to intangible assets were sought. These refer to hard to get capabilities indirectly linked to patents, machines, technologies, or processes. Some topics surpass disciplines boundaries, and an increasing number of authors relate performance with disciplines such as learning (Hult, Ketchen, & Nichols, 2003), employee behavior (Uzuneri & Nembhard, 1998), culture (West & Burnes, 2000), and knowledge management (Paiva, Roth, & Fernsterseifer, 2008). These studies are frequently supported by the knowledge-based view (KBV). Not many articles relate performance to KBV, and empirical evidence that knowledge influences performance is scarce. Steps to fill this gap are seen (e.g. Choo, Linderman, and Schroeder, 2007; Molina, Lloréns-Montes, & Ruiz-Moreno, 2007), but there is still opportunity for research in the area.

This thesis examined the effects of knowledge on performance, and the influence of turbulence in this relationship. It was hypothesized that knowledge, depicted as knowledge development (KD) and culture of competitiveness (CC), has a positive effect on firm performance (depicted as cost, profitability, and growth). However, under market turbulence manufacturing firms present a stronger effect of KD on performance (with a secondary role for CC), while service firms present a stronger

effect of CC on performance (competing with the role of KD). Given their high correlation and theoretical propositions, the possibility of synergy along KD and CC was studied through an interaction effect. The proposition that market turbulence has no direct effect on performance was also tested, although not hypothesized due to lack of ample theoretical support. Performance, a 2nd order latent variable, was measured based on the competitive performance measures of cost, profitability, and growth. This option was more satisfactory than isolated measurements considering one of these dependent variables at a time, as performance is a multidimensional concept that stretches beyond any one-dimensional indicator.

As a direct measurement was not possible, indirect measures were obtained through indicators. *CC* was defined as a latent 2nd order construct based on the latent 1st order constructs of *Learning*, *Innovativeness*, and *Entrepreneurial* orientations. Each of these 1st order constructs, in turn, had its own set of indicators, initially comprising four observable variables, obtained through the application of a tailor-made survey, where the intensity of the responses was captured into interval scales. Likewise: *KD* was defined as a latent 2nd order construct based on the latent 1st order constructs of *Knowledge Acquisition*, *Information Distribution*, *Shared Meaning*, and *Achieved Memory*; and *Performance* was defined as a latent 2nd order construct, based on the latent 1st order constructs of *Cost*, *Profitability*, and *Growth*.

Empirical data, resulting from a 41 questions survey, was sent to more than 10,000 potential respondents. Sampling was not randomly selected, but determined by convenience, with respondents contacted through: e-mail data bases (e.g. alumni from top Brazilian business schools); presentations on national workshops oriented to knowledge management discussions (e.g. Global Make Conference – GMC 2009); and ministration for MBA related students, in Operations Management and HR disciplines (e.g. professional masters in business from Fundação Getúlio Vargas, FGV). More than 3,000 answers were collected, comprising more than 1,206 firms. After data purification two samples emerged, one with 334 manufacturing and other with 509 service firms. Respondents were mainly from HR, operations, and financial areas, occupying leadership positions such as supervisor or manager.

The psychometric properties of the constructs were evaluated through a confirmatory factor analysis (CFA), where maximum likelihood (ML) was used as estimation method. The following latent variables were tested: *Learning*, *Innovativeness*, and *Entrepreneurial* orientations; *Knowledge Acquisition*, *Information Distribution*, *Shared Meaning*, and *Achieved Memory*; and *Cost*, *Profitability*, and *Growth*. After dimensionality, reliability, and validity considerations, three purified 2nd order latent variable models were assessed for CC, KD, and *Performance*. A complete measurement model connecting 1st and 2nd order indicators was performed, and measurement properties were reassessed when necessary. Then the structural model was calculated, resulting in estimates used in hypotheses testing. Model fit was evaluated by indices suggested in the SEM literature. Reliability was assessed through Cronbach alpha, composite reliability, and average variance extracted calculations. Discriminant validity sustained the 2nd order models, although values for KD qui-square difference extrapolated suggested limits.

The findings indicated no significant difference in the importance of knowledge on performance between manufacturing and service firms in the absence of market turbulence: knowledge development (KD) had a stronger effect than culture of competitiveness (CC) on firm performance. However, under market turbulence, manufacturers differed from service providers. The positive effect of KD was enhanced, while the positive effect of CC remained the same for manufacturing firms. On the other hand, the positive effect of KD was diminished, while the positive effect of CC was enhanced for service firms. This supported the argument concerning differences in the nature of manufacturing and service industries. From a managerial point of view, the results confirmed the importance of knowledge, irrespective of firm sector or market turbulence. However, while industrial firms should center efforts on KD, service firms must find a balance where knowledge development (e.g. norms, processes, routines) does not impair their culture of competitiveness (e.g. learning, innovation, entrepreneurship).

This thesis contributed to existing literature by proposing that: (1) the positive effect of knowledge on performance is confirmed; (2) under turbulent markets manufacturing and service firms have different responses concerning the influence of knowledge on performance; (3) a multidimensional performance construct based on

cost, profitability, and growth is an interesting way to evaluate firm sustained competitive advantage, rather than one-dimensional constructs; (4) the CC x KD interaction, found relevant for supply chains in previous studies, is not supported for firms; (5) differences in unit of analysis, e.g. from supply chains to firms, result in different effects of KD and CC on firm performance under market turbulence; (6) existing scales can be improved with the addition of more diverse indicators, capturing a wider range of concepts (e.g. information transfer measurement); and (7) results from previous studies are supported for Brazilian firms, a framework representing emerging markets, contributing for theory generalization.

The structure of this thesis starts with chapter 1, where context, concepts, method, and contribution are introduced. Chapter 2 anchors the theoretical foundations for *Manufacturing & Service Firms* (2.1), *Knowledge* (2.2), *Knowledge Development* (2.3), *Culture of Competitiveness* (2.4), *Turbulence* (2.5), and *Performance* (2.6). Chapter 3 briefly summarizes concept operationalization, while Chapter 4 describes methodology. Chapter 5 involves data acquisition, analysis, and initial discussions to Manufacturing (5.1) and Service (5.2) samples. Chapter 6 summarizes the findings, drawing conclusions and presenting this thesis' main contributions to academic and management studies. Chapter 7 presents bibliography, followed by the Appendixes.

2. THEORETICAL FOUNDATION

Studying firm's resources in management processes is a topic of interest for both academics and practitioners. The more is known on how resources affect firm performance, the better are the decisions managers can implement, and the more accurate are the models academics can work on. Recent work on operations management from (e.g.) Menor, Kristal, and Rosenzweig (2007) and Paiva *et al.* (2007) succeed on connecting knowledge resources to a strategic orientation. This thesis examined the effects of knowledge on performance, and the influence of turbulence in this relationship. Manufacturing and service industries were studied, as there is theoretical evidence that both may respond differently.

Sub-chapter 2.1 opens the theoretical discussion presenting a brief discussion on definitions, similarities, and differences along manufacturing and service firms. Sub-chapter 2.2 introduces the concept of firm knowledge. The emergent importance of knowledge as a strategic resource in academic studies is discussed, resulting in a theoretical framework based mainly on the resource and knowledge based views (RBV and KBV). The broader concept of knowledge is delimited, and organizational knowledge is defined as the focus of this thesis. The difference between explicit and tacit knowledge is discussed, and positioned as a discerning factor of strategic and common resources. Sub-chapter 2.3 presents knowledge development (KD) as an independent, 2nd order variable, constructed upon knowledge acquisition, information distribution, shared meaning, and achieved memory. The positive influence of KD on performance is hypothesized for manufacturing and service firms alike. Sub-chapter 2.4 presents culture of competitiveness (CC) as an independent, 2nd order variable, constructed upon learning, innovativeness, and entrepreneurial orientations. The positive influence of CC on performance is hypothesized for manufacturing and service firms alike. Sub-chapter 2.5 adds market turbulence as an independent, 1st order moderating variable, i.e. it influences the effects of both KD and CC on firm performance, however it does not contribute with any direct effect by itself. Moreover, it is hypothesized that manufacturing and service firms respond differently under the influence of market turbulence. Finally, sub-chapter 2.6 presents performance as a dependent, 2nd order variable, constructed upon cost, profitability, and growth. That a

multidimensional performance construct is theoretically supported and empirically validated later on is an important contribution of this thesis.

2.1. Manufacturing & Service Firms

In business administration firms are not always homogeneous. As each may have its specificity, different responses may be expected. Some generalization is possible, as groups may present similar reactions to similar inputs, but it is not uncommon to find in papers little mention to differences that might impact the presented results. As studying every effect for every firm would not be feasible, a compromise is possible by dividing them in categories, using criteria such as size (e.g. from small business to multinational companies), industry (e.g. North American Industry Classification System - NAICS), market (e.g. from local sales to overseas), and so on. Recognizing similar groups, relatively homogeneous, benefits research and strategy practice, as it enables some measure of generalization and better control of environment variance (Porto, Brito, Silva, Battaglia, & Brito, 2009).

In this thesis firms were grouped into two categories: manufacturing and service industries. These macro-sectors are responsible for the greater part of the world GDP and labor employment. Both are sufficiently different so that similar inputs may result in distinctive effects. And although there is a debate if manufacturers and service providers are really distinct from one another in the 21st century economy, there is a consensus that firms with some typical manufacturing characteristics may strongly differ from firms with some typical service characteristics.

This manufacturing-service division, therefore, considers ideal Weberian types, i.e. real firms rarely correspond exactly (or solely) to one category or the other. This ‘dipole’ is a simplification, although a useful one, as it provides an useful framework for operationalization and comparison. This thesis considered that, although some approaches may be analogous, the more a firm is involved in manufacturing-like activities, the more different it is from firms involved in service-like activities, and *vice-versa*. A brief conceptualization of manufacturers and service firms is presented next.

2.1.1. Manufacturing Firms

Manufacturers are an important economic source, responding for around 20% of GDP in USA and 30% in Brazil (Novo Cálculo do PIB, 2007; US GDP, 2007). Manufacturing firms have a historical relevance, and are intertwined to technological advances. Many of today business theories are based on manufacturing industrial systems, from Adam's Smith example of division of labor in pin factories (Smith, 1991), to production lines (e.g. Ford), to just in time practices (e.g. Honda) (Chase, Jacobs, & Aquilano, 2004). Some 'lessons learned' are frequently extrapolated to other sectors, such as service industries (Lotti, 2007; Sengupta, Heiser, & Cook, 2006). Moreover, manufacturing industries are important for an economy as they employ a huge share of the labor force, and produce materials required by sectors of strategic importance such as infrastructure (Manufacturing Industry, 2010)

Goods are typically produced, sold, and consumed. According to Standard Industry Classification (SIC) definitions, manufacturing firms (SIC Division D) are engaged in the mechanical or chemical transformation of materials or substances into new products. Products are things, that have to be manufactured from raw materials and distributed to clients (Fitzsimmons & Fitzsimmons, 1997). They have characteristics that allow proprietary patents, process, and equipments (Schroeder *et al.*, 2002). Manufacturing plays an important role in how firms compete, requiring a continual development of new capabilities (Hayes, 1985; Hayes & Pisano, 1996; Hayes & Upton, 1998). Roth and Miller (1990) and Swamidass and Newell (1987) demonstrate a positive effect of manufacturing in strategic decision making. To Ward, Bickford, and Leong (1996), manufacturing is an important part of strategy, as it embodies critical choices which require huge investments.

Many authors support that manufacturing firms are more and more similar to service providers, (e.g.) with highly perishable products, greater customer proximity, intense product customization (Correa & Caon, 2002; Fitzsimmons & Fitzsimmons, 1997; Gianesi & Correa, 1994; Mathe & Shapiro, 1993; Schemenner, 1999). Important differences exist among organizations, resulting in classificatory schemes based on (e.g.) output volume, product heterogeneity, demand variations, and so on (Slack,

Chamber, & Johnston, 2004). Later on this thesis, however, manufacturing firms will be operationalized as a homogenous group, to allow for statistical significance and clearer comparisons to service. Dividing theoretical and empirical considerations in manufacturing sectors would be more advisable, but it was not feasible.

2.1.2. Service Firms

Service firms are an important economic source, responding for around 80% of GDP in USA and 65% in Brazil (Novo Cálculo do PIB, 2007; US GDP, 2007). The increasing relevance of services is the result of a long–term production reorganization, pointed out by its growing weight in terms of employment, number of firms, and value added (Lotti, 2007). As the economy evolves from manufacturing to services, it is important to understand whether the lessons learned in manufacturing can be extrapolated to service, as effective strategies in one sector may not be appropriate in the other (Sengupta *et al.*, 2006).

Services are typically sold, produced, and consumed simultaneously. According to SIC definitions, service firms (SIC Divisions E–I) are those engaged in providing a wide variety of services for individuals, business and government establishments, and other organizations. Services are primarily ideas and concepts, activities that provide value in use over time, associated or not to a tangible product (Fitzsimmons & Fitzsimmons, 1997; Mathe & Shapiro, 1993). Services facilitate the production and distribution of goods, and or add value to people's lives through a variety of intangibles they provide (Haksever, Render, Russel, & Murdick, 2000). Services usually have a front-office, with high customer contact, supported by a back-office, which may resemble manufacturing plants (Correa & Caon, 2002). Front-office activities are less predictable or controllable, while more complex and variable (Fitzsimmons & Fitzsimmons, 1997).

Authors like Mathe and Shapiro (1993) support that the term 'service' is overused, meaning a variety of different things to different people. Services can be similar to production lines, or involve personal attention, or still be based on self-service activities (Chase *et al.*, 2004). As the number and types of service firms have grown, scholars have recognized that important differences exist among organizations, and

have offered classificatory schemes. Schmenner's (1999) two-dimensional typology for services distinguishes the degree of client interaction and labor intensity, comprising: the service factory (low client interaction, low labor intensity), mass services (low interaction, high intensity), the service shop (high, low), and professional services (high, high). Using a managerial perspective, Fitzsimmons and Fitzsimmons (1997) divide firms as:

- Business services: e.g. consulting, finance, banking.
- Trade services: e.g. retailing, maintenance, repair.
- Infrastructure services: e.g. communications, transportation.
- Social / personal services: e.g. restaurants, health care.
- Public administration: e.g. education, government.

Later on this thesis, service firms will be operationalized excluding trade services and public administration, recognizing that these two categories may have very distinct characteristics. As in Brazil education services commonly are not sponsored by the government, but by customers themselves, this type of firm was regrouped as a 'business service'.

2.1.3. Manufacturing and Service similarities

A growing body of research has suggested that in many instances manufacturing firms are taking on service characteristics and visa versa, blurring of the differences between them, raising the question if treating service as distinct from manufacturing is still appropriate (Chowdhurya & Miles, 2006). The differences between service and manufacturing firms are far fewer than one might be led to believe, with the growing recognition that increasingly products have short life cycles, increasing requests for customization, and rapid responses to changing customers (Mathe & Shapiro, 1993). In today's environment organizations must maintain an increasing level of customer orientation, therefore it has become increasingly difficult to distinguish firms as agriculture, manufacturing, or service (Schemenner, 1999)

Products are becoming increasingly dematerialized, creating increasing emotional relationships; services have to achieve satisfactory efficiency and cost levels, are

bound to economies of scale and scope, and face international competition as much as any manufacturing product (Correa & Caon, 2002; Fitzsimmons & Fitzsimmons, 1997; Mathe & Shapiro, 1993). In practice, there are companies who provide both manufacturing goods and services in the same process. Johnston (2005) see little distinction between manufacturing and service firms, with most manufacturing companies knowing they compete on service. By applying operations thinking to the area of service management we have the chance to make a significant contribution to academics and practitioners.

To many authors there is a continuum filled with tangible and intangible attributes sought by customers, where it is not unusual to have both products (e.g. printer) and services (e.g. printer maintenance) as important sources of revenue to the same firm (Mathe & Shapiro, 1993). Therefore, operation systems, and not firms, should be classified as pertaining to manufacturing or service - few companies are purely manufactures, or purely service providers (Chowdhurya & Miles, 2006; Gianesi & Correa, 1994). The manufacturing-service dichotomy might be full of fallacies as: not all manufacturing goods allow economically viable inventories; some services do not require client participation; some products need constant client-provider interaction; not all services are delivered in the presence of a representative; direct contact with the consumer is fostered in many manufacturers (Correa & Caon, 2002).

However, despite similarities there is enough space for manufacturing and service specificities. Environments are unique enough in both sectors to allow questioning direct application of manufacturing-based techniques without modifications to service providers, and *vice-versa* (Fitzsimmons & Fitzsimmons, 1997). To help illustrate, some topics specially relevant for manufacturing firms are *productivity*, *controls*, *age*, *capital*, and *turbulence*. In the same way, some topics specially relevant for service firms are *intangibility*, *structure*, *customers*, *innovation, service encounter, heterogeneity*, and *labor*. These topics are discussed along with knowledge development, culture of competitiveness, market turbulence, and performance conceptualization in the remaining part of this chapter.

2.2. The Concept of Knowledge

Knowledge is an old concept, dating back to Plato and Socrates, yet today it is not uncommonly heralded as one of the 'newest ideas in management', when 'new' is the idea of capturing knowledge gained by individuals and spread it to the firm (Takeuchi, 2001). Academicians and managers try to capture, enhance and apply new forms of knowledge to develop ideas, products and processes. However, it received greater attention since the mid 1990s, along with the shift from a society based on service goods to one based on information (Grant, 1996a). Production, acquisition, movement, retention, and replication of knowledge became important factors, as firms become repositories and coordinators of knowledge (Spender, 1996).

However, there is little understanding on how firms create and manage knowledge, with few systems to evaluate knowledge assets (Nonaka, Toyama, & Konno, 2001). Going back to Penrose (1959), knowledge is a latent resource waiting for a wake-up call. Studying is not simple. An unpublished report from McKinsey and Darmstadt University of Technology (Takeushi, 2001) stresses that knowledge: means different things to people; become outdated instantaneously; is more valuable if shared; cannot be planned *ex ante*; is not one-dimensional. Authors propose different approaches to its conceptualization, and special issues of the *Strategic Management Journal* (Knowledge and the Firm, 1996), *Management Science* (Managing Knowledge, 2003) and *Organization Studies* (Knowledge and Professional Organizations, 2003; Organizational Memory, 2006) show different theoretical and empirical approaches for knowledge management. These, among other articles, contribute to the so-called *Knowledge-Based View* (KBV) of the firm.

Knowledge is inherently indeterminate, continually emerging and evolving (thus dynamic), with an unstable and fluid nature that reflects its context (Nonaka *et al.*, 2001; Tsoukas, 1996). It seems to fit well to the idea of valuable, hard to get, imitate, and substitute assets, as it is mostly about understanding and context, a resource that cannot readily be bought and sold, and therefore must be built 'in house' (Teece, 2001). Knowing how to select, interpret and integrate knowledge is a valuable asset, a key resource for many firms, and the special skills of organizations for creating and

transferring it have been pointed as central to firm advantage (Modi & Mabert, 2007; Nahapiet & Ghoshal, 1998).

If control over scarce resources is a source of economic profits, then knowledge, which cannot be readily assembled or obtained through markets, is a strategic issue. Privately held knowledge may be a basic source of competitive advantage (Conner & Prahalad, 1996). As the transfer and recombination of organizational capabilities are the foundation of the firm's long run survival and growth, and as knowledge is a capability, then its study is relevant to better understanding competitive advantage (Zander & Kogut, 1995). It is the existence of knowledge of internal production techniques or external opportunities, in the hands of a small number of firms, which creates the market imperfections necessary to generate superior performance for some firms in detriment of other firms (Cyert, Kumar, & Williams, 1993).

Knowledge is a very comprehensive topic, so studying its influence in performance without simplifications to the concept would probably be an unfortunate enterprise. A common framework to divide knowledge in operational parts was proposed by Huber (1991), and applied by authors such as Schroeder *et al.* (2002), Hult *et al.* (2007), Menor *et. al* (2007), and Paiva *et al.* (2008). Therefore knowledge was interpreted through four inter-related processes: knowledge acquisition, information distribution, shared meaning, and achieved memory. But before these were presented, a study on the importance of knowledge in the academy of management was conducted, along with considerations on two central topics that anchor these four processes: the nature of organizational knowledge, and the different types of knowledge.

2.2.1. Literature on Knowledge Management

Being an all-inclusive, complex, multidimensional concept, the study of knowledge without the aid of a previously established framework would result, in a best case scenario, in a biased, subjective, not sufficiently comprehensive perspective. Meta-analysis and bibliometric studies help filling this gap, providing a seed upon which theoretical research may develop. Therefore, the starting point of this thesis was Acedo, Barroso, and Galan (2006) article on the dissemination and main trends of

the resource-based theory, where a series of fundamental articles on the knowledge based view (KBV) of the firm are suggested (Table 1).

Table 1. KBV seminal articles

Source: Acedo *et al.* (2006)

Authors	Year	Journal	Title
Nelson and Winter	1982	Book	An Evolutionary Theory of Economic Change
Cohen and Levinthal	1990	Administrative Science Quarterly	Absorptive capacity: a new perspective on learning and innovation
Kogut and Zander	1992	Organization Science	Knowledge of the firm, combinative capabilities, and the replication of technology
Levinthal and March	1993	Strategic Management Journal	The myopia of learning
Zander and Kogut	1995	Organization Science	Knowledge and the speed of the transfer and imitation of organizational capabilities
Grant	1996a	Strategic Management Journal	Toward a knowledge-based theory of the firm
Grant	1996b	Organization Science	Prospering in dynamically-competitive environments
Spender	1996	Strategic Management Journal	Making knowledge the basis of a dynamic theory of the firm
Conner and Prahalad	1996	Organization Science	A Resource-based Theory of the Firm: Knowledge Versus Opportunism
Szulanski	1996	Strategic Management Journal	Exploring internal stickiness: impediments to the transfer of best practice within the firm
Tsoukas	1996	Strategic Management Journal	The firm as a distributed knowledge system: a constructionist approach
Mowery, Oxley, and Silverman	1996	Strategic Management Journal	Strategic alliances and interfirm knowledge transfer
Teece, Pisano, and Shuen	1997	Strategic Management Journal	Dynamic capabilities and strategic management
Nahapiet and Ghoshal	1998	The Academy of Management Review	Social capital, intellectual capital, and the organizational advantage

According to this analysis, the journals with more contributions to the origins of KBV were the *SMJ - Strategic Management Journal* (seven occurrences) and the *OS - Organization Science* (four occurrences). A research was conducted in these,

searching for complementary articles concerning the importance of knowledge in firms. The year 1997 was taken as a starting point to capture the influence of *SMJ*'s 1996 special issue on *Knowledge and the Firm*. The year 2007 was taken as an ending point for being the last complete year before the start of this research. Crossing references along knowledge articles in these journals, a third publication emerged as a regular contributor, and included in the research base: the *AoM - Academy of Management Review*. To better capture the influence of knowledge on operational performance, the *JOM - Journal of Operations Management* and the *IJOPM - International Journal of Operations & Production Management*, were added to the research base. Therefore, a content analysis was performed considering these five journals, evaluating articles from the 1997-2007 period. The first evaluated journal was *SMJ*. A search in titles and abstracts for the word 'knowledge' resulted in 105 articles. Their abstracts were read, with the exclusion of texts where knowledge:

- Appeared as a general term, e.g. 'this article expands knowledge in the X area'.
- Was not directly related to an objective, construct or conclusion.
- Came as part of a review on others books or articles.

This reduced the initial list to 70 articles, which had their abstracts re-read. It was possible to identify that: in 15 knowledge supported a more important concept; in 45 knowledge was central; in 10 knowledge was the main purpose, developing KBV ideas directly. The years distribution is seen in Table 2. Not all 55 articles were relevant to knowledge study: e.g. 20 were discarded for dealing with specific types of knowledge (e.g. managers' privileged knowledge and the stock options market), and not on knowledge as a firm resource. Next, articles from *OS* (34), *AoM Review* (10), *IJOPM* (8), and *JOM* (7) were evaluated. A total of 94 papers were considered for a content analysis. Following Bardin's (1977) procedures abstracts were printed, read and marked. The most usual association involved knowledge and firm performance: 25 articles, distributed along all five journals, were dedicated to this subject. To assess themes associated with knowledge, words that expressed qualifications (e.g. ambiguity, base, critical), actions (e.g. codification, transfer, generation) or attributes (e.g. value, network, source) were sought.

Table 2. KBV related articles in *SMJ* (10 years range)

Source: Author.

YEAR	SUPPORT	CENTRAL	KBV	TOTAL
2007	0	5	0	**5**
2006	2	8	2	**12**
2005	7	5	0	**12**
2004	0	7	1	**8**
2003	1	3	1	**5**
2002	0	4	2	**6**
2001	1	4	0	**5**
2000	1	2	2	**5**
1999	0	4	1	**5**
1998	1	3	1	**5**
1997	3	0	0	**3**

A group of more than 300 words emerged, and those with similar meanings were fused, reducing to about 80. Only one appearance of a word was taken into account in each abstract, so repetition did not add importance. Occurrences were multiplied to the number of different journals represented, building a ranking. An arbitrary cut-off value of 10 was established, allowing a concentration in 21 words that substantiated the definition of the KD construct (top five in Table 3). Articles that contributed to their conceptualization and application intensely were carefully read, adding to Acedo *et al.* (2006) base. A common trait to these articles was the study of knowledge as an organizational phenomenon, apart from the knowledge an individual possesses, although linked to it in many aspects. Therefore, it was necessary to conceptualize organizational knowledge before proposing its influence on firm performance.

Table 3. Words with higher marks in KBV articles
Source: Author.

WORD	# TIMES	# JOURNALS	+20 Points
Transfer	23	4	92
Organizational	19	4	76
Acquisition	18	4	72
Sharing	14	3	52
Application	12	4	48

2.2.2. Organizational Knowledge

That individuals have knowledge is granted; that firms do so is open to discussion. While most explicit and all tacit knowledge are stored within individuals, much of it is created within a firm and is firm specific. Knowledge is not spontaneously organized; therefore firms offer useful structuring resources for it (Brown & Duguid, 2001; Grant, 1996b; Tsoukas, 1994). Personal knowledge can be readily bought and sold. Organizational knowledge is integrative, embedded in processes, routines and structures: in aspects such as rules, databanks, and manufacturing technologies knowledge is really observed (Kogut & Zander, 1992, 1993; Teece, 2001).

Firms know much more than what their contract say, and more than they are aware of. They have capabilities for creating and sharing knowledge that give advantage over other arrangements, such as open markets (Moran & Ghoshal, 1996). They provide opportunities for sustained interaction, bringing members together, supervising and coordinating activities (Nahapiet & Ghoshal, 1998). They are a distributed system that produces, uses, and transforms knowledge, involving rules and actions (Tsoukas, 1996). Knowledge about resources can never be collected by a single mind, because it never exists in concentrated or integrated form, but solely as dispersed, incomplete, and contradictory bits that separate individuals possesses - knowledge is not anyone's in its totality (Hayek, 1945). Firms excel in the task of acquiring, applying, creating and transferring knowledge, specially due to limitations imposed by bounded rationality (Conner & Prahalad, 1996).

Nonaka and Takeuchi (1995) see organizational knowledge as that which is shared by individuals, albeit transformed and amplified by the firm. While individual's knowledge is inherently transferable, social types of knowledge are embedded in routines, norms and culture, and thus firms have a special ease to create and transfer it (Kogut & Zander, 1992, 1993, 1996). Organizations are relatively well endowed with particularly tightly interconnected collective forms of knowledge promotion. They build a knowledge-intensive setting through heavy investment in resources, encouraging the development of team relationships, personal trust, norm-based control, and connections across porous boundaries (Nahapiet & Ghoshal, 1998). If knowledge was only held at individual level, then firms could change simply by employee turnover, which is hardly observable (Kogut & Zander, 1992). Firm's functional knowledge is nested within a higher-order set of principles, resting in human resources. They use their structure and schemes to enhance transfer and communication of skills and capabilities, based on history and experience (Tsoukas, 1994; Tsoukas & Vladimirou, 2001; Zander & Kogut, 1995).

Firms evolve by adapting the body of knowledge shared by their members. They provide a context in which knowledge is selected by interaction with the environment and stored in routines available to future use (Giovanni, Nelson, & Winter, 2000; Nelson & Winter, 1982). The possession of knowledge is an attribute of the firm, and is not reducible to what any single individual knows. While in the open market an individual applies someone else knowledge only after internalizing it, in firms this same individual uses the knowledge of another before he fully understands or agrees, orientated by routines and goals (Conner & Prahalad, 1996). Organizations promote cooperation, exchange, and blending of employees' existing knowledge, modeling how learning occurs. This is possible because firms provide mechanisms for coordination, allowing the integration of individuals' specialized knowledge without the need for communicating it entirely or explicitly (Grant, 1996a).

The knowledge of a firm is a dispersed reflection of its individuals' knowledge, with very few means of controlled emergence (Kulkki & Kosonen, 2001). Today's is a 'knowledge economy', where the challenge is how to build, combine and integrate the knowledge of many thousands of individuals, creating an environment in which

information accumulates and is shared at low cost (Nonaka & Teece, 2001). Tsoukas (1996) stresses a crucial point: organizational knowledge is never complete, and cannot be surveyed as a whole. It is inherently indeterminate and continually reconfiguring. Thus every organization is constantly acquiring new knowledge.

However, different types of knowledge render different services to the firm (Penrose, 1959). There is ample evidence supporting that (e.g.) although explicit knowledge may have great value, it is not strategic, as it can be easily copied and transferred. To obtain sustained competitive advantage firms would have to invest in not so evident, more difficult to understand and transfer, tacit knowledge. These differences and its implications are discussed next.

2.2.3. Different Types of Knowledge

There are probably as many types of knowledge as there are definitions. As noted by Spender (1996), knowledge in many different ways is created, circulated, stored and applied within a firm. Classifications are merely Weberian ideal types, and every real firm has a complex mix. Back in ancient Greece it was proposed that people ‘knew’ in two ways: one based on experience (Aristotelian position), through data acquisition and analysis; and other based on the exercise of reason (Platonist position), through pure logical reasoning. In the academy one of the most cited authors in the study of knowledge is Polanyi (1962, 1966), who distinct between explicit (abstract) and tacit (experience) types of knowledge. Both are in the same continuum, so they are not alternative modes of knowing: the boundary is porous and flexible, and there is traffic between the domains.

Explicit knowledge is objective, abstractive, theoretical, prepositional, declarative. It can be codified, communicated, and stored with few problems of integration, retrieval or assimilation (Nahapiet & Ghoshal, 1998). There are several commercial systems and consulting professionals specialized in help firms to store information (e.g. SAP), re-examine processes (e.g. ISO implementation), and develop platforms for internal exchange (e.g. Intranets). However difficult these explicit knowledge activities may be, they are easily bought and sold in markets. Although they may be valuable, and sometimes even hard to imitate, there are plenty of substitutes, and implementation

is easily transferable. So, explicit knowledge has to be measured as a contributor to performance, however its hole is not central to competitiveness. Tacit knowledge, on the other hand, is subjective, personal, bounded, acquired through personal experience. It represents a shared *corpus* of implicit, embedded routines, which individuals use to practice their skills through social arrangements (Conner & Prahalad, 1996; Grant, 1996b; Mowery, Oxley, & Silverman, 1996). Tacit knowledge resides in the enactment, remaining relatively hidden from its 'actors', although sustained through their interaction (Nahapiet & Ghoshal, 1998). It implies a more complex integration, dependent upon communication (Demsetz, 1988). Much knowledge is tacit, residing in routines that are not easy to assimilate and use, and that demands a high level of prior accumulated knowledge (Cohen & Levinthal, 1990). These complexities are further increased when different types of knowledge require integration (Grant, 1996a). However hard some firms try to emulate practices observed in competitors, they fail, as this 'hidden knowledge' is not easily bought and sold in markets. Moreover, it is valuable, very hard to imitate, difficult to substitute, and implementation is hard to transfer. So, tacit knowledge has to be measured as a critical contributor to performance, as it is central to competitiveness.

Tacit knowledge can be expressed if one focus attention to it, and explicit knowledge is grounded on a tacit component - both are not made of 'discrete beans which may be ground, lost or reconstituted, but they are interrelated' (Tsoukas, 1996). Both may be viewed as object and action, in which progress is made through engagement with the world - firms try to pool, share, and leverage all the distributed knowledge available to them (Nahapiet & Ghoshal, 1998). Tacit and explicit knowledge are intertwined and never at rest; they are fluid, in dynamic movement, challenged by actions and experiences derived form context (Kulkki & Kosonen, 2001). Therefore, measuring knowledge involves taping both explicit and tacit knowledge. Tacit knowledge is personal, hard to formalize, difficult to communicate or share. It is deeply rooted in an individual's action and experience, as well as in his (hers) ideals, values, and emotions. Rarely can it be subject to 'packaging and transferring' (Takeuchi, 2001). Measurement of tacit knowledge requires an understanding of if, how, and how frequently individuals gather in groups to discuss, converge, and share what they know (e.g. regular meetings, inter-areas discussions, information sharing).

As much imperfect as these activities may be to tap tacit knowledge, they are an effective way to transfer to the firm what is embedded in each worker's experience.

The vast bulk of knowledge is tacit, unseen, 'stored' in social identity and practice. However, a communicable cap of this 'iceberg' of preconscious collective human knowledge is explicit (Polanyi, 1962). This is related to processes, symbols, charts, files, codes, training, and other easily observable sources of information available to the firm. Measurement of explicit knowledge requires an understanding of if, how, and how frequently individuals register what they know and make it available to others (e.g. write manuals, revise procedures, present workshops). These activities allow knowledge to be found in different places, integrated through common processes and language that foster exchange.

2.2.4. Summary

There is ample academic evidence that knowledge: is an important topic; can be intrinsically related to the firm; and can be divided into smaller concepts (e.g. tacit and explicit) for a better understanding of its influence in organizations. A wide range of possibilities can be considered on measuring knowledge. If the intent is strategic, a preponderance on tacit over explicit has to be present, focusing on human relations more than on systems and equipment. Trying to encompass the whole concept of knowledge would lead to confusion, with extremely complex and difficult analysis.

Therefore, the knowledge concept must be broken in interpretable chunks. The first division implemented in this thesis was that proposed by Hult *et al.* (2007), breaking knowledge in knowledge development (KD) and culture of competitiveness (CC). Even these two sub-divisions are complex, multidimensional theoretical pieces, that have to be further divided to achieve operationalizable constructs.

2.3. Knowledge Development (KD)

Knowledge development relates to the ability of a firm to process information, changing its range of potential behaviors, resulting in a wider range of options to act,

through processes that are frequently interpersonal or social. This concept was obtained from Huber (1991), an influential article that divides the management of organizational knowledge into: knowledge acquisition, information distribution, information interpretation, and organizational memory. This framework, used by several authors (e.g. Hult *et al.*, 2007; Marr & Spender, 2004; Menor *et al.*, 2007; Schroeder *et al.*, 2002; Szulanski, 1996), is depicted next.

2.3.1. Knowledge Acquisition

Knowledge acquisition is the first KD process proposed by Huber (1991). As knowledge supports decisions it is important, to managers and academics alike, to understand how firms access and utilize knowledge, i.e. their ability to assimilate information from the environment (Cohen & Levinthal, 1990; Grant, 1996b; 2001, 2002). Firms find and move knowledge in an internalization process. *Finding* involves searching, *moving* involves practice, and both relate to aligning different ways of doing things (Brown & Duguid, 2001). Acquisition usually occurs through the arrival of new knowledge, blended to that presently possessed (Conner & Prahalad, 1996).

New knowledge may come from external activities such as customer surveys, Research & Development, performance reviews, and analyses of competitor's products (Huber, 1991). It also occurs through comparison of performances from different firms. Acquisition also comes from internal activities such as cross-functional teams, employee suggestions, and task experience (Schroeder *et al.*, 2002; Szulanski, 1996). Knowledge is obtained through interaction of individuals that continuously analyze procedures, conventions, and norms (Grant, 1996b). Each employee possesses diverse and different knowledge structures, all of which, once combined, allow novel linkages (Cohen & Levinthal, 1990). Acquisition is not always available to be distributed, as it is subject to casual ambiguity. Too often the context is poorly appreciated, and sometimes it is so complex that the firm itself does not understand it (Teece, 1976; Lippman & Rumelt, 1982). Due to cognitive limits knowledge is acquired in a highly specialized form, and the organization is responsible to aggregate its ‘chunks’ and integrate them to develop further knowledge (Grant, 1996a, 1996b, 2001). Firms with potentially synergistic knowledge are often not aware of where such information could serve, and so do not route it to

these destinations. Also, those which might be able to use the knowledge often do not know of its existence or whereabouts (Huber, 1991).

Knowledge acquisition, thus, may not be ‘taken for granted’, and while many firms can develop skills, few are successful in applying the acquired knowledge to their activities (Garvin, 1993). Information distribution, then, is the next step.

2.3.2. Information Distribution

Information distribution is the second KD process proposed by Huber (1991), and is used as interchangeable with *knowledge transfer*, both related to the process by which information is shared. To Teece (2001) the large size of enterprises, their global reach, market competitiveness, the distributed nature of competence within the business, and the availability of tools to assist transfer, all sharpened the importance of accomplishing knowledge transfer in the firm. The central dimension of firms is to create and transfer knowledge efficiently within their context (Kogut & Zander, 1992). Transfers avoid duplicity efforts, capturing benefits of pockets of excellence and great ideas, replicating what works better (Szulanski, 1996). Distributable Information may reside in design, production, installation, operations, maintenance, management, sales, and so on (Zander & Kogut, 1995).

The more easily knowledge can be understood, the shorter is the time to transfer it. Grant (1996b) emphasizes that most knowledge is tacit, and transfer is difficult. Therefore firms establish modes of interaction that minimize the barriers, standardizing information through systems such as directives, plans, schedules, forecasts, and policies. Also they create routines, simple sequences that support complex patterns of interaction. Information, then, is distributed through rules, procedures, and practices that ensure the experiences of individuals are passed on, converting collective knowing into improved performance (Arrow, 1974; Levinthal & March, 1993; Modi & Mabert, 2007). However, knowledge transfer is subjected to some conditions to be effective (Huber, 1982). The probability that *A* rout information to *B* is related to: views of the information's relevance; current workload; power and status; the costs of routing the information; rewards and penalties expected; frequency of information exchange in recent past. Group problem solving and

decision making, specially when applied to complex and uncertain tasks, provide more communication-intensive integration, facilitating information distribution (Grant, 2002). Sole teams are unable to access the full range of knowledge in a firm, as coordination restricts their size. But this can be partially addressed if membership is fluid, so that expertise can be tapped among different groups when needed.

Therefore, effective information distribution requires that individuals occupy multiple roles in many teams (Grant, 1996b). This is not free of challenges: professional identification may conflict with the need to integrate, e.g. engineers may have problems communicating with salesmen (Kogut & Zander, 1992). This problem is attenuated when the transfer is horizontal, i.e. within the same function. The development of a broad and active network strengthens individual's knowledge, and by shared coding schemes information is distributed more effectively within groups. Also, knowledge transfer is not a purely rational process. Shared narratives, myths and metaphors provide powerful means for exchanging and preserving knowledge (Nahapiet & Ghoshal, 1998). Stories full of details facilitate (or compromise) the exchanging of experience, enabling (or impeding) the development of improved practice. Associated with knowledge transfer are concepts such as culture, motivation, learning, routines, and leadership (Conner & Prahalad, 1996).

People have different knowledge sets, which exert a powerful inertia against the distribution of information (Nahapiet & Ghoshal, 1998). The harder it is to codify, to the point where it can only be acquired through practice, the more slow, costly, and uncertain the transfer is (Kogut & Zander, 1992). If explaining to each other the reasons behind one's position is costly, the better a firm endows information interpretation, the more it may benefit from knowledge transfer.

2.3.3. Shared Meaning

Shared meaning is the third KD process proposed by Huber (1991), and is used as interchangeable with *information interpretation*, relating to how information receives commonly understood interpretations. Interpretation is giving meaning, a process through which people translate events and share understandings. The more knowledge is gained, the more varied interpretations are developed (Daft & Weick,

1984). Shared meaning is socially constructed, and is affected by prior information, and by the way new input is communicated. It does not mean that members agree completely on a subject, but that coordinated action is achieved through the distribution and use of the information (Hult *et al.*, 2007). It is not necessary for all employees to share the same interpretations, what is needed is joint action based on a set of directives or goals (Donnellon, Gray, & Bougon, 1986).

It is important to notice that interpretation is less effective if information exceeds the subject's processing capacity. When presented with a too complex stimulus the subject perceives in it what he or she is ready to 'believe'. The more complex the stimulus, the more perception will be determined by what is already in the subject's mind (Bruner, 1957). This is related to Simon's (1991) concept of bounded rationality, i.e. how much information a person may posses and access in order to make a decision. Different interpretations may easily emerge, and have to be dealt with in order to make knowledge useful and efficient.

Due to irreducible differences in the knowledge possessed by individuals common interpretation is hardly automatic, and objections may not be transposed despite all efforts. E.g. parties may have different expectations about future gains, even after each does its best to explain their reasoning to the others and to understand the alternative positions. Irreducible differences in knowledge can lead individuals to expect different outcomes (Conner & Prahalad, 1996). Different skills and backgrounds result in each knowing different things, or knowing them in different ways (Brown & Duguid, 2001). This information is stored in the firm's memory (next), allowing it to more readily accumulate additional information needed to exploit available new knowledge (Donnellon *et al.*, 1986).

To combine information gained through social exchange, different parties in a firm must have knowledge overlap. Then, group-specific communication codes are valuable assets, acting as 'grease' that increases information exchange (Nahapiet & Ghoshal, 1998). This is important to integrate knowledge through cross-functional teams or through job-rotation, as employees develop a commonality that help group what is known. Grant (1996b) suggests as characteristics that ease interpretation:

- Language: mean by which employees discuss and exchange information. It filters events and activities, providing a common conceptual apparatus for evaluating the benefits of exchange and combination.
- Symbols: literacy and familiarity with the same symbols (e.g. software) enhance the efficiency and intensity of communication.
- Specialization: workers must not have entirely separated knowledge, or else they won't be able to integrate beyond the most primitive level.
- Shared meaning: cognitive frameworks, metaphor and analogies, stories as vehicles that mold and reconcile individual experiences and understandings.
- Recognition of domains: effective knowledge integration requires that each individual is aware of everyone else's knowledge repertoire.

Knowledge interpretation, then, depends upon a value system that evaluates, justifies and determines the quality of knowledge a group creates. To Nonaka *et al.* (2001), this shared meaning dictates which ideas are needed, created and retained in a firm. Organizations are subject to inertia, so it is difficult for them to diverge from a course set by previous successful experiences. Past interpretations often prevail, and are connected to the achieved memory.

2.3.4. Achieved Memory

Achieved memory is the fourth and last KD process proposed by Huber (1991), and is used as interchangeable with *knowledge base*, relating to prior knowledge that enables recognition of information value, its assimilation, and application (Cohen & Levinthal, 1990). What a firm knows is not easy to specify, stock, or measure. It is hard to realize inventories of knowledge, specially where situations are numerous and shifting. Thus, a firm must continually increase its knowledge base: by the time knowledge is needed, it is too late to gain; before it is needed, it is hard to specify what might be required (Levinthal & March, 1993). Failure (e.g.) to introduce new technologies may be consequence of a mismatch between the current achieved memory and new product requirements (Teece, 1988). The key to efficiency relies on creating mechanisms that quickly embed learning, transferring knowledge into rules, directives, tasks, routines, and joint problem solving (Huber, 1991; Grant, 1996a).

2.3.5. KD Influence on Firm Performance

Many authors connect elements of knowledge development to performance. Pisano (1994) suggests that there is an empirical link between cumulative production experience (i.e. knowledge) and manufacturing performance. To Rosenzweig and Roth (2004) the capacity to value, assimilate, and apply new knowledge reflects in operational know-how, resulting in superior results. To Lucier and Torsilieri (2001) knowledge accelerates performance improvement. A number of recent articles - (e.g.) Hanvanich, Sivakumar, and Hult (2006), Hult *et al.* (2007), Paiva *et al.* (2008), Menor *et al.* (2008), Fugate, Stank, and Mentzer (2009) - linked some measure of organizational knowledge to firm performance. These papers have a common trait, in that knowledge affects performance positively. This may be so given some firm characteristics that establish a link between these variables. Some examples are: productivity, control, and structure. Once again, these are Weberian types, i.e. some firms may pursue superior productivity, or better controls, or more IT, than others.

Productivity: investment and decision priorities are assigned for products and production lines, focusing on superior resource utilization (Fitzsimmons & Fitzsimmons, 1997; Murdick, Render, & Russel, 1990). Materials are often over 60% of costs, so many savings come from inventory reductions and transportation efficiencies (Frohlicha & Westbrook, 2002). Increase automation is sought, and there are usually high productivity gains through the implementation of broad technological innovations (Fitzsimmons & Fitzsimmons, 1997). Higher performance is expected from superior productivity, obtained through more accurate, controlled, and refined processes; better processes result from better knowledge development (KD) practices, e.g. knowledge acquisition, transfer, interpretation, and storage into the firm; so KD should reflect positively on firm performance.

Controls: the physical handling of a product (or service inputs) leads to standardized and centralized procedures and controls (Sengupta *et al.*, 2006). Controls allow for superior quality surveillance, setting reference for business drivers (e.g. six-sigma) that impact performance (Johnston, 1999). Controls support productivity efforts. Better controls are a consequence of better knowledge development (KD) practices,

particularly on information acquisition and interpretation. So KD should reflect positively on firm performance.

Structure: service firms may present distinctive characteristics, so that productivity, controls, and or IT may not represent relevant goals. This may be due to intense customization and a close, idiosyncratic contact with the customer. However, in these occasions direct customer contact and participation means standing near them, i.e. either the customer comes to the service, or the provider goes to the customer (Fitzsimmons & Fitzsimmons, 1997; Murdick *et al.*, 1990). Than, more physical sites become necessary, and more challenges due to geographic dispersion arise (Frohlicha & Westbrook, 2002). The proliferation of small, decentralized units demand enhanced coordination tools. Coordination is based on norms, directives, routines, and other explicit and tacit knowledge components. Higher performance is expected from customer proximity, depending upon better knowledge development (KD) practices, e.g. knowledge acquisition, transfer, interpretation, and storage. So, once again, KD should reflect positively on firm performance.

Productivity, control, and structure are by no means the only theoretical justifications for a positive impact of knowledge on performance. However, they are sufficient to the proposition of a first hypothesis:

> *Hypothesis 1:* Knowledge development (KD) has a positive association with firm performance.

KD operationalization was based on the four processes proposed by Huber (1991). In turn, each one of these was operationalized through a survey, based on existent scales, improved by this thesis theoretical research and pilot testing. They were represented through indicators with the following characteristics:

- Knowledge acquisition: the questions evaluated the ability to efficiently search and internalize ideas related to processes, products, and services, detecting environmental changes and comparing internal results with external benchmarks.
- Information distribution: the questions evaluated the ability to gather into groups to spread information, both internally and externally generated, in a planned, fast, and structured way.

- Shared meaning: the questions evaluated the ability to effectively share information, debating the most relevant events, taking advantage of internally developed language and symbols.
- Achieved memory: the questions evaluated the ability to hold knowledge in the firm, formally assigning time to build a collective knowledge to be stored in rules, procedures, and files (e.g. intranet).

These processes, however, were considered insufficient to a proper representation of the broader knowledge concept. That is because, specially in the learning literature, pure knowledge is seen as no more than abstract thinking if not put into practice. To be really useful to firm performance, knowledge has to be not only embedded, but also enacted. Hult *et al.* (2007) propose the culture of competitiveness (CC) construct to fill this gap, with an orientation to learn, innovate and entrepreneur.

2.4. Culture of Competitiveness (CC)

Culture of competitiveness (CC) relates to the ability of a firm to learn, create, and execute actions directed to customer satisfaction, resulting in more effective actions. This concept was proposed by Hult *et al.* (2007), who divided CC into learning, innovativeness, and entrepreneurial orientations. This framework allows for a good assessment of the influence of turbulent markets on the relationship between knowledge and performance (sub-chapter 2.5).

Culture is a complex, multidimensional, multidisciplinary, all-inclusive construct. It may be focused through quite different perspectives: sociological, anthropological, geographical, managerial, and many others. In the academy of management authors such as Geert Hofstede, Edgard Schein and Robert Cooke study organizational culture, a dimension of the broader concept that focus on shared basic assumptions from a group inside a firm, a pattern that reinforces what has worked well enough to be considered valid and, therefore, to be taught to new members as the right way (Schein, 1997). Organizational culture is an intangible resource, developed through interaction and cooperation, that provides employees with a pattern of shared values and beliefs, binding them together (Hult, Ketchen, & Nichols, 2002; Weick, 1987)

One possible division of the comprehensive culture concept is what Hult et al. (2007) define as a culture of competitiveness (CC), a complimentary construct proposed by the authors in their study of knowledge effects on performance. CC is the result of a learning, innovativeness, and entrepreneurial orientations. These were considered by the authors as even more important subjects for performance than KD. Moreover, CC would antagonize KD in turbulent markets, i.e. the knowledge effect based on learn-innovate-do would go against the knowledge effect based on get-transfer-interpret-embed for cycle time performance in manufacturing supply chains. To the authors this CC resource functions as a guide for meeting customers' desires, and depend upon the interrelatedness of the three orientations:

> *Each of these (…) is necessary, but individually insufficient for the emergence of the higher order intangible strategic resource of culture of competitiveness. (…)* [*CC*] *can provide a sustainable competitive advantage and enhanced performance. (*Hult *et al.,* 2007, p1038)

Learning, innovativeness, and entrepreneurial orientations are conceptualized next. Also, following Hult *et al.* (2007) proposition of an important interaction factor, the synergy between CC and KD is also discussed.

2.4.1. Learning Orientation

Learning orientation is generation of insights that have potential to shape products and processes. There is a growing consensus that firms must become more effective learners if they are to cope with today's fast changing reality, as manufacturers are challenged to deliver larger quantities of timely, factual information, that workers must learn at maximum rate (Uzumeri & Nembhard, 1998). Learning has an important role to performance, consistent with RBV criteria for achieving sustainable competitive advantage: it is haphazard and multi-faceted, occurring in unpredictable ways, difficult to codify and leading to causally ambiguous impacts (Schroeder *et al.*, 2002).

Organizational learning is path dependent, for what a firm has done in the past tends to predict what it can do in the future. Learning builds on past experience, with a self-

reinforcing nature (Pisano, 1994; Stata, 1989). Firms develop and sustain cultures concerned with how people convert experience into reconfiguration of assumptions, frameworks, and actions. These include procedures, routines, training sessions, and auditing that detect when individual action varies beyond specified thresholds, keeping dispersion within certain boundaries (Kim, 1993; Levinthal & Lerup, 2006). Therefore, learning orientation is part of the culture of competitiveness.

Whether firms adapt their internal process more successfully than others are critical issues in understanding organizational learning (Pisano, 1994). When practice with a problem is discontinued before it is learned, little transfer occurs to the next series, and time and effort is spent when the activity is reassessed (Argyris, 1995; Cohen & Levinthal, 1990). Learning is multifunctional, as workers with varied experiences bring ideas on how to improve, or new ways to understand problems. It includes incorporating a wide range of suggestions into process and products (Schroeder *et al.*, 2002). Therefore, more learning is observed where more innovation occurs, a covariance resulting from learning and innovative orientations being indicators of CC.

However, suggestions do not come to action if the internal environment does not foster feedback. Learning depends upon engaging in practice, developing with others a common understanding of the work and how it fits into the world (Brown & Duguid, 2001; Gavetti & Levinthal, 2000). It includes self-appraisal activities, which involve workers in choosing, planning, and implementing actions (Huber, 1991; Rosenzweig & Roth, 2004). If workers lack the knowledge and skills for the implementation of their tasks, high internal competence cannot be achieved (Adler, Goldoftas, & Levine, 1999). Incorporating workers suggestions into the development of processes and products is a condition for considering the lessons learned (Hall, 1987). Therefore, more learning is observed where more actions occur, a covariance resulting from learning and entrepreneurial orientations being indicators of CC.

To Schroeder *et al.* (2002) learning can be divided into internal and external learning. External learning is obtained through interactions with the environment, especially from suppliers and customers. So, learning is relevant in supply chains, where firms alternate as suppliers and customers, a proposition studied by Hult *et al.* (2007). On the other hand, internal learning is obtained through intra-firm activities, especially

from suggestion programs and multiple tasks training. So, learning is relevant in firms, where lessons from inside may contribute to performance.

Finally, investment in training (therefore, in learning) should lead to improvement in worker performance, with reflections in productivity (Adler & Clark, 1991). Authors found support for an empirical link between cumulative experience and performance (Rosenzweig & Roth, 2004; Stata, 1989). Others concluded that learning affect performance, mediated by factors such as proprietary process and equipment (e.g. Shcroeder *et al.*, 2002) or knowledge (e.g. Paiva *et al.*, 2008). Some claim that the ability of firms to sustain high performance over long periods of time depends primarily upon learning (Pisano, 1994).

2.4.2. Innovativeness Orientation

Innovativeness orientation is as openness to new ideas, and their generation. It is universally perceived as exploring something new, that has not existed before. A firm's level of overall innovativeness manifests its capability to explore new possibilities. The general direction of these possibilities is closely related to the nature of a firm existing resources, and to the type and range of productive services they can render (Penrose, 1959). To Cho and Pucik (2005) innovativeness positively affect profitability, being related to firm performance, and being a driver of growth. The authors, examining other studies, present that:

> *Damanpour and Evan (1984) reported a positive relationship between organizational innovation and performance. Similarly, Subramanian and Nilakanta (1996) found that innovativeness had a positive effect on organizational performance. (…) Kleinschmidt and Cooper (1991) indicate a positive relationship between innovativeness and profit or growth performance at the firm level (Cho & Pucik, 2005: p.557).*

Innovation can be connected to the broader knowledge concept, as an application of knowledge to produce new knowledge. Actions to improve human resources (e.g. training and learning by doing, both elements of the CC construct), are mechanisms that give rise to changes in knowledge (Turvani, 2002). The capacity of a firm to

innovate is linked to the development of specific, local forms of knowledge. Also, innovation can be connected to entrepreneurship, representing an incentive to growth and a source of competitive advantage (Penrose, 1959). It is managerial thinking and acting upon existing available resources, upon new market opportunities, that proportionate firm growth.

2.4.3. Entrepreneurial Orientation

Entrepreneurial orientation is the pursuit of opportunities and renewal of activities in the firm. The abilities of firms to perceive and respond to opportunities depends on the specific capabilities they embody, therefore some firms are able to respond to an opportunity better and faster than others (Richardson, 2002). Entrepreneurial judgment refers to perceiving potential new resource combinations and exchanges, influencing the speed at which firms grow (Ghoshal, Hahn, & Moran, 2002). It is context dependent, based on the suitability of actions to particular market institutions, in a particular place and time.

To Foss (2002) RBV theorists not uncommonly forget that the actual application of resources in production create revenue (i.e. entrepreneurial orientation), not mere their possession. Richardson (2002) corroborates, proposing that the capabilities of a firm depend on qualities of a different kind, e.g. courage and patience (which may be associated to entrepreneurial orientation). Entrepreneur and knowledge may be linked, resulting in superior performance. Entrepreneurs are convinced that the more they learn, the greater will be their prospects of successful action, so that more knowledge likely improves the efficiency and profitability of the firm (Penrose, 1959). Entrepreneurial judgment is related to the organization of information-gathering within a firm (i.e. knowledge), and is an integral part of the growth process.

2.4.4. CC Influence on Firm Performance

There are reports in the literature connecting elements of culture of competitiveness (e.g. learning) to performance. Levinthal and March (1993) see performance increased by learning, as more experienced and trained workers produce better. Schroeder *et al.* (2002) suggest that learning has an important role to manufacturing

performance, resulting in competitive advantage. While empirical articles are limited (e.g. Hanvanich *et al*., 2006; Hult *et al.*, 2007), some theoretical bases concerning firm characteristics may be applied to support a positive effect of CC on performance. Some examples are: experience, customer participation, customer satisfaction, and innovation. Once again, these are presented as Weberian types, i.e. some firms may pursue innovation more than others, while others focus on the service encounter.

Experience: firm survival is positively related to age, meaning the more firms are in the market, the more they learn about how to stay in business and increase efficiency (Lotti, 2007). Processes may represent decades of continuous learning through successive improvements (Chase *et al.*, 2004). The accumulation of skills may be an asset stock, specific to the firm, based on mass efficiency, interconnectedness, erosion prevention, and casual ambiguity. Asset stock accumulation leads to sustainable competitive advantage (Dierickx & Cool, 1989), resulting in superior performance. Considering that learning orientation is an element of the culture of competitiveness construct, CC should reflect positively on firm performance.

Customer Participation: the distinction between products and services is becoming blurred. More and more manufactured products carry along some kind of service (e.g. personal computers); several services are rendered by complex manufactured products (e.g. banking systems) (Chase *et al.*, 2004; Fitzsimmons & Fitzsimmons, 1997; Murdick *et al.*, 1990; Schemenner, 1999). The result is that firms increasingly search for more contact with their customers (e.g. B2B, B2C, telemarketing). This results in active participation of both customer and front line worker, demanding from this last group a high level of personal judgment, based on careful training programs (Chase *et al.*, 2004; Fitzsimmons & Fitzsimmons, 1997; Gianesi & Correa, 1994; Murdick *et al.*, 1990). Higher performance is expected from better trained workers; training is in the core of internal learning, an element of a culture of competitiveness (CC). So CC should reflect positively on firm performance.

Customer Satisfaction: the interaction between customer and service (or product) is mediated by the worker. However well trained as the worker may be, he will not be prepared to face every possible situation when meeting the client. In these opportunities, his (her) decisions will be supported by the firm's culture (Chase *et al.*,

2004; Fitzsimmons & Fitzsimmons, 1997). In other words, products and services are an extension of organizational culture (e.g. JetBlue low cost textbook). Workers need autonomy to decide what is best, apart of rules and procedures. Decisions are driven by judgment, founded on a shared set of values and beliefs. Unspoken rituals and norms may decisively contribute to client satisfaction in an exchange, so CC should reflect positively on firm performance.

Innovation: firms strive to be pioneers, transforming their 'learning by doing' in innovation (Pires, Sarkar, & Carvalho, 2008). At the same time, classic entry barriers, such as capital cost or proprietary technology, are increasingly reduced in many sectors (Fitzsimmons & Fitzsimmons, 1997; Lotti, 2007; Schemenner, 1999). Given lower entry barriers, new ideas may be easily copied, and innovation must be provided in an on-going basis in the struggle for market position. Higher performance is expected from innovative firms, while an innovativeness is an element of a culture of competitiveness (CC). So CC should reflect positively on firm performance.

Experience, customer participation, customer satisfaction, and innovation are by no means the only theoretical justifications for a positive impact of a culture of competitiveness on performance. However, they are sufficient to the proposition of a second hypothesis:

> *Hypothesis 2:* Culture of competitiveness (CC) has a positive association with firm performance.

CC operationalization was based on the three processes proposed by Hult *et al.* (2007). In turn, each one of these was operationalized through a survey, based on existent scales, improved by this thesis theoretical research and pilot testing. They were represented through indicators with the following characteristics:

- Learning orientation: the questions evaluated the ability to efficiently train workers for multiple tasks in multiple areas, also considering their contributions to process and products improvement.
- Innovativeness orientation: the questions evaluated the ability to foster new ideas, implementing them into the firm, given an stimulating internal environment.

- Entrepreneurial orientation: the questions evaluated the ability to put the ideas into practice, assuming risks and keeping up to the latest process and technological developments.

These processes, therefore, complement the representation of the knowledge concept. However, one more trait proposed by Hult *et al.* (2007) must be considered, i.e. the possible synergy between KD and CC positively contributing to performance.

2.4.5. CC and KD Interaction

As both knowledge development (KD) and culture of competitiveness (CC) are elements of a more comprehensive knowledge concept, it is expected that both should be strongly related to each other, with possible synergy between them. It is not uncommon to find authors proposing CC and KD as interconnected, synergistically leading to superior performance (e.g. Garvin, 1993).

From a culture to knowledge perspective, a worker involved in new experiences (i.e. learning) integrates his (her) observations into knew knowledge, applied to problem solving in the firm. Learning is knowledge creation through the transformation of experience, and once transferred becomes embedded in the firm's memory and structure (Kim, 1993). Organizational learning occurs as employees obtain the knowledge and recognize it as potentially useful (Huber, 1991). To Hult *et al.* (2007), learning is the missing link between culture and knowledge, integrating these frameworks. Firms with a stronger learning orientation not only gather and disseminate information, an action in the KD domain, but also review their interpretations and question the dominant logic, resulting in better processes (Baker & Sinkula, 1999). Therefore, learning results in enhanced knowledge, which in turn contributes to better performance

From a knowledge to culture perspective, firms with stronger knowledge development support behaviors that, given time, become inherent as part of their culture, driving actions and speeding decisions (Slater & Narver, 1995). Achieved memory, under the KD domain, preserves certain behaviors, mental maps, norms, and values over time (Hedberg, 1981). Knowledge gathered by workers, represented by insights and skills,

become embedded in the firm's routines, practices, and beliefs (Argyris, 1976; Grant, 1996a). Organizational life is characterized by meetings, conferences, and social events that can be viewed as collective investment for the institutional creation and maintenance of dense networks of social relationships. This provides unplanned and unstructured opportunities for the coming together of ideas (KD) that may lead to the serendipitous development of new intellectual capital and organizational routines (CC) (Nakapiet & Ghoshal, 1998).

Firms develop closely coordinated working arrangements, where each worker applies his knowledge through apparently automatic patterns of interaction. This coordination relies heavily on informal procedures, commonly understood roles and interactions established through training and repetition, supported by some level of background knowledge (Cohen & Levinthal, 1990). Whilst a firm operates with a high degree of standardization (KD), its routines evolve to respond to operational problems, in a dynamic reenactment involving continuous change (CC) (Levinthal & Lerup, 2006). Therefore, knowledge results in culture reenactment, which in turn contributes to better problem solving, leading to superior performance.

The possibility that CC and KD correlate and, even more important, may interact with each other (i.e. they have a multiplying effect on each other), resulting in superior performance, has to be considered. Growth, an element of performance, implies a need of productive services, supplied by flows of knowledge. Therefore, the absence of knowledge may limit the potential of the firm to develop its innovative projects (Turvani, 2002). In other words, the interaction between a knowledge flow (KD) and innovative actions (CC) is necessary for continuous firm growth. As proposed by Hult *et al.* (2007:1039), 'neither CC nor KD is sufficient to maximize performance. Instead, they supplement and reinforce each other for a stronger strategic effect than either alone can provide'.

These arguments are by no means the only theoretical justifications for a positive impact of the culture and knowledge synergy on performance. However, they are sufficient to the proposition of two further hypothesis.

Hypothesis 3: Culture of competitiveness (CC) and knowledge development (KD) are associated to each other.

Hypothesis 4: The culture of competitiveness (CC) and knowledge development (KD) interaction has a positive association with firm performance.

The interaction is later operationalized mathematically, by multiplying CC and KD measures and analyzing the combined effects on performance. This way, knowledge is 'fully covered' - at least the part of the concept delimited in this thesis proposition. However, although KD and CC are expected to affect positively performance, the nature and intensity of this effect may be subject to market turbulence. Specially when manufacturing and service firms are taken as separated groups, some of their distinctive characteristics may result in somewhat different effects of KD and CC on performance. This possibility is discussed next.

2.5. Moderating Effect of Turbulence on KD and on CC

Several structural dimensions may affect firm operations, influencing its tasks. Some are shaped by the environment, while others emerge from inside, given the nature of the products and or services rendered. Starbuck (1976) proposes a classification for these possibilities, summarized by Dess & Beard (1984) as munificence (capacity, resource availability), dynamism (stability-instability, turbulence), and complexity (task homogeneity-heterogeneity, dispersion-concentration). All three might have the potential to interfere in the effects of independent variables on firm performance. Munificence (e.g.) may stimulate growth; dynamism (e.g.) may restrict profitability; complexity (e.g.) may increase costs. However, it should not be expected that all three influence the knowledge effect on performance in the same way.

Considering actual information technology and its availability (e.g. Google, EDI), munificence may have little influence. Knowledge is abundant and increasingly available in most sectors, and the usage of knowledge as a strategic resource is what may bring differentiation (Grant, 1996a; Hult *et al.*, 2007). Complexity, on the other hand, should influenced the effect of knowledge on performance: more complexity

implies more internal activities, resulting in more need for information, integration and coordination flows. Therefore, a moderating effect (Baron & Kenny, 1986; Muller, Judd, Yzerbyt, 2005) possibly exists for complexity. This was not empirically tested in this thesis because task complexity operationalization would demand a finer sampling, involving many different sectors, leading to more comprehensive and controlled sampling. A sufficient number of observations in each sector, adequate for statistical analysis, might not be reached. This possibility was discarded *ex ante*, but remains as a suggestion for complimentary studies.

At last, dynamism also might be expected to interfere in the effects of knowledge on performance. As external environment changes, e.g. due to market turbulence, knowledge development and culture of competitiveness may react differently. This possibility was inserted in this thesis for a number of reasons. First, the perception of external instability may be less biased than that of task complexity, as turbulence is a more intuitive concept - the measurement of turbulence might be more accurate. Second, market instability can be easily applied to completely different firms (e.g. from bakeries to petrochemical firms), irrespective of their sector. Third, the media continually provides information for all publics (specially managers), through diverse formats (e.g. magazines, Internet), on how X or Y markets are under intense change (or not). Fourth, there are previous studies (e.g. Hult *et al.*, 2007) and scales (e.g. Jaworski & Kohli, 1993) that may be adapted for rigorous academic measurement of dynamism elements (e.g. technology turbulence). Definitions on market turbulence, as well as its possible moderating effect on KD and CC, are presented next.

2.5.1. Market Turbulence

Dynamism reflects the degree of uncertainty on environment conditions, when important factors that influence decision making are in constant upheaval (Miller & Friesen, 1983; Randolph & Dess, 1984). It is closely related to environmental turbulence, which relates the magnitude of changes in the level of key variables, as well as the unpredictability of their future state. Turbulence usually is an exogenous factor to firms: government changes, increased competition, operations complexity, and changing consumer preferences, all contribute to the uncertainty and complexity of the environment in which firms operate (Haksever *et al.*, 2000). Change is a rule,

not an exception, given a series of phenomena such as globalization, interest rates, inflation, exchange rates, political and legal turbulence, regulation and deregulation, mergers and acquisitions, quick pace of new technologies, and so on (Correa & Caon, 2002). Competitive suppliers, active competitors producing close substitutes, and potentially changing customers would be included in the group of environmental elements that influence the performance of an organization (Dess & Beard, 1984). This 'environmental turbulence' may be divided into elements such as market turbulence (e.g. Hult et al., 2007), technological turbulence (Hanvanich *et al.*, 2006), and industry turbulence (i.e. entry and exit rates) (e.g. Lotti, 2007). The first category was of greater interest in this thesis.

Market turbulence is the rate of change in the composition of customers and their preferences (Hanvanich *et al.*, 2006). In turbulent markets firms tend to have new customers, with new needs, and changing preferences (Jaworski & Kohli, 1993). To survive in this environment responsiveness to change is a key factor, and market turbulence is expected to be an important determinant of performance under high competitive intensity: 'changes can come from anywhere without notice and produce consequences unanticipated' (Pfeffer & Salancik, 1978: 68). Managerial perceptions regarding uncertainty shapes decision making, so inputs based on culture and knowledge are influenced by beliefs about external scenarios, therefore influencing their effects on performance (Hult *et al.*, 2007).

Before studying these moderation effects, it is important to stress that in this thesis' bibliography revision no evidence was found of a direct effect of market turbulence on performance. Hult *et al.* (2007) and Hanvanich *et al.* (2006) do not find turbulence as a predictor to cost, profitability, or growth. Porto *et al.* (2009) suggest that more dynamic environments, given characteristics such as higher risks, great instability, and more elaborate resource needs, lead to quite ordinary firm profitability. Given the insufficient references in this thesis' to support this argument, the absence of a direct effect of market turbulence on performance, although statistically tested, was studied as a proposition, and not as a hypothesis. Turbulence's role was considered an influence in other predictors, working solely as a moderator (Hanvanich *et al.*, 2006; Hult *et al.*, 2007; Mackinnon, Lockwood, Hoffman, West, & Sheets, 2002).

Market turbulence operationalization was based on an one-dimensional construct, adapted from Jaworski and Kholi (1993), following Hult *et al.* (2007) suggestion. In the survey, turbulence was represented by indicators with characteristics such as fast changes in customer preference, needs, and desires. This process influences both KD and CC effects on performance, as discussed next.

2.5.2. Turbulence and Knowledge Development

Literature provides evidence for a connection between turbulence and knowledge development. Firms gather knowledge, providing reserves against future threats and tools for exploring (or exploiting) opportunities (Loasby, 2002). To cope with change and uncertainty firms may develop several knowledge bases. The more turbulent is the environment, the more development is necessary for better performance (Foss, 2002). Also, as the pace of change increases, a premium on knowledge emerges, as it provides a greater arsenal of wisdom to overcome quick changes (Hult *et al.*, 2007). Broader knowledge results in greater ability to adapt, guaranteeing sustainable earnings (Levinthal & March, 1993). So, in changing environments (e.g. turbulent markets), knowledge might generally have a greater positive effect on performance. Also, decision speed seems to affect firm performance in fast changing environments, and fast decision makers use more information (Eisenhardt, 1989).

It could be expected, then, that in turbulent environments greater knowledge would impact decision making, contributing to superior firm performance. However, Hanvanich *et al.* (2006) observed that the relationship between memory (a KD element) and performance is weaker under market turbulence. An explanation is that under high turbulence past knowledge may not be useful in new settings, maybe even delaying necessary paradigm shifts, so that organizational memory may bring about inferior firm performance. Therefore, the moderating effect of turbulence on the KD effect on performance is subject to mixed conclusions. Discerning manufacturing and service firms may provide an acceptable explanation for these different results, throwing some light. Recalling the rationale presented for KD effect on performance, the main characteristics listed were related to productivity, control, IT, and structure. Structure was listed last to strengthen the link to service providers, as productivity and control are typically manufacturers traits (IT is central to both industries).

Therefore, it would be expected that the more a manufacturing firm is ‘pushed’, e.g. given extreme market conditions, the more it would have to rely on its knowledge.

Manufacturers are also usually *capital intensive* (Fitzsimmons & Fitzsimmons, 1997). Productive resources (e.g. buildings, equipment) may take a long time to be acquired, to be put to production, and even to be discarded (Chase *et al.*, 2004). Capital alone may provide productivity gains in manufacturing firms (Haksever *et al.*, 2000). Economies of scale and learning curves are also important, as cumulative processes refinements, based on successive contributions subjected to time diseconomies (Chase *et al.*, 2004; Dierickx & Cool, 1989; Slack *et al.*, 2004). Higher performance is expected from better decisions as to where, when, and how invest money and other resources (e.g. time) in turbulent environments. In this scenario better decisions emerge from superior knowledge development (instead of harsh action). So KD should reflect more positively on performance, under turbulent environments, for manufacturing firms.

Service providers, on the other hand, are more subjected to *heterogeneity*, due to highly variable, non-standard output. Each client may vary in terms of desires, demand is more difficult to predict, sales fluctuations are more erratic, variations are typically more severe and frequent (Frohlicha & Westbrook, 2002). Usually economies of scale are traded by economies of scope, i.e. offering small quantities of a wide range of services in the same opportunity (Fitzsimmons & Fitzsimmons, 1997; Haksever *et al.*; 2000; Murdick *et al.*, 1990). In turbulent markets, higher performance is expected from service firms that are more heterogeneous. Heterogeneity may be obtained through stronger worker initiative, resulting from more frequent transgressions of norms, directives, routines, and other explicit (and even tacit) knowledge development components. So KD should reflect less positively on performance, under turbulent environments, for service firms.

These arguments are by no means the only theoretical justifications for a difference on the impact of knowledge development on performance under market turbulence. However, they are sufficient to the proposition of a fourth hypothesis:

Hypothesis 5: Market turbulence has a different moderating influence on the effect of knowledge development (KD) on performance in manufacturing and in service firms.

The moderation is later operationalized mathematically by multiplying KD and market turbulence measures and analyzing the combined effects on performance.

2.5.3. Turbulence and Culture of Competitiveness

Literature provides evidence for a connection between turbulence and culture of competitiveness - specially entrepreneurial orientation. Entrepreneurship is important in a changing and uncertain world (Foss, 2002). In markets that continually change, opportunities move quickly, and once behind it is difficult to catch up (Eisenhardt, 1989). The environment of a firm affects, and is affected by, both entrepreneurial judgment and organizational capability (Ghoshal *et al.*, 2002). As intuition may allow managers to react quickly and accurately to changes, it would be expected that in turbulent markets greater propensity to entrepreneurial orientation (an element of CC) might impact fast decision making, leading to superior firm performance. However, Hult *et al.* (2007) find quite the opposite in supply chains, arguing that under market turbulence the gap between customers desires and firm perceptions shifts so quickly that existing culture of competitiveness have a negative effect, disorientating learning, innovativeness, and entrepreneurial activities. Reversing the argument once again, Hanvanich *et al.* (2006) find the relationship between learning orientation (part of CC) and performance stronger under high market turbulence.

Once again turbulence moderation effect is subject to mixed conclusions, this time involving the influence of CC in performance. Discerning manufacturing and service firms may provide, once more, an acceptable explanation for these different results. Recalling the rationale presented for CC effect on performance, the main characteristics listed were related to experience, customer participation, customer satisfaction, and innovation. While experience and innovation may be considered neutral, customer participation and satisfaction are much more evident in service providers than in manufacturers. Therefore, it would be expected that the more a

service firm is ‘pushed’, e.g. given extreme market conditions, the more it would have to rely on its culture.

Service providers are also usually more *labor intensive*. Being more ‘people oriented’, obsolescence commonly arises from stagnation of workers’ skills (Frohlicha & Westbrook, 2002; Murdick *et al.*, 1990). The focus shifts from proprietary process and equipment to human resources (Fitzsimmons & Fitzsimmons, 1997). As many decisions are taken locally, outputs are more uncertain, and workers are encouraged to act as entrepreneurs, free to act given their superior customer experience (Mathe & Shapiro, 1993; Sengupta *et al.*, 2006). Service capacity is altered by changes in labor, a highly flexible resource, so an effective way to cope to fast environmental changes is to constantly train employees (Correa & Caon, 2002; Murdick *et al.*, 1990). In turbulent markets, higher performance is expected from more flexible firms. Flexibility is expected from better trained workers, and training is part of internal learning, an element of culture of competitiveness; so CC should reflect more positively on firm performance in turbulent environments for service firms.

Manufacturers, on the other hand, are more subjected to *caution* when investing in new products, processes, and or facilities. When turbulence is high, market’s desires shift rapidly and unpredictably. What customers want may rapidly differ from what products offer, forming fluid and nebulous gaps in a fast developing pace (Hult *et al.*, 2007). Rapid change can be detrimental to embedded cultural competencies: firms may learn what is not in need, working on ideas not aligned to market, resulting in implementations detrimental to performance. Therefore, CC should reflect negatively on firm performance in turbulent environments for manufacturing firms.

These arguments are by no means the only theoretical justifications for a difference on the impact of culture of competitiveness on performance under market turbulence. However, they are sufficient to the proposition of a fifth hypothesis.

> *Hypothesis 6:* Market turbulence has a different moderating influence on the effect of culture of competitiveness (CC) on performance in manufacturing and in service firms.

The moderation is later operationalized mathematically by multiplying CC and market turbulence measures and analyzing the combined effects on performance. Therefore, a conceptualization of performance and ways to its measurement must be provided.

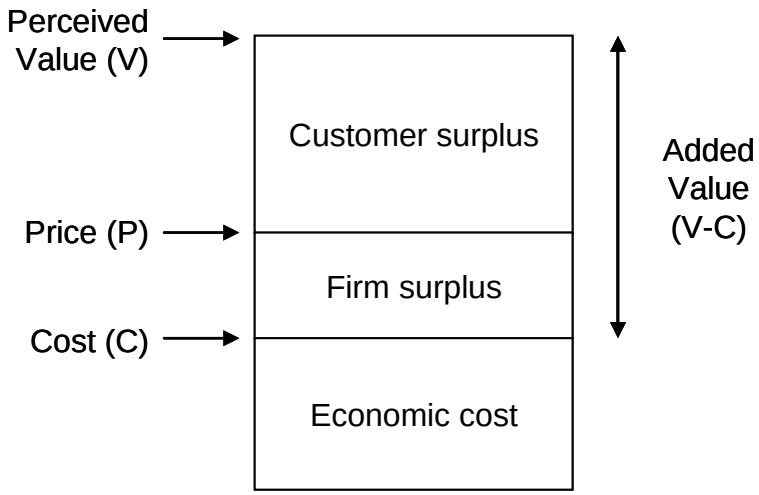
2.6. Performance

Explaining performance variation is an enduring theme, probably one of the most studied concepts in firm strategy (Combs, Crook, & Shook, 2004; Venkatraman & Ramajunam, 1986). However, despite its central role, firm performance is a construct still lacking more precise definitions and operationalizations among researchers (Brito, 2009). Interpretations frequently involve casual conceptions, not uncommonly through models that ignore important multiple effects (e.g. the influence by prior performance). Simple one-dimensional interpretations of performance are common, and many key independent variables are not observed directly. The research context provides numerous barriers to detailed, multiple-site, historical studies that might yield data more appropriate to the task (March & Sutton, 1997). One central question concerns which dimensions one may choose to represent performance, and how to correctly assess them. There are several possible metrics: financial measures (e.g. ROI, ROA), operations measures (e.g. quality, reliability, cycle time), market measures (e.g. market share, total sales). Venkatraman and Ramanujam (1986) suggest a model based on financial (profitability, growth, market value) and operational performance (quality, innovation, customer satisfaction, reputation). Santos (2009) proposes a 2^{nd} order construct based on profitability and growth. However, before choosing among any of these possibilities, it would be interesting to review why performance is relevant in the first place.

Firms pursue performance through time, i.e. sustainable competitive advantage (SCA). SCA relates to the ability to create superior economic value, compared to its competitors (Peteraf & Barney, 2003). Economic value, in its turn, represents the difference between what customers see as their benefit, subtracted from economic costs incurred by the firm to render the product or service (Figure 1).

Although perceived value (V – C) does not depend of price (P), price establishes how the competitive advantage effect will manifest itself on performance. Given a similar market structure for all competitors, setting prices in higher levels causes a move towards profitability. On the other hand, setting prices in lower levels causes a move towards growth, as the customer will sense a superior benefit, amplifying his will to buy more from this firm (Barney & Clark, 2007). It is important to stress that the V-C difference is not automatically or perfectly transferred to growth, as there are issues such as capacity (e.g. launching the first I-Phone) and inertia (e.g. it takes time to reach all customers). However, it is expected that a sensible part of its manifestation will be measurable through growth indices (e.g. sales, market share, employees).

Figure 1. Price and value allocation.
Adapted from Barney and Clark (2007, p.26)



Costs apparently play no direct part, but firms with lower costs have a greater range of strategic possibilities at hand. Perceived benefit and price, detached from costs considerations, may very well lead to beloved, bankrupted firms (e.g. Panam). These considerations conceptually justify the analysis of these three dimensions of performance: cost, profitability, and growth. Early works on strategy (e.g. Ansoff, Ohmae, Penrose) had a strong focus on growth; contemporary studies on strategy focus on profitability (e.g. Combs, Crook, Venkatraman). Operational performance literature (e.g. DeMeyer, Ferdows, Hayes, Upton) focus on cost (along with measures such as quality, dependability, and flexibility).

Therefore, cost, profitability, and growth will be elements of a 2nd order performance construct in this thesis. As in Sengupta *et al.* (2006), these measures were chosen also for their applicability across a broad spectrum of industrial classifications. At last, given the multi-industry context of this thesis, these dependent variables were designed to capture firm perceived performance relative to its competitors, to avoid confounding the results with disparate inter-industry standards.

2.6.1. Cost

In this thesis cost will be interpreted as cost efficiency. Usually with focus on cost savings, rsearch on manufacturing practices and their relationship to performance have been conducted for long since (Schroeder *et al.*, 2002). After Skinner (1969, 1974) proposes a more elaborated role to manufacturing in business strategy, 'manufacturing capabilities' emerge as complimentary to cost, with measures such as dependability, flexibility, and quality (e.g. Boyer & Lewis, 2002; Hayes & Pisano, 1996; Hayes & Upton, 1998; Rosenzweig & Roth, 2004; Swink & Way, 1995). However, the perception that cost is central remains, and to some extent manufacturing's job still encompasses being as cost efficient as possible (Ward *et al.*, 1996). Firm performance is strongly related to the choice of operational decisions (e.g. capacity, technology, workforce, quality systems) and their impact in operational priorities (e.g. cost, quality, flexibility, and delivery) (Boyer & Lewis, 2002; Ward, Duray, Leong, & Sum, 1995).

A central theme of operations strategy involves how these capabilities are acquired, and how they contribute to a firm's profitability. Capabilities can be considered as stocks of strategic assets, accumulated through a flow of investments over time, a pattern that cannot be easily imitated, acquired or substituted. They are complex, subject to different interpretations by academics and practitioners alike, and capturing them requires great effort (Corbett & Wassenhove, 1993). Although most operational capabilities are multidimensional, they are typically built as one-dimensional indicators, so that distinctions between them are suppressed, leading to confusion in interpretation and generalization (Flynn & Flynn, 2004). However common, cost definitions are not homogeneous, and measurement is diverse. Examples of studies

that propose or operationalized cost as a metric for performance are: Flynn and Flynn (2004); Leong, Snyder, and Ward (1990); Rosenzweig and Roth (2004); Schroeder *et al.* (2002); Vickery, Droge, and Markland (1994); and Ward *et al.* (1996).

Even so, Noble (1995) sees no 'one right way' to combine the multiple indicators that underlie concepts such as cost, specially when each measures a different sub-dimension, and not the capability as a whole. While a more comprehensive framework may be achieved (Table 4), a possible definition to cost is 'producing more spending less'. The cost structure of firms can vary greatly, and its measurement involves indicators such as productivity (output per employee), variable costs (labor, raw materials, energy), fixed costs (plant, capacity, machinery), and stock turnover (Slack *et al.*, 2004; Ward *et al.*, 1996).

Table 4. Operational performance objective constructs
Source: Author.

Authors	Cost
Kim and Arnold, 1992	Competitive price
Corbett and Wassenhove, 1993	Developing, producing, delivering, servicing, disposing
Vickery *et al.* (1994)	Production
Ward *et al.*, 1995	Unit costs, materials, overhead, inventory
Noble, 1995	Inventory, work-in-process, overhead, process, labor productivity, machine time, materials shortage, substitute
Ward *et al.*, 1996	Capital, overhead, labor productivity, materials
Ward, McCreery, Ritzman, and Sharma, 1998	Production, labor productivity, capacity utilization, inventory, productivity
Boyer and Lewis, 2002	Inventory, capacity, production, labor productivity
Schroeder *et al.* (2002)	Percentage of sales
Rosenzweig and Roth, 2004	Production
Flynn and Flynn, 2004	Production

It is important to point that operational measures, such as cost, as not a privilege of manufacturing firms. Gianesi and Correa (1994) propose as criteria for measuring

competitiveness in service operations, along others, indicators such as flexibility, reliability, availability, time, and cost. To Chase *et al.* (2004) speed, variety, quality, and price are determinants of both manufacturing and service performance. Therefore, cost is an important performance indicator for both sectors.

2.6.2. Profitability

Profitability may be the most common representation of firm performance, reflecting how well a firm employ its resources to generate profit (Lumpkin & Dess, 1996; Pace, Basso, & Da Silva, 2003). Profitability measures evaluate (e.g.) liquidity, returns, investments, assets, and debts, measuring firm past financial performance (Brigham, Gapenski, & Ehrhardt, 1999). Investors pay special attention to indices like these, expecting past efficiency to provide future rents. Practitioners and researchers investigating firm performance:

> *(…) have used a variety of measures of profitability: ROA (Zajac, Kraatz, and Bresser, 2000), ROE (Delios and Beamish, 1999), and ROI (Busija et al., 1997; Desset al., 1997; Johansson and Yip, 1994). We measured a firm's profitability performance by three profitability ratios: ROA, ROE, and ROI* (Cho & Pucik, 2005: p.562).

Also, a firm financial performance is frequently measured by the its' profit-related results, and compared with those of its direct competitors (Sengupta et al., 2006). This was later considered in the measurement tool for profitability.

2.6.3. Growth

The term growth may have different connotations in the study of management processes. It may denote an increase in amount (e.g. output, sales), in size (e.g. new product line), in improvements (e.g. quality) (Penrose, 1959). Firms are 'real-life' organizations, consisting of human and non-human resources, cohesive shells that may expand given market opportunities and 'excess' resources (Pitelis, 2002). Growth is an evolutionary process, based on the cumulative expansion of collective knowledge, in the context of a purposive firm. Therefore, the concept of firm growth is

broader than the simple increase in total sales or number of employees (Brito & Vasconcelos, 2009).

Growth is connected to both knowledge development (KD) and culture of competitiveness (CC). A firm's growth is limited by the growth of knowledge within it (Penrose, 1959). In the long run a firm may only expand upon it ability to establish knowledge 'bases', from which it can adapt and extend its operations in an uncertain, changing, and competitive (i.e. turbulent) world. Increased knowledge of firm's resources creates options for growth (Foss, 2002). Also, a firm's growth is dependent upon the entrepreneur within it (Penrose, 1959). In the long run a firm may only expand upon the ability of its managers to render service resources into action, enlarging its capabilities and offering more innovative products and services to the market. The entrepreneurial firm commits part of its resources to growth, investigating possible avenues for profitable expansion.

A wide variety of researchers have used growth either as a sole measure of firm performance or in combination with profitability (Cho & Pucik, 2005). Profits are a condition of successful growth, so both may be equivalent criteria for investment selection (Penrose, 1959). Profit and growth can be competing or complementary objectives, as resources can be used to promote one or both. Therefore, competitive advantage could be seen as a composition of growth and rents, and understanding the nature of the variability in both can support better decisions (Brito & Vasconcelos, 2009). A number of studies (e.g. Hawawini, Subramanian, & Verdin, 2003; Misangyi, Elms, Greckhamer, & Lepine, 2006; Rumelt, 1991) considered financial performance as the dependent variable, but growth can also be seen as an evidence of success and a dimension of performance in a broader sense.

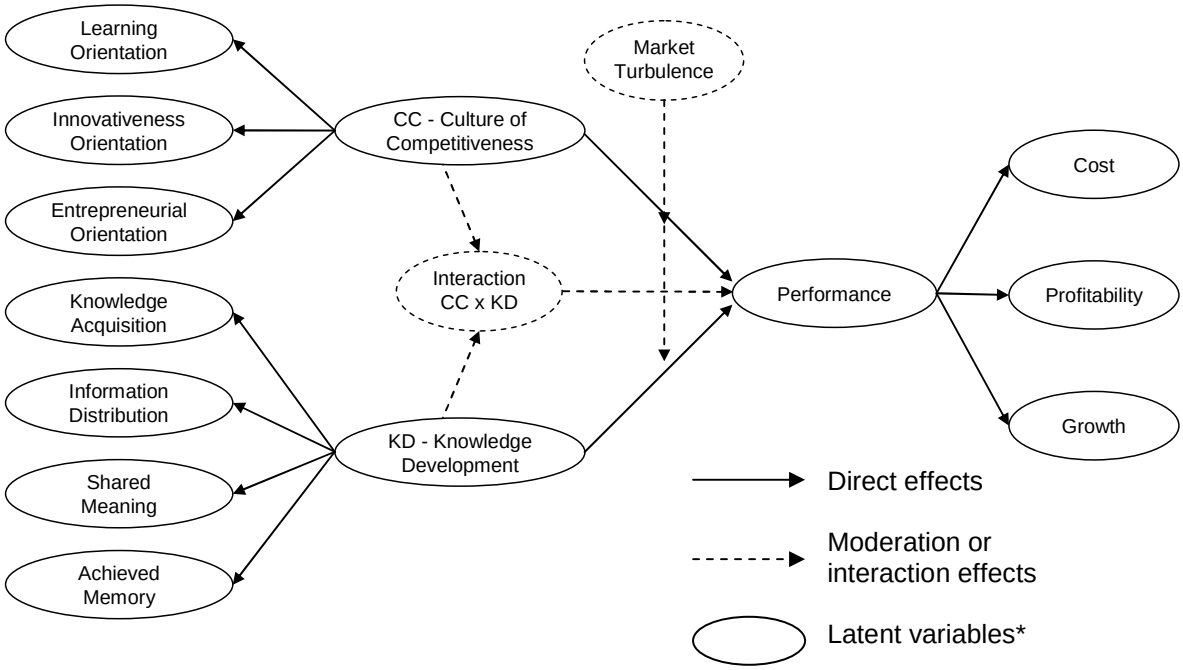
At last, the conceptualizations and hypothesis from this chapter had to be translated into operationalized variables and measurable models. This is done next.

3. RESEARCH OPERATIONALIZATION

The main concepts studied in this thesis were proxies of culture of competitiveness, knowledge development, market turbulence, and firm performance. Culture of competitiveness, a pattern of shared values and beliefs that drive the approach to the marketplace, was formed by learning, innovativeness, and entrepreneurial orientations (Hult *et al.*, 2007). Knowledge development, a haphazard and multi-faceted process, was formed by knowledge acquisition, information distribution, shared meaning, and achieved memory (Huber, 1991; Hult *et al.*, 2007). Turbulence was formed by market turbulence, the rate of change in customers' preferences that affect the environment in which the firm exists (Jaworski & Kholi, 1993). Firm performance was formed by cost, profitability, and growth (Kim & Arnold, 1992; Combs *et al.*, 2004; Penrose, 1959).

Given time and resource constrains in the thesis, CC, *Turbulence*, and *Performance* conceptualization and measurement were taken from existing literature with little modifications. The focus was directed toward KD conceptualization, where a more comprehensive literature review was performed, resulting in propositions for new indicators. Efforts were also directed to discuss Manufacturing and Service firms as independent sets, with sometimes similar, other times different responses to environmental stimuli. The model tested in this thesis is presented in Figure 2. CC was narrowed to internal sources of learning, to the firm's innovative capacity, and to the firm's entrepreneurial actions. KD was focused on the ability to acquire knowledge externally to the firm, to transfer the information internally along different areas, to develop a shared understanding to the whole firm, and to store this achieved memory in tangible (e.g. procedures) and intangible (e.g. routines) ways. Market turbulence was interpreted as the rate to which consumers foster and demand changes in products and services. Performance was expanded to more general measures, from cycle time to a firm's cost, profitability, and growth results.

Figure 2. Culture, Knowledge, and Performance.
Adapted from Hult *et al.* (2007)



** Indicators and respective error factors were suppressed for better model visualization. Each 1st order latent variable has from 3 to 5 indicators, represented by questions in the survey.*

3.1. Hypothesis

Chapter 2 provided the theoretical foundation for hypothesis formulation. Recalling and regrouping, the formulated hypothesis were:

Hypothesis 1: Knowledge development (KD) has a positive association with firm performance.

Hypothesis 2: Culture of competitiveness (CC) has a positive association with firm performance.

Hypothesis 3: Culture of competitiveness (CC) and knowledge development (KD) are associated to each other.

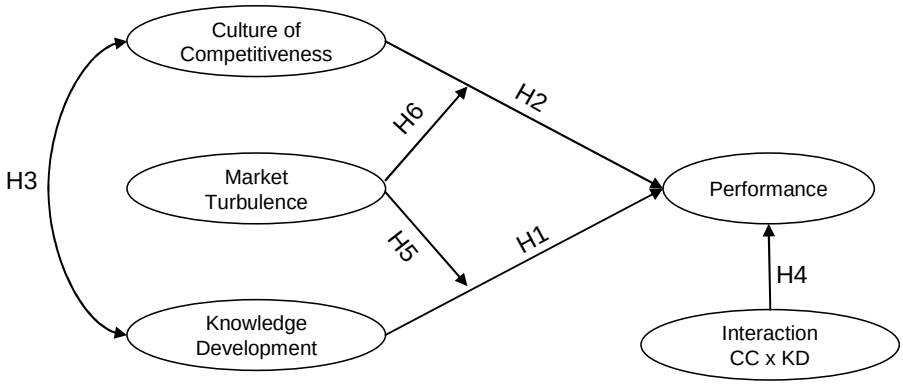
Hypothesis 4: The culture of competitiveness (CC) and knowledge development (KD) interaction has a positive association with firm performance.

Hypothesis 5: Market turbulence has a different moderating influence on the effect of knowledge development (KD) on performance in manufacturing and in service firms.

Hypothesis 6: Market turbulence has a different moderating influence on the effect of culture of competitiveness (CC) on performance in manufacturing and in service firms.

How these hypothesis fit in Figure's 2 model is summarized in Figure 3 and Table 5.

Figure 3. Summarized model, with hypothesis.
Source: Author.



3.2. Hypothesis Testing

Hult *et al.* (2007), Jaworski and Kholi (1993), Moorman and Miner (1997), and Schroeder *et al.* (2002), among others, provided the measurement framework for testing knowledge influence on performance under market turbulence. Past research, while contributing with insights for operations management literature, was not exhaustive. Hult *et al.* (2007) (e.g.) focused on supply chains, i.e. inter-reliant units that work through network structures. This thesis focus on the firm, i.e. a fully operational structure based on a series of integrated systems. The authors

considered cycle time as dependent variable, the length between taking an order and delivering it to the customer (an important success indicator of a supply chain, e.g. Dell, Zara, Toyota). This thesis considers cost, profitability, and growth, grouped in a performance construct, as dependent variables. They worked with American respondents from manufacturing firms. This thesis works with Brazilian respondents from manufacturing and service firms (Brazil representing an emerging global player).

Replicating elements of previous operationalizations contributes to the consolidation of theory and the development of more reliable scales in operations management. Working with a different unit of analysis reinforces generalization, where later studies and current results converge. Also this thesis promote contributions of its own, given some distinctive measurement characteristics, e.g. multiple scores for one given firm were averaged, controlling for multiple respondent bias. These replications and contributions are performed next.

4. RESEARCH METHODOLOGY

The main objective of this thesis was to empirically test the effect of knowledge on performance, and the possible influence of market turbulence as a moderator. The specific objectives were: literature review on culture, knowledge, and performance; measurement scale translation and refinement; survey execution to a wide range of firms; data analysis using descriptive statistics, SEM, and linear regressions; model refinement and hypotheses testing *per si*; conclusion on the suggested propositions. These steps are clarified and detailed next.

4.1. Instrument Development

As a direct measurement was not possible, indirect measures were obtained through indicators. *CC* was defined as a latent 2nd order construct based on the latent 1st order constructs of *Learning*, *Innovativeness*, and *Entrepreneurial* orientations. Each of these 1st order constructs, in turn, had its own set of indicators, initially comprising four observable variables, obtained through the application of a tailor-made survey, where the intensity of the responses was captured into interval scales. Likewise: *KD* was defined as a latent 2nd order construct based on the latent 1st order constructs of *Knowledge Acquisition*, *Information Distribution*, *Shared Meaning*, and *Achieved Memory*; and *Performance* was defined as a latent 2nd order construct, based on the latent 1st order constructs of *Cost*, *Profitability*, and *Growth*.

A traditional way to describe the actions implemented for measurement development involve: construct domain specification, sampling generation, pilot data collection, measurement purification, effective data collection, reliability and validity assessment, and norm development. Forza's (2002) suggestions for survey research in Operations Management were followed. Based on links to the theoretical level, a research design was developed and discussed, supporting a pilot test. Pilot data collection provided inputs for design review, until an acceptable set of questions, rules, fill devices, samples, and contact forms was achieved. Then data was collected

for theory testing, supported by statistical analysis to test the hypothesis. At last, results were summarized and reported in this thesis. In summary:

- To assess *Culture of Competitiveness* scales developed by Schroeder *et al.* (2002) and Hult *et al.* (2007) were translated to Portuguese and revised.
- To assess *Knowledge Development* scales developed by Hult *et al.* (2007) were translated to Portuguese and revised, with additional questions not empirically tested before based on works of Levinthal and March (1993), Szulanski (1996), Nahapiet and Goshal (1998), Daft and Weick (1984), Donnellon *et al.* (1986), Conner and Prahalad (1996), and Grant (1996b).
- To assess *Market Turbulence* scales developed by Hult *et al.* (2007), based on Jaworski & Kholi (1993), were translated to Portuguese and revised.
- To assess *Performance* scales developed by previous thesis and dissertations on FGV, specially Santos (2008), were revised.

APPENDIX 2 presents the complete, revised questionnaire. A website was designed to support respondents (www.pesquisa-competividade.com), and an Internet engine hosted the survey (www.zoomerang.com). Modifications from the original to revised scale involved barriers such as (but not limited to) translation, unity of analysis, question differentiation, and theoretical inputs. Initially the scales for *CC* and *KD* were extracted from Hult *et al.* (2007). For every question previous works referenced by the authors were recalled, so the original indicators could be recovered and analyzed. New questions were added based on literature review. Scales with as much as four questions expanded to up to eleven.

The enlarged scales were adapted for the new unity of analysis (supply chains to firms), new background (marketing to operations), and new language (English to Portuguese), giving origin to a first draft. This was discussed among academic scholars and management professionals, so that questions could be refined and adjusted. When modifications were suggested, preference was given to sustain indicators as in Hult *et al.* (2007), as this scale was validated and served as the starting point for this thesis. Also, questions rejected by Hult *et al.* (2007) took precedence for deletions. This process is illustrated in APPENDIX 3.

A second draft emerged and was subjected to pilot testing. A total of six rounds, involving about 180 professionals, students from extension or MBA programs in Brazilian top business schools (e.g. FGV, Insper) was conducted for questionnaire refinement. For every set of answers Cronbach alphas were calculated for the 1st order latent constructs (e.g. *Learning Orientation*), theory was revised, adjustments were discussed with fellow academics, and a new version of the survey was prepared. Pilot testing (e.g.) pointed that the learning orientation construct had measurement problems, with bias to 'agree' and 'completely agree'. Therefore, Hult *et al.* (2007) scale was substituted by Schroeder *et al.* (2002) 'internal learning' scale, which proved more stable. This measurement instrument review process took three months, from January to March 2009, and resulted in the final version used for data gathering. This procedure was necessary to prevent measurement error, i.e. the result of poor question wording or questions being presented in such a way that inaccurate or non interpretable answers are obtained (Dillman, 2007).

After theoretical and empirical considerations, an updated list of indicators was achieved for the independent 1st order latent constructs (APPENDIX 2). Questions 1 to 32 were responded based on a five point Likert scale, where the respondent gave his opinion ranging from *Completely Disagree* (1) to *Totally Agree* (5). Questions 33 to 41 were also based on a five point Likert scale, but the respondents had to compare their firm to competitors, based on results of the last three years, ranging from *Much Worse* (1) to *Much Better* (5). Therefore, all indicators were scalar, being later associated integer numbers from 1 to 5. Based on this measurement, descriptive statistics (mean, standard deviation, kurtosis, asymmetry, minimum, maximum, outliers, missing values) was calculated for each question (APPENDIX 4).

SEM calculations were imputed with scalar data, directly obtained from the questions. Linear regression calculations were imputed with standardized summated values, obtained from grouping questions around their respective latent constructs. Factor loadings, indicator errors, factor correlations, intercepts, and factor means were calculated, and were always presented as normalized results. With 37 revised questions, the measurement input matrix had 703 elements, with 131 freely estimated model parameters, resulting in 572 degrees of freedom - an over identified model where loadings, errors, covariances, and fit calculations could be statistically

estimated. Finally, reliability issues were dealt with, along with content, convergent, discriminant, and criterion-related validity.

4.2. Data Collection

Data collection was complex, extending itself for about nine months. This was considered necessary in an attempt to: maximize the number of valid responses; and cover all major national encounters on knowledge held in Brazil during the year 2009. Several sources were sought, with different success levels. Data handling involved several steps, conducted with a preoccupation for cutting of responses that were not at least 90% complete. These and other considerations are presented next.

4.2.1. Data Sources

A survey that was conducted, focused on professionals with leadership positions in Brazilian organizations, regardless of sectors, geographical regions or others censoring characteristics. Division was performed later, when respondents were grouped in independent samples based on firm sector (e.g. Manufacturing). Sampling was casual, as potential respondents were contacted through:

- E-mail data bases (e.g. *FGV Online*, *Conexão*, CIESP, ABRH-AM). An invitation was sent electronically, with an hyperlink to the survey website.
- Presentations on national workshops oriented to knowledge management discussions (e.g. GMC, WBICGC, KM). A short speech introduced the study, printed questionnaires were distributed, delivery kiosks were implemented, and participants received result feedback at the event closure.
- Ministration for MBA related students, in operation management and HR disciplines (e.g. MBA HR FIA, MPA FGV, CEAG FGV). A short speech introduced the study, printed questionnaires were distributed, and participants were asked to deliver their answers to their professors.

This data collection strategy resulted in a wide disclosure: several thousands professionals were contacted, e.g. receiving an e-mail or watching a presentation of this thesis in a seminar. The exact numbers are not available, as some data sources

(e.g. FGV Online) did not disclosure the actual number of people the contact was sent to. However, it was possible to estimate more than 5.000 respondents' visits to the survey website. Data gathering was conducted from April to October 2009, and the entities that contributed with the 3,037 total answers were:

- *FGV Online*: subsidiary of the FGV Business School responsible for e-learning activities. With around 3 million participants (including students and alumni), it performed an email action for an unknown number of potential respondents (the information was undisclosed for this thesis). The survey was assessed through a web link, and 2,222 answers were obtained.
- *ABRH-AM*: regional office of the *Brazilian Society of Human Resources*. The survey was delivered in their *IX Amazon Human Resources Congress*, with 450 questionnaires distributed, and 91 answers.
- *Conexão*: business school in the Vale do Paraiba region (SP). The survey was sent to 600 alumni, with 105 answers.
- *FGV CEAG & MPA,* and *FIA HR MBA*: extension students from distinct business schools, attending to HR and Operations disciplines, were invited to answer the survey, either through e-mail or in its printed form. They represented a wide range of firms, with around 280 potential participants that provided 165 answers.
- *GMC 2009*: national workshop sponsored by *The Know Network*, held in São Paulo (SP) on May 2009. The survey was distributed to around 300 participants, with 53 answers.
- *KM 2009*: national workshop sponsored by SBGC (*Brazilian Society of Knowledge Management*), held in Salvador (BA) on September 2009. The survey was distributed to around 450 participants, with 97 answers.
- *IX WBICGC*: regional workshop sponsored by Embrapa Oriental (government foundation), held in Belém (PA) on June 2009. About 200 potential respondents were present, representing mainly government-related firms. The survey was distributed to all participants, with 53 answers.
- SUFRAMA: government office responsible for industrial incentives in the Amazon region. These participants, comprising 238 firms, were contacted in several ways to answer the survey. Techniques proposed by Dillman (2007) were employed, and 73 answers were obtained.

- CIESP: class association of São Paulo state industries. Its associate list in the Vale do Paraiba involved 317 firms, and its participants were contacted in several ways to answer the long survey. Techniques proposed by Dillman (2007) were employed, and 55 answers were obtained.

From the start, actions were planned to foster participation, involving, but not limited to (Dillman, 2007) the following:

- In the website, through mail, and during seminars, the survey was introduced to potential respondents in a positive way. Rewards were offered, such as: complete access to research material, magazines and sticks as tokens of gratitude, 'thank you' messages, easy wording, interesting question order, short survey, open space for advice and feedback, results presentation in open debates, minimization of personal information requests, and other actions were extensively sought during survey application.
- Sponsorship by legitimate authority was highly evidenced. Snow ball support was gathered with academic (e.g. FGV, UFAM), government (e.g. SUFRAMA, FUCAPI), and associations (e.g. SBGC, ABRH) groups. Invitations included several logos, and for each contacted partner a new institution would present itself offering support (e.g. ISAE after ABRH-AM).
- Special attention was given to survey layout, design, and easy-to-answer engine. As e-mails were the main publicizing vehicle, several considerations were made on wording, emphasis and readability for any type of software. In answer to respondent distrust (e.g. e-mail virus preoccupations), a phone and a dedicated website were available. If the respondent preferred to type the website, the string was an easy one, with only common words, all related to the research, such as www.pesquisa-competitividade.com/manaus.

The mixed-mode format proposed by Dillman (2007) was conducted for part of the sample, specially for SUFRAMA and CIESP groups. In some occasions data was collected from different members of a firm (usually HR or Operations professionals), contacted through regular mail, e-mail, telephone, or even personally (as during seminars). Although web based and printed questionnaire were pretty much the same, it is possible that the vehicle (Internet *versus* paper) may have influenced answers in some unforeseen way (e.g. web answers can be modified leaving no

mark, while changing opinion in a paper leads to scraping). Despite use of Dillman's (2007) techniques, response was bellow initial expectations: around 60% among MBA-like students, and 15% in tightly controlled populations (e.g. SUFRAMA), workshops, congress, and e-mailing. It is important to stress that it was impossible to determine response rate for *FGV OnLine*, as the number of e-mails sent with the link to the survey was not released by the institution. One possible explanation for low response rate resides on the poor quality of data bases (e.g. CIESP). The total number of participants, however, was sufficient for a statistical analysis. The fact that a convenience sample was used, and not a statistical one, is relevant, but not determinant - while probability sampling are preferred, the important feature of a sample comprises if it is suitable to test the theory (Lee & Lings, 2008).

4.2.2. Data Handling

The survey was usually ministered in very tight windows:

- *FGV Online*: opened on September 11 and closed on December 17, with 65.5% responding in the first 3 days, and 92.2% responding in the first week.
- *ABRH-AM*: all answers obtained from October 9 to 10, in their congress.
- *Conexão*: opened on September 11 and closed on December 23, with 58.1% responding in the first 3 days, and 86.7% responding in the first week.
- *FGV CEAG & MPA,* and *FIA HR MBA*: opened on August 12 and closed on September 29. Each class was contacted in a different week, responding in the same Internet engine, so its was not possible to determine a percentage of answers for the first 3 or 7 days. However, 90.3% responded in up two weeks.
- *GMC 2009*: all answers obtained from May 26 to 28, in their congress.
- *KM 2009*: all answers obtained from September 23 to 25, in their congress
- *IX WBICGC*: all answers obtained from June 2 to 4, in their congress.
- SUFRAMA: opened on June 24 and closed on September 17, with 13.7% responding in the first 3 days, and 21.9% responding in the first week. A 2nd wave, started on July 13, helps explaining the dispersion.
- CIESP: opened on July 22 and closed on October 1st, with 40.0% responding in the first 3 days, and 43.6% responding in the first week. A continuous wave of phone calls from opening to closure helps explaining the dispersion.

As in each group data was usually collected in less than a week, comparing early and late respondents made little sense. When reinforcements were implemented, they were done in the next two days of data collection start. *FGV Online*, which accounts for 73.2% of all respondents, counted with no reinforcements at all. The groups with continuous reinforcements for larger time-frames were CIESP and SUFRAMA, where a significant dispersion in response dates was obtained. However, they contributed only to 4.2% of the total data. Therefore, checking for systematic differences between early and late respondents did not apply to this thesis, as for the majority of respondents no significant additive efforts were performed along time to stimulate answers. On the other hand, comparing one group to the other implied in systematic differences, e.g.: WBICGC concentrated government respondents; GMC 2009 and MBA students concentrated service firms from São Paulo. In the end, non-response bias could not be assessed, as details from each origin group were not available in most cases. So non-response bias was an inhibitor in this thesis analysis, and conclusions had to be interpreted with caution. The large number of responses was a mitigating factor, as the greater the sample of firms, the more it is likely to represent Brazilian firms population. However, obtained data did not allow for statistic generalization, as discussed in methodology.

Next, data handling involved a missing value purification processes for the 3,037 answers, with the elimination of 1,002 respondents due to:

- Answers with more than two missing values along the CC indicators.
- Answers with more than two missing values along the KD indicators.
- Answers with more than one missing value along the *Turbulence* indicators.
- Answers with more than two missing values along the *Performance* indicators.
- Answers with more than four missing values along the entire questionnaire.
- Respondents from non-Brazilian firms (e.g. Angola).
- Respondents currently unemployed.

The number of respondents after data purification was adequate. The remaining 2,035 answers were subjected to a descriptive statistical analysis for each question (APPENDIX 4), and results were acceptable for all parameters: means were between 2.6 and 3.6; standard deviations between 0.8 and 1.3; kurtosis absolute maximum was 1.3; asymmetry absolute maximum was 0.6; and maximum number of missing

values for a question was 26 (less then 1.5%). Univariate normality was considered acceptable, and remaining missing values were substituted by the respective question's mean. Respondents represented more than 1.206 organizations, that were divided into six categories: Service (800), Manufacturing (511), Government (264), Commerce (135), 3rd Sector / NGO (49), and Unidentified (276). Professionals from different areas participated, with highlights to *HR* (13%), *Management* (10%), *Operations* (9%), and *Finance* (7%). They had titles such as director, manager, consultant, leader, and specialist. All were instructed to focus on their strategic business unit upon answering the questions. No relevant outliers were found, and a summary of the complete sample characteristics is presented in Table 5.

Table 5. Complete sample characteristics
Source: Author

ORIGINS	#
FGV Online	1552
Manaus	110
Vale do Paraíba	107
MBA Disciplines	141
Workshops	125
Total	**2035**

MACRO SECTOR	#
Service	800
Manufacturing	511
Government	264
Commerce	135
3rd Sector	49
Unidentified	276
Total	**2035**

AREA	#
HR	257
Management	200
Operations	172
Finance	132
Unidentified	343
Other	931
Total	**2035**

TOP 5 INDUSTRIES
Education
Finance
Consulting
Health Care
Automotive

TOP 5 FIRMS
Banco do Brasil
Itaú Unibanco
CEF
Embrapa
Petrobras

The survey could not correctly assess Government, as some constructs were not fit for the public sector (e.g. *Profitability*). Inferences from Unidentified had little use, as it was impossible to determine which samples they represented. Commerce did not have sufficient independent observations. Authors such as Fitzsimmons and Fitzsimmons (1997) propose commerce as trade services (e.g. retailing), therefore Commerce should be a part of Service sector, and responses should be summated

for them. 3rd Sector / NGO was not considered for: being too small, and being inadequate to some constructs (e.g. *Profitability*). Given these absences, the complete sample was taken as a reference, and no statistical inferences (other than descriptive statistics) were performed for it - only Manufacturing and Service were further analyzed. After eliminating respondents that did not identify their firm, and after controlling for multiple respondents by reducing all inputs from a same firm to its mean, the Manufacturing sample ended with 334 valid respondents, while the Service sample ended with 509 valid respondents.

4.3. Model Estimation & Evaluation

4.3.1. Models

Assessments based on Brown (2006) and on Raykov and Marcoulides (2000) were done to estimate the model, using SPSS 16 and AMOS 16 softwares. The psychometric properties of the constructs were evaluated through a confirmatory factor analysis (CFA), where maximum likelihood (ML) was used as estimation method (Brown, 2006). Three 1st order latent variable models were tested: (1) *Learning*, *Innovativeness*, and *Entrepreneurial* orientations (Figure 4a); (2) *Knowledge Acquisition*, *Information Distribution*, *Shared Meaning*, and *Achieved Memory* (Figure 5a); and (3) *Cost*, *Profitability*, and *Growth* (Figure 6a). After dimensionality, reliability, and validity considerations, three purified 2nd order latent variable models were assessed, respectively for CC (Figure 4b), KD (Figure 5b), and *Performance* (Figure 6b). A complete measurement model connecting 1st (Figure 7) and 2nd order (Figure 8) indicators was performed, and measurement properties were reassessed when necessary. Then the structural model (Figure 9) was calculated, resulting in estimates used in hypotheses testing.

Figure 4. 1st and 2nd order latent variables models for CC.

Source: Author.

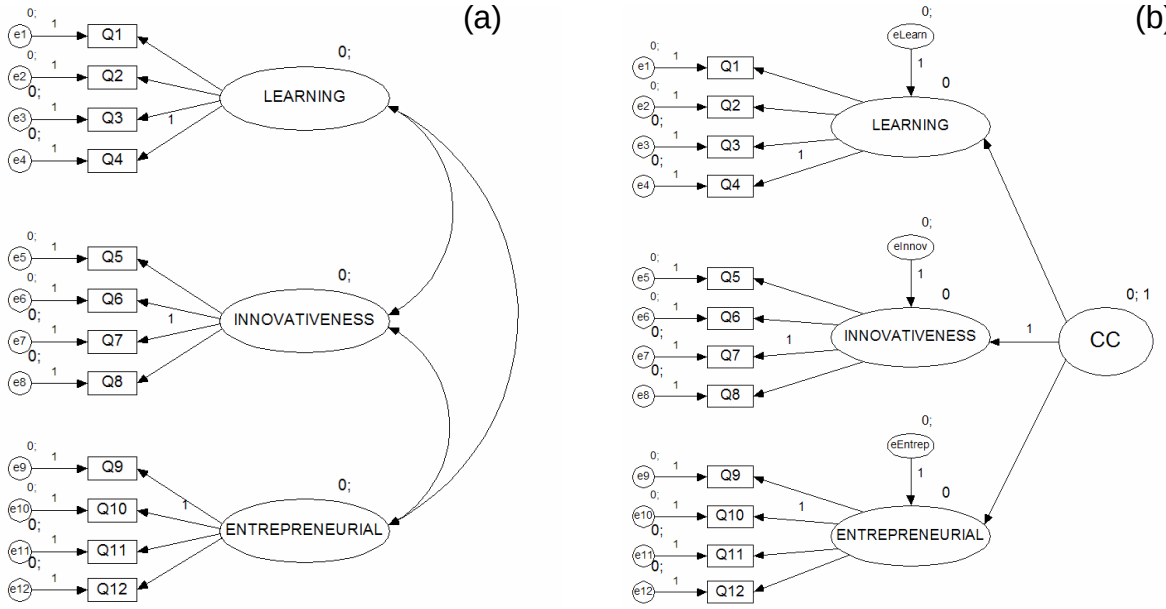


Figure 5. 1st and 2nd order latent variables models for KD.

Source: Author.

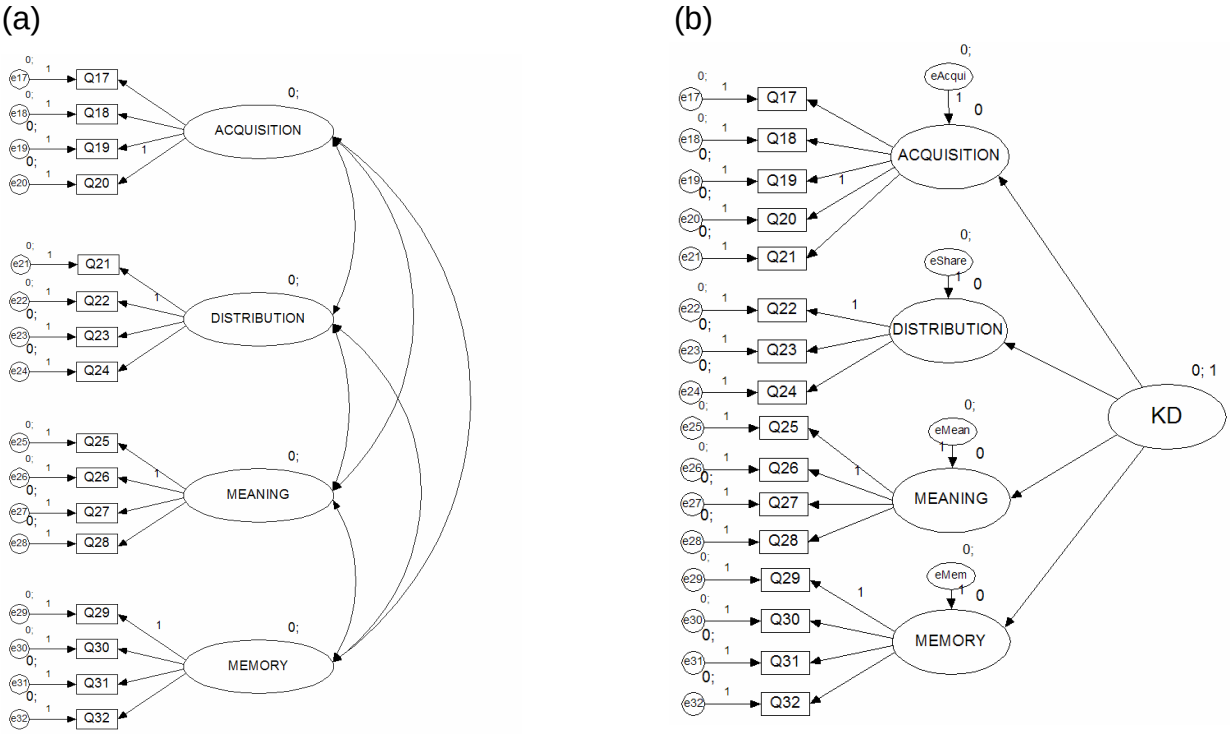


Figure 6. 1st and 2nd order latent variables models for *Performance*.

Source: Author.

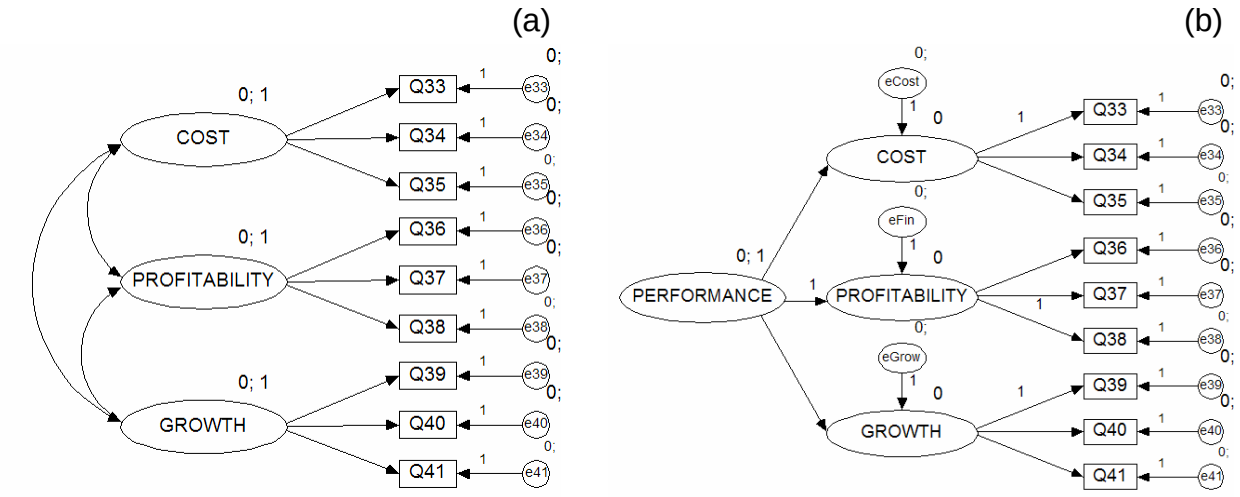


Figure 7. Complete 1st and 2nd order measurement models.

Source: Author.

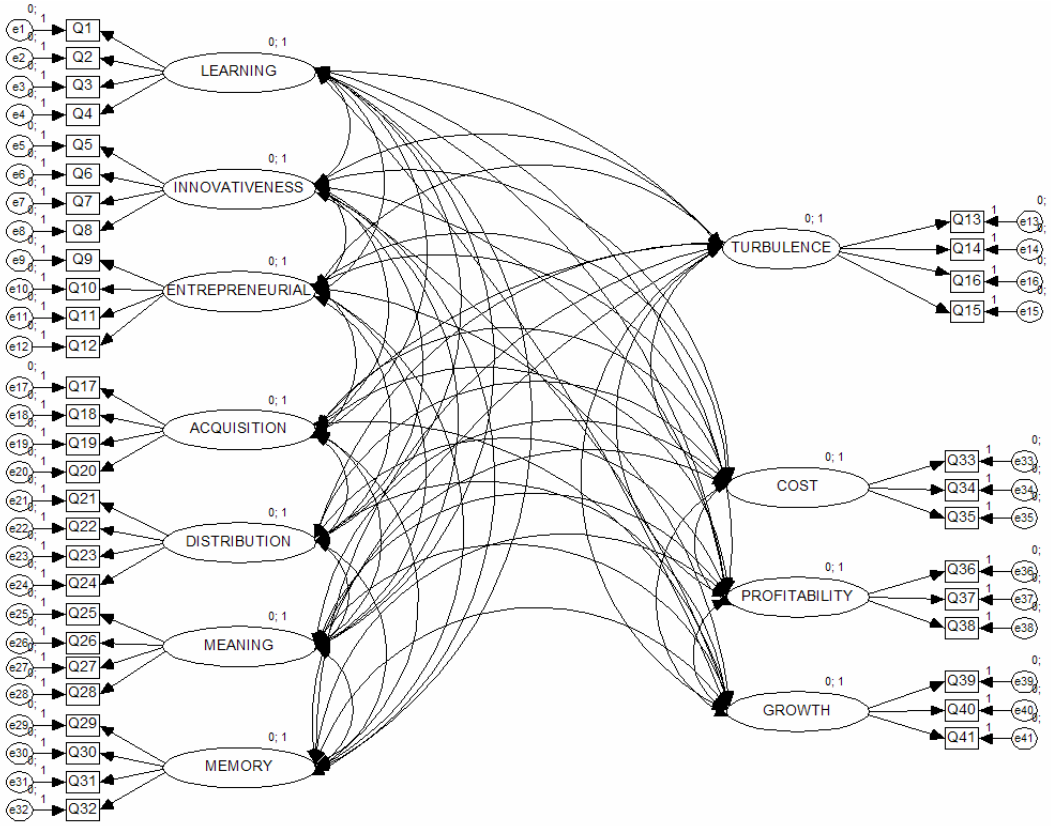


Figure 8. Complete 1st and 2nd order measurement models.

Source: Author.

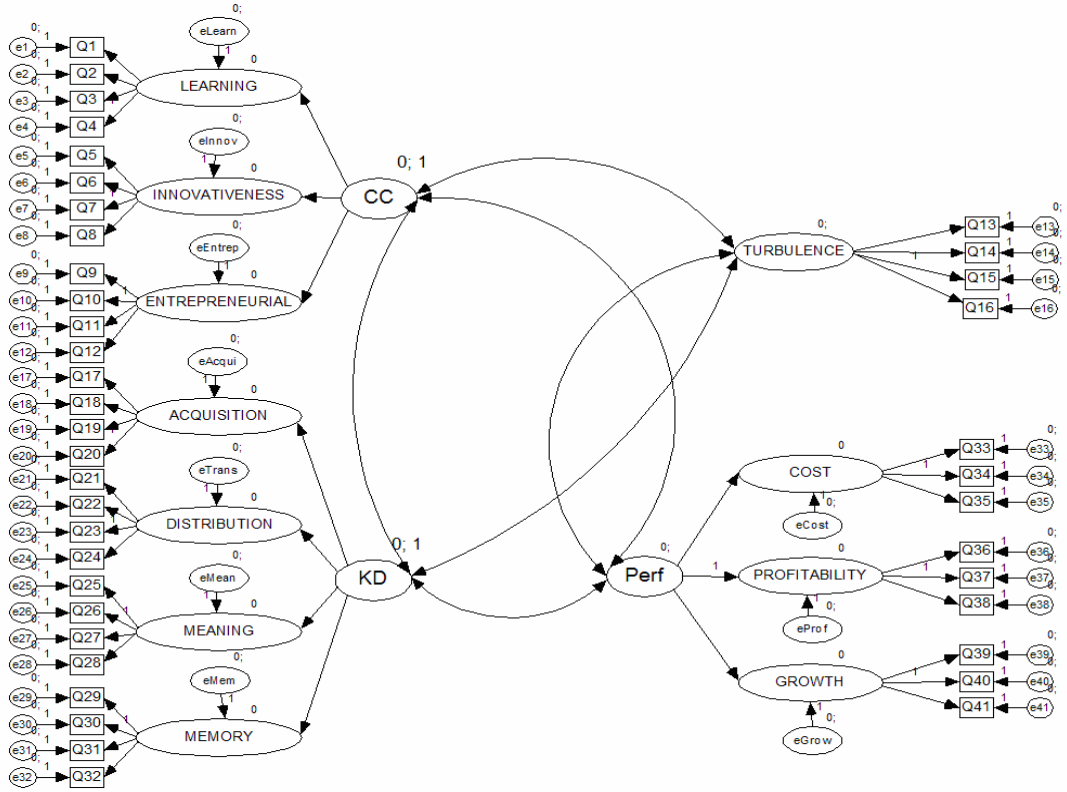
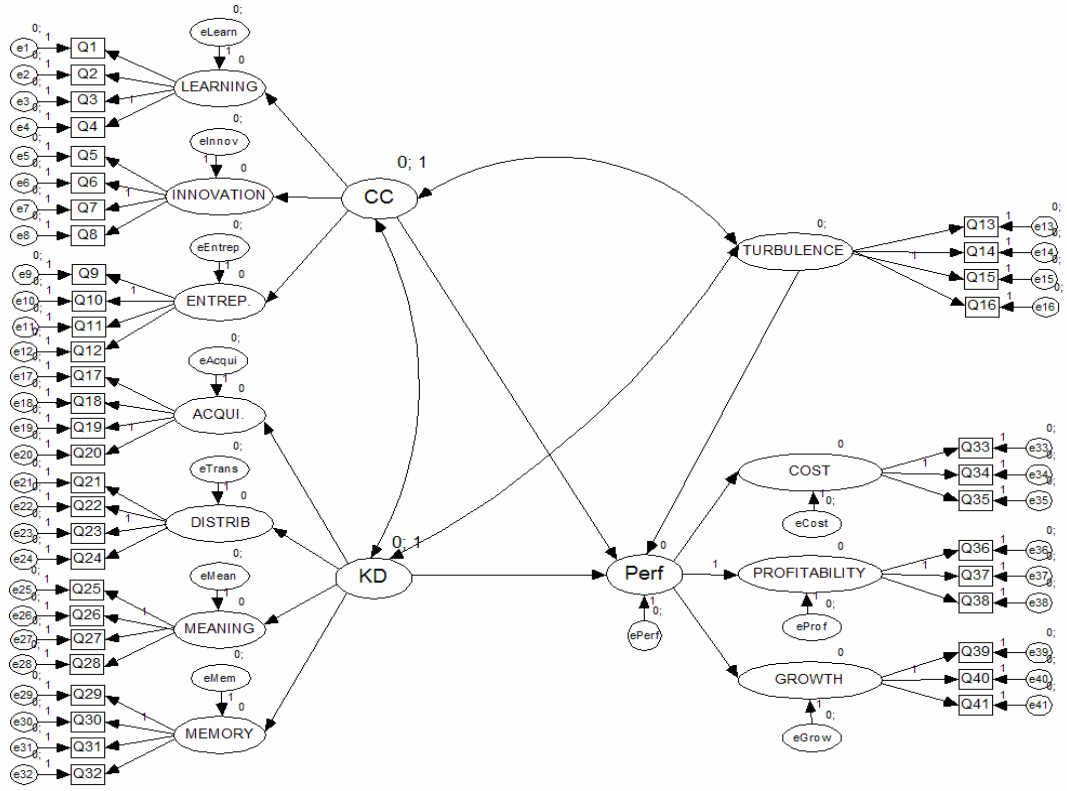


Figure 9. Structural model.

Source: Author.



4.3.2. Measurement Properties

Dimensionality assessment involved testing the model through confirmatory factor analysis (CFA). To use Maximum Likelihood the advisable minimum size for the sample is 100, and the ratio between number of subjects and parameters must be above 5:1, as model stability would be really doubtful when a ratio is less than this value (Hair *et al.*, 1995; Kline, 1998). Also, multivariate normal distribution of variables must be assumed, although only univariate normality was assessed in data analysis. This is a limitation, but not a definitive one: ML is a robust method, and the main implication of lack of multivariate normality is underestimation of confidence intervals. Loadings and covariances were observed to check if variables had problems concerning one-dimensionality (none were found). Items underlying a construct were sufficiently different from each other to guarantee independence, and sufficiently correlated to one another to guarantee existence of a latent variable (Netmeyer *et al.*, 2003). Factor loadings were greater than .30, an indication (in applied research) that they were meaningful (Brown, 2006). No estimates took out-of-range values such as completely standardized factor correlations that exceed 1.0, negative factor variances, or negative indicator error.

Model fit was evaluated using indices recommended by Brown (2006), Kline (2004), and Shumacker and Lomax (1996):

- NFI, normed fit index. Values bellow .90 can usually be improved substantially.
- RFI, relative fit index. Values close to 1 indicate a very good fit.
- IFI, incremental fit index. Values close to 1 indicate a very good fit.
- TLI, Tucker-Lewis coefficient. Values bellow .90 can usually be improved.
- CFI, comparative fit index. Values above .90 indicates acceptable model fit.
- RMSEA, root mean square error of approximation. Some authors suggest values bellow .08 as adequate model fit (e.g. Brown, 2006), while others prefer a .05 reference (e.g. Kline, 2004).

NFI and RFI are positively sensitive to the increment of sample sizes, so goodness-of-fit measures may present artificially strong results if the sample is large (Kline, 1998; Paiva *et al.*, 2008). Other measures, such as TLI, should be more advisable in this situation. Also, goodness-of-fitness indices were only one aspect of model

evaluation, as it was equally important to examine areas of potential localized strains in the solution. These were provided by modification index (MI) and error standard covariance residuals (SRC) analysis. The MI reflected an approximation of how much model qui-square would decrease if the parameter was freely estimated, and the largest MI values were dealt with (Brown, 2006). The SRC matrix provided information on how well each variance and covariance was reproduced by the model's parameter estimates. These values, that could be interpreted as Z scores, were specially observed if greater than 1.96 (to a 5% significance level) and 2.58 (to a 1% significance level). It is important to notice, however, that MI and standardized residuals are sensitive to sample size. Thus, a modification based on either was done only when there existed a compelling substantive basis for doing so, supported by empirical, conceptual, and practical consideration.

Reliability concerned permanent effects that persisted from sample to sample. It was assessed in two ways: comparing results along Manufacturing and Service; testing constructs internal consistency in both samples. Internal consistency assessed the presence of items interrelatedness, i.e. high inter item correlation (Netmeyer *et al.*, 2003). Its evaluation was performed through Cronbach alpha, composite reliability (CR), and average variance extracted (AVE) calculations. Cronbach alpha represented the proportion of a scale's total variance that attributable to a common source. Netmeyer *et al.* (2003) suggest values greater than .70. Composite reliability (CR) was calculated based on the formula $CR\eta = \Sigma(\lambda\gamma i)^2 / (\Sigma(\lambda\gamma i)^2 + \Sigma\varepsilon i)$, where: $CR\eta$ = composite reliability for scale η; λyi = standardized loading for scale item γi, and εi = measurement error for scale item γi . Parameter estimates and associated *t*-values were also examined. CR values greater than .70 were considered adequate, given .40 minimum factor loadings. Average variance extracted (AVE) was calculated based on the formula $V\eta = \Sigma\lambda\gamma i^2 / (\Sigma\lambda\gamma i^2 + \Sigma\varepsilon i)$, where: $V\eta$ = average variance extracted for η; λyi = standardized loading for scale item γi, and εi = measurement error for scale item γi. AVE values greater than .50 were considered adequate (Netmeyer *et al.*, 2003).

Construct validity represented the degree to which measures obtained actually correctly evaluated the latent construct they intended to. The steps involved were: (1) theory specification (constructs and their relations); (2) measurement method

development; (3) empirical tests on how well indicators measured the constructs; and (4) structural test, where relations encountered were evaluated (Netmeyer *et al.*, 2003). Step 1 was achieved through literature revision; step 2 involved reassessment and revision of Hult *et al.* (2007); step 3 pertained data collection and measurement model analysis; and step 4 was conducted in structural models analysis. Other necessary checks, suggested by Netmeyer *et al.* (2003), were also performed to assess construct validity:

- Face validity: inspection of the final product to make sure nothing went wrong in transforming plans into an instrument. Involves ease of use, proper reading level, clarity, easily read instructions, and easy to use response formats. Successive versions of the questionnaire, revisions with academics, and feedback from respondents were constantly incorporated in the survey.
- Content validity: evaluation of items (indicators), establishing if they constituted a proper sample of the theoretical domain in every variable. Items had to be relevant to and representative of the construct, and were screened by 'judges' with expertise: advice from HR and operations professionals, as well as five successive pilot studies, involving 181 respondents, and a post-test study with more 130 respondents, helped instrument refinement.
- Criterion validity: observation of the extent to which current measures covaries with previously validated measures of the constructs. Final results were related to Hult *et al.* (2007), although not entirely similar. Differences between the studies (e.g. sample, country, unity of analysis, dependent variables) may explain why criterion validity was not completely achieved. Although considering Hult *et al.* (2007) as a starting point, this thesis was not a replication of that study.
- Discriminant validity: a convergence test across different measures of the same variable was performed, followed by a test for divergence between measures of related, but conceptually distinct, concepts.

Discriminant validity calculations were presented in Chapter 5. Convergence was observed for CC, as *Learning*, *Innovativeness* and *Entrepreneurial* orientations had correlations higher than .73 in the 1st order model, and loadings higher than .84 in the 2nd order models. Convergence was observed for KD, as *Knowledge Acquisition*, *Information Distribution*, *Shared Meaning*, and *Achieved Memory* had correlations higher than .69 in the 1st order model, and loadings higher than .80 in the 2nd order

models. Convergence was observed for *Performance*, as *Cost*, *Profitability*, and *Growth* had correlations higher than .76 in the 1st order model, and loadings higher than .85 in the 2nd order models. At last, discriminant validity was calculated, using qui-square comparison to evaluate if the involved matrices did not differ (Brown, 2006). Variables in a same construct were expected to discriminate, e.g. *Learning*, *Innovativeness* and *Entrepreneurial* orientations were expected to significantly differ from one another. The possible pairs were examined in a series of two-factor CFA models (e.g. *Learning* against *Entrepreneurial* orientations), first separating the variables, and next placing all indicators as components of only one variable. All pairs were highly discriminant.

Finally, 1st and 2nd order models were expected NOT to discriminate. When, after qui-square testing, the 2nd order model did not statistically differ from the 1st order model, it could be said that both models had similar fit to data, not differing significantly from one another. Therefore, the 2nd order model could be accepted. When 1st and 2nd order models were discriminant, the 2nd model had to be rejected, as it statistically represented a significant worse fit to data than the 1st order model. In these cases other arguments had to be presented to validate the 2nd order model, e.g. theoretical considerations and high factor loadings.

4.4. Methodological Limitations

As carefully as data collection could have been conducted, limitations were present *ex ante*. Problems identified by Forza (2002) in survey occurred to some extent, like insufficient clarity of concepts, lack a common terminology among respondents, and sample selection and description. To the author, each data collection method has merits and shortcomings, so decisions on which method is best must be based on the needs of the specific survey as well as time, cost and resource constraints.

Back to Dillman (2007), despite efforts to minimize survey error, they were relevant in some aspects. Choosing not to gather a random sample incurred in sampling error. Coverage error was present as some respondents were sought in several ways (mail, e-mail, phone), while others received only an e-mail. Also, those who were part of an

association (e.g. ABRH-AM) and those who were present in a seminary (e.g. GMC 2009) had higher chances to participate than others. Nonresponse error was not assessed, as with an undefined population it is not feasible to extract comparable characteristics among people who responded the survey and those that did not. These limitations weaken the power and generalization of the thesis' conclusions.

5. DATA ANALYSIS & REPORT

5.1. Manufacturing

The Manufacturing sample considered 334 respondents. A summary of data origin, sector, area, and firms is presented in Table 6. These inputs were subjected to descriptive statistical analysis for each question, and results were acceptable for all parameters: mean values were between 2.6 and 3.7; standard deviations between 0.8 and 1.2; kurtosis absolute maximum was 1.1; asymmetry absolute maximum was 0.6; and maximum number of missing values for a question was five (less then 1.5%). Univariate normality was considered satisfactory. Next each latent variable had their questions summated, e.g. Q1 + Q2 + Q3 + Q4 formed *Learning Orientation*. Means, standard deviations, and variables correlations were calculated (Table 7).

Table 6. Manufacturing: characteristics summary.
Source: Author.

DATA ORIGINS	#
FGV Online	192
Manaus	21
Vale do Paraíba	41
CEAG, MBA, MPA	22
GMC, WBICGC, KM	4
Multiple* Sources	54
Total	**334**

TOP 5 INDUSTRIES
Civil Construction
Automotive
Food & Beverage
Electronics
Metallurgy

TOP 5 AREAS
HR
Operations
Finance
Management
Trading

TOP 5 FIRMS
Petrobras
AmBev
Embraer
Daiichi
BASF

** Multiple groups two or more respondents from the same firm, e.g. one Natura respondent contacted through FGV Online and two Natura respondents contacted through GMC 2009 are represented as one input for Multiple sources in Data Origins.*

5.1.1. Manufacturing: CC Measurement Properties

CC measurement properties were assessed. Dimensionality involved testing the model through CFA, checking out-of-range estimates, and calculation of SEM fit (e.g. MI, SRC, CFI, RMSEA). Reliability involved internal consistency assessment through Cronbach alpha, composite reliability (CR), and average variance extracted (AVE) calculations. Validity involved discriminant validity, calculated through qui-square

testing, observing if latent variables were discriminant of each other, and if 2nd order models were not discriminant from their 1st order counterparts.

Table 7. Manufacturing: descriptive statistics.

Source: Author.

/	Mean[A]	S.D.	LO	IO	EO	MT	KA	ID	SM	AM	CO	PR
LO	3.22	1.09	-									
IO	3.20	1.00	.64	-								
EO[D]	3.08	1.03	.51	.68	-							
MT[D]	3.42	1.04	.06[N]	.13*	.13	-						
KA	3.37	.94	.52	.63	.63	.25	-					
ID[D]	3.16	1.03	.63	.57	.52	.15	.65	-				
SM[D]	3.01	.99	.56	.51	.48	.10[N]	.57	.74	-			
AM	3.43	.98	.56	.47	.42	.01[N]	.50	.55	.58	-		
CO	3.33	.88	.35	.35	.33	.04[N]	.38	.34	.35	.33	-	
PR	3.45	.95	.20	.23	.29	.05[N]	.32	.22	.18	.25	.59	-
GR	3.39	.90	.29	.31	.33	.04[N]	.36	.33	.27	.31	.52	.65

/ Learning Orientation (LO); Innovativeness Orientation (IO); Entrepreneurial Orientation (EO); Turbulence (MT); Knowledge Acquisition (KA); Information Distribution (ID); Shared Meaning (SM); Achieved Memory (AM); Cost (CO); Profitability (PR); Growth (GR). Values are significant at the $p < 0.01$ (two-tailed), except those marked with (N) for non-significant or (*) for $p<.05$.

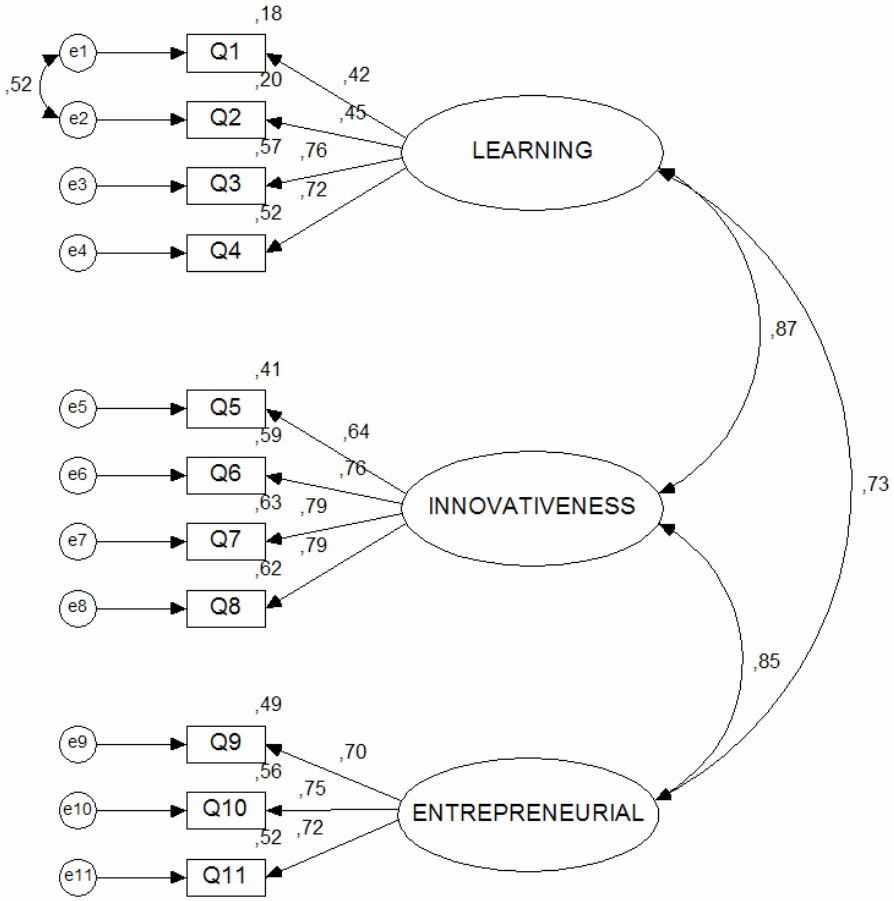
[A] Obtained dividing the summated mean by the number of questions.

[D] One question belonging to these constructs was deleted after model purification in Chapters 5.1.1, 5.1.2, and 5.1.3.

A measurement model for *Learning*, *Innovativeness*, and *Entrepreneurial* orientations was tested, and initial fit indices were: χ^2 = 168; df = 51, NFI = .90, RFI = .87, IFI = .93, TLI = .90, CFI = .92, RMSEA = .08 (Min=.07; Max=.10). Model purification started with MI analysis. Covariance of Q1 and Q2 error components (MI=85) indicated possible common method bias (CMB) problems. APPENDIX 5 explains how CMB was tested through a complementary survey, justifying the e1e2 correlation of .52. Correlating e1 and e2 improved fit indices, but reduced Q1 and Q2 loadings (this trade off was considered acceptable). Next, *CC* indicators loadings were analyzed: Q1 (.42) and Q2 (.45) were problematic, mainly due to error correlation (which diminishes loadings), but still above the .40 reference; Q12 (.34) was deleted because it does not contribute sufficiently to explain *Entrepreneurial Orientation*.

Other questions might improve model fit if deleted, but there was no further reason for elimination. Loadings and covariances were valid to p<.001, and errors standardized residual covariances (SCR) were bellow 1.96. Although several MIs for correlated measurement errors were greater then 3.84, none was considered a threat to one-dimensionality. As for MI for loading highly on a non-predicted factor, still the loadings for these items to their intended factors were high in comparison (Netmeyer *et al.*, 2003). Therefore, after removing inadequate items (Figure 10), a good fit to the data was achieved for the first order based CFA: χ^2 = 64, df = 40, NFI = .96, RFI = .94, IFI = .98, TLI = .98, CFI = .98, RMSEA = .04 (Min=.02; Max=.06).

Figure 10. Manufacturing: CC measurement model (standardized estimates).
Source: Author



Cronbach alphas ranged from .72 to .83. Composite reliabilities (CR) ranged from .72 to .86, factor loadings ranged from .45 to .85 (p < .001), and average variances extracted (AVE) ranged from .52 to .80 (Table 8). Discriminant validity was tested for

each pair of latent variables, to a .01 significance level (Table 9). All these values were considered acceptable.

Table 8. Manufacturing: internal validity for *CC*.

Source: Author

CONSTRUCTS	Alpha	CR	AVE	Min	Max
Learning Orientation	.72	.72	.52	.45	.78
Innovativeness Orientation	.83	.86	.80	.68	.85
Entrepreneurial Orientation	.76	.79	.67	.72	.77

Alpha = Cronbach Alpha; CR = Composite Reliability; AVE = Average Variance Extracted; Min = minimum loading observed; Max = Maximum loading observed.

Table 9. Manufacturing: discriminant validity for CC.

Source: Author

VARIABLES (PAIRS)	χ^2 DIFFERENCE
Learning x Innovativeness	18.5
Learning x Entrepreneurial	48.3
Innovativeness x Entrepreneurial	31.1

The acceptance of a 2nd order construct must be first founded on theoretical considerations (judged to exist in this case), and then supported empirically by a non-significant difference between the model where the 1st order constructs freely correlate and the 2nd order construct model itself. The chi-square test can be used to test the differences between the two models, since they can be considered nested. However, when a 2nd order model is built upon three latent variables, 1st and 2nd order models have both the same degrees of freedom, and no comparison is possible. One way to counter this problem is to add a fourth latent variable to test the qui-square. In this thesis, *Turbulence* was added to such an intent (Figure 11). Fit indices (Table 10) were similar for both models, and with a χ^2 difference of 3.5 for two degrees of freedom, models were not discriminant to a .10 significance level. Thus, *Culture of Competitiveness* was accepted as a satisfactory 2nd order model.

Table 10. Manufacturing: fit indices for CC.

Source: Author

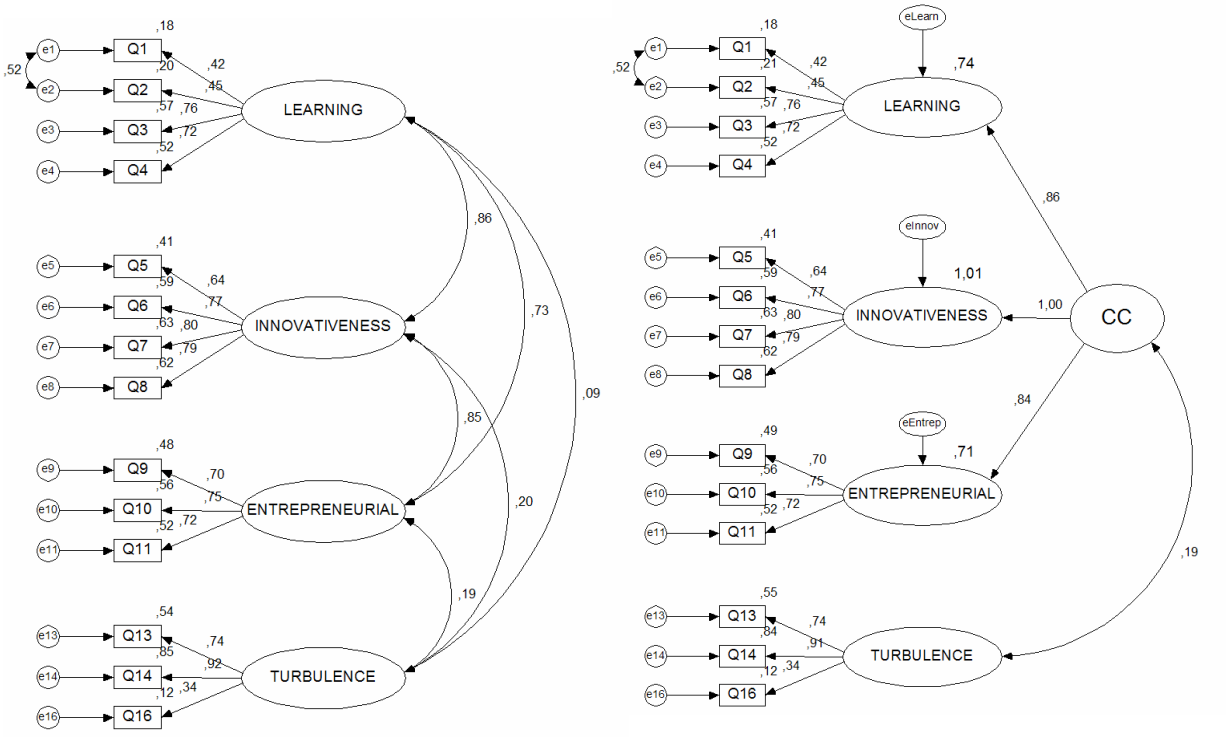
Model	χ^2	*df*	*NFI*	*RFI*	*IFI*	*TLI*	*CFI*	*RMSEA*	*Min*	*Max*
1st Order	109.5	70	.94	.92	.98	.97	.98	.04	.02	.06
2nd Order	113.0	72	.94	.92	.98	.97	.98	.04	.03	.06

χ^2 = Qui-square; df = degrees of freedom; NFI, RFI, IFI, TLI, CFI = various fit indices; RMSEA = root mean square error of approximation; Min = minimum possible value for RMSEA given data; Max = maximum possible value for RMSEA given data.

The results indicate that there is support for each construct's higher-order structure: *Learning* (loading = 0.86, *t*-value = 11.9, $p < 0.001$), *Innovativeness* (loading = 1.00, *t*-value = 15.6, $p < 0.001$), and *Entrepreneurial* (loading = 0.84, *t*-value = 12.4, $p < 0.001$) orientations function as 1st-order indicators of the *CC* higher-order construct.

Figure 11. Manufacturing: CC 2nd order model (standardized estimates).

Source: Author



5.1.2. Manufacturing: KD Measurement Properties

The measurement model for *Knowledge Acquisition, Information Distribution, Shared Meaning,* and *Achieved Memory* was tested, and initial fit indices were: χ^2 = 375; df =

98, NFI = .86, RFI = .84, IFI = .90, TLI = .87, CFI = .90, RMSEA = .09 (Min=.08; Max=.10). Model purification started with MI analysis. Q21 (MI=91) and Q24 (MI=98) related pairs accounted for half of the total MI. Both questions were part of *Information Transfer*, and suffered no modifications from Hult *et al.* (2007). As the authors deleted Q21 after measurement purification, and given Q21 higher SRC errors values, Q21 was deleted. Next, given its high value (MI=26), and according to APPENDIX 5 CMB analysis, Q29 and Q30 had their errors correlated. Then Q27, a non-established indicator, later added to Hult *et al.* (2007) construct, was deleted given its high contribution to MI. Finally, *KD* indicators loadings were analyzed, and none had a value bellow .50.

Other questions might have improved model fit if deleted, but there was not further reason for elimination. Loadings and covariances were valid to p<.001, and errors standardized residual covariances (SCR) were bellow 1.96, except for Q20xQ28 (2.2). Although several MI for correlated measurement errors were greater then 3.84, none was considered a threat to unidimensionality. As for MI for loading highly on a non-predicted factor, still loadings for these items to their intended factors were high in comparison. Therefore, after removing inadequate items (Figure 12), a good fit to the data was achieved for the first order based CFA: χ^2 = 175; df = 70, NFI = .92, RFI = .90, IFI = .95, TLI = .94, CFI = .95, RMSEA = .07 (Min=.05; Max=.08).

Cronbach alphas ranged from .76 to .81. CR ranged from .73 to .82, factor loadings ranged from .54 to .84 (p < .001), and AVE ranged from .53 to .73 (Table 11). Discriminant validity was tested for each pair of latent variables, to a .01 significance level (Table 12). All these values were considered acceptable.

The chi-square test was used to test the differences between the 1st and 2nd order models (Figure 13), since they can be considered nested. Fit indices (Table 13) were similar for both models, and with a χ^2 difference of 8.6 for two degrees of freedom, models were discriminant to a .10 significance level, and not discriminant to a .01 significance level. Considering that: χ^2 testing is specially rigorous for larger sample sizes; fit indices were still at adequate levels; differences on loadings smaller than

.02; theoretical background supports the construct (Huber, 1991; Hult *et al.*, 2007), *Knowledge Development* was accepted as a 2nd order model.

Table 11. Manufacturing: internal validity for KD.

Source: Author

CONSTRUCTS	Alpha	CR	AVE	Min	Max
Knowledge Acquisition	.79	.79	.65	.64	.73
Information Distribution	.81	.81	.73	.69	.81
Shared Meaning	.80	.82	.73	.66	.84
Achieved Memory	.76	.73	.53	.54	.68

Alpha = Cronbach Alpha; CR = Composite Reliability; AVE = Average Variance Extracted; Min = minimum loading observed; Max = Maximum loading observed.

Figure 12. Manufacturing: KD measurement model (standardized estimates).

Source: Author

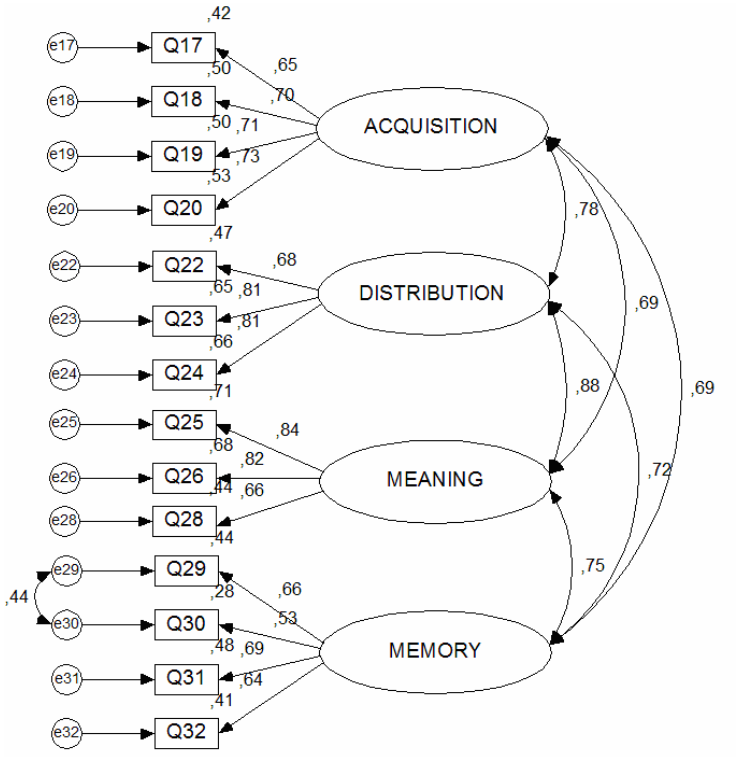


Table 12. Manufacturing: Discriminant validity for KD.

Source: Author

VARIABLES (PAIRS)	χ^2 DIFFERENCE
Acquisition x Distribution	49.7
Acquisition x Meaning	120.4
Acquisition x Memory	61.3
Distribution x Meaning	26.9
Distribution x Memory	56.1
Meaning x Memory	51.8

The results indicate that there is support for each construct's higher-order structure: *Knowledge Acquisition* (loading = 0.80, *t*-value = 11.4, $p < 0.001$), *Information Distribution* (loading = .95, *t*-value = 12.3, $p < 0.001$), *Shared Meaning* (loading = .92, *t*-value = 15.5, $p < 0.001$), and *Achieved Memory* (loading = 0.64, *t*-value = 10.1, $p < 0.001$) function as first-order indicators of the *KD* higher-order construct.

Table 13. Manufacturing: Fit indices for KD.

Source: Author

Model	χ^2	*df*	*NFI*	*RFI*	*IFI*	*TLI*	*CFI*	*RMSEA*	*Min*	*Max*
1st Order	175.2	70	.92	.90	.95	.94	.95	.07	.05	.08
2nd Order	183.8	72	.92	.90	.95	.93	.95	.07	.06	.08

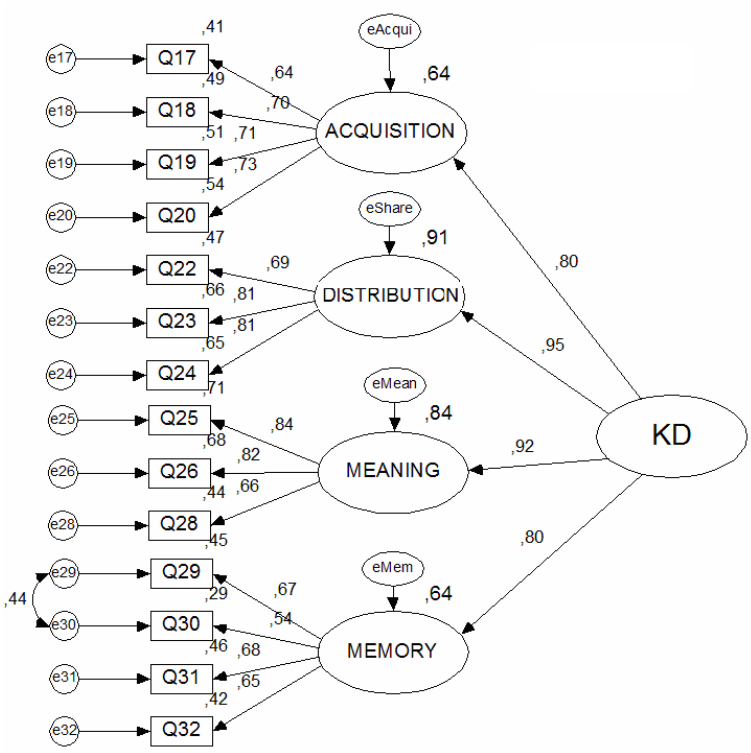
χ^2 = Qui-square; df = degrees of freedom; NFI, RFI, IFI, TLI, CFI = various fit indices; RMSEA = root mean square error of approximation; Min = minimum possible value for RMSEA given data; Max = maximum possible value for RMSEA given data.

5.1.3. Manufacturing: Performance & Turbulence Measurement Properties

Turbulence was assessed along with *Performance*. The measurement model for *Cost*, *Profitability*, *Growth*, and *Turbulence* was tested, and initial fit indices were: χ^2 = 181; df = 59, NFI = .91, RFI = .88, IFI = .94, TLI = .92, CFI = .94, RMSEA = .08 (Min=.07; Max=.09). Model purification started with MI analysis. More then one question presented relevant MI values, specially those connected to *Cost* and *Growth*

constructs. However, in order to maintain at least three indicators per construct, none was deleted. As for *Turbulence*, Q15 (.46) and Q16 (.34) had low loadings. Analyzing errors, all pairs of values with SCR > 1.96 were related to Q15, which was deleted. Although Q16 continued with a low loading (.36), it was maintained to allow *Turbulence* to remain with at least three indicators.

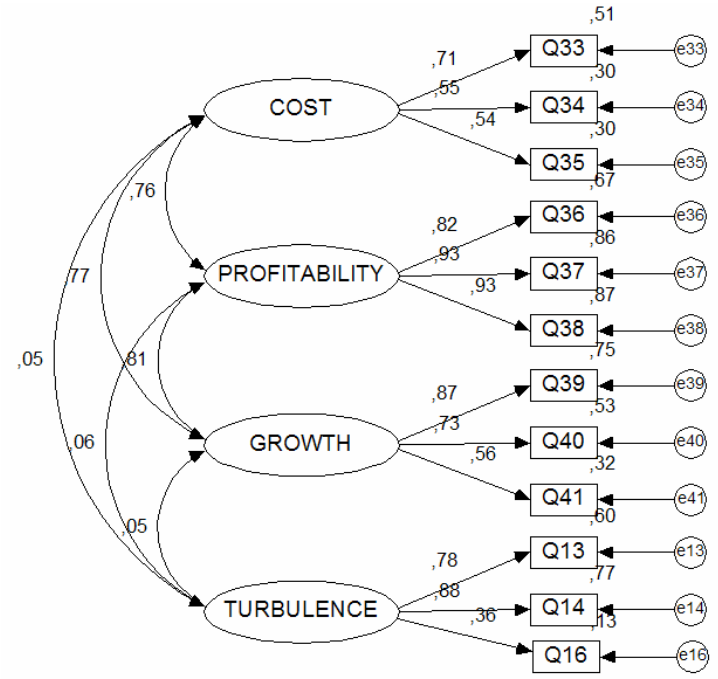
Figure 13. Manufacturing: KD 2nd order model (standardized estimates).
Source: Author.



Other questions might have improved model fit if deleted, but there was not further reason for elimination. Loadings and covariances were valid to p<.001, and three error pairs sustained a SCR > 1.96. Although several MIs for correlated measurement errors were greater then 3.84, none was considered a threat to unidimensionality. As for MI for loading highly on a non-predicted factor, still the loadings for these items to their intended factors were high in comparison. Therefore, after removing inadequate items (Figure 14), a good fit to the data was achieved for the first order based CFA: χ^2 = 155; df = 48, NFI = .92, RFI = .89, IFI = .94, TLI = .92, CFI = .94, RMSEA = .08 (Min=.07; Max=.10).

Figure 14. Manufacturing: *Performance & Turbulence* measurement model.

Source: Author



Cronbach alphas ranged from .64 to .92. CR ranged from .66 to .94, factor loadings ranged from .36 to .95 ($p < .001$), and AVE ranged from .44 to .93 (Table 14). Values were considered acceptable for *Profitability* and *Growth*. *Cost* did not have loadings below .50, however its CR and AVE were below ideal limits. On the other hand, *Turbulence* had in Q16 a very low loading, but with acceptable CR and AVE as a whole. Next, discriminant validity was tested for each pair of latent variables, to a .01 significance level (Table 15). All these values were considered acceptable.

Table 14. Manufacturing: internal validity for *Performance & Turbulence*.

Source: Author

CONSTRUCTS	Alpha	CR	AVE	Min	Max
Cost	.64	.66	.44	.57	.73
Profitability	.92	.94	.93	.85	.95
Growth	.78	.79	.69	.59	.89
Turbulence	.69	.73	.60	.36	.88

Alpha = Cronbach Alpha; CR = Composite Reliability; AVE = Average Variance Extracted; Min = minimum loading observed; Max = Maximum loading observed.

Table 15. Manufacturing: Discriminant validity for *Performance & Turbulence*.
Source: Author

VARIABLES (PAIRS)	χ^2 DIFFERENCE
Cost x Profitability	34.9
Cost x Growth	26.8
Cost x Turbulence	128.0
Profitability x Growth	83.5
Profitability x Turbulence	139.7
Growth x Turbulence	241.5

The chi-square test was used to test the differences between the 1st and 2nd order models (Figure 15), since they can be considered nested. Fit indices (Table 16) were similar for both models, and with a χ^2 difference of .10 for two degrees of freedom, models were not discriminant to a .10 significance level. Thus, *Performance* was accepted as a satisfactory 2nd order model. The results indicate that there is support for each construct's higher-order structure: *Cost* (loading = 0.85, *t*-value = 10.8, $p < 0.001$), *Profitability* (loading = .95, *t*-value = 16.5, $p < 0.001$), and *Growth* (loading = .89, *t*-value = 15.0, $p < 0.001$) function as first-order indicators of the higher-order construct of *Performance*.

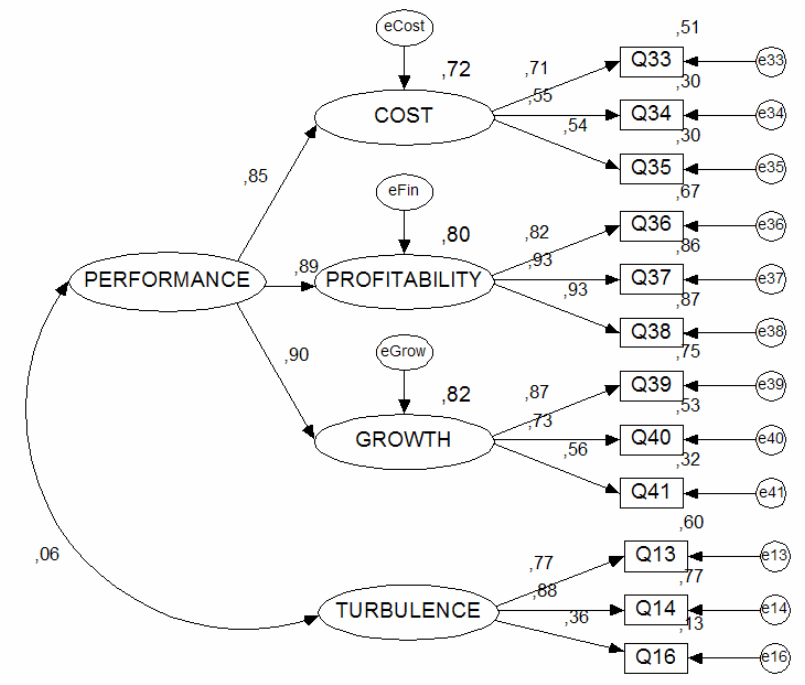
Table 16. Manufacturing: Fit indices for *Performance & Turbulence*.
Source: Author

Model	χ^2	*df*	*NFI*	*RFI*	*IFI*	*TLI*	*CFI*	*RMSEA*	*Min*	*Max*
1st Order	154.8	48	.92	.89	.94	.92	.94	.08	.07	.10
2nd Order	154.9	50	.92	.90	.94	.93	.94	.08	.06	.09

χ^2 = Qui-square; df = degrees of freedom; NFI, RFI, IFI, TLI, CFI = various fit indices; RMSEA = root mean square error of approximation; Min = minimum possible value for RMSEA given data; Max = maximum possible value for RMSEA given data.

Figure 15. Manufacturing: *Performance & Turbulence* 2nd order model (standardized estimates).

Source: Author.

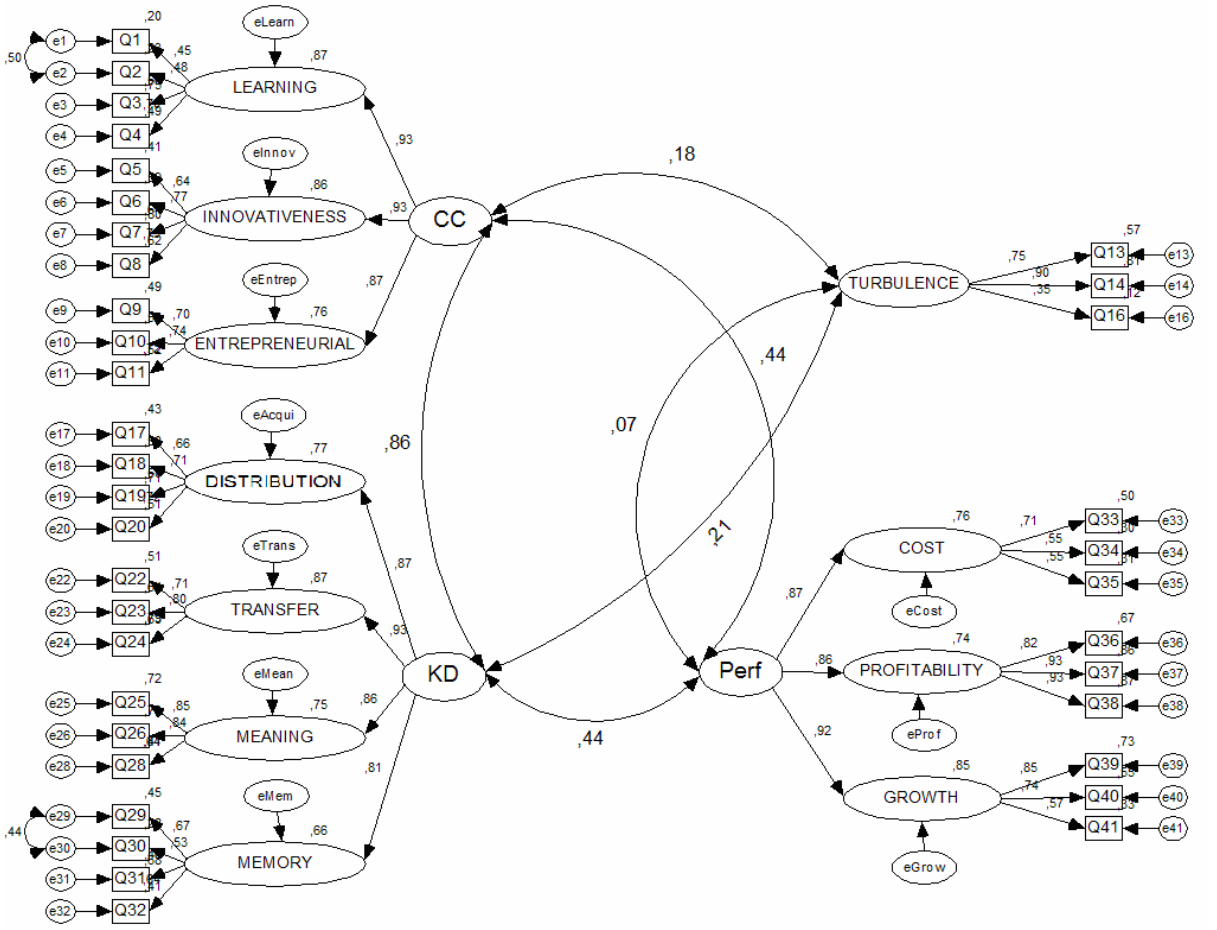


5.1.4. Manufacturing: Complete Measurement Model

The complete measurement model (Figure 16) groups 2nd order models, providing a last analysis before measurement. Fit indices were reassessed: χ^2 = 1137; df = 611, NFI = .83, RFI = .82, IFI = .92, TLI = .91, CFI = .91, RMSEA = .05 (Min=.046; Max=.055). The highest MI value was MI=30 (less then 3% of total), and 39 error pairs had a SCR > 2.0, four above 3.0 (maximum for Q14Q17 = 4.0). Greater model complexity resulted in some worsened (NFI, RFI, MI, SCR) and some improved (RMSEA) indices, but the whole model was considered acceptable, and no further refinements were sought. CC and KD were correlated to *Turbulence*, to *Performance* and strongly to each other. *Performance* and *Turbulence* were little correlated.

Figure 16. Manufacturing: Complete 2st order model.

Source: Author



All measures significant to p<.001

5.1.5. Manufacturing: Structural Model

The structural model substitutes some covariances in the 2nd order complete model for direct effects, based on theoretical justifications. The direct effects of CC, KD, and *Turbulence* on *Performance* (Figure 17 A) were tested. Also, to explore possible response differences among the dependent variables, *Cost*, *Profitability*, and *Growth* were also tested separately from *Performance*, one at a time (Figure 17 B, C, D). Fit indices and observed loadings were summarized in Table 17 and Table 18. Covariances and loadings were significant to p<.001, except for the effects of CC, KD, and Turbulence on Performance, non-significant to p<.10.

Figure 17 (A). Manufacturing: structural model for *Performance*.

Source: Author

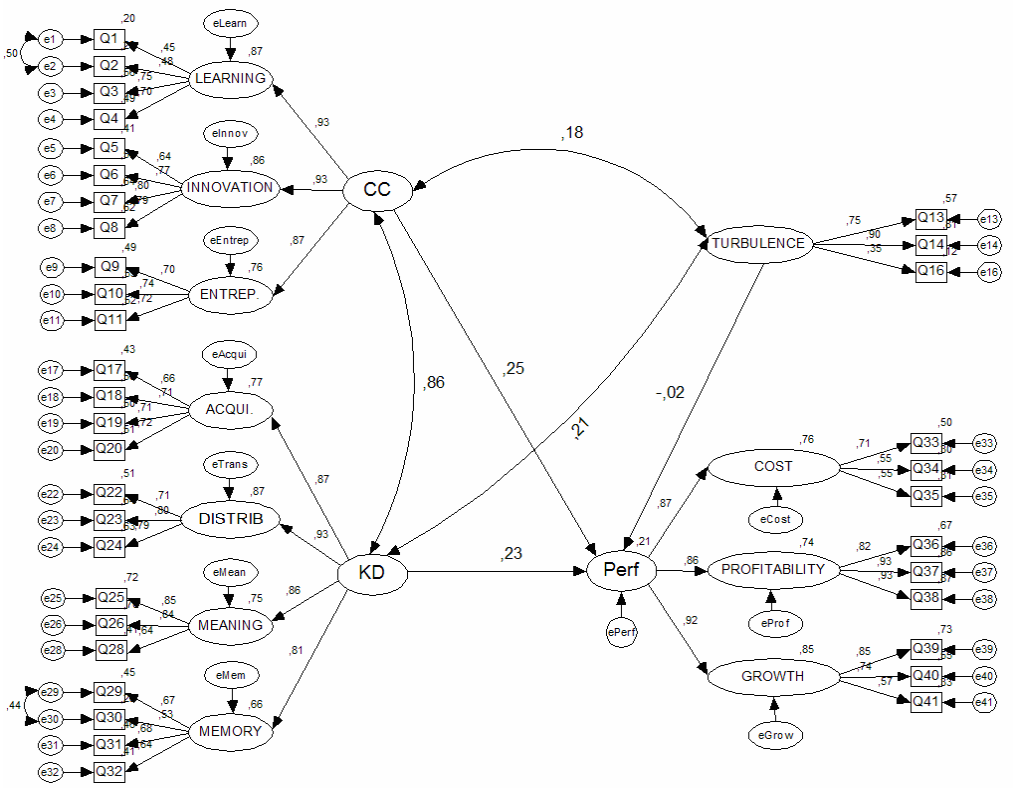


Figure 17 (B). Manufacturing: structural model for *Cost*.

Source: Author

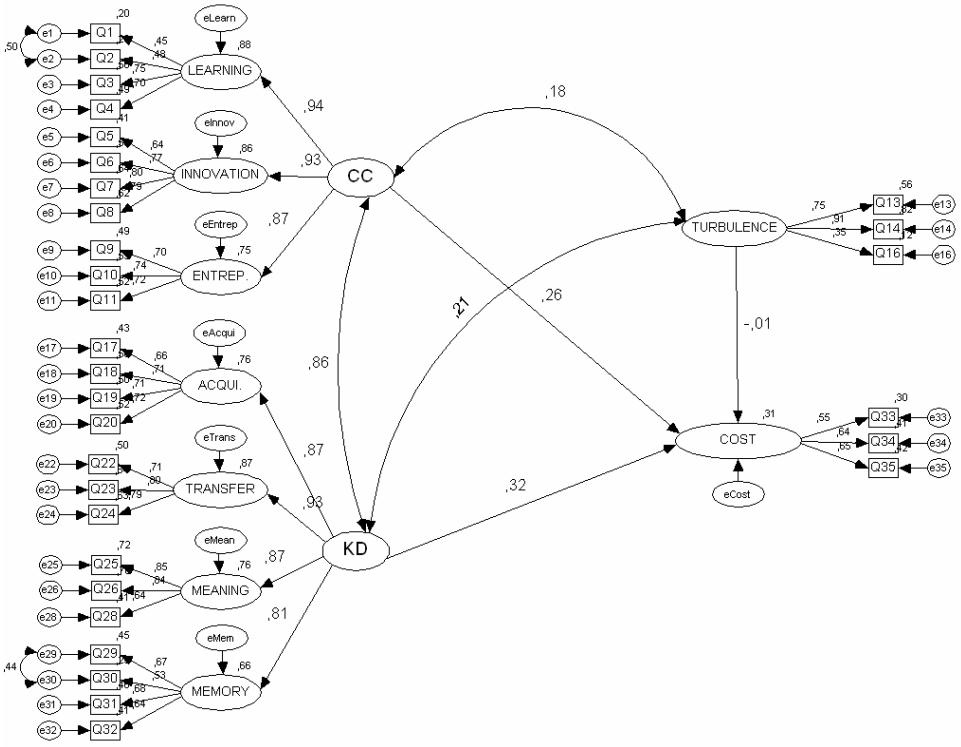


Figure 17 (C). Manufacturing: structural model for *Profitability*.

Source: Author

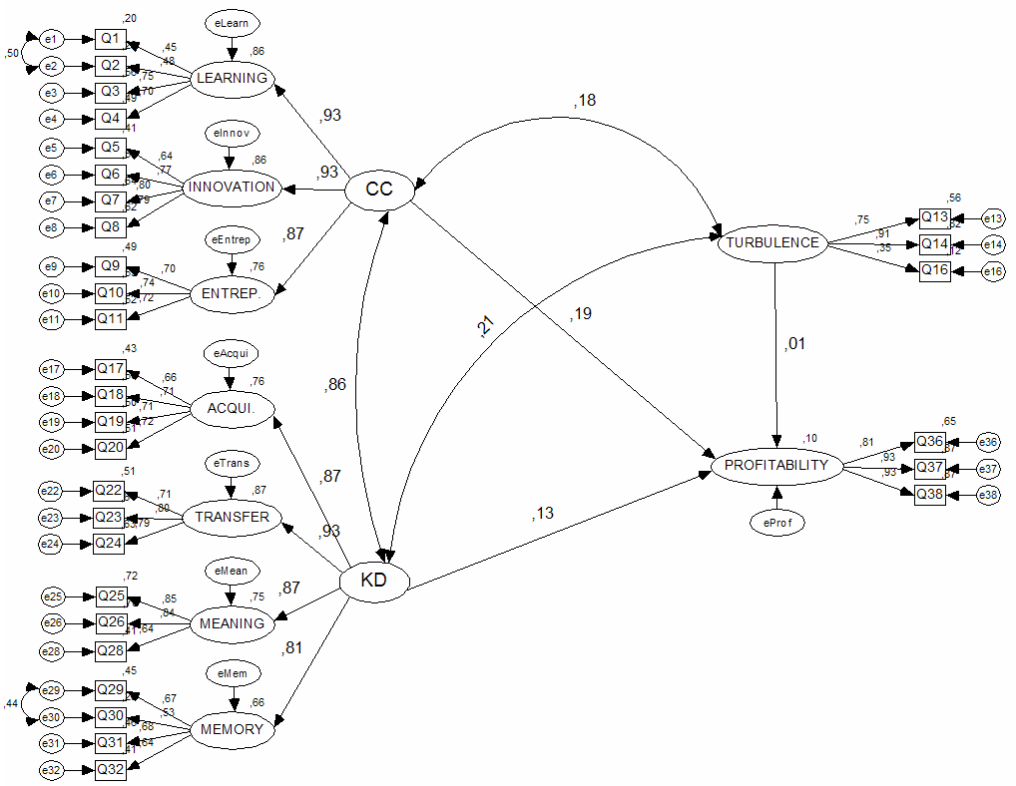


Figure 17 (D). Manufacturing: structural model for *Growth*.

Source: Author

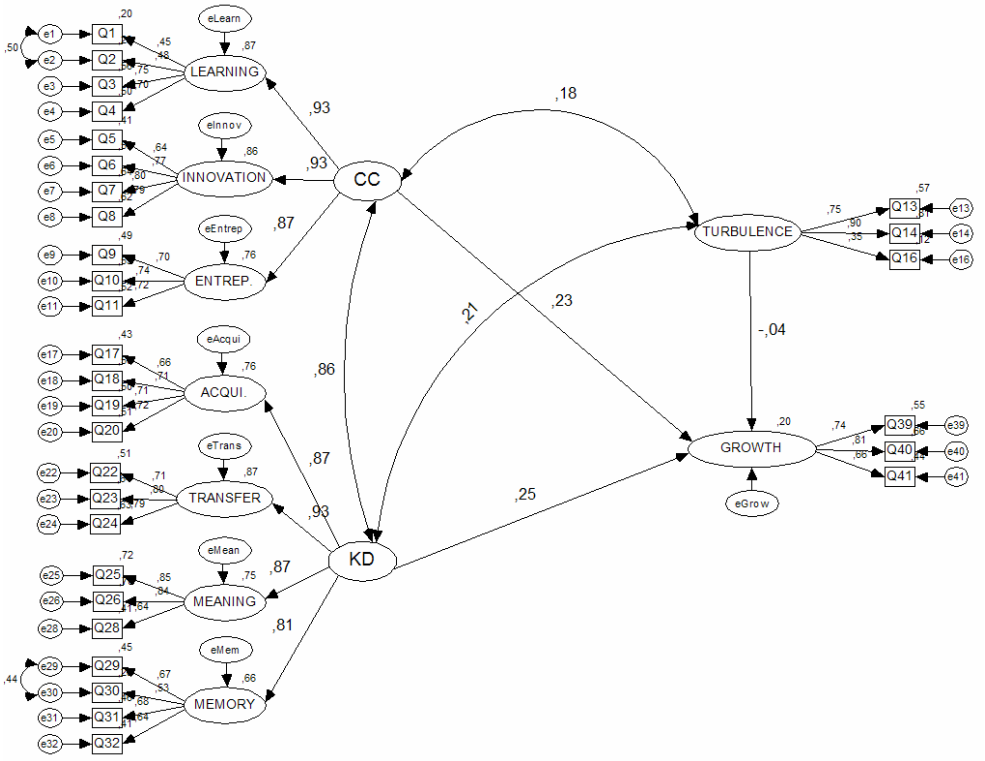


Table 17. Manufacturing: fit indices.

Source: Author

Model	χ^2	*df*	*NFI*	*RFI*	*IFI*	*TLI*	*CFI*	*RMSEA*	*Min*	*Max*
Performance	1137	611	.83	.82	.92	.91	.91	.05	.045	.055
Cost	800	419	.85	.83	.92	.91	.92	.05	.047	.058
Profitability	805	419	.86	.84	.93	.92	.93	.05	.047	.058
Growth	788	419	.85	.83	.92	.91	.92	.05	.046	.057

χ^2 = Qui-square; df = degrees of freedom; NFI, RFI, IFI, TLI, CFI = various fit indices; RMSEA = root mean square error of approximation; Min = minimum possible value for RMSEA given data; Max = maximum possible value for RMSEA given data.

Table 18. Manufacturing: models loadings.

Source: Author

	R^2	*CC*	*KD*	*Turb*
Performance	.21	.25 (1.60)	.23 (1.43)	-.02 (-.34)
Cost	.31	.26 (1.48)	$.32^{\dagger}$ (1.85)	-.01 (-.10)
Profitability	.10	.19 (1.27)	.13 (.84)	.01 (.16)
Growth	.20	.23 (1.41)	.25 (1.53)	-.04 (-.67)

(†) p< .10; (*) p< .05; (**) p< .01; (***) p< .001

Although NFI and RFI were below the .90 reference, the models were considered acceptable, as the increasing complexity might have been the main reason for their deterioration. Explained R^2 were relevant for all dependent variables, although only marginally for *Profitability*. CC had coefficients from .19 to .26, not significant in all cases. KD had coefficients from .13 to .32, not significant in all cases (except for a slight significance for *Cost*. *Turbulence* offered no explanation for any dependent variable. Therefore, the SEM provided little statistically significant information for hypothesis testing, and the lack of observable direct effects did not comply with existent theory. To check these results a series of linear regressions were fulfilled.

5.1.6. Manufacturing: Linear Regressions

Linear regressions were based on two equations. *Main Effects* considered the direct effects of the independent variables CC, KD, and *Turbulence* on *Performance*, *Cost*, *Profitability*, or *Growth*. Therefore:

- Performance = k1 + α1*KD + β1*CC + γ1*Turbulence + ε1.
- Cost = k2 + α2*KD + β2*CC + γ2*Turbulence + ε2.
- Profitability = k3 + α3*KD + β3*CC + γ3*Turbulence + ε3.
- Growth = k4 + α4*KD + β4*CC + γ4*Turbulence + ε4.

Where the constant k was the intercept and ε was the error (both not presented in the results). This equation is equivalent to the previously tested SEM of Figure 17. The main difference is that while SEM considered each indicator independently, in the linear regression the indicators were summated to form CC, KD, *Turbulence* and the dependent variables. The *Interaction* equation considered not only the direct effects of independent variables on the dependent variables, but also the interactions of: CC and KD, CC and *Turbulence*, KD and *Turbulence*. Therefore:

- Performance = k5 + α5*KD + β5*CC + γ5**Turbulence* + δ5*CC*KD + ζ5*CC**Turbulence* + θ5*KD**Turbulence* + ε5.
- Cost = k6 + α6*KD + β6*CC + γ6**Turbulence* + δ6*CC*KD + ζ6*CC**Turbulence* + θ6*KD**Turbulence* + ε6.
- Profitability = k7 + α7*KD + β7*CC + γ7**Turbulence* + δ7*CC*KD + ζ7*CC**Turbulence* + θ7*KD**Turbulence* + ε7.
- Growth = k8 + α8*KD + β8*CC + γ8**Turbulence* + δ8*CC*KD + ζ8*CC**Turbulence* + θ8*KD**Turbulence* + ε8.

This equation was not tested through SEM given limitations in AMOS 16 to assess interactions of 2nd order latent variables. Again, the indicators were summated to form CC, KD, *Turbulence* and the dependent variable, and the summated indicators were multiplied to form the interaction terms.

For both *Main Effects* and *Interaction* equations, values were normalized to diminish scale effects (e.g. summated CC mean was 30.6, while CC*KD mean was 1,594.3). The calculations were performed through two-step linear regressions, first with *Main*

Effects variables (Table 19), and then with the *Interaction* variables (Table 20). Differently from the SEM, statistical significance was achieved for several loadings. Explained R^2s were smaller, but relevant (although marginally for *Profitability*).

Table 19. Manufacturing: regression model 1 (Main Effects) analysis.
Source: Author

	R^2	CC	KD	Turb
Performance	.19	.18* (2.38)	.29*** (3.77)	-.01 (-.29)
Cost	.19	.19* (2.53)	.28*** (3.70)	-.03 (-.54)
Profitability	.09	.12 (1.54)	.20* (2.51)	.00 (.04)
Growth	.16	.16* (2.04)	.26*** (3.40)	-.02 (-.31)

(†) p< .10; (*) p< .05; (**) p< .01; (***) p< .001

Table 20. Manufacturing: regression model 2 (Interaction) analysis.
Source: Author

	R^2	CC	KD	Turb	CC*Turb	KD*Turb	CC*KD
Performance	.20	.20* (2.56)	.27*** (3.54)	-.02 (-.45)	-.12 (-1.48)	.13† (1.68)	.06 (1.26)
Cost	.21	.18* (2.39)	.29*** (3.78)	-.04 (-.81)	.00 (-.06)	-.05 (-.69)	.13* (2.57)
Profitability	.11	.15† (1.81)	.18* (2.25)	-.01 (-.17)	-.15† (-1.77)	.15† (1.90)	.04 (.80)
Growth	.17	.18* (2.30)	.24** (3.09)	-.01 (-.25)	-.13 (-1.59)	.20* (2.56)	.00 (.03)

(†) p< .10; (*) p< .05; (**) p< .01; (***) p< .001

CC had positive coefficients, from .12 to .20, not significant only for *Profitability* in the *Main Effects* equation. KD had positive coefficients, from .18 to .29, significant in all cases. *Turbulence* as a direct effect offered no explanation for any dependent variable (coefficients were nearly null). However, except for *Cost*, *Turbulence* slightly moderated KD **positively**; and for *Profitability* *Turbulence* slightly moderated CC

negatively. The interaction between CC and KD offered explanation for *Cost* only, affecting the dependent variable positively.

The main similarities of these results to those encountered by Hult *et al.* (2007) were: the absence of a direct influence from *Turbulence* on any dependent variable; the nature of *Turbulence* moderating effect when present, positive for KD and negative for CC; for Cost, the interaction between CC and KD was relevant. That said, the following differences were observed:

- Added explained R^2 in the *Interaction* equation was lower (.02 against .04).
- KD had a stronger direct influence than CC.
- The CC * KD interaction was not relevant for *Performance*, *Profitability*, or *Growth*.

These results are reassessed and discussed in the next chapter.

5.1.7. Highlights for Manufacturing Analysis

Concerning SEM:

- CC had Q1 and Q2 with low loadings (.42; .45).
- KD had RMSEA = .07, and 2nd order model was not discriminant only to .01.
- *Turbulence* had Q16 with very low loading (.36) and low alpha (.69).
- *Performance* had RMSEA = .08.
- *Cost* had low alpha (.64), CR (.66), and AVE (.44).
- Complete measurement model had low NFI (.83) and RFI (.82).
- Structural models had low NFI and RFI, and no significant loadings at .05.

Concerning the results:

- *Performance* was accepted as a 2nd order construct.
- *Performance* = .27*KD + .20*CC + ε (explained R^2 = .20).
- *Cost* = .29*KD + .18*CC + .13*CC*KD + ε (explained R^2 = .21).
- *Profitability* = .18*KD + ε (explained R^2 = .11).
- *Growth* = .24*KD + .18*CC + .20*KD**Turbulence* + ε (explained R^2 = .17).

5.2. Service

The Service sample considered 509 respondents. A summary of data origin, sector, area, and firms is presented in Table 21. These inputs were subjected to descriptive statistical analysis for each question, and results were acceptable for all parameters: mean values were between 2.7 and 3.7; standard deviations between 0.8 and 1.3; kurtosis absolute maximum was 1.3; asymmetry absolute maximum was 0.7; and maximum number of missing values for a question was 10 (less then 2.0%). Univariate normality was considered satisfactory. Next each latent variable had their questions summated, e.g. Q1 + Q2 + Q3 + Q4 formed *Learning Orientation*. Means, standard deviations, and variables correlations were calculated (Table 22).

Table 21. Service: characteristics summary.
Source: Author.

DATA ORIGINS	#
FGV Online	395
Manaus	32
Vale do Paraíba	19
CEAG, MBA, MPA	19
GMC, WBICGC, KM	8
Multiple* Sources	36
Total	**509**

TOP 5 INDUSTRIES
Consulting
Education
IT
Health Care
Finance

TOP 5 AREAS
Management
HR
Finance
Operations
Trading

TOP 5 FIRMS
Banco do Brasil
Itaú Unibanco
CEF
FGV
Bradesco

** Multiple groups two or more respondents from the same firm, e.g. one Natura respondent contacted through FGV Online and two Natura respondents contacted through GMC 2009 are represented as one input for Multiple sources in Data Origins.*

5.2.1. Service: CC Measurement Properties

A measurement model for *Learning*, *Innovativeness*, and *Entrepreneurial* orientations was tested, and initial fit indices were: χ^2 = 377; df = 51, NFI = .88, RFI = .84, IFI = .89, TLI = .86, CFI = .89, RMSEA = .11 (Min=.10; Max=.12). Model purification started with MI analysis. Covariance of Q1 and Q2 error components (MI=120) indicated possible common method bias (CMB) problems. APPENDIX 5 explains how CMB was assessed through a complementary survey, justifying the e1e2 correlation of .50. Correlating e1 and e2 improved fit indices, but reduced Q1 and Q2

loadings to .45 and .42 (respectively). Although problematic, these values were above the .40 reference, and thus sustained. On the other hand, Q12 (.42) was deleted for not contributing sufficiently to explain *Entrepreneurial Orientation*.

Table 22. Service: descriptive statistics.
Source: Author.

/	Mean[A]	S.D.	LO	IO	EO	MT	KA	ID	SM	AM	CO	PR
LO	3.26	1.16	-									
IO	.3.31	1.09	.68	-								
EO[D]	3.07	1.11	.57	.71	-							
MT[D]	3.55	1.03	.00[N]	.08[N]	.08[N]	-						
KA	3.38	1.01	.55	.67	.59	.02[N]	-					
ID[D]	3.25	1.09	.55	.56	.54	.02[N]	.65	-				
SM[D]	3.13	1.08	.55	.60	.52	.00[N]	.63	.77	-			
AM	3.42	1.03	.52	.53	.49	.00[N]	.62	.63	.64	-		
CO	3.34	.88	.35	.38	.34	.02[N]	.43	.36	.38	.39	-	
PR	3.37	.97	.22	.26	.27	.03[N]	.26	.25	.30	.26	.55	-
GR	3.52	.96	.04[N]	.03[N]	.09*	.00[N]	.04[N]	.01[N]	.00[N]	.10*	.04[N]	.01[N]

/ Learning Orientation (LO); Innovativeness Orientation (IO); Entrepreneurial Orientation (EO); Turbulence (MT); Knowledge Acquisition (KA); Information Distribution (ID); Shared Meaning (SM); Achieved Memory (AM); Cost (CO); Profitability (PR); Growth (GR). Values are significant at the $p < 0.01$ (two-tailed), except those marked with (N) for non-significant or (*) for $p<.05$.

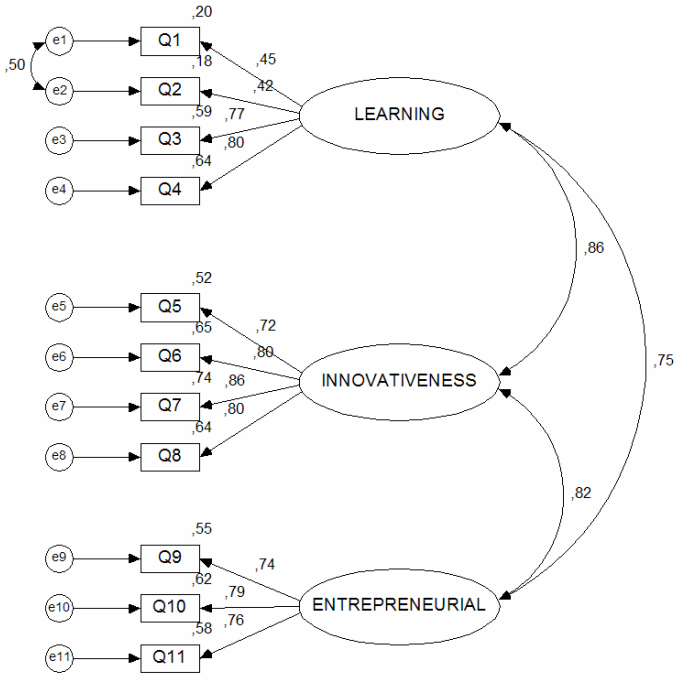
[A] Obtained dividing the summated mean by the number of questions.

[D] One question belonging to these constructs was deleted after model purification in Chapters 5.2.1, 5.2.2, and 5.2.3.

Other questions might improve model fit if deleted, but there was no further reason for elimination. Loadings and covariances were valid to $p<.001$, and errors standardized residual covariances (SCR) were bellow 1.96. Although several MIs for correlated measurement errors were greater then 3.84, none was considered a threat to unidimensionality. As for MI for loading highly on a non-predicted factor, still the loadings for these items to their intended factors were high in comparison. Therefore, after removing inadequate items (Figure 18), a good fit to the data was achieved for the first order based CFA: $\chi^2 = 210$, df = 40, NFI = .93, RFI = .90, IFI = .94, TLI = .92, CFI = .94, RMSEA = .09 (Min=.08; Max=.10).

Figure 18. Service: CC measurement model (standardized estimates).

Source: Author



Cronbach alphas ranged from .73 to .80. Composite reliabilities (CR) ranged from .72 to .88, factor loadings ranged from .43 to .87 ($p < .001$), and average variances extracted (AVE) ranged from .53 to .83 (Table 23). Discriminant validity was tested for each pair of latent variables, to a .01 significance level (Table 24). All these values were considered acceptable.

Table 23. Service: internal validity for *CC*.

Source: Author

CONSTRUCTS	Alpha	CR	AVE	Min	Max
Learning Orientation	.73	.72	.53	.43	.80
Innovativeness Orientation	.87	.88	.83	.73	.87
Entrepreneurial Orientation	.80	.81	.72	.75	.79

Alpha = Cronbach Alpha; CR = Composite Reliability; AVE = Average Variance Extracted; Min = minimum loading observed; Max = Maximum loading observed.

The chi-square test was used to test the differences between 1st and 2nd order models (Figure 19), since they can be considered nested. *Turbulence* was added as a fourth variable to force a difference of degrees of freedom. Fit indices (Table 25)

were similar for both models, and with a χ^2 difference of 11.0 for two degrees of freedom, models were discriminant to a .10 significance level.

Table 24. Service: discriminant validity for CC.

Source: Author

VARIABLES (PAIRS)	χ^2 DIFFERENCE
Learning x Innovativeness	44.1
Learning x Entrepreneurial	86.5
Innovativeness x Entrepreneurial	95.2

Figure 19. Service: CC 2nd order model (standardized estimates).

Source: Author

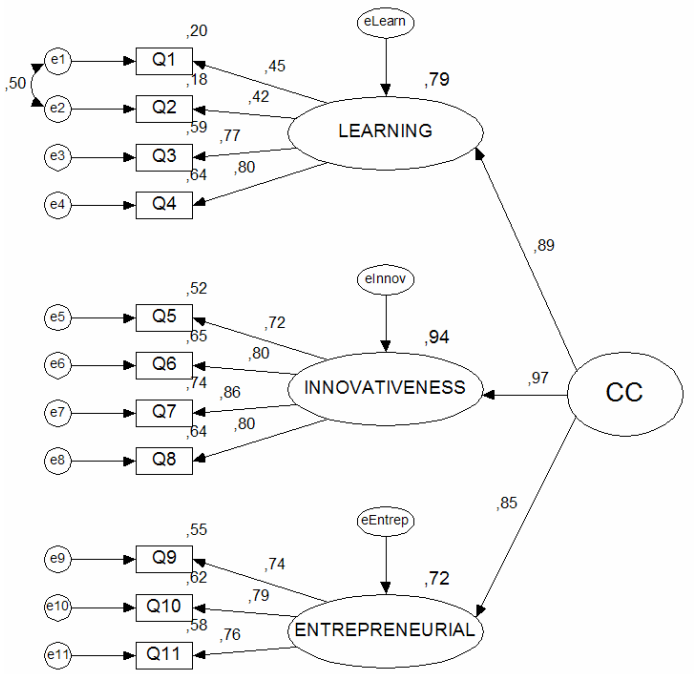


Table 25. Service: fit indices for CC & *Turbulence*.

Source: Author

Model	χ^2	*df*	*NFI*	*RFI*	*IFI*	*TLI*	*CFI*	*RMSEA*	*Min*	*Max*
1st Order	258.6	70	.92	.90	.94	.92	.94	.07	.06	.08
2nd Order	269.6	72	.92	.90	.94	.92	.94	.07	.06	.08

χ^2 = Qui-square; df = degrees of freedom; NFI, RFI, IFI, TLI, CFI = various fit indices; RMSEA = root mean square error of approximation; Min = minimum possible value for RMSEA given data; Max = maximum possible value for RMSEA given data.

Considering that: χ^2 testing is specially rigorous for larger sample sizes; fit indices were still at adequate levels; differences on loadings smaller than .04 (mainly related to *Turbulence*); theoretical background supports the construct (Hult *et al.*, 2007), *Culture of Competitiveness* was accepted as a satisfactory 2nd order model. The results indicate that there is support for each construct's higher-order structure: *Learning* (loading = 0.89, *t*-value = 17.4, $p < 0.001$), *Innovativeness* (loading =.97, *t*-value = 21.2, $p < 0.001$), and *Entrepreneurial* (loading = 0.85, *t*-value = 16.5, $p < 0.001$) orientations function as 1st-order indicators of the *CC* higher-order construct.

5.2.2. Service: KD Measurement Properties

The measurement model for *Knowledge Acquisition, Information Distribution, Shared Meaning,* and *Achieved Memory* was tested, and initial fit indices were: $\chi^2 = 407$; df = 98, NFI = .91, RFI = .89, IFI = .93, TLI = .92, CFI = .93, RMSEA = .08 (Min=.07; Max=.09). Model purification started with MI analysis. Q21 and Q23 (both with summated MI=115) related pairs accounted for most MI amount. Both questions were part of *Information Transfer*, and suffered no modifications from Hult *et al.* (2007). As the authors deleted Q21 after measurement purification, and given Q21 higher SRC errors values, Q21 was deleted. Next, given its high value (MI=36), and according to APPENDIX 5 CMB analysis, Q29 and Q30 had their errors correlated. Then Q28, a non-established indicator, later added to Hult *et al.* (2007) construct, was deleted given its high contribution to MI. Finally, *KD* indicators loadings were analyzed, and none had a value bellow .50.

Other questions might have improved model fit if deleted, but there was not further reason for elimination. Loadings and covariances were valid to p<.001, and errors standardized residual covariances (SCR) were bellow 1.96, except for Q17xQ22 (2.5). Although several MI for correlated measurement errors were greater then 3.84, none was considered a threat to unidimensionality. As for MI for loading highly on a non-predicted factor, still loadings for these items to their intended factors were high in comparison. Therefore, after removing inadequate items (Figure 20), a good fit to the data was achieved for the first order based CFA: $\chi^2 = 189$, df = 70, NFI = .95, RFI = .93, IFI = .97, TLI = .96, CFI = .97, RMSEA = .06 (Min=.05; Max=.07). Cronbach

alphas ranged from .79 to .84. CR ranged from .77 to .85, factor loadings ranged from .59 to .89 ($p < .001$), and AVE ranged from .61 to .79 (Table 26).

Figure 20. Service: KD measurement model (standardized estimates).

Source: Author

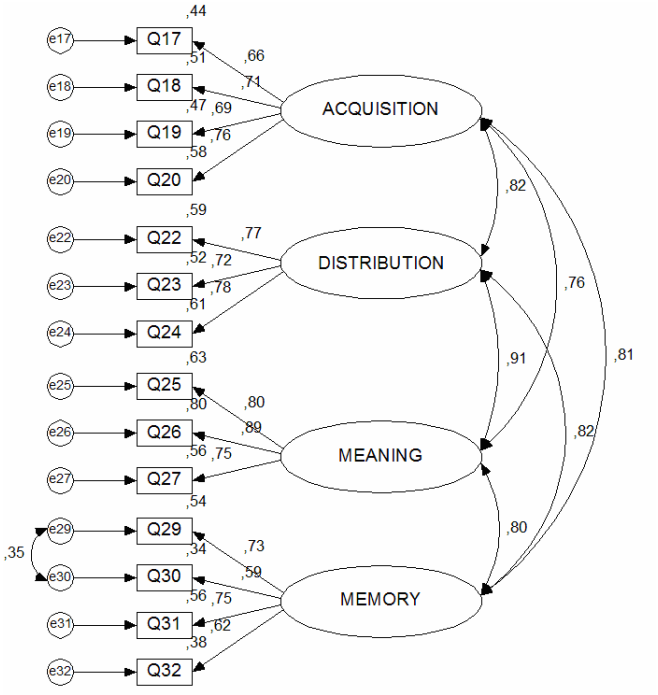


Table 26. Service: internal validity for KD.

Source: Author

CONSTRUCTS	Alpha	CR	AVE	Min	Max
Knowledge Acquisition	.80	.80	.67	.67	.76
Information Distribution	.80	.80	.70	.72	.78
Shared Meaning	.84	.85	.79	.75	.89
Achieved Memory	.79	.77	.61	.59	.75

Alpha = Cronbach Alpha; CR = Composite Reliability; AVE = Average Variance Extracted; Min = minimum loading observed; Max = Maximum loading observed.

Discriminant validity was tested for each pair of latent variables, to a .01 significance level (Table 27). All these values were considered acceptable. The chi-square test was used to test the differences between the 1st and 2nd order models (Figure 21), since they can be considered nested. Fit indices (Table 28) were similar for both

models, and with a χ^2 difference of 13.4 for two degrees of freedom, they were discriminant to a .01 significance level.

Table 27. Service: discriminant validity for KD.
Source: Author

VARIABLES (PAIRS)	χ^2 DIFFERENCE
Acquisition x Distribution	64.0
Acquisition x Meaning	156.8
Acquisition x Memory	62.4
Distribution x Meaning	30.3
Distribution x Memory	44.9
Meaning x Memory	77.6

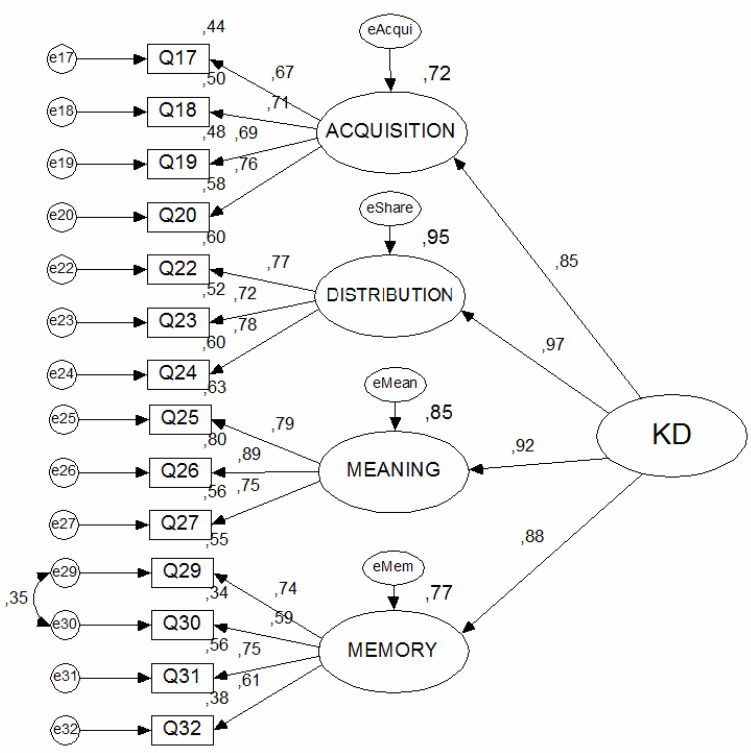
Table 28. Service: fit indices for KD.
Source: Author

Model	χ^2	*df*	*NFI*	*RFI*	*IFI*	*TLI*	*CFI*	*RMSEA*	*Min*	*Max*
1st Order	189.4	70	.95	.93	.97	.96	.97	.06	.05	.07
2nd Order	202.8	72	.95	.93	.96	.95	.96	.06	.05	.07

χ^2 = Qui-square; df = degrees of freedom; NFI, RFI, IFI, TLI, CFI = various fit indices; RMSEA = root mean square error of approximation; Min = minimum possible value for RMSEA given data; Max = maximum possible value for RMSEA given data.

Considering that: χ^2 testing is specially rigorous for larger sample sizes; fit indices were still at adequate levels; differences on loadings smaller than .02; theoretical background supports the construct (Huber, 1991; Hult *et al.*, 2007), *Knowledge Development* was accepted as 2nd order model. The results indicate that there is support for each construct's higher-order structure: *Knowledge Acquisition* (loading = 0.85, *t*-value = 16.0, $p < 0.001$), *Information Distribution* (loading = .87, *t*-value = 18.4, $p < 0.001$), *Shared Meaning* (loading = .92, *t*-value = 22.0, $p < 0.001$), and *Achieved Memory* (loading = 0.88, *t*-value = 15.5, $p < 0.001$) function as first-order indicators of the *KD* higher-order construct.

Figure 21. Service: KD 2nd order model (standardized estimates).
Source: Author.



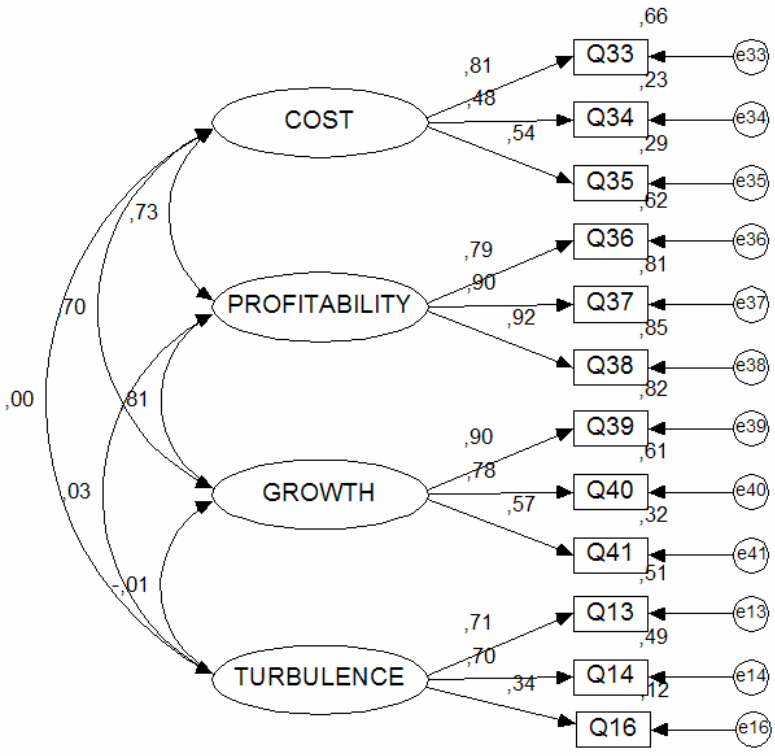
5.2.3. Service: Performance & Turbulence Measurement Properties

Turbulence was assessed along with *Performance*. The measurement model for *Cost*, *Profitability*, *Growth*, and *Turbulence* was tested, and initial fit indices were: χ^2 = 262; df = 59, NFI = .91, RFI = .88, IFI = .93, TLI = .90, CFI = .93, RMSEA = .08 (Min=.07; Max=.09). Model purification started with MI analysis. More then one question presented relevant MI values, specially those connected to *Cost* and *Growth* constructs. However, in order to maintain at least three indicators per construct, none was deleted. As for *Turbulence*, Q15 (.20) and Q16 (.34) had low loadings. Analyzing errors, all pairs of values with SCR > 1.96 were related to Q15, which was deleted. Although Q16 continued with a low loading (.34), it was maintained to allow *Turbulence* to remain with at least three indicators.

Other questions might have improved model fit if deleted, but there was not further reason for elimination. Loadings and covariances were valid to p<.001, and three error pairs sustained a SCR > 1.96. Although several MIs for correlated

measurement errors were greater then 3.84, none was considered a threat to unidimensionality. As for MI for loading highly on a non-predicted factor, still the loadings for these items to their intended factors were high in comparison. Therefore, after removing inadequate items (Figure 22), a good fit to the data was achieved for the first order based CFA: χ^2 = 234; df = 48, NFI = .92, RFI = .88, IFI = .93, TLI = .91, CFI = .93, RMSEA = .09 (Min=.08; Max=.10).

Figure 22. Service: *Performance & Turbulence* measurement model.
Source: Author



Cronbach alphas ranged from .59 to .90. CR ranged from .62 to .92, factor loadings ranged from .35 to .94 (p < .001), and AVE ranged from .40 to .90 (Table 29). Values were considered acceptable for *Profitability* and *Growth*. *Cost* did not have loadings below .50, however its CR and AVE were below ideal limits. *Turbulence* had in Q16 a very low loading, along with low CR and AVE. However, if further questions were deleted from the construct it would not be possible to estimate its parameters correctly, therefore Q16 was maintained. Next, discriminant validity was tested for each pair of latent variables, to a .01 significance level (Table 30). All these values were considered acceptable.

Table 29. Service: internal validity for *Performance & Turbulence*.

Source: Author

CONSTRUCTS	Alpha	CR	AVE	Min	Max
Cost	.68	.67	.47	.51	.81
Profitability	.90	.92	.90	.82	.94
Growth	.79	.82	.74	.59	.92
Turbulence	.59	.62	.40	.35	.72

Alpha = Cronbach Alpha; CR = Composite Reliability; AVE = Average Variance Extracted; Min = minimum loading observed; Max = Maximum loading observed.

Table 30. Service: discriminant validity for *Performance & Turbulence*.

Source: Author

VARIABLES (PAIRS)	χ^2 DIFFERENCE
Cost x Profitability	75.8
Cost x Growth	81.6
Cost x Turbulence	182.6
Profitability x Growth	155.6
Profitability x Turbulence	182.5
Growth x Turbulence	181.4

The chi-square test was used to test the differences between the 1st and 2nd order models (Figure 23), since they can be considered nested. Fit indices (Table 31) were similar for both models, and with a χ^2 difference of 1.0 for two degrees of freedom, models were not discriminant to a .10 significance level. Thus, *Performance* was accepted as a satisfactory 2nd order model. The results indicate that there is support for each construct's higher-order structure: *Cost* (loading = 0.80, *t*-value = 13.9, $p < 0.001$), *Profitability* (loading = .92, *t*-value = 20.7, $p < 0.001$), and *Growth* (loading = .88, *t*-value = 19.3, $p < 0.001$) function as 1st first-order indicators of the higher-order construct of *Performance*.

Figure 23. Service: *Performance & Turbulence* 2nd order model (standardized estimates).

Source: Author.

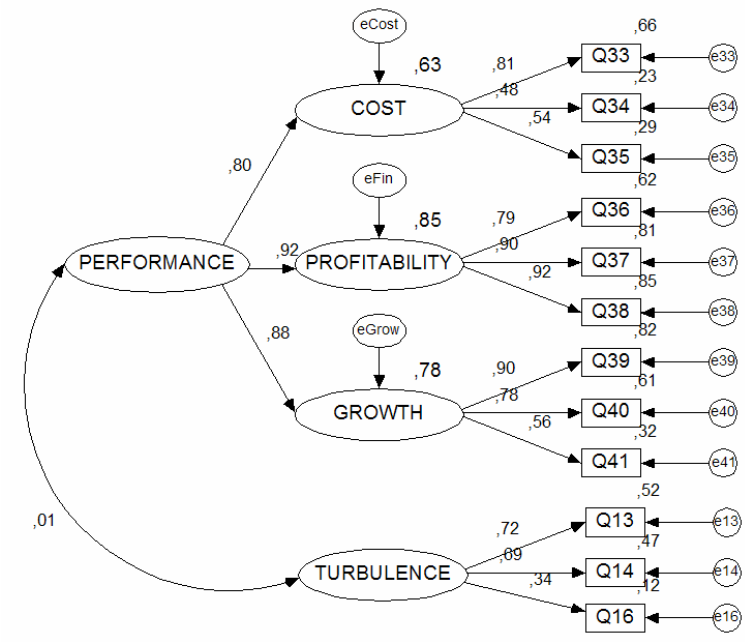


Table 31. Service: fit indices for *Performance & Turbulence*.

Source: Author

Model	χ^2	*df*	*NFI*	*RFI*	*IFI*	*TLI*	*CFI*	*RMSEA*	*Min*	*Max*
1st Order	233.6	48	.92	.88	.93	.91	.93	.09	.08	.10
2nd Order	234.6	50	.92	.89	.93	.91	.93	.09	.07	.10

χ^2 = Qui-square; df = degrees of freedom; NFI, RFI, IFI, TLI, CFI = various fit indices; RMSEA = root mean square error of approximation; Min = minimum possible value for RMSEA given data; Max = maximum possible value for RMSEA given data.

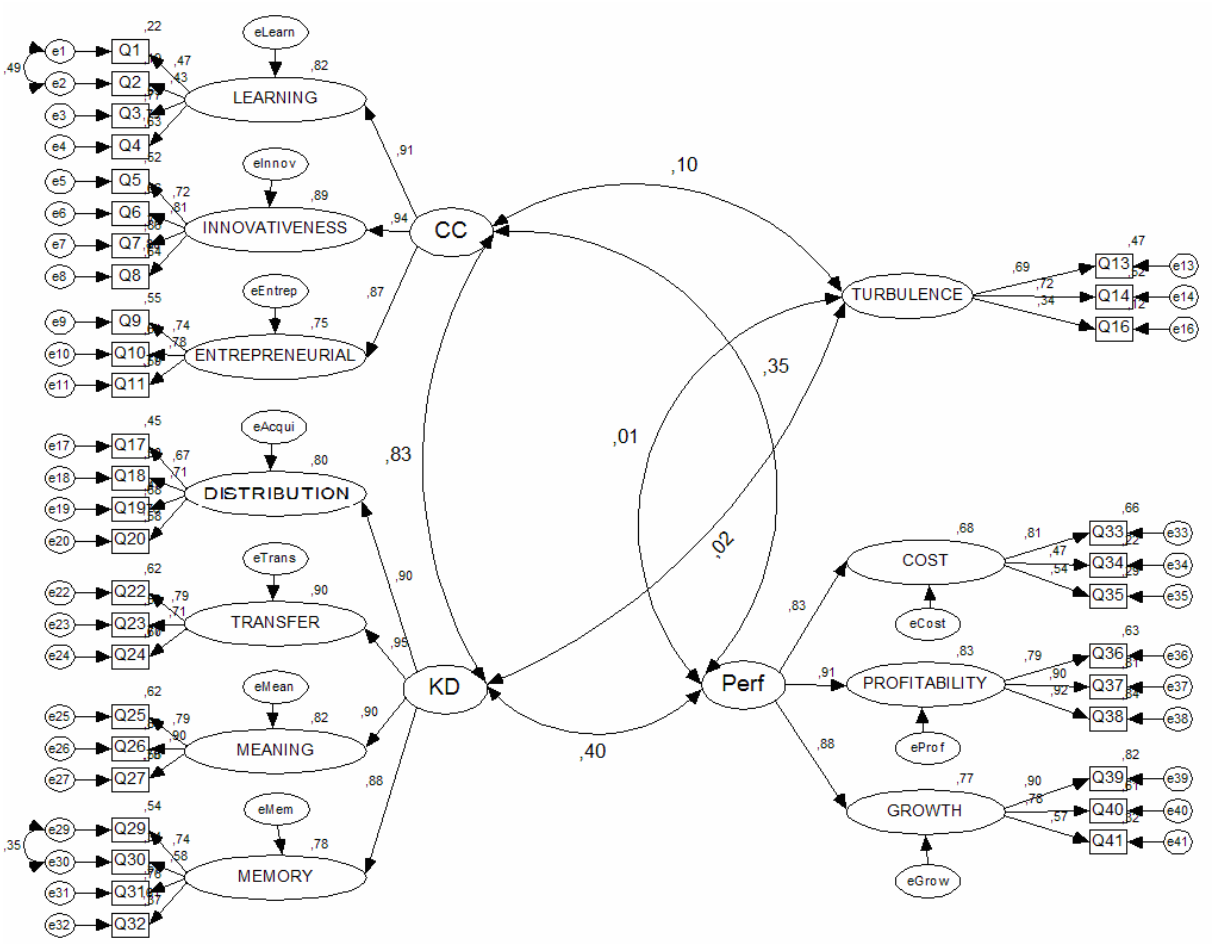
5.2.4. Service: Complete Measurement Model

The complete measurement model (Figure 24) groups 2nd order models, providing a last analysis before measurement. Fit indices were reassessed: χ^2 = 1410; df = 611, NFI = .87, RFI = .86, IFI = .92, TLI = .91, CFI = .92, RMSEA = .05 (Min=.047; Max=.054). The highest MI value was MI=75 (4.2% of total), and 87 error pairs had a SCR > 2.0, 24 above 3.0 (maximum for Q34Q35 = 5.8). Greater model complexity resulted in some worsened (NFI, RFI, MI, SCR) and some improved (RMSEA) indices, but the whole model was considered acceptable, and no further refinements

were sought. *Turbulence* was slightly correlated only to CC, CC and KD were correlated to *Performance*, and strongly to each other.

Figure 24. Service: complete 2st order model.

Source: Author



All measures significant to p<.001

5.2.5. Service: Structural Model

The structural model substitutes some covariances in the 2nd order complete model for direct effects, based on theoretical justifications. The direct effects of CC, KD, and *Turbulence* on *Performance* (Figure 25 A) were tested. Also, to explore possible response differences among the dependent variables, *Cost*, *Profitability*, and *Growth* were also tested separately from *Performance*, one at a time (Figure 25 B, C, D). Fit indices and observed loadings were summarized in Table 32 and Table 33. Covariances and loadings were significant to p<.001, except for the effects of CC, KD, and Turbulence on Performance, non-significant to p<.10.1

Figure 25 (A). Service: structural model for *Performance*.

Source: Author

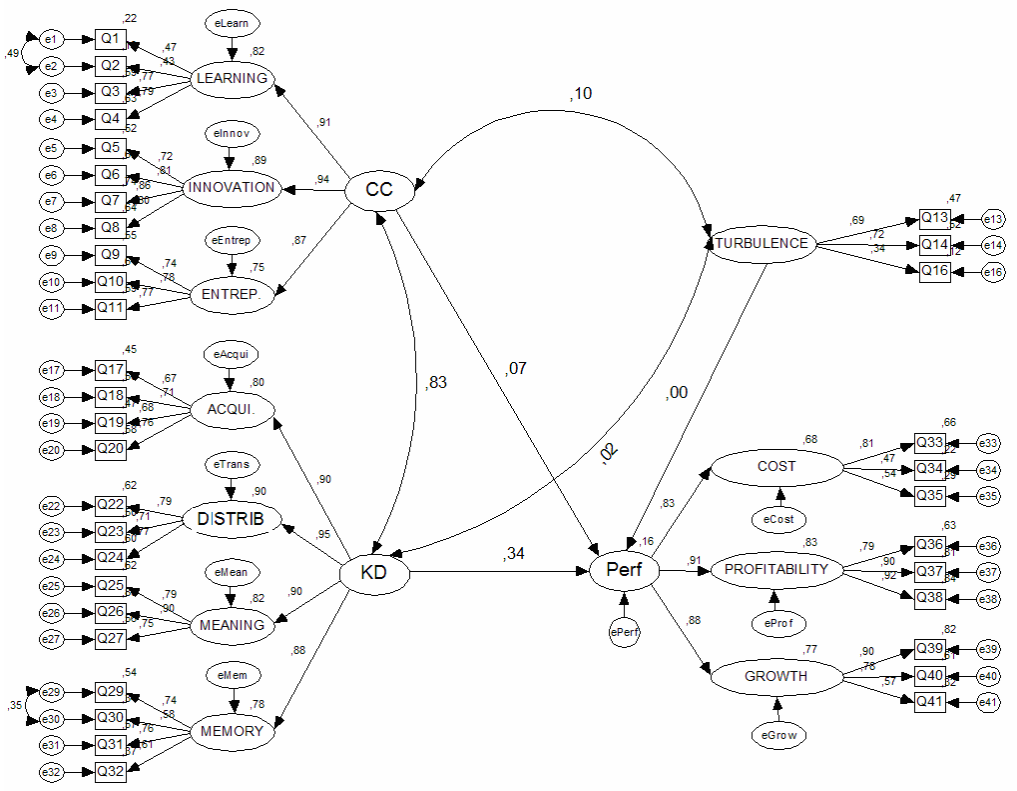


Figure 25 (B). Service: structural model for *Cost*.

Source: Author

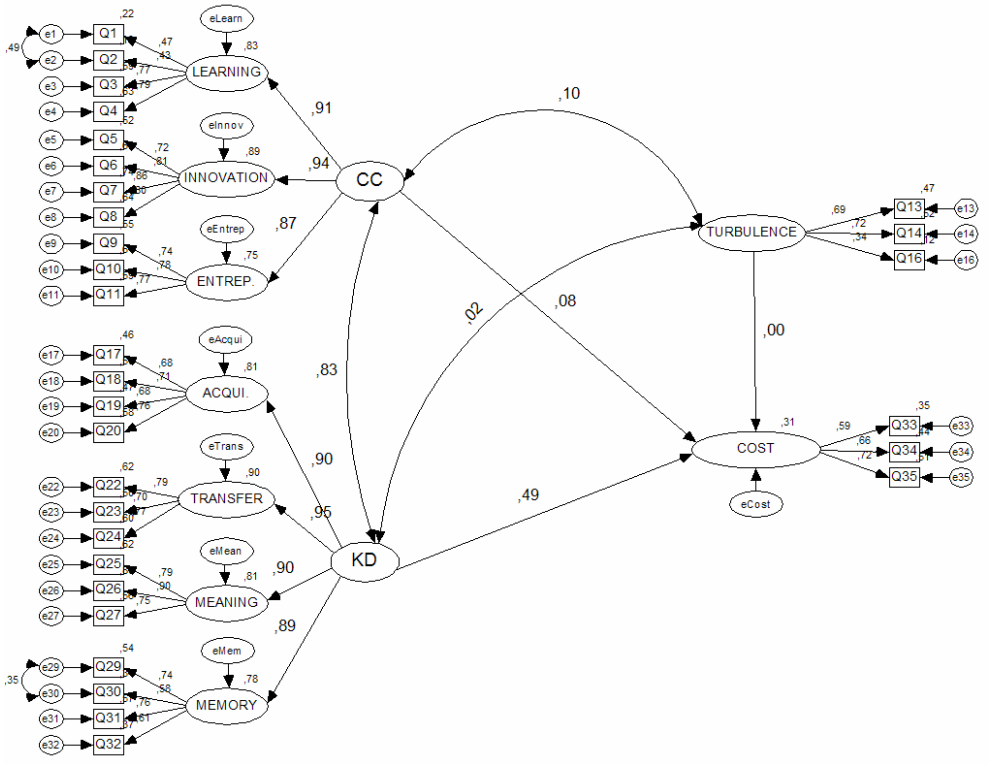


Figure 25 (C). Service: structural model for *Profitability*.

Source: Author

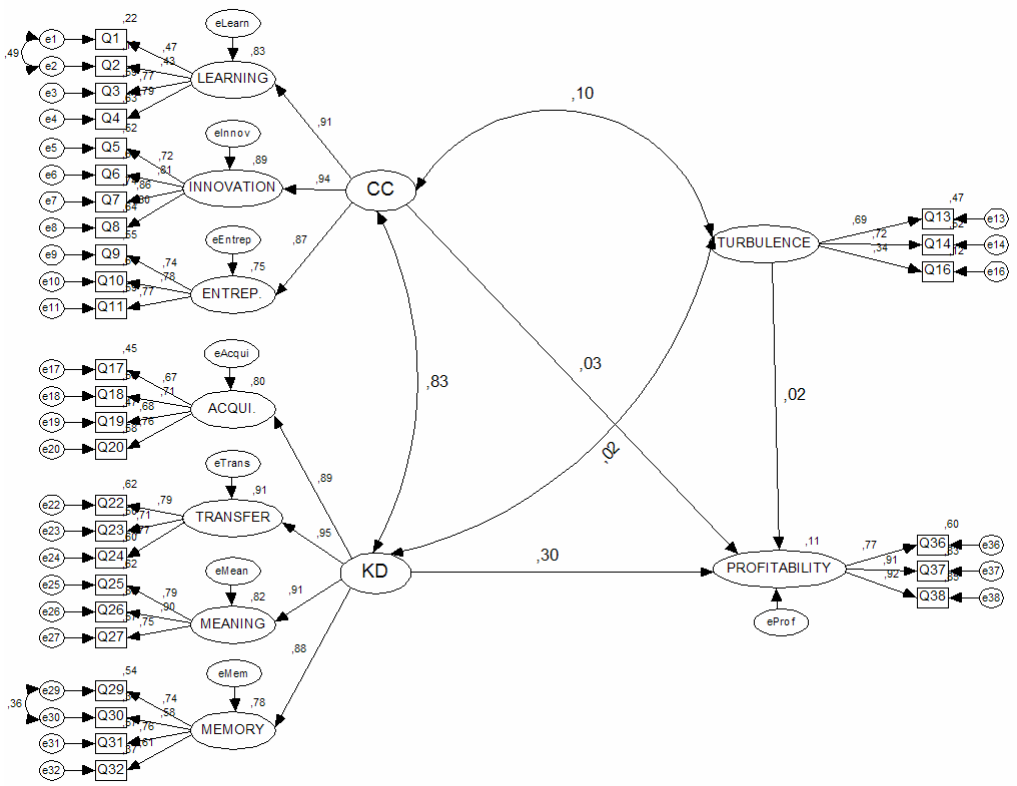


Figure 25 (D). Service: structural model for *Growth*.

Source: Author

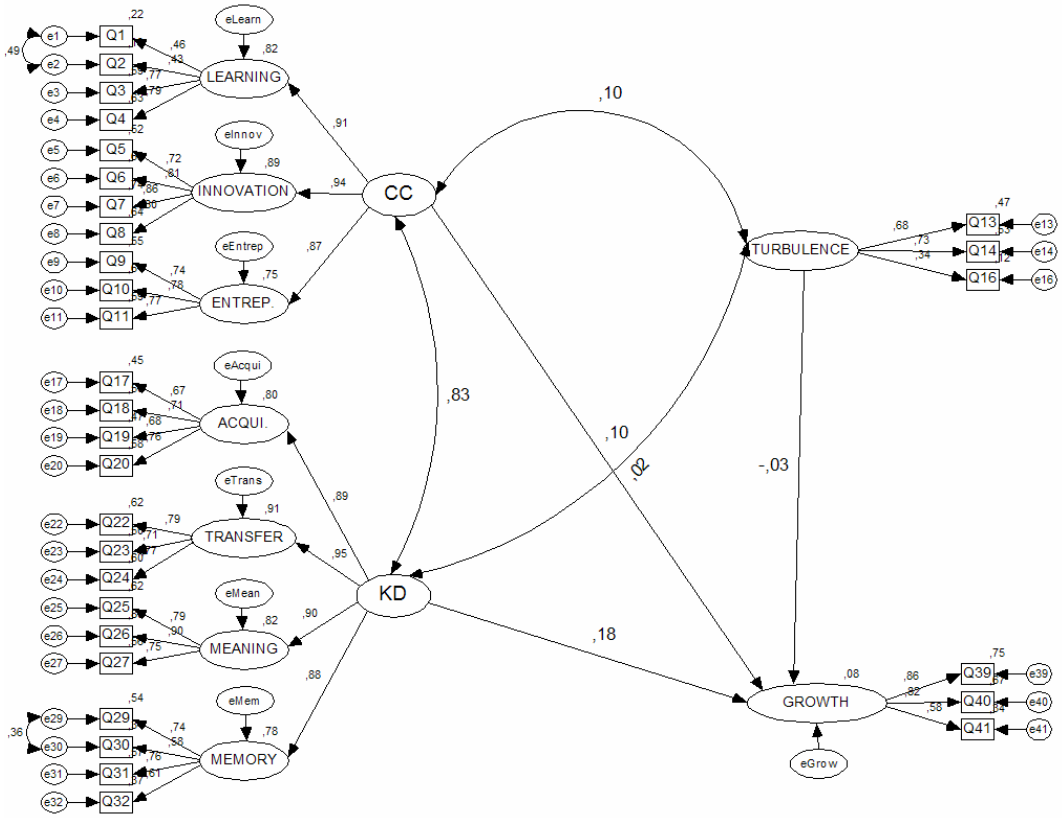


Table 32. Service: fit indices.

Source: Author

Model	χ^2	df	NFI	RFI	IFI	TLI	CFI	RMSEA	Min	Max
Performance	1410	611	.87	.86	.92	.91	.92	.05	.047	.054
Cost	966	419	.88	.87	.93	.92	.93	.05	.047	.055
Profitability	928	419	.90	.88	.94	.93	.94	.05	.045	.053
Growth	913	419	.89	.88	.94	.93	.94	.05	.044	.052

χ^2 = Qui-square; df = degrees of freedom; NFI, RFI, IFI, TLI, CFI = various fit indices; RMSEA = root mean square error of approximation; Min = minimum possible value for RMSEA given data; Max = maximum possible value for RMSEA given data.

Table 33. Service: model loadings.

Source: Author

	R^2	*CC*	*KD*	*Turb*
Performance	.16	.07 (.67)	.34** (3.09)	.00 (.00)
Cost	.31	.08 (.69)	.49*** (4.09)	.00 (.04)
Profitability	.11	.03 (.27)	.30** (2.82)	.02 (.46)
Growth	.08	.10 (.91)	.18† (1.62)	-.03 (-.52)

(†) p< .10; (*) p< .05; (**) p< .01; (***) p< .001

Although NFI and RFI were below the .90 reference, the models were considered acceptable, as the increasing complexity might have been the main reason for their deterioration. Explained R^2 were relevant for all dependent variables, although only marginally for *Profitability* and *Growth*. CC had coefficients from .03 to .10, not significant in all cases. KD had coefficients from .18 to .49, significant in all cases (weaker for *Growth*). *Turbulence* offered no explanation for any dependent variable. Therefore, the SEM provided some statistically significant information for hypothesis testing, and observable direct effects complied little with existent theory. To check these results a series of linear regressions were fulfilled.

5.2.6. Linear Regressions

Linear regressions were based on *Main Effects* (Table 34) and *Interaction* equations (Table 35). The dependent variable was represented by *Performance*, *Cost*, *Profitability*, or *Growth*. For both *Main Effects* and *Interaction* equations, values were normalized to diminish scale effects, and calculations were performed through two-step linear regressions.

Table 34. Service: regression model 1 (Main Effects) analysis.
Source: Author

	R^2	CC	KD	Turb
Performance	.16	.14* (2.27)	.29*** (4.77)	.02 (.48)
Cost	.22	.15* (2.50)	.35*** (6.04)	.01 (.27)
Profitability	.10	.11† (1.77)	.23*** (3.70)	.03 (.62)
Growth	.05	.09 (1.38)	.15* (2.36)	.01 (.23)

(†) p< .10; (*) p< .05; (**) p< .01; (***) p< .001

Table 35. Service: regression model 2 (Interaction) analysis.
Source: Author

	R^2	CC	KD	Turb	CC*Turb	KD*Turb	CC*KD
Performance	.18	.13* (2.10)	.31*** (5.10)	.04 (1.04)	.17** (2.76)	-.15* (-2.41)	.02 (.56)
Cost	.23	.14* (2.38)	.36*** (6.12)	.03 (.67)	.13* (2.19)	-.04 (-.59)	-.04 (-.90)
Profitability	.12	.10 (1.56)	.26*** (4.09)	.05 (1.26)	.21*** (3.20)	-.18** (-2.74)	.02 (.34)
Growth	.06	.09 (1.32)	.17** (2.63)	.02 (.52)	.08 (1.22)	-.14* (-2.07)	.07 (1.52)

(†) p< .10; (*) p< .05; (**) p< .01; (***) p< .001

Differently from the SEM, statistical significance was achieved for several loadings. Explained R^2s were smaller, but relevant (although only marginally for *Profitability*

and for *Growth*). CC had positive coefficients, from .09 to .15, significant only to Performance and Cost. KD had positive coefficients, from .15 to .36, significant in all cases. *Turbulence* as a direct effect offered no explanation for any dependent variable (coefficients were nearly null). However, except for *Cost*, *Turbulence* moderated KD **negatively**; and except for *Growth*, *Turbulence* moderated CC **positively**. The interaction between CC and KD offered no explanation for any dependent variable.

The similarity of these results to those encountered by Hult *et al.* (2007) was the absence of a direct influence from *Turbulence* on any dependent variable. That said, the following differences were observed:

- Added explained R^2 in the *Interaction* equation was lower (.02 against .04).
- KD had a stronger direct influence than CC.
- The CC * KD interaction was not relevant.
- The nature of *Turbulence* moderating effect when present, negative for KD and positive for CC, was the opposite of what the authors found.

These results are reassessed and discussed in the next chapter.

5.2.7. Highlights for Service Analysis

Concerning SEM:

- CC had Q1 and Q2 with low loadings (.42; .45), RMSEA = .09, and 2nd order model was discriminant to .01.
- KD had RMSEA = .06, and 2nd order model was discriminant to .01.
- *Turbulence* had Q16 with very low loading (.35), and low alpha (.59), low CR (.62), and low AVE (.40).
- *Performance* had RMSEA = .09, and low RFI (.89).
- *Cost* had low alpha (.68), CR (.67), and AVE (.47).
- Complete measurement model had low NFI (.87) and RFI (.86).
- Structural models had low NFI and RFI, with significant loadings only for KD.

Concerning the results:

- *Performance* was accepted as a 2nd order construct.
- *Profitability* had low explained variance, so results were accepted with reserves.
- *Performance* = .31*KD + .13*CC + .17*CC**Turbulence* - .15*KD**Turbulence* + ε (explained R^2 = .18).
- *Cost* = .36*KD + .14*CC + .13*CC**Turbulence* + ε (explained R^2 = .23).
- *Profitability* = .26*KD + .21*CC**Turbulence* - .18*KD**Turbulence* + ε (explained R^2 = .12).
- *Growth* = .17*KD - .14*KD**Turbulence* + ε (explained R^2 = .06).

5.3. Manufacturing & Service Comparison

After presenting hierarchical linear regression results for Manufacturing and Service separately, its is convenient to show them in the same page, so that comparison is easier to grasp. Table 36 presents these results, omitting values with both loadings smaller than .10 and no significance to $p < .05$.

Table 36. Manufacturing & Service comparison.
Source: Author

	R^2	CC	KD	Turb	CC*Turb	KD*Turb	CC*KD
PERFORMANCE							
Manufacturing	.20	.20*	.27***	-	-.12	.13†	-
Service	.18	.13*	.31***	-	.17**	-.15*	-
COST							
Manufacturing	.21	.18*	.29***	-	-	-	.13*
Service	.23	.14*	.36***	-	.13*	-	-
PROFITABILITY							
Manufacturing	.11	.15†	.18*	-	-.15†	.15†	-
Service	.12	.10	.26***	-	.21***	-.18**	-
GROWTH							
Manufacturing	.17	.18*	.24**	-	-.13	.20*	-
Service	.06	-	.17**	-	-	-.14*	-

(†) p< .10; (*) p< .05; (**) p< .01; (***) p< .001

6. CONCLUSIONS

This thesis aim was to contribute to academic and managerial practice by focusing on the effects of knowledge on performance, considering possible moderating effects of market turbulence, in manufacturing and service firms. Drawing on the RBV and KBV, and on empirical data collected from Brazilian firms, evidence of significant effects were found. First, knowledge development and culture of competitiveness positively affected performance, with a stronger effect of KD. Second, although KD and CC are highly correlated (coefficient always above ,80 with $p<.001$), their interaction had no significant effect on performance, irrespective of the sector (except for a subtle significance when cost was taken as dependent variable for manufacturing firms). Third, manufacturers and service providers react differently under market turbulence, with inverted signs in some situations. Under turbulence: the positive effect of KD on performance is enhanced, while the positive effect of CC remains practically the same for manufacturing; the positive effect of KD on performance is diminished, while the positive effect of CC is enhanced for service. Therefore, there is empirical evidence that, in some situation, manufacturing and service firms may behave differently.

From a managerial point of view, the results confirm the importance of knowledge, irrespective of firm sector or market turbulence. However, while industrial firms should center efforts on KD, service firms must find a balance where knowledge development (e.g. processes, norms, routines) does not impair their culture of competitiveness (e.g. learning, innovation, action). This chapter examine these conclusions in more detail, also stressing important limitations and proposing future research possibilities.

6.1. Contribution

There are several ways through which studies may contribute to academic research. This thesis: expanded existing theory on the knowledge based view (KBV) of the firm;

refined measurement scales; and added some generalization to previous results, sampling data from an emergent industrial country. The main contributions were:

1. The positive effect of knowledge on performance was confirmed.
2. Under turbulent markets manufacturing and service firms responded differently
3. A multidimensional performance construct based on cost, profitability, and growth was achieved.
4. The CC x KD interaction, found relevant for supply chains in previous studies, was not supported for firms.
5. Differences in unit of analysis, e.g. from supply chains to firms, resulted in different effects of KD and CC on firm performance under market turbulence.
6. Existing scales could be improved with the addition of more diverse indicators, capturing a wider range of concepts (e.g. information transfer measurement).
7. Results from previous studies were supported for Brazilian firms, a framework representing emerging markets, what contributed for theory generalization.

These points are discussed in detail next, along with implications of these findings for manufacturers and for service firms alike.

6.1.1. The Positive Effect of Knowledge on Performance

Recollecting, knowledge was depicted into KD and CC. The combined effect of both always impact firm performance positively, irrespective of the sector. The moderating effect of market turbulence may strengthen or weaken KD or CC effects, however under no circumstance a combined negative effect could be observed. Therefore, **Hypotheses 1 and 2 were supported by the data**. Taking service firms (e.g.), under market turbulence the summated effect of KD (+.31) with KD*Turbulence (-.15) was still positive (+.16). Therefore, no matter what, knowledge affected performance positively, once operationalized through KD and CC. Theoretical support is abundant for the positive effect of knowledge on firm performance (Conner & Prahalad, 1996; Cyert *et al.*, 1993; Fugate *et al.,* 2009; Lucier & Torsilieri, 2001; Modi & Mabert, 2007; Nahapiet & Ghoshal, 1998; Penrose, 1959; Rosenzweig & Roth, 2004; Zander & Kogut, 1995), as well as empirical support (e.g. Hanvanich *et al.,* 2006; Hult *et al.,* 2007; Menor *et. al.,* 2007; Paiva *et al.,* 2008; Schroeder *et al.,* 2002; Sengupta *et al.,* 2006; Sohal *et al.,* 2001).

Considering separately KD and CC effects on performance, the main effect for KD was more significant than that of CC, suggesting that KD always had a direct link with performance, while CC could have some influence or not. Generally speaking, firms might benefit by building knowledge development first, and then emphasizing a culture of competitiveness. This contradicts Hult et al. (2007), where the authors suggest that manufacturing supply chains firms might benefit by building a CC first, and then emphasizing KD once cultural elements are established. The explanation may reside in the existence of a knowledge based view (KBV), and not a cultural based view of the firm. When the firm is the unit of analysis, as in this thesis, there is ample literature supporting the major influence of knowledge development aspects (e.g. Cohen & Levinthal, 1990; Demsetz, 1988; Grant, 1996a, 1996b, 2001; Hayek, 1945; Kogut & Zander, 1992; Nahapiet & Ghoshal, 1998; Nonaka & Teece, 2001; Szulanski, 1996). Even when negatively moderated by turbulence, total effects of KD on performance remain positive, and at least equal (if not still superior) to those of CC. A firm is built upon knowledge, be it related to product, process, customer. Firms are efficient institutions to organize dispersed individual knowledge, enacting it to render productive services (Nonaka *et al.,* 2001; Takeushi, 2001; Tsoukas, 1996).

Although learning, innovativeness, and entrepreneurial orientations may positively contribute to performance, it is the acquisition, transfer, interpretation, and storage of knowledge in processes, routines, and employees that represent what a firm actually is (Arrow, 1974; Conner & Prahalad, 1996; Giovanni *et al.*, 2000; Grant, 1996a, 1996b; Kogut & Zander, 1992, 1996; Levinthal & March, 1993; Modi & Mabert, 2007; Mowery *et al.*, 1996; Nelson & Winter, 1982; Nonaka & Takeuchi, 1995; Teece, 2001). In supply chains, where exchange relations of independent firms are present, superior inter-firm culture may provide better results, as it may diminish gaps along firms that are different from one another (Hult *et al.*, 2007). There inter-firm knowledge development may be not so important, even undesirable and unfeasible, given industrial secrets and proprietary processes and equipment that should strategically remain within the firm only.

6.1.2. Responses under Market Turbulence

In manufacturers, market turbulence hardly had a moderating effect, with loadings only occasionally significant. When knowledge development was considered, the effect of turbulence was positive, reinforcing KD effect on performance: combined loadings went up from .24 to .44 (e.g. in *Growth*), suggesting a strong effect. The rationale is that under market turbulence superior *productivity*, *control*, *IT*, and other typically manufacturing characteristics, related to intensive application of knowledge, result in superior performance (Fitzsimmons & Fitzsimmons, 1997; Frohlicha & Westbrook, 2002; Hanvanich *et al.,* 2006; Johnston, 1999; Murdick *et al.*, 1990; Sengupta *et al.,* 2006; Sohal *et al.,* 2001). Also, better decisions on *capital intensive* investments, which involve long-time returns, economies of scale, and learning curves, emerge from superior knowledge development, instead of harsh action (Chase *et al.*, 2004; Fitzsimmons & Fitzsimmons, 1997; Haksever *et al.*; 2000; Slack *et al.*, 2004). So KD should reflect more positively on performance, under turbulent environments, for manufacturing firms. When culture of competitiveness was considered, the effect of turbulence was negative, reducing CC effect on performance: combined loadings went from .15 down to zero (e.g. in *Profitability*), suggesting a null effect of CC for manufacturers under turbulence. The rationale is that when market desires shift rapidly and unpredictably, and rapid changes can be detrimental to embedded cultural competencies: firms may learn what is not in need, working on ideas not aligned to market, resulting in implementations detrimental to performance (Hult *et al.*, 2007). So CC should reflect less positively on performance, under turbulent environments, for manufacturing firms.

In Service market turbulence had a more significant moderating effect. When knowledge development was considered, the effect of turbulence was negative, reducing KD effect on performance: combined loadings went down from .26 to .08 (e.g. in *Profitability*), suggesting a weaker effect. The rationale is that under market turbulence higher performance is expected from more heterogeneous service firms, a trait obtained through stronger worker initiative, resulting from transgressions of norms, directives, routines, and other knowledge development components (Frohlich & Westbrook, 2002; Fitzsimmons & Fitzsimmons, 1997; Haksever *et al.*; 2000; Murdick *et al.*, 1990). So KD should reflect less positively on performance, under

turbulent environments, for service firms. When culture of competitiveness was considered, the effect of turbulence was positive, reinforcing CC effect on performance: combined loadings went up from .26 to .47 (e.g. in *Profitability*), suggesting a stronger effect of CC for service firms under market turbulence.

The rationale is that under market turbulence superior *experience*, *customer participation*, *customer satisfaction*, and other typically service providers characteristics, related to and intensive organizational culture, result in superior performance (Chase *et al.,* 2004 ; Fitzsimmons & Fitzsimmons, 1997; Gianesi & Correa, 1994; Hanvanich *et al*., 2006; Levinthal & March, 1993; Lotti, 2007; Murdick *et al.,* 1990; Pires *et al.*, 2008; Schemenner, 1999). Also, better decisions on *labor intensive* investments, which involve 'people oriented' activities, training, local on-demand decisions, freedom of action, and flexible human resources emerge from a superior culture of competitiveness, instead of norms and rules (Correa & Caon, 2002; Fitzsimmons & Fitzsimmons, 1997; Frohlicha & Westbrook, 2002; Mathe & Shapiro, 1993; Murdick *et al.*, 1990; Sengupta *et al.*, 2006). So CC should reflect more positively on performance, under turbulent environments, for service firms. Therefore, **data provided evidence of sensible differences along Manufacturing and Service firms, supporting Hypotheses 5 and 6**.

Summarizing, the moderation of market turbulence on the effect of knowledge on performance was not only different for manufacturing and service firms, but opposite. The loading for the moderation of turbulence on KD was positive for manufacturers and negative for service providers, representing that the effect of KD on performance is stronger for manufacturers and weaker for service providers. On the other hand, the loading for the moderation of turbulence on CC was negative for manufacturers and positive for service providers, representing that the effect of CC on performance is weaker for manufacturers and stronger for service providers.

6.1.3. Multidimensional Performance Construct

Performance represented an adequate 2nd order construct, with a good explained variance (R^2 around .20), corroborating statements on its multidimensionality (Brito,

2009; Combs *et al.*, 2004; Crook *et al.*, 2008; Peteraf & Barney, 2003; Santos, 2008; Sengupta *et al.,* 2006; Venkatraman & Ramajunam, 1986).

Regarding *Performance* as a whole in manufacturing firms, in regular markets knowledge has a greater effect than culture. In the presence of market turbulence KD may be even more important. The managerial implication may be that if performance indicators are insufficient or not precise, and or if managers are not sure as how to position their firms in terms of market turbulence, to invest in knowledge development is the right way to go. There is evidence of knowledge-related applications in manufacturers constantly implemented by firms in an effort to enhance productivity (e.g. six sigma, lean production, ISO programs, 5S, just in time, cross-docking systems, automated manufacturing). This thesis provides theoretical and empirical support for consultants and managers' claims that knowledge-related tools are important for overall firm performance.

Regarding *Performance* as a whole in service firms, in regular markets knowledge has a much greater effect than culture. In the presence of market turbulence, however, KD becomes less important, and CC much more important. The managerial implication may be that when turbulence is high market's desires shift rapidly and unpredictably, and it is imperative for service firms to rely in their culture. A strong internal culture supports actions of the frontline worker, which acts like a conduit providing service (that may be even detached from usual procedures) and receiving feedback from the customer. This flexibility is more important to the service firm than its knowledge arsenal. Service performance requires some level of worker independence from established knowledge, so he (she) may take the correct decisions right in the 'moment of truth', supported by the shared beliefs and values of the firm (i.e. culture). CEOs, leaders, consultants, and gurus have an 'inventory' of stories and evidences of 'common people' stepping ahead of difficulties in 'troubled times' to provide 'fantastic solutions' to customers. These may find theoretical and empirical support in this thesis.

High explained variance in *Cost* (R^2 around .20) suggests that this construct is more dependent of what a firm can do (e.g. manage its CC and KD), independent of external influences. Although rarely used as a strategic measurement of

performance, cost is often cited as an important operational indicator, if not 'the' most important (Boyer & Lewis, 2002; Chase *et al.,* 2004; Corbett & Wassenhove, 1993; Flynn & Flynn, 2004; Gianesi & Correa, 1994; Hayes & Pisano, 1996; Hayes & Upton, 1998; Leong *et al.*, 1990; Noble, 1995; Rosenzweig & Roth, 2004; Skinner, 1969, 1974; Slack *et al.,* 2004; Swink & Way, 1995; Vickery *et al.,* 1994; Ward *et al.,* 1996). The amount of positive variance explained for cost may be repeated with other operations performance indicators such as reliability, flexibility, speed, and quality. An independent sample, not reported on this thesis due to insufficient number of respondent, tested these other indicators as dependent variables. Results suggest that, except for quality, all may have explained variances more representative even than cost, so future research should complement operational performance with indicators such as these.

Regarding *Cost* in manufacturing firms, in regular markets knowledge has a greater effect than culture. In the presence of market turbulence KD may be even more important. The managerial implication may be that investments to reduce costs, focusing on areas such as processes and controls (e.g. lean manufacturing, ERP implementation), are necessary in all situations, even more when fast change is present. Learning, innovation, and entrepreneurial orientations are secondary (even neutral), as the 'bulk' of manufacturing initiatives continually improves acquiring new knowledge, transferring, incorporating, and storing it internally, through superior hard-to-copy proprietary processes and equipments. If the CC x KD correlation is not spurious, specifically in cost knowledge and culture are synergic, given the proximity and importance of supply chain management to manufacturers costs.

Regarding *Cost* in service firms, in regular markets knowledge has greater effect than culture. In the presence of turbulence, however, both are matched. The managerial implication may be that investments to reduce costs have to focus on processes and controls (e.g. new IT, ERP implementation) in all situations, and also consider learning, innovation, and entrepreneurial orientations as equally important when continuous change in customers preferences is a day-to-day part of the business.

Low explained variance in *Profitability* suggests that financial results are more dependent on factors other than those directly controlled by firms (e.g. interest and

exchange rates). However, an explained R^2 around .10 indicated that investments on KD and CC do impact profitability, resulting in managerial arguments for activities such as process developments, training programs, and organizational culture initiatives. Moreover, profitability was once more validated as a significant part of a more general performance construct (Brigham *et al.*, 1999; Lumpkin & Dess, 1996; Pace *et al.*, 2003; Sengupta *et al.,* 2006).

Regarding *Profitability* in manufacturing firms, in regular markets knowledge and culture have similar effects. In the presence of market turbulence, however, KD becomes more important, and CC less important (even nullified). The managerial implication may be that when turbulence is high markets shift rapidly and unpredictably, and culture is not able to fill gaps on costumers' preferences. The learning orientation, based on internal contributions, is inadequate to external upheavals. The innovativeness orientation, based on fast changes, may direct efforts wrongly. The entrepreneurial orientation, based on edgy (maybe untested) technology, may implement bad choices. Knowledge is the safe port for profitability, as the more a firm knows about its processes and products, the better it can exploit opportunities, specially in fast changing sets. It is important to remark, however, that exploitation may compromise the future, given its suppressive effect on exploration (March, 1991; Benner & Tushman, 2003).

Regarding *Profitability* in service firms, in regular markets knowledge has a much greater effect than culture. In the presence of market turbulence, however, both are matched. The managerial implication may be that when turbulence is high, as the environment's pace of changes increases, a firm with more knowledge may be trapped in what it knows, being overcome by rapidly created complexities. There is evidence, specially in high technology industries (e.g. software and computer games) of firms attached too long to obsolete knowledge bases, loosing the 'next wave' due to insufficient learning, innovation, and or action, resulting in stumbling financial results and, not uncommonly, bankruptcy.

Low explained variance in *Growth*, specially in service firms, suggests that the need for fast expansion (e.g. little room for patents and proprietary processes) demands quick responses to specific market opportunities, generally outside the grasp (or, at

least, control) of the firm. Disciplines other than knowledge or culture are necessary to understand growth performance. These result have to be interpreted with caution, as survey respondents gave their subjective perception of firm growth. However, all in all, at least a small significant proportion of performance could be explained by a combination of culture, knowledge, and turbulence. And growth could be measured as a significant component of firm performance (Brito & Vasconcelos, 2009; Cho & Pucik, 2005; Foss, 2002; Penrose, 1959; Pitelis, 2002; Rumelt, 1991).

Regarding *Growth* in manufacturing firms, in regular markets knowledge has a greater effect than culture. In the presence of market turbulence KD may be even more important. The managerial implication may be that a firm with more knowledge has a greater arsenal of wisdom to overcome (and benefit from) rapidly created complexities (and expansion opportunities). There is evidence of fast growth in turbulent markets, be it through expansion or acquisition. Knowledge augments the number of alternatives at hand.

Regarding *Growth* in service firms, in regular markets knowledge has a greater effect than culture. In the presence of market turbulence KD becomes less important, with no effects on CC. Also, explained variance for Growth in Service is low (.06). The managerial implication may be that expansion opportunities in fast changing service environments are based on so radical changes that the firm's knowledge skills and cultural background are of limited use. Schumpeterian competition may provide a better approach in this situation, resulting in more significant results.

6.1.4. CC and KD Interaction

CC and KD covariance had a loading superior to .80 ($p<.001$) in all situations. Therefore, **Hypotheses 3 was supported by the data**. However, the interaction effect of CC and KD on *Performance* was not statistically significant, with coefficients near zero in most cases, differing from previous studies (Hult *et al.*, 2007) with theoretical support (Argyris, 1976; Baker & Sinkula, 1999; Cohen & Levinthal, 1990; Garvin, 1993; Grant, 1996a, 1996b; Hedberg, 1981; Kim, 1993; Levinthal & Lerup, 2006; Nakapiet & Ghoshal, 1998; Slater & Narver, 1995). Therefore, **Hypotheses 4 was not supported by the data**. The explanation may reside in two major points:

empirically, in the different units of analysis used, from supply chains to firms; theoretically, in the difference between a high correlation and an interaction.

The CC x KD interaction is relevant for supply chains because isolated initiatives concerning one lack effect if the other is not present. When several interconnected firms are considered, knowledge without action means no sensible transferable results; action without knowledge means uncertainty on results. Strengthening relations among independent firms may provide grouped action based on mutual knowledge, therefore superior results. Inside a firm, knowledge is more homogeneous and better distributed than in a supply chain. Also, action is more effective given hierarchical and managerial prerogatives (‘bosses’ are clearly identifiable in a firm, but not so in supply chains). Although there is a high correlation between CC and KD (i.e. firms with great quantity of one show great quantities of the other), their combined effects are not as synergetic. In other words, the presence of both CC and KD along firms in supply chains has a greater synergic component than inside one given firm.

But why should the CC x KD interaction affect positively performance measured as *Cost* in manufacturing firms? One possible explanation is that this result is spurious, and later studies might be performed to assess that. Another explanation is that, for manufacturers, significant amounts of operational costs are associated to incoming materials supplied by other firms. I.e., the supply chain effect may impact the firm’s costs directly, and therefore the synergy between CC and KD may be present. In service firms costs are mostly related to internal costs, specially labor, so the supply chain effect is not as pronounced.

6.1.5. Unit of Analysis, Scale Improvement, and Brazilian Framework

Unit of analysis had an influence on results, specially comparing firms to supply chains. Moderation of market turbulence was shallow for manufacturing firms, influencing KD positively and CC negatively to some extent. In service firms the effect was stronger, influencing KD negatively and CC positively, inverting what was found in Hult *et al.* (2007). This was somewhat expected, as Hanvanich *et al.* (2006), when studying a simplified model using firms as unit of analysis, concluded that market

turbulence weakens the effects of memory on performance (a negative moderation on KD) and strengthens the effects of learning on performance (a positive moderation on CC). In other words, Hult found different results for different units of analysis.
Scale improvement was obtained in two ways. First, translating and adapting the measurement from English to Portuguese provided more application possibilities (another step to scale validation). Coefficients, loadings, and other statistical values were adequate after refinement, and similar to those found in the original articles. Second, inserting new indicators to cope with a broader KBV context allowed for a more comprehensive measurement of the constructs, specially KD. New questions based on theory were successfully added to the scales, providing more alternatives to empirical research. Substituting Hult *et al.* (2007) learning orientation scale by Schroeder *et al.* (2002) internal learning provided an important focus on what occurs inside a given firm. At last, the successful proposition of a performance measure based on cost, profitability, and growth was an interesting empirical step on competitive advantage measurement (Brito, 2009; Combs *et al.*, 2004; Crook *et al.*, 2008; Peteraf & Barney, 2003; Santos, 2008; Venkatraman & Ramajunam, 1986).

Finally, analyzing a Brazilian framework contributed to spread the validity of previous studies to emerging markets. Although a statistical sample was not possible, the expressive number of respondents provided some generalization to the results. That they were similar to those obtained in USA may indicate that in an increasingly globalized world, differences along firms due to the countries were they are installed in (or originated from) are diminishing.

6.1.6. Managerial Implications

Theoretical foundations and empirical data supported the claim that under regular market circumstances knowledge development leads to better firm performance, for both Manufacturing and Service firms. However, in turbulent markets knowledge has an even more pronounced effect in Manufacturing firms, while it looses strength and gives place for a preponderant effect of a culture of competitiveness in Service firms. This difference may be connected to intrinsic differences along typical manufacturers and typical service providers discussed in Chapters 2.5 and 2.6.

Even when market turbulence is high, manufacturers usually have to comply with greater investments, e.g. fixed assets. Capital employment is a sensitive subject. Product development, production output, and market entry are commonly measured in months, no matter how turbulent the environment is. As huge resources are employed, being sure of making the right decision is paramount to performance, and knowledge is the base of pondered decision making. The eager for competitiveness without sufficient knowledge may imply in important misjudgments (e.g. Mercedes-Benz A-Class factory in Brazil). Last, but not least, the need for higher productivity, better controls, and up to date IT benefits those that have a wider pool of knowledge to draw from. Service firms, on the other hand, usually require less capital employed. The distance between a decision, or an idea, and its implementation is shorter, possibly less costly, and sometimes solely based on worker initiative and training. Results may be obtained in a quicker pace, but so does obsolescence. New technologies may bring ‘instant’ obsolescence, and present market leaders may vanish if they do not change fast enough (e.g. pager services). Being able to rapidly learn what is new, innovate over it, and implement changes may be as important in Service as all ability a firm has on acquiring, transferring, interpreting, and storing knowledge. Last, but not least, services are intangible, customer-dependent, subjective (e.g. customer encounter), and highly based on labor, so when change is needed firms are even more dependent upon people than on process or equipment.

Another point is that processes are in the core of industrial activity. Production has to be refined, and experience with what is made is a strategic resource, subjected to time compression diseconomies. It is not uncommon that market leaders are the companies that, long ago, were present in the first wave of a product (e.g. Bayer, GE, Whirlpool). Irrespective of market turbulence, most day-to-day industrial products are similar to their ancestors, as complete ruptures are not that frequent (e.g. cars have had combustion engines, wheels and clutch for more than 100 years). On the other hand, mainly in turbulent markets, change is the core of service activity. New services have to be created, and past experience may delay (or even block) the ‘next wave’. It is not uncommon that leaders are the companies that, not long ago, did not even exist in the ‘first wave’ of a service (e.g. JetBlue, Google, Vodafone). Many actual services are not similar to their ancestors, and ruptures are more usual.

All in all, a managerial summary of this thesis' findings would state that:

- KD influences performance irrespective of firm sector, i.e. investing in knowledge development activities will inexorably lead to positive performance.
- Turbulence does not influence performance directly irrespective of firm sector.
- The CC x KD interaction usually does not influence performance irrespective of firm sector, except for cost in manufacturers. Although a balance between CC and KD may still be desirable, given high correlation coefficients, there is little evidence that they may respond synergistically.
- Under turbulence manufacturers should priorize knowledge development over a culture of competitiveness, i.e. the more the firm knows, the better.
- Under turbulence service providers should priorize a culture of competitiveness over knowledge development, i.e. the more the firm acts, the better.
- Also, market turbulence has a more intense effect on service firms, so managers must be intensely connected to what happens in their environments. Spending more time with customers than enhancing internal processes may be advisable.

All conclusions presented offer some contribution to the study of knowledge and performance, both for managers and academics alike. However, some important limitations may be taken into consideration, as discussed next.

6.2. Final Remarks

First, the main limitation of this thesis is probably related to sampling. The use of a casual sample instead of a statistical one lead to generalization issues. Even though a large number of respondents were obtained there is no guarantee that they correctly represent the universe of Brazilian manufacturing and service providers. Also, acceptance of respondents from different areas (e.g. HR, operations, finance) and with different hierarchical status (e.g. analysts, supervisors, directors) may have lead to biased results, as these do not exactly represent the same group of respondents. The lack of systematization on gathering multiple respondent per firm (i.e. some firms had one respondent, others had up to 25) also did not contribute to a more robust study, although it is more desirable to have many answers from a firm

than just a single participant. Sampling may also have privileged participants from the São Paulo state, although several efforts were made to bring the research to many different states (e.g. Amazonas, Pará).

Side note: *Pará and Amazonas were studied as this thesis intended also to compare performance of firms from these regions to that of more industrial states (e.g. SP), to explore possible effects of government subsides on knowledge development, culture of competitiveness, market turbulence, and performance. However, data was not sufficient for a proper analysis.*

Second, a method limitation involved the lack of a SEM analysis of moderations and interactions along 2nd order variables. It would have been important to accomplish these calculations, comparing them with the results obtained from hierarchical linear regressions. Given the technical impossibility of performing these procedures in the AMOS software, samples might have been split in 'lower turbulence' and 'higher turbulence' respondents in order to indirectly assess if in more turbulent markets the expected results should be confirmed. The SEM analysis performed for the direct effects model (no interactions or moderations) found no support for the hypothesis, except for the influence of KD on performance when *Cost* is taken as the independent variable. It would be unwise to judge based on SEM, as this model was incomplete, therefore could provide only inconclusive, non-definite results. Given the large number of respondents, split samples might have been used to support internal validity. Also, although several dependent variables were separately tested (performance, cost, profitability, growth), no model considered the possibility of an effect of only KD or only CC on performance. This lack of alternative models excluded interesting possibilities, such as the complete mediation of culture by knowledge to result in superior performance.

Third, theoretical support was limited due to the large number of variables involved. As the main focus was on effects of knowledge, supported by a KBV framework, greater attention was given to this topic. Although several authors were sought to support hypotheses and propositions related to culture, turbulence, performance, and differences along manufacturing and service firms, not always the bibliography was as comprehensive as it should have been, and theoretical discussions may not have

been as extensive as they should be. Dealing with several concepts, with multiple operationalizations, second order effects, moderations and interactions resulted in increased complexity. That a satisfactory model was proposed, that sufficient data was obtained, and that robust conclusions were presented, is somewhat surprising given resource and time restrictions.

Fourth, measures were subjective, possibly leading to less accurate results (specially for the dependent variables). However, as all firms were identified, it is theoretically possible to reach each one and gather complimentary data. Fifth, inferences were restricted by use of cross-sectional data, instead of long-term observations, so that only a picture of the present state was obtained. However, as knowledge and culture are usually hard to change manifestations of a firm, results regarding these variables may be valid to a reasonable amount of time.

Future research could perform a better division on manufacturing and service firms, stressing process and customer contact characteristics over general classifications. E.g. although banks represented service, they may have more of a manufacturing characteristic than a Harley Davidson manufacturer. Differences along functional areas (e.g. HR over finance), hierarchical position (e.g. analysts over CEOS), firm size, geographical position, and other classifications should be more carefully considered. Most of all, statistical sampling would be desirable to enhance generalization. Considering other performance manifestations, such as operations competitive priorities (e.g. reliability, flexibility, quality) would also enhance the applicability of these findings.

Summarizing, one of the central trends in today's business 'pop-management' is that the world is moving to an information or knowledge society. Firms have to tap into the repository of knowledge present in their workers, suppliers, and customers to develop solutions for increasingly complex and fast changing problems. Indeed, giant companies emerge from nowhere in a matter of few years; or are formed through increasingly bigger mergers and acquisitions. At the same time, there are more and more small business fighting in the competitive interstices left by these giants, with high incentive for entrepreneurship as cheaper capital is available and home-based solutions are a reality given modern facilities as the Internet. Drawing on multiple

theories, this thesis advances the research on KBV, discussing previous findings and contributing to insights on how performance is affected by knowledge. Given the investments managers do in knowledge-related initiatives, and the need for direction and evidence that these investments truly lead to superior results, this research helps closing the gap between what we know and what we need to know about the determinants of knowledge development, culture of competitiveness, and their effect on performance in regular and turbulent market conditions.

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APPENDIX 1: Resumo em Português

Efeitos do conhecimento no desempenho de firmas de manufatura e serviços

Pesquisas ligadas à vantagem competitiva são importantes ao estudar como certas empresas obtém desempenhos superiores ao de seus concorrentes. Cada vez mais a visão baseada em recursos (RBV) serve de base teórica para desvendar como as empresas desenvolvem recursos estratégicos, difíceis de serem comercializados, copiados ou substituídos, colocando-se à frente de seus competidores(Barney, 1986, 1991, 1995; Conner, 1991; Dierickx & Cool, 1989; Wernerfelt, 1984). Certos temas relevantes mostram-se multidisciplinares, e um número crescente de autores relaciona o desempenho da firma a áreas como aprendizado (Hult, Ketchen, & Nichols, 2003), comportamento organizacional (Uzuneri & Nembhard, 1998), cultura (West & Burnes, 2000), e gestão do conhecimento (Paiva, Roth, & Fernsterseifer, 2008). Partindo da estrutura proposta por Hult, Ketchen, & Arrfelt (2007) esta tese pesquisa os efeitos do desenvolvimento do conhecimento (KD) e da cultura de competitividade (CC) no desempenho das empresas, e a influência da turbulência de mercado nessas relações. Os resultados sugerem que tanto KD quanto CC têm um efeito sobre o desempenho, porém isso não ocorre com a sua interação. Mais importante, em mercados turbulentos empresas de manufatura e de serviços apresentam comportamento distintos. Nas empresas de manufatura há um efeito maior do conhecimento (KD) no desempenho se o ambiente é mais turbulento, com um papel secundário para cultura (CC). Nas empresas de serviços há um efeito maior da cultura (CC) no desempenho se o ambiente é mais turbulento, enquanto que o efeito do conhecimento (KD) é atenuado. Além disso, a proposição de que a turbulência de mercado não tem um efeito direto sobre o desempenho é observada.

KD, CC e *Desempenho* são medidos indiretamente através de indicadores. CC, um padrão de crenças e valores compartilhados que orientam a relação com o mercado, é definida como um constructo latente de 2ª ordem, baseada nas orientações para o *Aprendizado*, a *Inovação* e o *Empreendedorismo*, todos constructos latentes de 1ª ordem (Hult *et al.*, 2007). Cada um desses constructos possui seu próprio grupo de indicadores, formados inicialmente por quatro variáveis observáveis, obtidas através

de respostas a um questionário para perguntas apresentadas numa escala Likert de cinco pontos. KD, um processo por vezes casual cercado de diversas possibilidades, é definido como um constructo latente de 2ª ordem, baseado nos constructos latentes de 1ª ordem de *Aquisição do Conhecimento*, *Distribuição da Informação*, *Significado Comum* e *Memória Adquirida* (Huber, 1991; Hult *et al.*, 2007). *Turbulência de Mercado*, ligada à velocidade com que os clientes mudam suas preferências afetando o ambiente de atuação das empresas, é definida diretamente como um constructo latente de 1ª ordem (Jaworski & Kholi, 1993). Finalmente o *Desempenho* é definido como um constructo latente de 2ª ordem, baseado nos constructos latentes de 1ª ordem de *Custo*, *Lucratividade* e *Crescimento* (Kim & Arnold, 1992; Combs *et al.*, 2004; Penrose, 1959). O modelo completo é ilustrado na Figura 2 (p. 64).

A aquisição de dados foi realizada a partir do envio de um questionário para mais de dez mil respondentes potenciais. A amostragem foi casual, ao invés de aleatória, e os respondentes foram contatados principalmente por meio de bases de dados de e-mail. Mais de três mil respostas foram obtidas, representando mais de 1200 firmas diferentes. Após a limpeza dos dados duas amostras foram consideradas para análise, uma com 334 empresas de manufatura e outra com 509 empresas de serviços. Os respondentes fazem parte principalmente das áreas de RH, operações e finanças, ocupando posições de liderança tais como supervisor e gerente. Para cada questão foi realizada uma estatística descritiva. Para testar as hipóteses uma modelagem por meio de equações estruturais (SEM) foi utilizada diretamente sobre as perguntas do questionário. Além disso, cálculos de regressão hierárquica linear foram realizados, partindo de valores somadas que agruparam as variáveis (após normalização) em seus constructos de 2ª ordem. Cargas fatoriais, indicadores de erro, interceptos, e médias dos fatores foram calculados. Com 37 questões (após a revisão), a matriz de mensuração contou com 703 elementos e 131 parâmetros livres para estimação do modelo, resultando em 572 graus de liberdade – um modelo sobre-identificado onde cargas, erros, covariâncias, e ajustes podem ser estimados estatisticamente. Assim, as propriedades psicométricas dos constructos foram avaliadas por meio de análises fatoriais confirmatórias (CFA), onde a função de máxima verossimilhança (ML) foi utilizada como método de estimação. Após analisar a dimensionalidade, confiabilidade e validade do modelo de medição, um

modelo estrutural foi proposto e testado, apresentando índices de ajuste satisfatórios quando comparados à literatura de SEM. A confiabilidade foi avaliada a partir dos valores do alfa de Cronbach, da confiabilidade composta (CR), e da variância média extraída (AVE). A validade discriminante sustentou os modelos de 2ª ordem, apesar de por vezes o valor da diferença dos qui-quadrados se mostrar superior aos limites sugeridos pela literatura.

Os resultados da pesquisa mostram que, em mercados com pouca turbulência, não há diferenças significativas entre empresas de manufatura e serviços com relação aos efeitos do conhecimento e da cultura no desempenho. Nesse ambiente o desenvolvimento do conhecimento (KD) tem um efeito maior que a cultura de competitividade (CC) na performance. No entanto, em mercados turbulentos estes setores apresentam comportamentos diferentes, embasando a idéia de diferenças na natureza entre operações de manufatura e serviços. Do ponto de vista gerencial as conclusões da tese reforçam a importância do conhecimento, independentemente do setor ou do ambiente a que a empresa está sujeita. No entanto, enquanto manufaturas devem focar seus esforços em KD, empresas de serviços precisam encontrar um meio termo para que ações voltadas à gestão do conhecimento (e.g. normas, processos, rotinas) não interfiram com o desenvolvimento de sua cultura de competitividade (e.g. aprendizagem, inovação, empreendedorismo), pois esta é igualmente importante nesse casos para o resultado superior da empresa.

Esta tese contribui para literatura existente ao propor que: (1) há um efeito positivo do conhecimento no desempenho, reforçando proposições teóricas da visão baseada no conhecimento (KBV); (2) diferentes setores comportam-se de modo diferente (até mesmo oposto) em ambientes de mercado turbulentos; (3) a criação de um constructo multidimensional para o desempenho baseado em custo, lucratividade e crescimento é uma alternativa interessante para avaliar a vantagem competitiva sustentável das empresas; (4) a interação entre CC e KD, que aparece como relevante em estudos anteriores, não é encontrada; (5) diferenças de unidade de análise, de cadeias de suprimento pra firmas individuais, resultam em diferentes efeitos de KD e CC no desempenho em mercados turbulentos; (6) as escalas existentes foram aprimoradas para incluir indicadores mais distintos, capturando uma gama maior de possibilidade nos constructos (e.g. mensuração da transmissão

do conhecimento); e (7) resultados obtidos em estudos anteriores são observados em empresas brasileiras, contribuindo para generalização da teoria. Um resumo gerencial das conclusões dessa tese permite propor que:

- O desenvolvimento do conhecimento influencia positivamente o desempenho independentemente do setor, ou seja, investir em KD levará inexoravelmente a um resultado superior.
- A turbulência de mercado, independentemente do setor, não influencia a performance diretamente.
- A interação entre CC e KD não influencia a performance, independentemente do setor. Apesar de ser desejável manter um equilíbrio entre CC e KD, dada sua alta correlação, há poucas evidências de que ambos respondam com sinergia.
- Na turbulência empresas de manufatura devem priorizar a gestão do conhecimento sobre o desenvolvimento de uma cultura de competitividade, i.e. quanto mais conhecimento uma firma tiver, melhor.
- Na turbulência firmas de serviços devem priorizar a cultura de competitividade sobre a gestão do conhecimento, i.e. quanto mais uma firma agir, melhor.
- A turbulência de mercado tem efeito maior sobre empresas de serviço. Gestores dessas organizações devem estar ainda mais atentos ao que ocorre em seus ambientes. Passar mais tempo com os clientes no lugar de sentar numa escrivaninha para aprimorar os processos tende a ser aconselhável.

Concluindo, uma das principais vertentes observadas hoje no mundo dos negócios refere-se à migração do mundo para uma sociedade baseada na informação. As empresas precisam acessar cada vez mais o repositório de conhecimento existente em seus colaboradores, fornecedores, e clientes para desenvolver soluções voltadas a problemas cada vez maiores e mais complexos. Mega-corporações emergem praticamente do nada em poucos anos; ou são continuamente formadas a partir de fusões e aquisições. Ao mesmo tempo há mais e mais pequenos negócios lutando nas brechas deixadas por estes gigantes, fazendo valer seu empreendedorismo e com acesso cada vez maior a fontes baratas de capital, aplicando soluções caseiras a partir de escritórios alocados em suas “garagens”, dadas as facilidades atuais de comunicação (e.g. Internet). Baseando-se em múltiplas teorias o presente estudo amplia a pesquisa sobre a KBV, discutindo achados anteriores e contribuindo com

idéias sobre como o desempenho é afetado pelo conhecimento. Considerando os investimentos que os gestores realizam em atividades de gestão do conhecimento, e a necessidade de direcionamento e evidências de que tais ações realmente levam a resultados superiores, esta pesquisa ajuda a encurtar a distância entre o que se sabe e o que é preciso descobrir sobre as influências do desenvolvimento do conhecimento e da cultura de competitividade no desempenho das organizações.

APPENDIX 2: Questionnaires

CULTURA DE COMPETITIVIDADE & TURBULÊNCIA

Marque **1** se você **DISCORDA TOTALMENTE** da afirmação

Marque **2** se você **DISCORDA** da afirmação

Marque **3** se você **NEM DISCORDA, NEM CONCORDA** com a afirmação

Marque **4** se você **CONCORDA** com a afirmação

Marque **5** se você **CONCORDA TOTALMENTE** com a afirmação

	Discordo Totalmente 1	Discordo 2	Nem Discordo, Nem Concordo 3	Concordo 4	Concordo Totalmente 5
1. Nosso pessoal é treinado em outras áreas da empresa, para ocupar o lugar de outros se necessário.					
2. Nosso pessoal é treinado para realizar múltiplas tarefas.					
3. Nossos gestores levam a sério todas as sugestões de melhoria propostas.					
4. Muitas sugestões de melhoria são implementadas na empresa.					
5. Inovações, baseadas em pesquisas, são rapidamente aceitas em nossos processos.					
6. Procuramos ativamente por idéias inovadoras.					
7. A inovação é encorajada na empresa.					
8. A inovação é rapidamente aceita na empresa.					
9. Investimos adequadamente em pesquisa & desenvolvimento.					
10. Enfatizamos a liderança tecnológica na empresa.					
11. Introduzimos rapidamente novas tecnologias na empresa.					
12. Temos uma inclinação por projetos arriscados.					
13. As preferências dos nossos clientes mudam rapidamente.					
14. Nossos clientes procuram o tempo todo por novidades.					
15. Há muitos clientes comprando conosco pela 1ª vez.					
16. Novos clientes têm necessidades que os clientes antigos não têm.					

DESENVOLVIMENTO DO CONHECIMENTO

	Discordo Totalmente 1	Discordo 2	Nem Discordo, Nem Concordo 3	Concordo 4	Concordo Totalmente 5
17. Nos reunimos regularmente para discutir possíveis novos produtos.					
18. Somos eficientes em detectar mudanças no ambiente externo.					
19. Comparamos nossa performance com o mercado, via benchmarking e busca por “melhores práticas”.					
20. Nos empenhamos continuamente em obter e absorver novos conhecimentos gerados externamente.					
21. Frequentemente temos encontros entre áreas para discutir tendências para empresa.					
22. Dedicamos tempo para discutir necessidades futuras da empresa com outras áreas.					
23. Sabemos rapidamente quando algo importante ocorre em outra área da empresa.					
24. Quando descobrimos algo importante para empresa rapidamente alertamos as outras áreas.					
25. Compartilhamos informações efetivamente entre todas as pessoas da empresa.					
26. Desenvolvemos um entendimento compartilhado sobre as informações disponíveis.					
27. Debatemos em grupos os eventos mais importantes para desenvolvermos um significado em comum.					
28. Possuímos uma linguagem própria que ajuda as áreas a trocarem conhecimentos.					
29. Possuímos grande conhecimento sobre os produtos e processos da empresa.					
30. Temos muita experiência sobre nossos produtos e processos.					
31. Investimos tempo para registrar de alguma forma nosso conhecimento na empresa.					
32. O conhecimento sobre um mesmo processo ou produto pode ser encontrado com diferentes pessoas.					

CUSTOS, LUCRATIVIDADE & CRESCIMENTO

Agora o enfoque está na competitividade da sua empresa, comparando-a com outras firmas do setor. Indique sua percepção sobre o desempenho de vocês em relação à média de mercado.

Marque **1** se sua unidade de negócios foi **MUITO PIOR QUE A MÉDIA**

Marque **2** se sua unidade de negócios foi **PIOR QUE A MÉDIA**

Marque **3** se sua unidade de negócios foi **IGUAL À MÉDIA**

Marque **4** se sua unidade de negócios foi **MELHOR QUE A MÉDIA**

Marque **5** se sua unidade de negócios foi **MUITO MELHOR QUE A MÉDIA**

	Muito Pior que a Média **1**	**Pior que a Média** **2**	**Igual à Média** **3**	**Melhor que a Média** **4**	**Muito Melhor que a Média** **5**
33. Produtividade					
34. Custos de mão de obra					
35. Custos de insumos					
36. Geração de caixa sobre faturamento					
37. Lucro operacional					
38. Lucro líquido					
39. Crescimento do faturamento					
40. Crescimento dos ativos					
41. Crescimento do número de funcionários					

INFORMAÇÕES GERAIS

O questionário é estritamente confidencial. As informações abaixo são variáveis de controle usadas para evitar a concentração de respondentes, o que enviesaria os resultados.

Site da empresa na Internet: _____

Setor a que a empresa pertence: _____

Sua atuação na empresa: _____

APPENDIX 3: Questionnaire Construction

This is an example on how scales were refined. Several times considerations like these were performed. Those are not presented here in their totality, but are available under request.

ENLARGED SCALES FOR CC AND KD

Learning Orientation:
Our ability to learn is the key to improvement in the manufacturing process (Hult *et al.*, 2007).
Once we quit learning in the manufacturing process we endanger our future (Hult *et al.*, 2007).
The sense around here is that employee learning is an investment not an expense (Hult *et al.*, 2007).
The basic values of our manufacturing process include learning as a key to improvement (Hult *et al.*, 2007).

Innovativeness Orientation:
We actively seek innovative manufacturing ideas (Hult *et al.*, 2007).
Innovation is readily accepted in the manufacturing process (Hult *et al.*, 2007).
People are not penalized for new ideas that do not work (Hult *et al.*, 2007).
Innovation in our manufacturing process is encouraged (Hult *et al.*, 2007).
Technical innovation, based on research results, is readily accepted in manufacturing (Hult *et al.*, 2007).

Entrepreneurial Orientation:
We initiate actions to which other organizations respond (Hult *et al.*, 2007).
We are fast to introduce new administrative techniques and operating technologies (Hult *et al.*, 2007).
We have a strong proclivity for high-risk projects (Hult *et al.*, 2007).
We are bold in our efforts to maximize exploiting opportunities (Hult *et al.*, 2007).
We emphasize research and development and technological leadership (Hult *et al.*, 2007).

Market Turbulence:
Customers' preferences change quite a bit over time (Hult *et al.*, 2007).
Our customers tend to look for new products all the time (Hult *et al.*, 2007).
We have demand for our products from customers who never bought them before (Hult *et al.*, 2007).
New customers have product needs that are different from our existing customers (Hult *et al.*, 2007).
We continuously cater to many new costumers (Hult *et al.*, 2007).

Knowledge Acquisition
We meet regularly to find out what products we need in the future (Hult *et al.*, 2007).
We do a lot of in-house manufacturing research (Kohli *et al.*, 1993).
We are fast to detect changes in our customers' product preferences (Kohli *et al.*, 1993).
We poll internal clients al least once a year to assess the quality of our manufacturing (Kohli *et al.*, 1993).
We are fast to detect fundamental shifts in our industry (e.g. competition, technology, regulation) (Kohli *et al.*, 1993).
We periodically review the likely effect of changes in the manufacturing environment (Hult *et al.*, 2007).
Individuals from our manufacturing department interact directly with customers to learn how to serve them better (Kohli *et al.*, 1993).
We collect industry information by informal means (e.g. lunch with industry friends, talks with trade partners) (Kohli *et al.*, 1993).
In our business unit, intelligence on our competitors is generated independently by several departments (Kohli *et al.*, 1993).
We continually strive to obtain and absorb new knowledge generated by others (Levinthal and March, 1993).
We compare our performance to the market, through activities such as "benchmarking" and "best practices" searching (Szulanski, 1996).

Information Distribution

We frequently have interdepartmental meetings to discuss trends in manufacturing (Hult *et al.*, 2007).
We spend time discussing manufacturing future needs with other functional departments (Kohli *et al.*, 1993).
We immediately know when something important happens in the manufacturing process (Hult *et al.*, 2007).
We share data on internal clients satisfaction in the manufacturing process on a regular basis (Hult *et al.*, 2007).
When manufacturing finds out something important about competitors, it is fast to alert other departments (Kohli *et al.*, 1993).
Our business unit periodically circulates documents (e.g. reports, newsletters) that provide information on our customers (Kohli *et al.*, 1993).
There is minimal communication between marketing and manufacturing departments concerning market developments (Reversed - Kohli *et al.*, 1993).
We transfer knowledge using rules, procedures and other standardized practices (Levinthal and March, 1993).
We have shared narratives, myths and metaphors that exchange and preserve knowledge (Nahapiet and Gochal, 1998).
We set the industry standard in terms of following plans, schedules, forecasts, policies, and procedures (Grant, 1996b)
We engage in cross-functional teams and job rotation programs (Nahapiet and Goshal, 1998).

Shared Meaning

We share information effectively between the manufacturing participants (Hult *et al.*, 2007).
We share information effectively in the manufacturing process (Hult *et al.*, 2007).
We develop a shared understanding of the available manufacturing information (Hult, Ketchen, and Slater, 2004).
We develop a shared understanding of the implications of a manufacturing activity (Hult, Ketchen, and Slater, 2004).
We debate the most relevant events in groups in order to develop a shared meaning (Daft and Weick, 1984).
We have an uniform knowledge framing for most manufacturing issues (Donnellon *et al.*, 1986).
We tend to react more according to what is already on our minds than to what the new data brings us (Simon, 1991).
We do all efforts to transpose objections despite differences in knowledge possession (Conner and Prahalad, 1996).
One can easily perceive the value system of our group knowledge standards (Nonaka *et al.*, 2001).
We have a language, symbols, shared meanings, and common contexts that help all areas to exchange knowledge (Grant, 1996b).

Achieved Memory

We have a great deal of knowledge about the manufacturing process (Moorman and Miner, 1997).
We have a great deal of experience with the manufacturing process (Moorman and Miner, 1997).
We have a great deal of familiarity with the manufacturing process (Moorman and Miner, 1997).
We have invested a great deal of research and development in the supply management process (Moorman and Miner, 1997).
We spare time to store how we do things in operating procedures and scripts (Huber, 1991).
Our prior knowledge permit us to better understand the potential of manufacturing advances (Cohen and Levinthal, 1990).
Different areas have a knowledge overlap that allow us to better combine information (Nahapiet and Gochal, 1998).
We have a language, symbols, commonalities, shared meanings, and common contexts that help all areas to exchange knowledge (Grant, 1996b).
We continually strive to obtain and absorb new knowledge generated by others (Levinthal and March, 1993).

PURIFICATION EXAMPLES FOR CC AND KD (IN PORTUGUESE)

Orientação para Aprendizagem:

1. Nossa habilidade de aprender é a chave para melhoria no processo de produção.
2. Ao parar de aprender em nosso processo de produção colocamos nosso futuro em risco.
3. O sentimento por aqui é de que o aprendizado do colaborador é um investimento, e não uma despesa.
4. Os valores fundamentais do nosso processo de produção incluem o aprendizado como uma chave para melhoria.

☒ Os valores fundamentais do nosso processo de produção incluem o aprendizado como uma chave para melhoria. ***Excluído por não haver diferença substancial com a questão 24***.

Orientação Inovadora:

5. Procuramos ativamente por idéias inovadoras na produção.
6. A inovação é rapidamente aceita no processo de produção.
7. As pessoas não são penalizadas por novas idéias que não funcionam.
8. A inovação é encorajada em nosso processo de produção.

☒ A inovação técnica, baseada em resultados de pesquisas, é rapidamente aceita na produção. ***Excluído por não haver diferença substancial com a questão 30***.

Orientação Empreendedora:

9. Iniciamos ações que levam a reações de outras organizações.
10. Introduzimos rapidamente novas técnicas administrativas e tecnologias operacionais.
11. Temos uma forte inclinação por projetos de alto risco.
12. Somos ousados em nossos esforços para maximizar a exploração das oportunidades.

☒ Enfatizamos a liderança em P&D e em tecnologia. ***Excluído conforme Hult et al., 2007***.

Aquisição do Conhecimento:

13. Nos reunimos regularmente para descobrir de que produtos necessitaremos no futuro.
14. Fazemos com recursos próprios muita pesquisa na produção.
15. Somos rápidos em detectar mudanças nas preferências de produtos de nossos clientes.
16. Somos rápidos em detectar mudanças fundamentais em nossa indústria (ex. competição, tecnologia, regulação).
17. Comparamos nossa performance com o mercado, através de atividades como benchmarking e busca por “melhores práticas”.
18. Nos empenhamos continuamente em obter e absorver novos conhecimentos gerados por outros.

☒ Ao menos uma vez por ano realizamos pesquisas junto aos clientes internos para avaliar a qualidade da nossa produção. ***Excluído conforme Hult et al., 2007.***

☒ Revisamos periodicamente o provável efeito de mudanças no ambiente de produção. ***Excluído conforme Hult et al., 2007.***

Distribuição da Informação:

19. Empregamos tempo para discutir necessidades futuras da produção com outros departamentos.
20. Sabemos imediatamente quando algo importante ocorre no processo produtivo.
21. Quando a produção descobre algo importante sobre os competidores ela rapidamente alerta outros departamentos.
22. Transferimos conhecimento utilizando regras, procedimentos e outras práticas padronizadas.
23. Temos histórias, mitos e metáforas em comum que multiplicam e conservam o conhecimento.
24. Trabalhamos com times multifuncionais e programas de rotação de funções.

☒ Frequentemente temos encontros entre departamentos para discutir tendências na produção. ***Excluído conforme Hult et al., 2007***.

☒ Regularmente compartilhamos dados sobre a satisfação dos clientes internos com o processo produtivo. ***Excluído conforme Hult et al., 2007***.

Significado Compartilhado:

25. Compartilhamos informações efetivamente entre os envolvidos na produção.
26. Desenvolvemos um entendimento compartilhado sobre as informações de produção disponíveis.
27. Debatemos em grupos os eventos mais importantes para desenvolvermos um significado em comum.
28. Possuímos uma base uniforme de conhecimento sobre a maior parte das questões de produção.

29. Fazemos o possível para transpor objeções apesar de diferenças em domínios de conhecimento.
30. Possuímos uma linguagem, símbolos, significados compartilhados e contextos em comum que ajudam as áreas a trocarem conhecimentos.

☒ Compartilhamos informações efetivamente no processo de produção. ***Excluído por redundância***.

☒ Desenvolvemos um entendimento compartilhado sobre as implicações de uma atividade de produção. ***Excluído por ser um sub-caso da questão 14***.

☒ É fácil perceber o sistema de valores dos nossos padrões de conhecimento coletivo. ***A expressão "sistema de valores" confunde o respondente e é de difícil substituição***.

Memória Adquirida:

31. Possuímos um amplo conhecimento sobre o processo produtivo.
32. Possuímos uma ampla experiência com o processo produtivo.
33. Investimos tempo para registrar em procedimentos e roteiros operacionais como as coisas são feitas.
34. Nosso conhecimento anterior nos permite entender melhor o potencial de avanços na área de produção.
35. Áreas diferentes possuem intersecções de conhecimento que nos permitem combinar melhor as informações.

☒ Possuímos uma ampla familiaridade sobre o processo produtivo. ***Excluído por não haver diferença substancial entre experiência e familiaridade***.

☒ Temos investido significativamente em P&D no processo produtivo. ***Excluído conforme Hult et al., 2007***.

APPENDIX 4: Descriptive Statistics

Complete Data - Descriptive Statistics

	Statistic	Min	Max	Mean	Std. Deviation	Skewness	Std. Error	Kurtosis	Std. Error
Q1	2034	1	5	2,87	1,30	0,00	0,05	-1,29	0,11
Q2	2030	1	5	3,43	1,16	-0,52	0,05	-0,74	0,11
Q3	2030	1	5	3,16	1,12	-0,12	0,05	-0,92	0,11
Q4	2028	1	5	3,34	1,05	-0,35	0,05	-0,76	0,11
Q5	2030	1	5	3,04	1,07	-0,01	0,05	-0,82	0,11
Q6	2026	1	5	3,51	1,09	-0,49	0,05	-0,60	0,11
Q7	2027	1	5	3,39	1,14	-0,34	0,05	-0,81	0,11
Q8	2020	1	5	2,83	1,01	0,22	0,05	-0,60	0,11
Q9	2027	1	5	2,93	1,21	0,04	0,05	-1,01	0,11
Q10	2019	1	5	3,25	1,11	-0,31	0,05	-0,74	0,11
Q11	2022	1	5	2,99	1,08	0,00	0,05	-0,87	0,11
Q12	2024	1	5	2,60	1,07	0,30	0,05	-0,71	0,11
Q13	2025	1	5	3,27	1,09	-0,21	0,05	-0,87	0,11
Q14	2029	1	5	3,61	1,04	-0,54	0,05	-0,40	0,11
Q15	2026	1	5	3,43	1,00	-0,47	0,05	-0,35	0,11
Q16	2034	1	5	3,53	1,05	-0,49	0,05	-0,47	0,11
Q17	2032	1	5	3,24	1,09	-0,38	0,05	-0,80	0,11
Q18	2028	1	5	3,30	1,02	-0,36	0,05	-0,64	0,11
Q19	2028	1	5	3,39	1,05	-0,55	0,05	-0,43	0,11
Q20	2024	1	5	3,50	0,97	-0,54	0,05	-0,30	0,11
Q21	2020	1	5	3,11	1,15	-0,23	0,05	-0,94	0,11
Q22	2018	1	5	3,08	1,11	-0,16	0,05	-0,92	0,11
Q23	2031	1	5	3,10	1,14	-0,21	0,05	-0,98	0,11
Q24	2027	1	5	3,31	1,08	-0,37	0,05	-0,72	0,11
Q25	2023	1	5	2,93	1,15	0,09	0,05	-0,98	0,11
Q26	2020	1	5	3,10	1,05	-0,20	0,05	-0,79	0,11
Q27	2023	1	5	3,19	1,10	-0,33	0,05	-0,83	0,11
Q28	2025	1	5	3,17	1,07	-0,18	0,05	-0,88	0,11
Q29	2027	1	5	3,35	1,08	-0,40	0,05	-0,66	0,11
Q30	2017	1	5	3,59	1,01	-0,58	0,05	-0,27	0,11
Q31	2026	1	5	3,26	1,05	-0,30	0,05	-0,75	0,11
Q32	2031	1	5	3,40	1,07	-0,51	0,05	-0,60	0,11
Q33	2025	1	5	3,55	0,92	-0,42	0,05	-0,17	0,11
Q34	2032	1	5	3,24	0,94	-0,11	0,05	-0,38	0,11
Q35	2021	1	5	3,18	0,83	-0,04	0,05	0,01	0,11
Q36	2024	1	5	3,41	0,98	-0,30	0,05	-0,43	0,11
Q37	2015	1	5	3,42	0,97	-0,35	0,05	-0,41	0,11
Q38	2017	1	5	3,40	1,00	-0,29	0,05	-0,53	0,11
Q39	2015	1	5	3,53	0,95	-0,41	0,05	-0,29	0,11
Q40	2009	1	5	3,46	0,93	-0,27	0,05	-0,36	0,11
Q41	2024	1	5	3,24	1,00	-0,12	0,05	-0,50	0,11

Manufacturing - Descriptive Statistics

	Min	Max	Mean	Std. Error	Std. Deviation	Skewness	Std. Error	Kurtosis	Std. Error
Q1	1	5	2,87	0,07	1,23	0,03	0,13	-1,14	0,27
Q2	1	5	3,43	0,06	1,03	-0,43	0,13	-0,62	0,27
Q3	1	5	3,13	0,06	1,04	0,00	0,13	-0,74	0,27
Q4	1	5	3,45	0,05	0,93	-0,45	0,13	-0,40	0,27
Q5	1	5	3,05	0,05	0,98	0,03	0,13	-0,60	0,27
Q6	1	5	3,49	0,05	0,97	-0,39	0,13	-0,61	0,27
Q7	1	5	3,39	0,06	1,01	-0,29	0,13	-0,67	0,27
Q8	1	5	2,87	0,05	0,93	0,35	0,13	-0,28	0,27
Q9	1	5	2,98	0,06	1,11	0,06	0,13	-0,85	0,27
Q10	1	5	3,26	0,05	0,97	-0,16	0,13	-0,55	0,27
Q11	1	5	2,99	0,05	0,98	0,17	0,13	-0,67	0,27
Q12	1	5	2,62	0,05	0,94	0,25	0,13	-0,41	0,27
Q13	1	5	3,24	0,06	1,04	-0,17	0,13	-0,74	0,27
Q14	1	5	3,56	0,06	1,04	-0,62	0,13	-0,30	0,27
Q15	1	5	3,21	0,06	1,07	-0,35	0,13	-0,71	0,27
Q16	1	5	3,46	0,06	1,03	-0,38	0,13	-0,59	0,27
Q17	1	5	3,19	0,06	1,01	-0,19	0,13	-0,75	0,27
Q18	1	5	3,31	0,05	0,93	-0,32	0,13	-0,46	0,27
Q19	1	5	3,45	0,05	0,93	-0,43	0,13	-0,43	0,27
Q20	2	5	3,51	0,05	0,85	-0,39	0,13	-0,58	0,27
Q21	1	5	2,99	0,06	1,08	-0,04	0,13	-0,88	0,27
Q22	1	5	3,00	0,05	0,98	-0,08	0,13	-0,77	0,27
Q23	1	5	3,15	0,06	1,07	-0,26	0,13	-0,80	0,27
Q24	1	5	3,33	0,06	1,02	-0,28	0,13	-0,64	0,27
Q25	1	5	2,90	0,06	1,06	0,08	0,13	-0,80	0,27
Q26	1	5	3,05	0,05	0,90	-0,23	0,13	-0,54	0,27
Q27	1	5	3,12	0,06	1,02	-0,32	0,13	-0,65	0,27
Q28	1	5	3,08	0,06	1,01	-0,12	0,13	-0,89	0,27
Q29	1	5	3,43	0,05	0,97	-0,58	0,13	-0,24	0,27
Q30	1	5	3,68	0,05	0,92	-0,57	0,13	-0,28	0,27
Q31	1	5	3,23	0,05	0,98	-0,26	0,13	-0,61	0,27
Q32	1	5	3,37	0,05	1,00	-0,48	0,13	-0,49	0,27
Q33	1	5	3,62	0,05	0,86	-0,35	0,13	-0,16	0,27
Q34	1	5	3,21	0,05	0,87	-0,13	0,13	-0,12	0,27
Q35	1	5	3,15	0,05	0,84	0,01	0,13	-0,01	0,27
Q36	1	5	3,46	0,05	0,90	-0,28	0,13	-0,53	0,27
Q37	1	5	3,48	0,05	0,95	-0,36	0,13	-0,42	0,27
Q38	1	5	3,42	0,05	1,00	-0,28	0,13	-0,58	0,27
Q39	1	5	3,58	0,05	0,89	-0,43	0,13	-0,27	0,27
Q40	1	5	3,40	0,05	0,88	-0,26	0,13	-0,39	0,27
Q41	1	5	3,18	0,05	0,90	-0,03	0,13	-0,37	0,27

Service - Descriptive Statistics

	Min	Max	Mean	Std. Error	Std. Deviation	Skewness	Std. Error	Kurtosis	Std. Error
Q1	1	5	2,92	0,06	1,27	-0,06	0,11	-1,25	0,22
Q2	1	5	3,50	0,05	1,18	-0,62	0,11	-0,61	0,22
Q3	1	5	3,26	0,05	1,08	-0,20	0,11	-0,83	0,22
Q4	1	5	3,37	0,04	1,01	-0,36	0,11	-0,67	0,22
Q5	1	5	3,17	0,05	1,03	-0,12	0,11	-0,78	0,22
Q6	1	5	3,64	0,05	1,06	-0,59	0,11	-0,31	0,22
Q7	1	5	3,50	0,05	1,14	-0,42	0,11	-0,72	0,22
Q8	1	5	2,92	0,04	1,01	0,03	0,11	-0,67	0,22
Q9	1	5	2,91	0,05	1,15	-0,04	0,11	-0,95	0,22
Q10	1	5	3,28	0,05	1,08	-0,41	0,11	-0,61	0,22
Q11	1	5	3,04	0,05	1,06	-0,14	0,11	-0,73	0,22
Q12	1	5	2,68	0,05	1,10	0,11	0,11	-0,94	0,22
Q13	1	5	3,38	0,05	1,07	-0,33	0,11	-0,74	0,22
Q14	1	5	3,73	0,04	0,95	-0,71	0,11	0,18	0,22
Q15	1	5	3,56	0,04	0,92	-0,37	0,11	-0,46	0,22
Q16	1	5	3,54	0,05	1,02	-0,56	0,11	-0,21	0,22
Q17	1	5	3,27	0,05	1,08	-0,44	0,11	-0,69	0,22
Q18	1	5	3,36	0,04	0,97	-0,43	0,11	-0,42	0,22
Q19	1	5	3,38	0,05	1,02	-0,62	0,11	-0,26	0,22
Q20	1	5	3,52	0,04	0,98	-0,60	0,11	-0,04	0,22
Q21	1	5	3,16	0,05	1,12	-0,35	0,11	-0,79	0,22
Q22	1	5	3,17	0,05	1,10	-0,31	0,11	-0,78	0,22
Q23	1	5	3,16	0,05	1,13	-0,25	0,11	-0,86	0,22
Q24	1	5	3,42	0,05	1,03	-0,45	0,11	-0,48	0,22
Q25	1	5	3,01	0,05	1,12	0,01	0,11	-0,90	0,22
Q26	1	5	3,17	0,05	1,03	-0,38	0,11	-0,60	0,22
Q27	1	5	3,23	0,05	1,08	-0,34	0,11	-0,76	0,22
Q28	1	5	3,20	0,05	1,03	-0,25	0,11	-0,72	0,22
Q29	1	5	3,37	0,05	1,06	-0,43	0,11	-0,56	0,22
Q30	1	5	3,62	0,04	0,98	-0,58	0,11	-0,14	0,22
Q31	1	5	3,27	0,04	1,01	-0,38	0,11	-0,62	0,22
Q32	1	5	3,43	0,05	1,03	-0,54	0,11	-0,46	0,22
Q33	1	5	3,48	0,04	0,91	-0,36	0,11	-0,15	0,22
Q34	1	5	3,35	0,04	0,92	0,00	0,11	-0,43	0,22
Q35	1	5	3,19	0,03	0,79	-0,07	0,11	0,39	0,22
Q36	1	5	3,36	0,04	0,98	-0,39	0,11	-0,53	0,22
Q37	1	5	3,38	0,04	0,95	-0,40	0,11	-0,52	0,22
Q38	1	5	3,37	0,04	0,98	-0,30	0,11	-0,62	0,22
Q39	1	5	3,52	0,04	0,94	-0,48	0,11	-0,19	0,22
Q40	1	5	3,43	0,04	0,91	-0,35	0,11	-0,17	0,22
Q41	1	5	3,19	0,04	0,97	-0,02	0,11	-0,48	0,22

APPENDIX 5: Common Method Bias and Variance

Common Method Bias

Survey questions used a five point Likert scale, and were grouped according to their respective latent constructs. For example, learning orientation questions, however similar, were presented side by side. This, along with translation from English to Portuguese issues, and adaptation from supply chain to single firm, may induce common method bias. To check this a complementary survey was delivered to a new sample, not related to those previously used in the study, with around 2000 possible respondents. As a common method was to be tested, and not parameters of a population, preoccupations with sampling were eased.

Only *Learning Orientation* and *Achieved Memory* questions were used, to induce quick response and high participation. These constructs were chosen given their high MI values, both in isolated 1st order, and in complete measurement models. *Information Distribution* and *Shared Meaning* might have been included, but it was decided not to do so due to their strong correlation to each other (discussed later). The eight questions were put in a different order, and wording was slightly modified where phrases were too similar. A comparison between original and complementary survey phrasing and ordering is presented in Figure 26. A total of 130 answers were obtained, and fit analysis were conducted for this group. Table 37 and Table 38 present the original, complementary survey, and revised (error pairs correlated) SEM parameters for *Learning Orientation* and *Achieved Memory* obtained. There is an enormous improvement in the isolated 1st order latent variables indexes, whit benefits to the complete measurement model too (presented later).

Figure 26. Original and complementary survey.

Source: Author

ORIGINAL TEST	COMPLEMENTARY SURVEY
1) Employees are cross-trained at this plant so that they can fill in for others if necessary.	1) Employees are cross-trained at this plant so that they can fill in for others if necessary.
2) Employees receive training to perform multiple tasks.	29) We have a great deal of knowledge about the firm management process.
3) Management takes all product and process improvement suggestions seriously.	3) Management takes all product and process improvement suggestions seriously.
4) Many useful suggestions are implemented at this firm.	31) We invest time to store our knowledge in the firm.
29) We have a great deal of knowledge about the firm management process.	32) Knowledge of a given process or product may be assessed through different people.
30) We have a great deal of experience with our products and processes.	4) Many useful suggestions are implemented at this firm.
31) We invest time to store our knowledge in the firm.	2) Employees receive training to perform multiple tasks.
32) Knowledge of a given process or product may be assessed through different people.	30) We have a great deal of experience with our products and processes.

Table 37. Revised SEM parameters - *Learning Orientation* / *Achieved Memory*.

Source: Author

CONSTRUCTS	χ^2	*Df*	*Ratio*	*CFI*	*RMSEA*	*PCLOSE*
Learning Orientation						
Original	96.0	2	48.0	.81	.30	.00
Complementary survey	13.4	2	6.7	.90	.23	.00
Revised	.7	1	.7	1.00	.00	.65
Achieved Memory						
Original	37.4	2	18.7	.94	.19	.00
Complementary survey	4.4	2	2.2	.95	.11	.18
Revised	.0	1	.0	1.00	.00	.95

Table 38. Revised SEM parameters - *Learning Orientation* / *Achieved Memory*.

Source: Author

CONSTRUCTS	CR	AVE	Min	Max	Marked	MI > 10	Marked
Learning Orientation							
Original	.74	.54	.60	.69	-	e1e2 = 35 e1e3 = 10 e1e4 = 16 e2e3 = 13 e2e4 = 10 e3e4 = 64	Q1, Q2, Q3, Q4
Complementary survey	.75	.58	.49	.79	Q1	e1e2 = 12	Q1, Q2
Revised	.70	.50	.43	.79	Q3, Q4	-	-
Achieved Memory							
Original	.77	.62	.53	.85	-	e31e32 = 34	Q31, Q32
Complementary survey	.63	.36	.32	.68	Q30	-	-
Revised	.76	.60	.48	.89	Q32	-	-

The results strongly indicate common method bias, thus *Learning Orientation* and *Achieved Memory* may have errors correlated later for a best SEM fit (e.g. e3e4, e29e30). However, it is important to notice that the Q1xQ2 pair is complicated. Although reduced, the covariance between errors persist even after rephrasing and reordering. This persistence, i.e. the amount of MI that remains after common method bias treatment, can be interpreted as the existence of an unknown variable, not present in the model, explaining these indicators. This proposition cannot be proved with the available data. Revising Schroeder *et al.* (2003), KBV and HR literatures, Q1 and Q2 may be part of a *Training* construct, related to, but not fully explained, by *Learning Orientation*. Based on these arguments, although subject to criticism, e1e2 will be correlated in further analysis.

Common Method Variance

The possibility of common method variance will be assessed in different parts of this study, and an initial explanation is necessary. *Common Method Variance* (CMV) implies that the method drives respondents' answers, creating spurious relations along variables. In other words, independent of the firm current status in terms of culture, knowledge and

performance, the survey points towards the same result, whoever the respondent is, whatever the firm is. The following techniques evaluate or avoid CMV:

- Mix primary and secondary data: obtaining *Culture* and *Knowledge* estimates from survey respondents, while getting *Performance* data from firm balance sheets. In this manner independent and dependent variables are obtained in different sources, through completely different methods. As 1.509 respondents out of 2.035 identified their firms (74%), this alternative is feasible, and may be conducted as a complement to this study.
- Insert dummy questions: questions completely unrelated to the variables under study can be inserted in the survey. If they relate in a significant way with any construct, there is evidence of CMV. In this study such variables were not planned, and as there are very few control variables this alternative is not feasible.
- Exploratory factor analysis: if the number of factors in an exploratory factor analysis is well below the confirmatory factor analysis (CFA) model, then there is evidence for CMV (specially if one single factor explains most of the variance). In this study there are eleven 1st order latent variables (three in *CC*, four in *KD*, *Turbulence*, and three in *Performance*).

The exploratory factor analysis (Table 39) presents eight factors with eigenvalue greater than one, with the most relevant component explaining 17% of the extracted variance, therefore not presenting evidence of CMV.

Table 39. Exploratory factor analysis.

Source: Author

Total Variance Explained	Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %
1	6.9	16.8	16.8
2	5.5	13.3	30.2
3	4.7	11.4	41.6
4	2.1	5.1	46.7
5	2.1	5.1	51.8
6	1.7	4.0	55.8
7	1.5	3.8	59.6

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