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OPERATIONALIZING THE CONSTRUCT "REACTIVITIY": QUALITATIVE AND QUANTITATIVE ANALYSIS

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Content

General introduction

Supply chain management (SCM) involves managing complex flow of information, materials, and money across multiple functional areas both within and among companies. The aim is to achieve goals related to total system performance rather than the optimization of a single phase in a supply chain (Helo and Szekely, 2005). Typically the goals for SCM are to develop value-added processes that deliver innovative, high-quality, low-cost products on time with shorter development cycles and greater responsiveness (Fawcett and Magnan, 2004). This necessitates companies to identify, evaluate, rank, and manage its supply chain capabilities.

Since 1985, research and textbooks try to define precisely the meaning and the boundaries of SCM. Jones and Riley (1985), Houlihan (1988), Bowersox (1997), La Londe and Masters (1994 propose several well developed definition of SCM. All of them summarized in few lines a process whose difficulties and dangerous are instead not easy to figure out, whose complexity is absolutely intricate to manage, and whose benefits do not always match with the initial wishing expectations. One of the most complete and somehow complex definition has been recently provided by Mentzer et al. (2001), who propose SCM as "*the systematic, strategic coordination of the tradition business functions and the tactics across these business functions within a particular company and across business within the supply chain, for the purpose of improving the long-term performance of the individual companies and the supply chain as a whole*". This definition encompasses multitude theoretical, practical and managerial concerns that need to be carefully addressed.

Companies wish to perform with speed, quality and costs also causes firms to break down particularly during specific phases, e.g., the launch of new products

(Lee, 2004). As firms work in supply chains and networks to exploit the participants' core competences, they should also be prepared to manage the consequences of partnering, especially the ones generating uncertainty.

The sources of supply chain uncertainty are many, as different links of a supply chain are exposed to different types of sources. Supply chains even include uncertainty of sharing sensitive information such as inventory levels and production schedules with other channel members (Rahman, 2004). Dependence on outsourcing, tendency to accept short-term profits (Chandra and Kumar, 2000), pursuit to become more agile and lean adds to the overall risk susceptibility. Generally, organizations plan to protect against recurrent, low-impact risks in their supply chains but ignore high-impact, low-likelihood risks (Chopra and Sodhi, 2004). These may range from terrorist attacks (e.g. 7/11in New York or 7/7 in London), natural calamities (Tsunami, floods) or contagious epidemics (SARS, Bird flu). In addition to these, supply chain is also exposed to market risks like seasonality, volatility of fads, new product adoptions, and short product life (Johnson, 2001). All these predictable and unpredictable events have made organizations to rethink their management.

The traditional supply chain is defined as an integrated manufacturing process wherein raw materials are manufactured into final products and then delivered to customers (via distribution, retail, or both). Its implementation had primarily focused on the optimization of the procurement process from suppliers and the distribution of products to customers (Beamon, 1998). Its typical characteristics are: multiple partners, partner evaluations based on purchase price, cost-based information bases, arms-length negotiations, formal short-term contracts and

centralized purchasing (Spekman et al., 1998). All these features lead to forecast inaccuracies and slow response to the unexpected market changes.

New "forms" of supply chains have been operationalized, namely Lean, Agile, and Leagile supply chain. Each of them has been precisely described by the literature and numerous advantages and benefits are liked to their implementation. Leanness develops of a value stream to eliminate all possible waste along a process, an activity, or a supply chain. However, the emergence of a new business era characterized by continuous and unpredictable changes with a focus on core competence and mass customization has forced companies to find flexible ways to meet customer demand (Duclos et al., 2003). Agility is defined as business-wide capability that embraces organizational structures, information systems, logistics processes and, in particular, mindsets (Christopher and Towill, 2000). Agility focuses on maintaining good productivity under pressure of uncertainty (Helo, 2004). The goal in achieving agility is to establish a seamless supply chain in which all "players" think and act as one (Mason-Jones and Towill, 1999). An agile supply chain had been recognised as a competitive strategy for companies to survive and prosper (Xu et al., 2003).

Finally, Leagile is the concept recently proposed by several researchers (Naylor et al., 1999; van-Hoek, 2000; Mason-Jones et al., 2000; Christopher and Towill, 2001) and represents a combination of lean and agile. Mason-Jones et al. (2000) argued that agility can be used downstream and leanness upstream from the decoupling point in the supply chain. Thus, leagile enables cost effectiveness of the upstream chain and high service levels in a volatile marketplace in the downstream chain.

Although these three concept have been correctly operationalized and over investigated in research, practitioners and managers seem unconscious of implementation practices and the linked performance. Moreover, all concepts do no provide any definitive answer on the managing unexpected demand. While all the previous theoretical concepts appropriately work when the demand is either volatile or unpredictable, none of them perform adequately under unexpected demand. Subsequently, a research gap remains on the development of an atypical supply chain able to deal with unexpected demand and performance.

In this regard, this work seeks to introduce a novelty in this stream of the literature with the operationalization of a new concept that we name Reactivity. The final target of this work is to open a new stream of research on Reactive Supply Chain that take position among the previous contributions concerning Lean, Agile, and Leagile. As the concept is definitely new in the literature of operations and supply chain management, this work uses qualitative and quantitative research in order to address precisely and consistently the issue. Moreover, we focus our operationalization at the firm level, while extending the investigation on the entire SC in future work. This target appears quite reasonable as we need to develop a robust and accepted conceptualization at the beginning of our research development to extend it later on other domains (e.g., risk analysis). The application of Reactivity in SCM would represent an extension of Reactivity of single organizations. This is in line also with the previous developments in Lean, Agile, and Leagile, which have introduced the concept at the organizations and processes levels before to shift to SC (Faisal et al., 2004).

Unlike the research in Lean, Agile, and Leagile, we would contribute from a theoretical as well as a practical perspective. From a theoretical point of view, the

construct Reactivity takes a clear position among the existing ones considering the unexpected demand and the performance. Both issues have been mainly disregarded by previous works. From a practical point of view, we provide to managers and practitioners some managerial tools to investigate the performance and evaluate their status objectively. The existing studies on Lean, Agile, and Leagile do not provide any practical tool, therefore all issues remain abstract and no longer measurable. To properly succeed, this work consists of three chapters.

The first chapter reviews the literature on operations and supply chain management looking for applications and characterization of the construct Reactivity. Several conceptual inconsistencies highlight the knowledge surrounding that concept, that it is generally confused with Agile. Nevertheless, two main critical elements emerge: the unexpected demand and the performance. All the previous constructs are not able to perform adequately when unexpected demand occurs. Moreover, the performance obtained under such a conditions are evaluated with inappropriate tools. In order to define the concepts, structural interviews were conducted with the purpose to investigate the firms and supply chains' knowledge. The results of the qualitative analysis show that managers and firms are totally unaware of the meaning and the use of Reactivity. However, the characterization of unexpected demand and performance appears an unresolved issue. Performing under unexpected conditions is a tough target. The concept of Reactivity is then operationalized as the capability to work under unexpected conditions and to perform in terms of cost, quality, and time as working in standard frames. Finally, Reactivity may be assimilated to a dynamic operational capability that allows one to perform and succeed under unexpected demand.

The second chapter of this dissertation introduces an empirical work in order to detect which managerial practice should be adopted to become reactive. This is a deep gap existing in previous research in Lean, Agile and Leagile. All previous contributions, in fact, do not provide any managerial insights on which policies, strategies, practice a firm or a supply chain should adopt to become Lean, Agile, or Leagile. That is, previous research misses of any practical support and evidence for managers and practitioners, who are unconscious of the process to undertake to realize a specific status. By contrast, this work introduces an empirical verification to investigate which managerial practices form the Reactivity. Starting from the results of the qualitative analysis, this research provides en empirical evidence on the most effective strategies to be adopted. Moreover, the role of Reactivity is evaluated also in operational as well as financial terms. Managers and practitioners will thus possess a tool describing how to success in the implementation of reactivity and to evaluate its impact on operational and financial performance.

The third chapter proposes a measure of Reactivity that is called Reactivity index. The needs of this index emerged again from the literature on Lean, Agile, and Leagile since managers and practitioners are currently not able to figure out *how much* their firm or supply chain is either Lean, or Agile, or Leagile. The Reactivity Index is obtaining as combination of three other index of performance linked to time, quality, and cost performed under unexpected demand. A regression analysis shows which managerial practice firms should adopt in order to increase their Reactivity while the use of some dummy variables highlights the effectiveness of some managerial practices. In this sense, the work provides some

practical prescriptions to managers on the strategies and policies to be adopted to become reactive.

Finally, the combination of qualitative and quantitative analyses help substantially to properly operationalized Reactivity. The operationalization of such a concepts should always follows this mixed approach. Applying that concept to supply chain, it could be seen as an extension of Mentzer et al.'s (2001) definition that works out for both expected and unexpected demand. Organizations are generally not able to perform when unexpected event occurs since their activities and processes do not account unexpectedness. Firms and supply chain who are able to internalize that dynamic operational capability possess an edge of competitive advantage that appears definitely needed to face successfully today's worldwide competition.

Chapter 1

The operationalization of Reactivity: a qualitative investigation

1.1 Introduction

Numerous recent research in Operations and Supply Chain Management have developed particular firm's orientation such as Agile, Lean, and Leagile. Each of them has been deeply and carefully operazionalized by means of qualitative and theoretical research (Faisal *et al.,* 2006). Their operationalization has introduced interesting novelties in the literature showing several unexplored research directions and theoretical gaps where to contribute. Although their theoretical operationalization is well developed, their application appears no longer diffused and the real benefits only remain mainly artificial. When applying those concepts to business practice, firms are not able to define their boundaries, the advantages linked to a specific approach, and the implications for the management. For instance, the literature misses an appropriate measure for quantifying how much a firm is "Lean". Although this concept has hystorical theoretical development (e.g., the Lean Production) and the related benefits are clearly highlighted in the literature, the actual research does not find any real application. Moreover, the constructs developed up until now miss of some important features that this research seeks to identify.

Specifically, we characterize a new concept inside this stream of literature that we call Reactivity. Unlike Agile, Lean, and Leagile, Reactivity is not theoretical operationalized and known so far. The existing studies do not uniquely define that construct which is often ambiguously used by researchers and practitioners. As our purpose is the operationalization of a new concept, this studies applies qualitative research for modeling and investigating the construct of Reactivity as precisely as possible. The preliminary review of the literature does not help sufficiently in accurately defining this construct. Nevertheless, it

reveals that two main features have received little and ambiguous attention by the Agile, Lean, and Leagile: unexpected demand and performance.

Unexpected demand has been mainly characterized as anticipatable and unpredictable demand. Shafiri and Zhang (2001) proposes the satisfaction of unexpected demand as a feature of Agility that highlights the capacity of responding to changes in proper ways and due time by exploiting own capability of sensing, perceiving, and anticipating changes. In contrast, Naish (1989) underlines that unexpected demand is totally unpredictable and consequently any forecasting tools or capability of making predictions fail. Unexpected demand cannot be predicted or forecasted as demand shocks are totally unknown, unpredictable, and not at all anticipatable, resulting then unexpected. As this demand is not at all predictable, firms are generally not prepared to face it. This status may generate several inefficiencies therefore this research operationalizes Reactivity as the capacity of performing cost, time, and quality under unexpected demand. Under this point of view, Reactivity represents a dynamic capability that combines difficult-to-imitate resources and coordinates inter-organizational relationships globally (Teece et al, 1997). Since unexpected demand occurs sporadically and for short time-periods, firms enter in a hypercompetition state as competitive advantages can only be sustained for very short time period (D'Aveni, 1994). The sustainable competitive advantage loses any meaning being substituted by short period targets. A reactive firm is able to work within a hypercompetive environment redefining the parameters of competition based on cost, quality as well as time, and moving toward the unexpected market as first mover. It succeeds in satisfying adequately unexpected demand by performing

cost, quality, and time therefore gaining competitive advantage against the competitors.

This definition has found wide consensus by practitioners as resulting from the qualitative analysis. In addition, the latter highlights the variables influencing firm's Reactivity. The qualitative analysis has the purpose to operationalize the construct of Reactivity from a theoretical point of view and to show the practical benefits. It helps to model the construct and to precisely identify its differences with respect to the existing concepts.

The research is organized as the follow. First, it explores the existing literature on reactivity. Then, it compares theoretically the Reactivity with Agile, Lean, and Leagile in order to clarify their differences and introducing its two main pillars: unexpected demand and performance. Furthermore, it presents a qualitative analysis that reports the actual perceptions of Reactivity, exploring its characteristic and features. The final results are relevant for theorists and practice, introducing innovative and practical tools and opening unexplored research directions.

1.2 Recent developments on Reactivity: a literature review

Reactivity is not a new issue but involves numerous areas. Cannon (1932) introduces reactivity as "fight-or-flight" capacity response to stress: after facing a situation, an individual reacts by attacking (fight) or by escaping (flight). Fraser et al. (2000), writing about "negative reactions" in consuming food, explain the human reactions as physic nuisances and malaises, which require a reactive care.

Applied to management, Reactivity exalts the attributes of a post-Taylorian enterprise, enriching the original characteristics of efficiency and large-scale production with multitude of objectives. Peaucelle (2000) proposes the integration between Taylorian industry and five "zeroes" objectives by using the Kanban. This last guarantees, in fact, "acceptable reactivity" in terms of timeliness, no stock, and few outstanding and remarkable orders. Firms choose to be either reactive or productive: in the first case, flexibility is diffused everywhere and firms are flexibly oriented, whereas in the second case, organizations perform large scale production and bureaucracies (Askenazy et al, 2003).

Gaudenzi and Borghesi (2006) introduced reactivity as the targets of a particular SC focused on time compression, efficiency pipeline, and flexibility. Reactivity implies customer value and satisfaction. It reflexes the capacity of firms of working in an instable environment (Kiefer, 2000) and maximizing the performance. Volvo Car Technical Service, a division of Volvo Car Corporation, adopts a reactive rather a proactive strategy in new product and service development, by delivering exactly the technology required by the market (Ebrahimpur and Facob, 2001).

Huang, Trappey, and Yao (2006) associate the term reactivity to the agent's intelligence. After perceiving its environment, the agent reacts in a timely and appropriate manner (Sauer, Appelrath, 2003). Reactivity in production planning and scheduling implies quick changes after an internal disturbance. It may also be seen as a tool for product and service personalization: information system, automatic works, and appropriate management of flows play thus a crucial role.

Nakhla (1995) links reactivity to rapid decision making: wide range of products and high demand instability require reactive scheduling, when postponement represents the appropriate strategy for reaching this target. Cigolini, Cozzi, and Perona (2004) insert reactivity into the context of networking redesign in 3M's. The firm reallocate reactively its production capacity in different geographical contexts, from Europe to Asia and from North America to Latin America.

Reactivity requires collaborative practices and partnerships in the logistics channel (Bonet and Pachè, 2005). Pachè (1998) does not deal neither with the definition of reactivity nor with its measurement, but introduces Reactivity as a necessary attribute required for third-party logistics in grocery distribution, together with reliability and quality service.

Hardaker and Ahmed (1995) study similarity and differences between European and Japanese approaches in Computer-Integrated Manufacturing (CIM), indicating that Japanese are proactive, whereas Europeans are reactive.

Ferraud (1998) links reactivity to the competitive advantage obtainable from integration between Logistics Management and Information Systems, because both departments perform 100% level of service: Information System is able to react properly when developing, producing, and delivering products.

Analyzing previous studies, the characteristics and the meaning of reactivity can be summarized as the follows:

- appropriateness, immediateness, and opportunity to respond to a change;
- time compression;

- capacity to face the environment volatility and instability, as well as internal disturbance;
- development, production, and distribution of the product where and when customers need.

This article introduces the construct Reactivity by proposing theoretical concept, academic evidences, and empirical results. Contrarily to the established constructs in the area of the Operations and Supply Chain Management, Reactivity consists of two main pillars: the unexpected demand and the related performance. Unfortunately, the previous analysis of the literature does not uniquely conceptualize the Reactivity. The existing similarities with the constructs Agile, Lean, and Leagile leave theoretical confusion and scarce practical applications. One of the main targets of this study consists of the correct operationalization and positioning of Reactivity among the other constructs.

1.3 Reactivity against Agile, Lean, and Leagile

From a theoretical point of view, Reactivity is the natural evolution of Agility, introduced by Naylor et al. (1999). They state Agility as the use of market knowledge and virtual corporation to exploit profitable opportunities in volatile market place. Christopher and Towill (2001) compare this definition of Agile with the concept of Leanness, linked to Lean manufacturing and described as orientation for developing a value stream useful for eliminating waste, performing time, and enabling scheduling. For those reasons, the concept of Agility differs from Lean. Both Lean and Agile focus on customer responsiveness. Leanness emphasizes efficiency and cost reduction by

eliminating waste in operational process (van Hoek et al, 2001) and by resolving trade-offs based on physical assets, labor, capital, and land; Agility emphasizes the fast response to changing customer demand by providing a solution to tradeoffs based on time, information, and knowledge (van der Vorst et al., 2001). From these two definitions, the concept of Leagile emerges as the Agile and Lean orientations are merged, wherein the advantages of cost from lean and the benefits of time from agile are identified. Leagile enables cost-effectiveness of the upstream chain and high service levels in a volatile marketplace in the downstream chain by combining Lean and Agile approaches at the decoupling point (Faisal et al., 2006).

Nevertheless, this stream of literature misses a unique definition of unexpectedness. Shafiri and Zhang (2001) introduce Agility as the capacity of responding and advantaging from fast changes. Any organisation develops own ability of sensing, perceiving and anticipating changes in the business environment. Naish (1989) proof clearly that the last statement results valid exclusively when demand shocks can be anticipated. If not, the demand is unexpected and consequently any predictions fail. The unexpected demand concerns events and shocks totally unpredictable. Confounding anticipated and unexpected shocks makes broad mistakes as the variance of sales varies considerably. The difference between unpredictability and unexpectability makes Agile and Reactivity diverse constructs. Agility deals with unpredictable events that can be anticipated. Reactivity, instead, does not deal with predictable, perceivable, sensible, or anticipatable changes. Contrarily, it represents the capabilities in simultaneously optimizing firm's performance whenever unexpected demand occurs.

Moreover, Faisal *et al.* (2006) introduce Leagile as the capacity of working in volatile and unpredictable demand environment in which appropriate demand forecasting methods (algorithmic and consultative) work properly. According to Naish (1987) these methods are totally ineffective into an unexpected setting because the demand is sporadic, not linked to past demand or precedent events. In case of unexpected environment, firms carefully evaluate advantages and disadvantages in satisfying the demand since performance may change significantly.

Previous studies generally accost uncertainty to demand volatility, where the bullwhip effect is the main issue. The major causes of the bullwhip effect have been introduced by Lee et al. (1997), particularly associated with the prediction of demand: firms make predictions by probing the orders history and using several estimation methods (Lee et al, 1997). The bullwhip effect exists because manufacturers' variance exceeds the variance of the real demand (Forrester, 1961). While predictions may help in eliminating the bullwhip effect, any forecasting method result ineffective and the amplitude of the variance increases even more whenever unexpected demand occurs.

Christopher and Towill (2001) introduced the concept of Agile SC as the solution for eliminating volatility and reducing the bullwhip effect being the natural evolution of Lean SC: "Agility" works in less predictable environments with volatile demand and high unexpectedness; "Lean" performs high volume, low variety, and predictable environment (Webster, 2002). Christopher (2000) links volatility with the variety of demand experienced. The demand experienced allows for the study of the variance linked to historical orders and to predict the future by assuming that the future will behave similar to the past. In that sense,

any demand shocks might be anticipated while unexpectedness still remains. That approach, in fact, does not consider casual and sporadic demand manifestations generated by unknown events that totally change predictions and collapse the effectiveness of Agility and Leagility. From these reasons emerge the motivations for this paper. It proposes the construct Reactivity based mainly on unexpected demand and the related performance. Satisfying the unexpected demand implies a trade-off between customer satisfaction and performance. Reactivity is the operational dynamic capability enabling firms to satisfy unexpected demand without underperforming.

1.4 Reactivity as Operational Dynamic Capability

A reactive firm performs cost, time, and quality under unexpected demand relatively to a precise time period. The temporary and sporadic manifestation of the unexpected demand implies short time-period of competitive advantage and hypercompetition. The latter occurs when a firm intensifies the level of competition in the marketplace by continuously generating new competitive advantage and destroying, neutralizing or making obsolete rivals' advantage (D'Aveni, 1994). In this sense, reactive firms are able to satisfy the unexpected demand better than the competitors. They perform adequately cost, time, and quality as were working under standard conditions. Maximizing all those performance simultaneously is generally lightly considered when evaluating a first mover strategy. Although hypercompetition is defined as an environment of frequent competence-destroying turbulence (D'Aveni, 1999), Reactivity represents a operational dynamic capability able to sustain organization advantages and disrupt the advantages of competitors. According to Eisenhardt

and Martin (2000), the dynamic capabilities generate adaptive outcomes. A reactive firm is able to adapt own work shifting quickly from traditional to unexpected environments but never underperforming. Under this point of view, Reactivity fits with the definition of dynamic capability as the process to integrate, reconfigure, gain and release resources to match market changes (Eisenhardt and Martin, 2000). Hypercompetition needs changeable and flexible rather than single and designed strategy (D'Aveni, 1994). Reactivity represents a valid orientation to face hypercompetition under unexpected demand and gain short term competitive advantage. Hypercompetitive environments imply the right combination of capabilities. It represents a competitive situation where the key competitive success factor is the ability to constantly develop new products, processes or services providing the customer with increased functionality and performance. Reactivity enables a firms to combine the capabilities to perform adequately in terms of cost, quality and time under unexpected demand therefore resulting a suitable strategy for succeeding into hypercompetitive environments. In this sense, Reactivity represents a dynamic capability allowing adaptation, integration and reconfiguration of internal and external assets (Teece et al, 1997) to mach opportunities in a global marketplace subject to unexpected demand. The pressure imposed by competitors remains more or less the same until an external shock caused by event like September 11^{th} destabilizes it (D'Aveni, 2002). Reactive firms are able to control any pressure generated by those kind of events while putting even more pressure on competitors.

1.5 Reactivity and Performance

The Reactivity incorporates the effect caused by unexpected demand on three types of performance: cost, quality, and time. A reactive firm succeeds in

satisfying unexpected demand optimizing all those performances simultaneously. Especially for innovative products, reactivity appears a tough target, due to the demand unpredictability, unstable values of time, and rapid changes in cost. Reactivity varies considerably in innovative and mature settings, and this reinforces the need of a measure for both theorists and practitioners.

Reactivity accounts for performance of time in unexpected setting. Linking time with unexpected demand, it means system responsiveness. A number of studies discuss about time optimization in different fields (Gaudenzi and Borghesi, 2006; Kiefer, 2000; Tucker, Jones, 2000; Sauer, Appelrath, 2003; Askenazy end others, 2006), in case of actual or new products, but many of them argue the expected demand, while Reactivity encompasses unexpectedness:

"A reactive firm responses on time to unexpected demand".

Second, Reactivity comprises performance of cost. Unexpected demand raises the question of convenience of its satisfaction, since additional resources are required, and customer satisfaction might generate some inefficiencies. Rescheduling, additional supplies and employers, supplementary logistic service, and auxiliary controls are requested increasing further the cost (Ho and Carter, 1994). Satisfying unexpected demand is convenient whenever the variable cost associated with unexpected demand is equal to the standard variable production cost. The association between cost and reactivity is not clear, because of the interactions among processes and activities. With the tentative to fill this gap, this research states:

"A reactive firm satisfies unexpected requests at the same cost sustained for expected demand".

This statement introduces the capability of a firm of working at the same production cost independently if the demand is unexpected or not. The standard production cost of working under expected demand represents a benchmark to be reached when working under unexpected environment. Any deviation from it represents a source of inefficiency.

Finally, reactivity embraces performance of quality. Firms transfer same qualitative attributes to each product independently if it belongs to expected or unexpected demand: quality is always required regardless of the nature of the product, the market served, or the existing competition. Literature does not address the association between quality and the unexpected demand, probably according to Garvin (1987) who introduces quality as tacit product characteristics. Considering the link between reactivity and quality, this research states:

"A reactive firm produces high quality products when unexpected demand occours."

Using the previous statements, it is proposed a complete definition of reactivity embracing simultaneously unexpected demand as well as, time, cost, and quality.

"A reactive firm satisfies unexpected demand by performing simultaneously in terms of cost, time, and quality.

In order to find a robust correspondence between the Reactivity and the business world, the next section develops a qualitative analysis by means of structured interviews. This qualitative analysis investigates how practitioners perceive and define Reactivity, the main difference between expected and unexpected demand,

the related performance, benefits obtainable, as well as the drivers affecting the Reactivity.

1.6 Unexpectedness, volatility and unpredictability: a clarification.

There is a little confusion in the literature when using the terms volatility, unpredictability, and unexpectedness. When associating each of them to market demand, their difference enables the identification of the most appropriate managerial practices when choosing among Agile, Lean, and Leagile. Nevertheless, according to Faisal and other (2006), none of those performs under unexpected demand. This lack calls for a new orientation embracing "unexpectedness". Therefore, we develop Reactivity starting from the distinction between volatility, unpredictability, and unexpectedness.

Volatile demand matters demand-driven firm that has the ability to manage increased customer choices, product customization, rapid technological improvement, global competition and upstream supply fluctuations (Gangadharan, 2008). Volatile demand basically deals with quick market changes (INTEL, 2008). "Fashion goods" represent a clear example of volatile market (Christopher and Towill, 2001).

Unpredictable demand is inpatient (Kathleen et al, 2003). Unpredictable states are referred to as not-in-control trajectories manageably only by implementing adequate manufacturing and planning control system (Newman and Sridharan, 1995). Predictable events are controlled, unpredictable events are not. Nevertheless, they can be controlled by mean of informatic and statistical tools such as Advanced forecasting algorithms, Fourier/regression analysis, Time-series-based algorithm, Bayesian analysis (Moore, 2004). Among the information

system solutions offered to eliminate the unpredictability along the supply chains, ORACLE provides evaluable solutions to manage any unpredictable customer demand (www.oracle.com). Unpredictability matters random demand shocks reflecting changes in customers' tastes, technologies, operating efficiency, strikes, product variety, etc... (Swaminathan, 2001).

Unexpected demand derives from urgent surges (Gangadharan, 2008). Any information and statistical tool result totally ineffective and unable to detect "unexpectedness". In mobile networks, when an unexpected events occur the networks have no time to engineer for a specific call profile (BBC). Unexpectedness derives from abnormal variance of an event not at all predictable (Caton and Higgins, 1974). Firms make prediction and use information and statistical tools to face unpredictable demand that turns in handling the variance and the noises of predictions. When experiencing abnormal variance, the demand is unexpected. Amazon has recently launched the Amazon Kindle, a device to read electronic book and texts. Notwithstanding following the experts and observers' opinions, Amazon was unable to face such as an unexpected demand as its predictions were totally wrong.

1.7 Qualitative Analysis - Research methodology

The literature on reactivity embraces several areas, logistics, product development, production, information system, etc, and includes time, cost, innovation, and quality; at the same time, while there is a general confusion with regards to the definition of Reactivity, an in-depth investigation no longer has been conducted.

In order to precisely address its features, we develop a qualitative analysis. Three structured interviews have been administrated to managing director of companies belonging to different sectors. This analysis investigates the real and practical perceptions of Reactivity, the foundations of the unexpected demand as well as the related performance, exploring additionally its drivers.

Companies 1 is an international firm working in the elevator sector. It operates in more than 200 countries and possesses a market share higher than the 20%. Its activity is shared between production and service and both of them are furnished around the world. By rationalizing its production plants, it highly exploited efficiency in production and distribution increasing own market share and competitiveness.

Company 2 belong to the cosmetic sector and distributes its products around the world. By developing years of experience in this sector, the firm works with more than 20 brands gaining higher profit than his competitors. Although the production plants are mainly located in Europe, the company exports the major part of its production in 130 non-UE countries. By investing considerably in research and development, it has increased his own net profits of almost 20 times in the last 4 decades.

Based principally in Europe, Company 3 distributes several products through its wide international network. Its product portfolio includes high technological and cultural products. It accounts more than 100 specialized selling points and more than 50.000 visiting clients per day.

Table 1 reports the structured interviews to these three companies and the Part 1 contains the qualitative investigation for a successful operationalization.

Part 2 and Part 3 will be used later to as benchmark for the quantitative analysis especially for the data collection.

The Reactivity appears not well assessed and known within organizations. When organizing their business, firms do not think about their Reactivity. Moreover, their conceptualization is very closed to the performance of time. Any firm must satisfy on time the demand since this imply higher customer satisfaction and loyalty as well as competitive advantage. Apparently, firms feel to be reactive and performing time independently if the demand is unexpected or not. Therefore, the interviewer investigates the two novelties addressed for Reactivity: the unexpected demand and the related performance.

According to Naish (1898), firms distinguish correctly between expected and unexpected demand. In particular, the forecasting does not account unexpectedness. This latter is related to uncontrollable and unpredictable events that firms are not ready and able to face. When introducing performance, the managers arise several doubts concerning their ability to perform adequately. Although high standard of cost, quality, and time of unexpected demand are difficult to achieve, reactive firms perform all of them simultaneously.

Appendix I – Structured interviews

		Company 1	Company 2	Company 3
Part 1	What do you think about the reactivity of your firm?	I never thought about it before	Our firm is reactive because is able to satisfy customer order in any situation.	We are always reactive. Our customers have to be always satisfied on time. We do not have customer orders undelivered. This is important for increasing customer loyalty and gaining advantages against our competitors.
	Do you agree if we associate the reactivity to the satisfaction of the unexpected demand?	Well, I feel the reactivity as our capacity to deliver on time the demand. As an order arrives, it must be delivered under the planned lead time. We do not mind if the demand is forecasted or unexpected. It must be always satisfied.	We generally do not face with unexpected demand. Our forecasting system works adequately and the demand is quite stable as well. In case on unexpected, I think our systems are ready to face it.	Yes and no. Yes, because we always react satisfying the unexpected demand. No, because we react always independently if the demand is unexpected or not. Customers are the kings. They must be always satisfied. This is our policy.
	What is the difference between expected and unexpected demand?	The expected demand derives from our computational forecasting exploiting the information shared along the Supply Chain. As our purpose is to optimize production and delivery, we used to spend huge amount of money for forecasting as precise as possible. The unexpected demand is not comprised in our forecasting. It derives from events like September 11, unexpected financial changes or occasions like that implying strange behaviour of the demand that we are not able to manage or to predict.	We know our demand, so we do not face this distinction. The unexpected demand is not controllable, not forecasts about it.	The expected demand is quite known. We can face with. In the sense that, we can forecast it and we organize our activities according to. The unexpected demand is not predictable. We face constantly with and quite able to perform. It requires high flexibility. That job is not easy, fortunately we have adequate people and resources.
	When satisfying unexpected demand, is your firm performing as when satisfying the expected demand?	We try to do always our best, but it is very difficult to manage unexpected events.	We do not face unexpected demand, so I do not feel comfortable in answering to this question. But I am sure, in case of unexpected demand our firm will respond satisfactorily.	It is not always the case. Our ability to perform unexpected demand is not that much. As I was saying previously, our policy is to satisfy always the customers also when that job is not economically

				convenient for us. Customer satisfaction is more important than economic performance.
	When satisfying the unexpected demand, how does your firm perform in terms of cost, quality and time.	We try to perform adequately all these performance. We monitor constantly all of them. While the quality must be always satisfied, the performance of cost and time are not. For instance, we need to activate new logistic process for delivering the unexpected demand. This is not at all planned or us. The cost explodes while we cross our fingers concerning the time. We made some partnership with some special logistic operator although we have our own logistics network. In extreme and special case they are contacted but they are terribly expensive. Nevertheless, until now, we are satisfied on how they performed in terms of time.	If we should face unexpected demand, our firm will perform all these optimally.	Our costs are modestly controllable in the sense that they tend to increase. We try to manage them but it is difficult under unexpected environment. Conversely, we always optimize time and quality.
	Do you agree if we try to formulate a definition of reactive as the firm's ability to satisfy the unexpected demand performing cost, time and quality simultaneously?	Well, this is a nice definition of reactivity. I did not consider before also the cost and quality performance. In my mind I was thinking only in terms of time. Effectively, it is difficult to manage unexpected demand performing adequately time, cost and quality contemporarily. I think a reactive firm should do it. But I do not know if it exists.	It is a very ambitious target, but we can get it.	I think this definition is right. A firm should perform adequately cost, time and quality. We point out the optimization of time and quality as they are more directly linked to customer satisfaction. The minimization of cost is more our internal problem. If we can realize it, it will be great. Otherwise, it is ok as well, the importance is to satisfy the customer.
Part 2	As long as you satisfy the unexpected demand, which of these variables influence the reactivity of your firm? - Integrated information system - Standardized components/parts of your product - Centralized logistic - Unsaturated capacity along the Supply	 yes yes yes yes yes yes	 yes no no yes yes yes	 yes no yes yes yes yes

	Chain - Availability of workers - Stable Supply Chain relationships (suppliers turnover) - Strategic localization - Importance of the customer - Innovative product	yes yes yes	no no no	yes no no
Part 3	When you perform adequately the Reactivity, do you increase your competitive advantage and the customer satisfaction?	Our firm could have a substantial advantage on both sites because not all firms are reactive.	Yes. We work constantly for both.	As I anticipated, it is very difficult to manage the unexpected demand and hence being reactive. But we try to satisfy always the customers. This leads automatically to higher competitive advantage.

Then, the interviewer proposes the definition of Reactivity as capacity of satisfying the unexpected demand by performing cost, quality, and time simultaneously. All of them agree with this theoretical definition. It emerges as "ambitious" target since the unexpected demand generates innumerable difficulties and unpredictable changes. Up to now, firms emphasize the performance time when thinking about the unexpected demand. Cost and quality appear not directly linked to what and how representatives assume and feel Reactivity. Nevertheless, when introducing the performance of cost and quality, representatives recognize their importance in defining Reactivity. They cannot be disregarded in its operationalization that finally embraces both unexpected demand and the related performance.

Reactivity is a dynamic capability used by firms when unexpected demand occurs. Nevertheless, firms should evaluate always the performance related to their actions and strategies. When satisfying unexpected demand, firms could incur in no longer satisfying performance. In particular, performance of time, cost, and quality may decrease when unexpected events occur. The wishes to satisfy the customers are always the driving motivations. If it is true that the customer is the king, firms get higher competitive advantage only by adopting a broad perspective that embraces customer satisfaction as well as firms' performance.

1.8 Conclusion

This research attempts to operationalize the construct "Reactivity" in the domain of Operations and Supply Chain Management. The literature has already developed several constructs such as Agile, Lean, and Leagile. Nevertheless, we identify a theoretical gap when considering the unexpected demand and the performance. While the other constructs work under volatile conditions, a reactive firm is able to perform cost, quality

and time at the standard values also when unexpected demand occurs. A qualitative analysis based on structured interviews has been conducted to identify the level of knowledge of firms and practitioners in such an issue. The result shows that managers are not really concerned about any of the theoretical concepts developed. Nevertheless, they found Reactivity an interesting features to enhance competitive advantage and performance. Its future investigation is needed to address this research domain even clearly. The qualitative analysis highlights the satisfaction of the unexpected demand as well as the performance as the main features of the new concept. Reactivity may be therefore assimilated to a dynamic capability that allows one to face any hypercompetitive environment. Reactivity finds a position among the previous research in Agile, Lean, and Leagile. The qualitative analysis has helped substantially in defining the boundaries of Reactivity among the other constructs.

Further research is needed to provide more concrete prescriptions to firms. In particular, the qualitative analysis represents the first development of the construct while firms need a more realistic understanding of the issue. Especially in terms of strategies and practice, Reactivity may be practically developed as long as firms may intervene on their own industrial and logistic process to adopt that dynamic capability. That is, firms need to figure out how to become reactive. This is the main weakness of previous research in Agile, Lean, and Leagile. Research focuses on the main features of that concepts, the advantages obtainable in terms of operational performance, profit and competitive advantage. Nevertheless, none of those research highlight which strategy should be realized and implemented to get it. Future developments in this research domain should consider the opportunity to develop prescriptive research for firms. This research provides appropriate suggestions on the identification of the most suitable managerial practice. Future research should develop empirical studies to test the impact

of each practice on Reactivity and measure its real impact on economic and operational performance.

Chapter 2

An empirical investigation on Reactivity and performance

2.1 Introduction

Although the qualitative analysis of the construct Reactivity has highlighted its main features, firms and practitioners are really interested in which strategies and practice leads to it. Each of the potential managerial practices influence Reactivity with different amplitude. Theoretical research as well as qualitative investigations fail in providing a exhaustive answer. In order to overcome this limitation, this research characterizes the emerging variable Reactivity and to investigate its relationships with performance. Reactivity firms able to satisfy the unexpected demand always performing cost, time, and quality. They get considerable advantages exclusively under unexpected demand that implies short time-period of competitive advantage and the consequent development of the hypercompetition. According to Eisenhardt and Martin (2000), a dynamic capability allows to integrate, reconfigure, gain and release resources to match market changes. Reactive firms are able to do so whenever the demand shifts from predicted to unexpected. Under unexpected demand any forecasting and prediction is totally ineffective since unexpectedness derives from demand shocks not at all predictable (Naish, 1989). Reactivity represents the capability to satisfy the demand under these conditions always optimizing performance of cost, time, and quality and never disregarding the financial results. This feature mainly distinguishes Reactivity from other construct as Agile, Lean, and Leagile. According to Faisal et al (2006), the latter three fully ignore "unexpectedness" and the related performance.

As dynamic capability, the Reactivity represents mainly a feature, a firm's characteristic, an managerial orientation, deriving from several specific attributes able to realize it. We individualize those features by means of qualitative analysis in the previous chapter. Each of those contributes substantially for attaining Reactivity. In this sense, formative modelling appears quite appropriate for its investigation. Reactivity

represents in fact an "emergent" construct made throughout specific items. After forming Reactivity, its real effectiveness may be appreciated only investigating its relationships with the firms' performance. In particular, this research investigates whether Reactivity performs operational and financial performance under unexpected demand. We develop three indicators of operational performance represented by ROC (Reactivity on Cost), ROT (Reactivity on Time), and ROQ (Reactivity of Quality). These indicators result performed whenever a firm is reactive. The latent variable Reactivity applies as "latent" construct reflecting those three indicators. However, Reactivity cannot disregard the financial performance. As ROC, ROT and ROQ characterized exclusively operational performance, this research investigates the relationships between Reactivity and Financial performance. This investigation allows to appreciate Reactivity in terms of operational as well as financial performance motivating managers toward its implementation.

2.2 The pillars of Reactivity: unexpected demand and performance.

Competing inside the world of the business and facing the actual, aggressive global competition, firms look for various sources of sustainable competitive advantage. Any organization possesses numerous, hidden competences generating limited, temporary advantages and resulting in improving operational and economic targets. The literature presents some particular cases. In particular, firms develop own capabilities to be Agile, Lean, or Leagile according to the context, the environment, the involved subjects, the firms' targets. Within this framework, this study introduces the concept of Reactivity.

As the other orientations, Reactivity represents a dynamic capability. Each of them, in fact, presents particular and specific characteristics and works under certain conditions. Teece et al. (1997) define capabilities as "the key role of strategic

management in appropriately adapting, integrating, and reconfiguring internal and external organizational skills, resources, and functional competences to match the requirements of a changing environment". In addition, a dynamic capability represents "the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments". Furthermore, Eisenhardt and Martin (2000) define dynamic capabilities as "the processes to integrate, reconfigure, gain and release resources to match and even create market change as well as the organizational and strategic routines by which firms achieve new resources and configurations as markets emerge, collide, split, evolve, and die". According to Faisal *et al.* (2006), firms adopt specific orientations as Agile, Lean, Leagile in order to use and exploit specific skills and distinctive abilities facing particular characteristics of demand, producing unique and adequate products, and optimizing their performance accordingly.

Inside this stream of literature, we develop the dynamic capability Reactivity. It concerns firms' capability to face unexpected demand and optimize performance. Whenever unexpected demand occurs, reactive firms "integrate, build and reconfigure" their capabilities in order to face any market changes due to unexpectedness. Comparing Reactivity to Agile, Lean, and Leagile, this research characterizes its main features in terms of unexpected demand, characteristics of products, distinctive managerial practice as well as related performance.

2.3 Measuring the Reactivity

Performance matters from both an economical as well as an operational perspective. We develop three operational indicators of Reactivity measuring the firm's capacity to perform cost, time, and quality under unexpected conditions. This development represents a novelty inside the literature. First, none of the previous research has

elaborated any indicator of cost, time, and/or quality related to the satisfaction of unexpected demand. Second, existing research introducing Agile, Lean, and Agile misses any specific indicators of performance. This lack turns in missing chance of comparison between i.e. Agile firms. Moreover, managers are not able to identify how well their firm works with respect to the specific orientation adopted. Embracing unexpected demand and considering the features of the business equation represented by time, cost, and quality, we develop the following indicators of Reactivity:

- ***Reactivity on Time (ROT)*** measures the capacity in satisfying on time the unexpected demand and is given by the ratio between the unexpected demand satisfied on time and the total unexpected demand.

$$\text{ROT} = \frac{\text{Unexpected demand satisfied on time}}{\text{Total unexpected demand}}$$

Its best value is 100%, which means that all unexpected demand is satisfied on time and the system works reactively with respect to time.

- ***Reactivity on Cost (ROC)*** measures firms' capabilities to produce and deliver under unexpected demand conditions. Assuming that economies of scale may be no longer exploited, this indicator shows the gap between the variable production cost due to unexpected demand and the variable standard production cost.

$$\text{ROC} = \frac{\text{Standard variable production cost}}{\text{Variable production cost of unexpected demand}}$$

The variable production cost of unexpected demand is at least equal to the standard variable production cost. The latter represents a benchmark: when working under unexpected demand, in the best case the variable production cost is equal to the standard one, while in the worst case it increases considerably. The best value for ***Reactivity on Cost*** is 100%, showing a firm able to produce efficiently at the standard variable cost although unexpected events perturb the demand.

- ***Reactivity on Quality (ROQ)*** measures product reliability when working under expected conditions. It represents the well known *Quality Index* adjusted for accounting unexpectedness.

$$\text{ROQ} = \frac{\text{Unexpected demand delivered without defects}}{\text{Unexpected demand delivered}}$$

Its best value is 100%, reached whenever unexpected demand is delivered without defects and nonconformities.

Summarizing, *Reactivity is a dynamic capability enabling firms to successfully perform time, cost, and quality under unexpected demand.*

Nevertheless, two key-points are still unresolved. Which features enable a dynamic capability such as reactivity and what is its link with the financial performance. Firms are unaware on which attributes invest to become reactive. Previous researchers miss the exploration of this issue. Even firms willing to be Agile, Lean, or Leagile, unknown toward which directions devote efforts to attain the numerous and so lauded advantages. Moreover, firms are always conscious of the financial performance due to their actions. As long as firms satisfy unexpected demand, financial results perform unclearly.

In order to assess all those issues exhaustively, this research develops qualitative and quantitative analysis. The qualitative analysis allows to discover which managerial practice build up Reactivity. According to the qualitative results obtained, the quantitative analysis develops a structural equation model by specifying the constructs Reactivity and Financial Performance. In this sense, this research presents two further novelties. First, Reactivity appears a dynamic capability totally disregarded by previous studies so we operationalize an innovative construct inside the literature. Second, quantitative analysis to investigate Reactivity, while previous studies introduced principally theoretical concept, not at all supported by empirical research and mainly unknown by practice.

2.4 The main features of Reactivity.

Starting from the Faisal et al.'s (2006) contribution, this research presents the main features of Reactivity as compared to Agile, Lean and Leagile.

Naylor et al. (1999) present agility as the use of market knowledge and virtual corporation to exploit profitable opportunities in volatile market place. Christopher and Towill (2001) compare this definition of Agile with the concept of Leanness, linked to Lean manufacturing and described as orientation for developing a value stream useful for eliminating waste, including time, and for enabling scheduling. For those reasons, the concept of Agility differs from Lean. Both Lean and Agile focus on customer responsiveness. Leanness emphasizes efficiency and cost reduction by eliminating waste in operational process (van Hoek et al, 2001) and by resolving trade-offs based on physical assets, labor, capital, and land; Agility emphasizes the fast response to changing customer demand by providing a solution to tradeoffs based on time, information, and knowledge (van der Vorst et al., 2001). From these two definitions, the

concept of Leagile mergers Agile and Lean orientations, wherein the advantages of cost from lean and time from agile are considered. Leagile enables cost-effectiveness of the upstream chain and high service levels in a volatile marketplace in the downstream chain by combining Lean and Agile approaches at the decoupling (Faisal et al, 2006).

Christopher and Towill (2001) introduced the concept of Agile SC as the solution for eliminating volatility and reducing the bullwhip effect being the natural evolution of Lean SC: "Agility" is needed in less predictable environments where demand is volatile and the requirement of variety is high; "Lean" works best in high volume, low variety, and predictable environment (Webster, 2002). Christopher (2000) links volatility with the variety of demand experienced. The demand experienced allows for the study of the variance linked to historical demand and to predict the future demand by assuming its similar behavior with respect to the past. In that sense, any demand shocks might be anticipated while the problem of the unexpectedness still remains. Those paradigms, in fact, no longer consider casual and sporadic demand manifestations generated by unknown events that totally change the predictions and collapse the effectiveness of Agility and Leagility. The unexpected demand concerns events and shocks totally unpredictable. Confounding anticipated and unexpected shocks makes broad mistakes as the variance varies considerably.

We develop the construct Reactivity that overcomes this limitation as mainly based on unexpected demand and performance. Table 1 represents an adjustment of the table used by Faisal *et al.* (2006) to compare traditional, Agile, Lean, and Leagile paradigms. The market demand mainly distinguishes the constructs. This difference has been introduced previously and indicates under which conditions Reactivity performs successfully when compared to Agile, Lean, and Leagile. In addition, the next session introduces the further main point of difference between the paradigms.

Table 1 – Comparison between constructs

Attributes	**Traditional**	**Lean**	**Agile**	**Leagile**	**Reactive**
Market demand	Unpredictable	Predictable	Volatile	Volatile and unpredictable	Unexpected
Product variety	Low	Low	High	Moderate	High/moderate
Product life cycle	Long	Long	Short	Short	Short
Typical products	Standard products	Commodities	Highly customized products	Producer and customer	Highly customized product
Product conception	Producer	Producer	Producer and customer	Customized products	Supplier/producer/customer
Customer drivers	Cost	Cost	Lead time	Service level	Customization
Profit margin	Situational	Low	High	Moderate	Moderate
Information enrichment	Very little	Desirable	Obligatory	Essential	Essential
Forecasting mechanism	Independent at each echelon	Algorithmic	Consultative	Both/either	Ineffective
Dominant costs	Both	Physical costs	Marketability costs	Both	Flexible structure
Capacity to absorb SC risks	Moderate	Low	High	Moderate	High
Eliminate muda	Low priority	Essential	Desirable	Arbitrary	Essential
Network integration	Non existent	Desirable	Necessary	Obligatory	Necessary
Virtual integration	Low priority	Desirable	Necessary	Obligatory	Necessary
Information decoupling	Non existent	Advantageous	Necessary	Desirable	Necessary
Postponement	Non existent	Not required	Necessary	Desirable	Necessary
Performance of measurement:					
- quality	Product defect rate	Product defect rate	Customer delight	Customer delight	Product defect rate on unexpected deliveries (ROQ)
- cost	Market winner	Market winner	Market qualifier	Market winner	Market qualifier under unexpected demand (ROC)
- time	Market qualifier	Market winner	Market winner	Market winner	Market qualifier under unexpected demand (ROT)
Delivery penalties	Very few	Long term contractual	Loss of order	Loss of order	Loss of order

Regarding the features of the product, reactive firms ably face high/moderate product variety, with short product life cycle and high level of customization. Firms realizing modular artifacts fit adequately with those features. Reactivity implies high coordination between the SC members. Each of them participates to the product design while developing network and virtual integration appears strict needed conditions. Compared to other constructs, Reactivity mainly satisfies customers by adopting product customization approach. It appears then a dynamic capability highly oriented to customer satisfaction. Reactive firms perform, in fact, unexpected demand that is satisfying always customer even under unexpected conditions. Moreover, they realize customized products independently by the environmental circumstances therefore developing postponement strategy and information decoupling.

While obtaining moderate profit margin and considering essential the information enrichment, ineffectiveness of any forecasting mechanism represents one of the main point of difference compared to Agile, Lean and Leagile. Customer satisfaction, more then high profit margin, is the main driving motivation for investing in reactivity. Information enrichment is essential. The satisfaction of the unexpected demand requires information sharing at all level of the firm and the ineffectiveness of any forecasting mechanism reinforces even more that statement. Unexpected events are not predictable because totally independent by past and definitely uncontrollable by means of any information system solution. Faisal *et al.* (2006) introduce Leagile as the capacity of working in volatile and unpredictable demand environment in which appropriate forecasting methods, in particular algorithmic and consultative, predict adequately the demand. According to Naish (1987) into an unexpected setting these methods are totally ineffective because unexpected demand is sporadic, not linked to past demand or precedent events.

Firms should mainly invest in structure flexibility for reacting suddenly and adequately to unexpected demand. Together with information enrichment, possessing flexible structure is even more essential. The flexibility of activities and processes together with that of people enables firm's reactivity. These features eliminate any kind of *muda* and absorb the risks along the SC mainly due to unsatisfied customer and/or decreasing performance. As long as firms are not able to satisfy unexpected demand, any order is definitely lost. Reactive firms measure and monitor their dynamic capability Reactivity by using the indicators ROT, ROC, and ROQ.

2.5 Qualitative vs. quantitative analysis

Although the theoretical development of reactivity may attract the attention of researchers and practitioners, its exhaustive operationalization needs deep investigation. The qualitative analysis conducted in the previous chapter allows our objective to be reached. This approach represents in fact a novelty inside this stream of research. Previous contributions investigating Agile, Lean, and Leagile, never applied qualitative analysis for exploring whether managers and practitioners apply their main concepts and features according to the theoretical contributions. Three structured interviews have been administrated to managing director of companies belonging to different sectors. This analysis investigates the real perception of Reactivity, the foundations of the unexpected demand as well as the related performance, exploring additionally its drivers.

The structured interviews reveal a misperception of any theoretical constructs, not only Reactivity but also Agile, Lean, and Leagile. Firms organize and manage their business without adopting any of them. All managers agree in including both unexpected demand and performance when thinking and conceptualizing Reactivity.

Generally they associate Reactivity mainly to performance of time. They admit the narrowness of this viewpoint. They can never disregard performance of cost and time. The definition of Reactivity should definitely embrace both of them. The managers interviewed distinguish between expected and unexpected demand, and recognize unexpected events as sporadic and not at all predictable. Any forecasting fails when managing the unexpected demand since it relates to uncontrollable and unpredictable events. Performance under unexpected demand may not easily be optimized. When working with an unexpected demand several problems concerining the management arise so that the performance of cost, quality, and time are not 100% over standard control. Nevertheless, Reactive firms are characterized by a strong attitude to perform in any case.

The qualitative analysis highlights the needs of defining Reactivity as capacity of satisfying the unexpected demand by performing cost, quality, and time simultaneously. All the managers interviewed recognize it as an "ambitious" target. However, the implementation of adequate managerial practice may help especially the centralized logistic, the suppliers turnover, the ICT, the localization, the standardized components used. The result obtained from the qualitative investigation helps to make a questionnaire and develop quantitative analysis.

2.6 Quantitative analysis - Sample and Data description

The quantitative investigation of the construct Reactivity allows to discover which features form this dynamic capability and what benefits produces. While these latter involve indicators of operative performance under unexpected demand and financial results, the features forming the Reactivity are derived from the qualitative analysis. A questionnaire of 14 items has been administered involving:

- centralized logistic, suppliers turnover, ICT, localization, standardized components. These variables form the dynamic capability Reactivity.
- ROT, ROQ, and ROC. As these three indicators reflex how well a firm performs time, quality, and cost respectively under unexpected demand, they are used as manifest variables of the construct Reactivity.
- ROI, ROS, and ROA. These three financial indicators are the manifest variables of the construct Financial Performance. Reactivity influences operational as well as financial results, therefore we investigate the last relationship hypothesizing a positive influence of Reactivity on Financial performance.

The firms chosen for the study belonged to the Sectional Kitchen and Furniture Sector of the Italian market, and the initial list contained 300 firms.

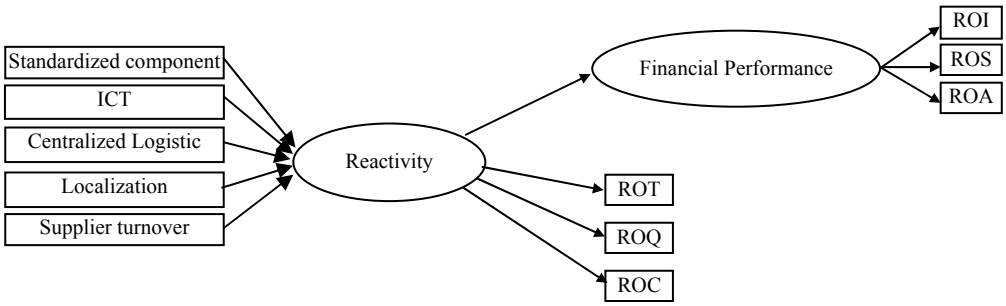
Representatives of each firm were contacted telephonically, inviting them to participate in the study. A total of 135 representatives agreed to participate: the vast majority answered directly by telephone, whereas some of them appreciated mail and fax: the former was expensive but effective, because the information were obtained immediately whereas the latter method was economically convenient but the answers arrived sometimes after three weeks. The data collection was completed in 2006. All the information about phone numbers, addresses, fax numbers as well as financial indicators were taken from the database AIDA.

Five personal interviews were conducted before starting the survey; the questionnaire was reviewed by clarifying any unfamiliar words and eliminating those redundant and ambiguous. These pre-tests helped in checking the content of the questionnaire, as well as judging its validity and conformity for the study. The final questionnaire consisted of 14 questions.

2.7 Research design

The quantitative analysis applies Structural Equation Modeling using both formative and reflective measurement models (MIMIC). This methodology fits adequately when investigating latent variables therefore it appears quite appropriate in operationalizing Reactivity. The research scheme shows two latent variables: Reactivity and Financial Performance. The construct Reactivity exhibits both formative and reflective indicators. Reactivity is an "emergent construct" as casual indicators "form" the dynamic capability. Furthermore, Reactivity is a "latent construct" as some indicators reflex the latent variable. Financial performance embraces financial measurement variables and helps in identifying whether Reactivity has positive influence on it.

Figure 1 – Path diagram of the research



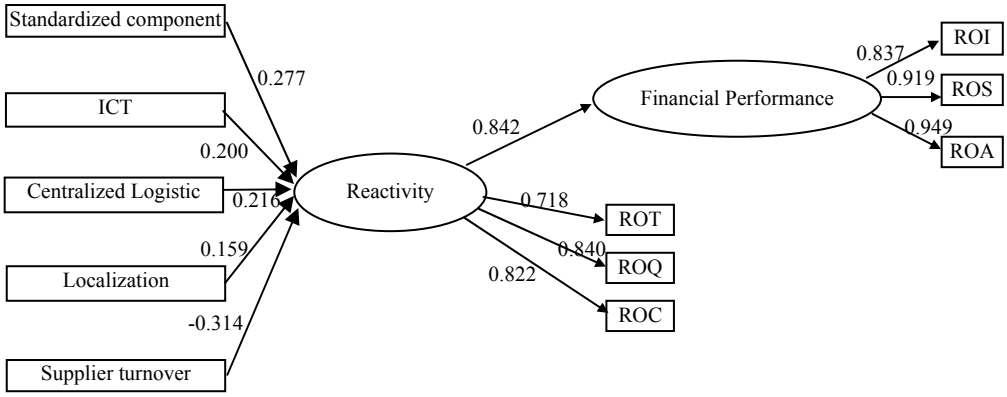
Three manifest variables (ROT, ROQ, and ROC) constitute the latent measurement model of Reactivity, while five formative indicators (centralized logistic, supplier turnover, ICT, localization, and standard components) define the formative measurement model. Financial performance is measured by means of three manifest variables (ROI, ROS, and ROA).

4.3 Structural Equation modeling

Instead of running Confirmatory Factor Analysis (CFA), we test our model by means of structural equation modeling using AMOS 7.0. Although Reactivity is exogenous, as

long as it presents formative indicators, the associated error term associated is strictly needed as captures the impact of all remaining causes no longer included in the model. Variation in the indicators precedes variations in the latent variable, hence the "surplus meaning" of the error term derives from the influence of unmeasured causes (Give Reference).

Figure 2 – Structural modelling



2.8 Assessment of the fit model

The significance of $\chi 2$ and the indices recommended for structural equation modeling show the fit of the model. The fit is acceptable when the index values are within the thresholds (Bollen, 1989). Chi-square statistic and fit indices NFI, RMSEA, GFI, AGFI, RFI, CFI, and RMR allows the fit evaluation. The Chi-square statistic ($\chi 2 = 46.886$ with 33 degrees of freedom) indicated the difference in the estimated covariance matrix and the covariance matrix derived from the data. As the ratio $\chi 2/df$ is lower than 2, the significant $\chi 2$ is due to the sample size.

All the results of the fit indices values are satisfactory. The Goodness-of-fit index (GFI) shows the amount of variance and covariance jointly explained by the model (Jöreskog and Sörbom, 1989). With a GFI of 0.955, the proposed model reproduces quite adequately the observed covariance matrix (Diamantopoulos, 1994). Nevertheless, GFI is below the generally accepted threshold 0.9. For this reason, more information can be

obtained from the Adjusted Goodness-of-fit index (AGFI), which takes into account the degree of freedom. The AGFI for our model is 0.909, higher than the generally accepted threshold of 0.8, thereby showing that the model has a good fit with respect to the degree of freedom.

The Normed Fit Index (NFI) provides a practical measure of model fit by ignoring the number of "sample size free" subjects (Bentler and Bonett, 1980). It shows a good model fit score of 0.951, higher than the general acceptable level of 0.9. The CFI, Comparative Fit Index (Bentler, 1990), measures the overall fit. If it is equal to 985, it means that the estimated model is appropriate within the population; values between 0.95 and 1.0 indicate good model fit (Hu and Bentler, 1999), as the generally accepted level is 0.9. The model output shows a CFI equal to 0.979, hence the model is satisfactorily acceptable. The Root Mean Squared Errors of Approximation (RMSEA) assesses overall model fit by including one penalty function for parsimony (Browne and Cudeck, 1989). The model reports a RMSEA lower than 0.051, suggesting good model fit. The literature generally considers values lower than 0.08 as reasonable (Jaccard and Wan, 1996), and the generally accepted threshold is 0.05. The AMOS output text file also reports the p-value associated to RMSEA as 0.445; therefore, showing the overall fit of the model. Root Mean Squared Residual (RMR) shows good performance when its values are close to 0, which indicates perfect fit. With RMR of 0.033, the model fits quite satisfactorily. Finally, all the fit indices support the final results, and the model can therefore be considered to support the research hypotheses adequately.

2.9 Discussion of the quantitative analysis

All formative indicators related to Reactivity are significant, that is each of them contributes significantly in forming the dynamic capability Reactivity. In particular,

standardized component exerts the highest positive contribution with a standardized factor loading of 0,277 and p-value <0.05. Centralized logistic and ICT offer a similar contribution resulting the standardized factor loadings 0.216 and 0.200 respectively. Both of them are highly significant showing a p-value lower than 0.05. Localization shows similar significance, although its real contribution is quite marginal compared to other as the standardized factor loading is 0.159. In addition, supplier turnover exerts the highest negative contribution to Reactivity. This result is in line with the research hypothesis stating the higher the supplier turnover base, the lower the Reactivity. The standardized factor loading is -0.314 significant at 0.05. Considering the absolute value of all formative indicators, supplier turnover is the highest standardized loadings, therefore reactive firms possess the dynamic capability Reactivity as long as they choose adequately suppliers base and invest in order to keep it as stable as possible. Afterwards, reactive firms should spend their efforts mainly in product design increasing the number of standardized part, managing their logistics activities internally rather than in outsourcing, implementing adequate ICT integrating and coordinating suppliers along the supply chain, and finally locating their activities as close as possible to the customers. Adopting these managerial practice builds up the dynamic capability Reactivity.

Beyond being formed by several indicators, Reactivity is measured by other three indicators expressed by ROT, ROC, and ROQ. These latter are the operational performance optimized by reactive firms. By implementing this measurement model, Reactivity shows the resulting benefits in operational terms when possessing that dynamic capability. All the three manifest variables measure adequately and significantly Reactivity showing p-value lower than 0.05. Nevertheless, their importance varies substantially. ROQ performs the highest standardized factor loading with value 0.840. The most important result obtained by Reactivity is represented by the

capability to perform high quality product when unexpected demand occurs. Nevertheless, the standardized factor loadings resulting for ROC and ROT show satisfactory results being 0.822 and 0.718 respectively. Reactive firm perform adequately both cost and time under unexpected conditions. Reactivity allows efficient production independently by the unexpectedness, satisfying fully all the lead times therefore always delivering on time its products.

Finally, this research investigates the relationships between Reactivity and Financial performance. In particular, the latent variable Financial Performance is measured by means of the classical indicators broadly known and applied in the literature including ROI, ROS, and ROA. All these three indicators measure significantly the construct showing p-values lower than 0.05. Moreover, all of them perform adequate and quite closed factor loadings. ROA performs better than the others showing a factor loading of 0.949, while ROS and ROI perform 0.919 and 0.837 respectively. Finally, when testing whether Reactivity influences positively Financial Performance, the results highly support significantly this research hypothesis with a beta of 0.842 with p-value lower than 0.05.

Finally, the discussion of the quantitative analysis ends evaluating the error associated to Reactivity. It shows in fact very low and significant variance resulting 0.273 and p-value lower than 0.05, suggesting that all the indicators emerged by the qualitative analysis and afterwards used for the quantitative investigation represent the most important variables forming Reactivity. The error term represents, in fact, all the impact of all remaining causes, diverse by those included in the model. As it is very low, the unmeasured causes have very low influence on the construct.

2.10 Conclusion

This research enriches the literature related to Agile, Lean, and Leagile with the concept Reactivity. Although those constructs are widely developed by previous research, Reactivity has the purpose to fill part of the literature related to unexpectedness and up to now disregarded. According to Faisal et al. (2006), Agile, Lean, and Leagile work under volatile and unpredictable conditions, while they appear inappropriate when facing unexpected demand. The distinction between volatile, unpredictable and unexpected demand addresses the main difference between the constructs. Under unexpected conditions, any statistic tools and information system generally used for making predictions is ineffective. Unexpected events are characterized by abnormal variance that makes unsuccessful Agile, Lean, and Leagile. This evidence calls for another "paradigm" describing firms able to perform cost, quality, and time under unexpected conditions. It is represented by Reactivity. Beyond embracing the theme of unexpectedness, Reactivity introduces insistently the issue of performance. Whether satisfying unexpected demand means satisfying always the customers, Reactivity does not disregard the performance. As unexpectedness implies abnormal variance, performance may deteriorate under unexpected conditions. Therefore, reactive firms should be able to perform cost, quality, and time adequately and simultaneously. In this sense, Reactivity is a dynamic capability as firms are able to integrate, reconfigure, gain and release resources to match market changes represented in this case by unexpected events. The temporary and sporadic manifestation of the unexpected demand implies short time-period of competitive advantage and hypercompetition. Possessing the dynamic capability Reactivity turns in abilities useful for disrupting the rivals' advantages.

This research introduces three indicators of performance of Reactivity: Reactivity on Cost (ROC), Reactivity on Time (ROT), and Reactivity on Quality (ROQ). They may be used exclusively to monitor firm's performance under unexpected demand meaning measuring how well firms perform Reactivity. This development represents another novelty inside the literature. None of the previous researches concerning Agile, Lean, and Leagile introduce specific indicator of performance for their concepts. Reactive firms are able to satisfy unexpected demand by performing cost, time, and quality simultaneously.

As previous researches have fully disregarded unexpectedness and Reactivity, this research tries to provide an exhaustive operationalization developing qualitative and quantitative analyses. Under this point of view, the combination of the two research methods represents an absolute novelty inside this stream of research. Previous research introducing Agile, Lean, and Leagile misses any qualitative and quantitative investigation, with the consequence that the three concepts result theoretically well assessed and developed by the literature while ignoring totally their real uses and practical effectiveness. By developing qualitative and quantitative investigation, this research introduces a new theoretical concept finding broad agreements by managers and practitioners. The qualitative analysis helps in individualizing what are the features forming the Reactivity such that firms may invest on them for implementing this dynamic capability. From the qualitative analysis five attributes drive throughout Reactivity: centralized logistic, suppliers turnover, ICT, localization, standardized components. By investing in these features firms may develop Reactivity. Based on this result, quantitative analysis investigates whether all these features contribute effectively in forming Reactivity and moreover whether it provides high operative as well as financial performance.

Operative performance are investigated by means of ROT, ROC, and ROQ, while financial results through ROI, ROS, and ROA. Structural equation modeling applies using formative and reflective indicators. The formative indicators form the construct Reactivity, while the reflective ones show whether operational and financial results are both performed. In this way the research provides two main streams of information. First, it suggests which features allow to create the Reactivity. Second, it provides motivations for implementing this new orientation by showing its links with operational and financial performance.

The results show clearly that all the features emerged from the qualitative investigation provide a significant contribution in forming the Reactivity. In particular, firms should invest in collaboration and coordination with suppliers, reducing as much as possible their turnover. Stable relationships along the supply chain appear essential for implementing Reactivity and then satisfying unexpected demand performing cost, time, and quality. Furthermore, positive and significant contribution derives from the appropriate product design that includes numerous standardized components. As the number of standard parts increases, Reactivity increases as well, therefore providing incentives for designing products accordingly. In addition, firms get Reactivity when managing their logistics activities in a centralized way and when implementing integrated ICT with their suppliers. Finally, localization is relevant as well. Compared to other features, it appears quite marginal as the contribution offered in forming Reactivity is not that elevated. Nevertheless, it is positive and significant, therefore the localization of production plants and/or distribution centre matter substantially whenever investing in Reactivity.

Whether those features show to managers and practitioners through which directions investing when wishing to become reactive, this research investigate its relationships

with operational and financial performance to highlight the real benefits obtainable. By investing in Reactivity both operational and financial performances improve significantly. Operational performance show how firm perform cost, time, and quality under unexpected conditions. Reactive firms obtain high performance of quality. Independently whether the demand is unexpected, quality of products results the operational indicator performed better than the others. However, Reactivity reflexes satisfactory performance of cost and time as well, showing its capacity to produce efficiently and deliver on time the products also when working under unexpected conditions.

Finally, this research investigates the relationships between Reactivity and financial performance. The optimization of operational performance appears a necessary but not at all sufficient condition for investing in Reactivity as financial performance matters consistently. The quantitative analysis shows a significant and positive influence of Reactivity on financial indicators, driving and motivating managers throughout its implementation since operational as well as financial performance are substantially improved.

We develop the concept of Reactivity enriching the stream of literature related to Agile, Lean, and Leagile. Contrarily to previous contributions developing and proposing those concepts, we develop Reactivity be means of theoretical evidence as well as qualitative and quantitative analysis. The contemporaneous application of all them furnishes an exhaustive analysis for making relevant theoretical contributions and providing adequate suggestions for practice. Firms can create and improve their reactivity reducing the supplier turnover and investing in product design, integrated information system, centralized logistic, and localization. This research reveals that Reactivity increases both operational and financial performance. In order to satisfy

adequately customers under unexpected conditions and improve operational and financial performance simultaneously, investing in Reactivity appears one of the most suitable and appropriate alternative.

Chapter 3

Measuring the global Reactivity:

index development and empirical analysis

3.1 Introduction

The recent interest emerged around some constructs such as Agile, Lean, and Leagile has increased the attention of researchers for the theoretical remaining gaps. Although those constructs have been precisely presented and clearly operazionalized, the literature misses their unique measure. That is, the actual research misses a measure that describes the performance of a specific orientation. For instance, firms and practitioners have ample knowledge on the advantages linked to Agility. Some research (??) introduced the main advantages and benefits for agile firms. Nevertheless, the literature lacks of a precise measure to quantify "how much" a firm is agile. This gap provokes a certain perplexity between managers who are driven by the theoretical research through the implementation of a agile strategy but without being able to measure it. Moreover, it seems that any firm may reach a certain level of agileness. Since its measure is missing, managers and researchers are able to compare the agileness of two firms: although two firms are Agile, we are not able to measure which one is the most Agile.

Unlike the pervious studies on Agile, Lean, and Leagile, this chapter proposes a unique measure for the construct Reactivity, namely *Reactivity index*. While the first chapter has operationalized the construct and the chapter two has highlighted the main difference with respect to the others, this research seeks to develop a unique measure of Reactivity and to test whether its performance is influenced by the managerial practices.

Although their theoretical development is well supported, their application appears no longer diffused and the real benefits only remain mainly theoretical. When applying those concepts to business practice, firms are not able to define their boundaries, the advantages linked to a specific approach, and the implications for the management.

Specifically, we characterize a new concept inside this stream of literature that we call *Reactivity*. Unlike Agile, Lean, and Leagile, Reactivity is not already theoretical

operationalized and known. The existing studies do not uniquely define that construct which is often ambiguously used by researchers and practitioners. As its purpose is the operationalization of a new concept, this research applies qualitative for modeling and investigating the construct of Reactivity as precisely as possible. The preliminary review of the literature does not help sufficiently in accurately defining this construct. Nevertheless, it reveals that two main features have received little and ambiguous attention by Agile, Lean, and Leagile: unexpected demand and performance.

Unexpected demand has been mainly characterized as anticipatable and unpredictable demand. Shafiri and Zhang (2001) proposes the satisfaction of unexpected demand as a feature of Agility as the capacity of responding to changes in proper ways and due time by exploiting own capability of sensing, perceiving, and anticipating changes. In contrast, Naish (1989) highlights that unexpected demand is totally unpredictable and consequently any forecasting tools or capability of making predictions work. Unexpected demand cannot be predicted or forecasted and linked to demand shocks totally unknown. Reactivity deals with unpredictable demand shocks not at all anticipatable, resulting then unexpected. As this demand is not at all predictable, firm are generally not prepared to face it. This status may generate several inefficiencies therefore this research operationalizes Reactivity as the capacity of performing cost, time, and quality under unexpected demand. Under this point of view, Reactivity represents a dynamic capability as it combines difficult-to-imitate resources and coordinates inter-organizational relationships globally (Teece et al, 1997). Since unexpected demand occurs sporadically and for short time-periods, firms enter in a hypercompetition state as competitive advantages can only be sustained for very short time (D'Aveni, 1994). The sustainable competitive advantage loses any meaning being substituted by short period targets. A reactive firm is able to work within a hypercompetive environment redefining the parameters of competition based on cost,

quality as well as time, and moving toward the unexpected market as first mover. They succeed in satisfying adequately unexpected demand by performing cost, quality, and time therefore conquering a short competitive advantage against the competitors.

This definition has found wide consensus by practitioners as evidenced by the qualitative analysis. In addition, the latter evidences the variables influencing firm's Reactivity. The qualitative analysis has the purpose to operationalize the construct of Reactivity from a theoretical point of view and to highlight the benefits reachable in practice. It helps to model the construct and to precisely identify its differences with respect to the existing concenpts.

The research is organized as the follow. First, it develops the Reactivity Index (RI) to measure and compare firms' performance. Furthermore, it tests whether the strategies emerged from the qualitative investigations are good predictors of Reactivity. Finally, the empirical analysis ends testing whether RI is a suitable predictor for operational and financial performance.

3.2 The Reactivity Index (RI)

Cost, time, and quality are the parameters of the business equations (Cumming, 1998), defined by Atkinson (1999) "the iron triangle": independently by the sector, firms never sacrifice any type of performance. This statement drives through the need of an indicators of performance reflecting firm's Reactivity and embracing cost, time and quality. Therefore, this research presents the Reactivity Index, a useful tool for quantifying firm's Reactivity. It summarizes the capacity of a firm to work under unexpected demand performing cost, time, and quality. In addition, it represents a measure for comparing firms in terms of Reactivity. This index introduces an original novelty in the literature. All the contributions concerning Agile, Lean, and Leagile have

missed the development of any indicator for quantifying the amplitude of each orientation, leaving their application only a theoretical issue. If one would quantify the "agileness" of a firm, the literature misses a defined indicator. The Reactivity index overcomes this weakness reassuming all the characteristics early extracted from the previous contributions as well as from the qualitative analysis. Since previous studies do not develop indicator of performance based on unexpected demand, this dissertation proposes three indicators of performance associate with time, cost, and quality, respectively, as well as the Reactivity Index based on their interaction.

Reactivity on Time (ROT) measures the capacity in satisfying on time the unexpected demand and is formed by the ratio between the unexpected demand satisfied on time and the total unexpected demand. Its best value is 100%, which means that all unexpected demand is satisfied on time and the system works reactively with respect to time.

Quality Index shows the reliability in producing outputs under expected conditions, without defects or nonconformities. In order to investigate quality in an unexpected setting, this research develops the ***Reactivity on Quality (ROQ),*** by investigating if the unexpected demand delivered respects the standard of quality and fixed targets. Its best value is 100%, which is reached whenever unexpected demand delivered on time misses of any defects and/or nonconformities. The system is reactive with respect to quality if it succeeds in assuring total quality in unexpected demand environment.

Reactivity on Cost measures firms' capabilities in producing and delivering in the unexpected demand situation by sustaining costs equal to the standard variable production cost. Assuming that economies of scale are already entirely exploited, this index measures the distance between the standard variable production cost and the

marginal variable cost needed for satisfying unexpected requests: when the latter is higher, the costs for unexpected demand are higher than standard, hence the system cannot work in unexpected situations and it becomes inefficient. Knowing that the economies of scale effect are over, the marginal variable cost for unexpected demand should be at least equal to the standard variable production cost. In this case, they are equal, and the system works at standard cost for both expected and unexpected demands. The best value for ***Reactivity on Cost*** is 100%.

Figure 1 shows the construction of Reactivity Index by using the three indicators introduced earlier.

Figure 1 :Reactivity Index

Reactivity Index =	Time	x	Quality	x	Cost
	⬇		⬇		⬇
Partial Indicators of Reactivity =>	ROT	x	ROQ	x	ROC
	⬇		⬇		⬇
	$\frac{\text{Unexpected demand delivered on time}}{\text{Total unexpected demand}}$	x	$\frac{\text{Unexp.demand delivered without defects}}{\text{Unexpected demand deliver on time}}$	x	$\frac{\text{Standard Variable Production Cost}}{\text{Marginal Variable Cost for Unexp.Dem.}}$

The Reactivity Index is a heterogeneous indicator formed by one economic and two noneconomic indicators: the former, *ROC*, is associated with the efficiency of the system, being able to produce a standard variable cost independent from the nature of the demand, whereas *ROQ* and *ROT* belong to the category of noneconomic performance, because they are measured using non-monetary units for which the links with the economic results is not calculable “a priori” (De Toni and Tonchia, 2001).

Reactivity Index is computed by multiplying the three indexes described before; its best value is 100%, reached whenever all partial indexes take maximum value. In this case the system is reactive, because it has the capabilities and the ability to satisfy the

unexpected demand in terms of time, cost, and quality. If the Reactive Index is lesser than 100%, the analysis of its structure reveals the responsible causes.

3.3 QUALITATIVE AND QUALITATIVE ANALYSIS

This research combines the results of qualitative and quantitative analysis in order to investigate the variables influencing the Reactivity as well as their amplitude. Previous researches investigating Agile, Lean, and/or Leagile disregard totally any quantitative and qualitative analysis. The result is that these concepts find scarce real applications and are quite unknown to managers and practitioners, and their operationalization is mainly theoretical. This research introduces quantitative and qualitative analysis for overcoming all these problems. The qualitative analysis allows to individualize the variables influencing the Reactivity, while the quantitative investigation estimates their significance and amplitude.

3.4 Investigating the variables influencing Reactivity

The Part 2 of the structured interviews contains a list of dummy variables. This qualitative investigation searches for the features influencing the Reactivity. The literature does not provide uniquely and clearly these evidences therefore the interviewer presented a set of dummy variables for investigating whether they influence or not the Reactivity. The variables affecting the Reactivity are: integrated information system, standardized components/parts of the product, centralized logistic, unsaturated capacity along the Supply Chain, availability of workers, stable Supply Chain relationships, strategic localization, importance of the customer, product innovation. A questionnaire containing all these dummy variables has been administered for exploring

their impact on Reactivity by means of quantitative tools. We use the sample data described in the second chapter.

3.5 Quantitative analysis - Regression analysis

The quantitative analysis uses a regression model for investigating the variables influencing significantly the Reactivity. We use E-Views 5.0 to run all empirical tests. The dependent variable is the Reactivity Index, broadly characterized previously. Independent measures reflex the variables emerged from the qualitative investigation. The relevant details of the measures are described below.

Standard components (STC). The explanatory variable "Standard Components" represents the practice of using standard and interchangeable parts and elements. They are module, platform, and interface, extremely important for characterizing a reactive environment. The higher the use of standard components, the higher is the reactivity.

Logistic (LGSTC). This independent variable underlines the critical role of logistic: optimal materials, parts, final products, and services management need adequate implementation of the logistic system (Nyhuis and Vogel, 2006). This function has primary and vital importance to firms due to its direct impact on the retail and wholesale performance. Firms should appropriately identify the logistic sources, by negotiating contracts and updating the system based on information about products, processes, competition, and macro/micro economic issues, customers' needs. Despite this critic motivations, logistic are often managed via outsourcing, although this strategy could be suboptimal for performing Reactivity. From that motivation, this research hypotheses that the more the logistic is managed centrally, the higher the reactivity.

Information system (IS). All firms need adequate Information System to be implemented. It allows for performance improvement and rapid decision making. It is a

necessary tool for reducing uncertainty: firms reduce the negative impact of the bullwhip effect along their supply chain by exchanging information and building up an adequate IS (Yu et al, 2001). For the high initial investments of time and costs required and its characteristics of irreversibility, this function can manage in outsourcing although this strategy could be less effective. IS manages numerous interconnections between companies, by consenting data and information transfers, data generation and processing time, database integration, accurate and timelier information flow, and responsiveness. The higher the orientation in using integrated IS, the higher the Reactivity .

Unsaturated capacity (UC). The dummy explanatory variable "Unsaturated capacity" emphasizes the presence of available capacity necessary for satisfying the unexpected demand, and assumes value "0" when capacity is saturated and "1" otherwise. The more a firm has unsaturated capacity, the more is its increase in Reactivity. The surplus of capacity is mainly employed for satisfying unexpected demand: if a firm possesses some unexploited capacity, the possibility to satisfy unexpected demand increases. From this perspective, the choice of capacity becomes generally more critical and complicated. The presence of unsaturated capacity implies an over structure, not exploited entirely, which requires higher initial investments and generates additional variable costs. Firms face the trade-off higher over structure cost and unexpected demand lost, knowing that the latter one could activate future further and dangerous indirect effects.

Availability of workers (AW). The variable "Availability of workers" explains the capacity to organize additional turns, recruit temporarily, or outsource some extra human resources. Firms may have some over capacity independently for the demand,

whereas the problem of availability of workers raises only in case of unexpected demand. The faster the recruiting process, the higher the reactivity.

Supplier's turnover (ST). This explanatory variable indicates the stability of relationships among supply chain members. The higher it is, the lower is the reactivity. If supplier turnover is high, a firm needs to search frequently for new supplier, highlighting different strategic vision as well as targets and purposes of each member.

Localization (LCLZTN). Firm's localization and proximity are extremely important to realize coordination among firms and to serve successfully the market by exploiting simultaneously the economies of proximity (Torre and Gilly, 2000). The purpose of these decisions is closely related to the market as much as possible, in order to react appropriately and satisfy customers' needs. The right localization, in fact, increases the final customers' value (Rahman, 2006) and becomes particularly relevant in providing multitude of services (Hoek, 2000). Distance between firms and customers worsen the Reactivity. Therefore, the more a firm is located far from the customer, the lower the reactivity.

Importance of the customer (IC). The explanatory variable "Importance of the customer" specifies customer relevance in making profit. The customers could not be all equal in generating value, revenues, and profit. Differences may emerge from the quantity purchased over time, the status of new or old customer, and the potential future value obtainable. Firms identify and classify their customers and decide by evaluating some attributes. Whenever the customer is important, firms have some motivations and interests in satisfying him, regardless of the expected or unexpected demand. For that reason, it is hypothesized that the more a customer is important, the higher the Reactivity.

Innovative product (IP). This is a dummy explanatory variable, which assumes value "0" when the product is innovative and "1" otherwise. For innovative products, reactivity is not immediately achievable because processes and activities are not definitely established, and not only the results of the unexpected demand but also those of the expected demand are unpredictable, and parameters of cost, time, and quality are totally unstable. The hypothesis made is that whenever a product is innovative, reactivity decreases.

The general specification of the multiple regression model can be expressed as follows:

$$Reactivity = \beta_0+\beta_1 STC+\beta_2 LGSTC+\beta_3 IS+\beta_4 UC+\beta_5 AW-\beta_6 ST+\beta_7 LCLZTN+\beta_8 IC+IP\ \beta_9+\varepsilon$$

where $\beta_{i,}$ with i=1..9, are the coefficients of each independent variables to be estimated and ε is the error. Starting from this model, this research investigates the role of fixed and variant exploratory, and the restricted model without any non-significant variables.

Table I. Descriptive statistics and correlation matrix (n=135 observations)

	REA	AW	IC	IP	IS	LCLZTN	LGSTC	ST	STC
REA	1,000								
Availability of Worker	0,455	1,000							
Importance of the Customer	-0,036	-0,047	1,000						
Product innovation	-0,454	-0,364	0,023	1,000					
Information System	0,421	0,321	0,037	-0,307	1,000				
Localization	0,325	0,153	-0,054	-0,329	0,127	1,000			
Centralized logistics	0,412	0,140	-0,100	-0,225	0,135	0,127	1,000		
Supplier Turnover	-0,443	-0,282	-0,009	0,308	-0,189	-0,248	-0,239	1,000	
Standard components	0,458	0,160	-0,016	-0,209	0,169	0,084	0,422	-0,244	1,000
Unused Capacity	0,254	-0,017	-0,075	0,078	0,086	0,027	0,122	-0,086	0,134

3.6 Quantitative results

The regression analysis was conducted by implementing 4 models. For each model, table 2 reports the estimated values of beta, the standard errors, as well as the Tolerance and VIF (Variance Inflation Factor). These last two indexes are proposed with the purpose to study the multicollinearity between independent variables. The Tolerance is

1 - R^2 for the regression of one independent variable on all other independents, ignoring the dependent. For each independent variable Tolerance is unique, and optimal values should be higher than 0.3 to indicate absence of correlation between independents. Tolerance gives information on standard errors: the more the multicollinearity, the lower the tolerance, the higher the standard error of regression coefficients. The VIF is the reciprocal of Tolerance. It shows how much the variance of coefficient estimate is being inflated by multicollinearity: the higher it is, the higher multicollinearity is present. High values of VIF and low values of Tolerance evidence severe multicollinearity effects. Moreover table 1 reports the White's Heteroskedasticity Test, F-statistic and the Jarque-Bera test. White's test is a test of the null hypothesis of no heteroskedasticity against heteroskedasticity of some unknown general form (White, 1980). The author describes this approach as general test for model misspecification, since the null hypothesis underlying the test assumes that the errors are both homoskedastic and independent of the regressors, and that the specification of the model is correct. Failure of any one of these conditions could lead to a significant test statistic. Conversely, a non-significant test statistic implies that none of the three conditions is violated (Quantitative Micro Software, 2004). The F-statistic and Prob (F-statistic) show the significance of each regression model. The Jarque-Bera test is used for testing whether the residual are normally distributed. If it is the case, the statistical test should not be significant. This analysis uses E-views 5 and SPSS 13.0.

Table II. Regression models based on Reactivity.

	Model 1	Model 2	Model 3	Model 4
Constant	-81.415 [a] ** (25.325) [b]	-98.248*** (17.181)	-19.582*** (23.804)	-78.644***(19.073)
Standardized components	26.878** (8.059) [0.780 [c]; 1.282 [d]]	46.609*** (8.430) [0.968; 1.034]		26.915** (8.024) [0.781; 1.281]
Centralized Logistics	17.678* (7.793) [0.778; 1.286]		28.203*** (7.851) [0.895; 1.117]	17.551* (7.725) [0.785; 1.274]
Information System	18.621**(6.619) [0.833; 1.200]	33.646*** (7.190) [0.959; 1.043]		18.696**(6.578) [0.837; 1.194]

Unused Capacity	7.187** (2.276) [0,940;1.064]		8.786*** (2.433) [0.960; 1.041]	7.158** (2.260) [0,945;1.058]
Availability of worker	12,426** (3.686) [0.789; 1.267]		15.432*** (3.878) [0.833; 1.201]	12,389** (3.666) [0.792; 1.262]
Localization	6.169* (2.882) [0.863; 1.159]	11.566*** (3.151) [0.980; 1.021]		6.146* (2.868) [0.865; 1.156]
Importance of the Customer	1.580 (9.451) [0.975; 1.026]		3.506 (10.174) [0.982; 1.018]	
Product Innovation	-7.666* (3.305) [0.709;1.411]		-12.126*** (3.378) [0.792; 1.262]	-7.662* (3.292) [0.709;1.411]
Supplier Turnover	-6.104** (2.515) [0.805; 1.242]		-8.119** (2.668) [0.836; 1.196]	-6.125* (2.503) [0.807; 1.239]
Adjusted R^2	0.543	0.380	0.491	0.547
WHT (*F-stat)*	1.044°°	1.207°°	0.879°°	1.111°°
Jarque-Bera Test	1,606##	1,850##	8,619	1,488##

[a] Unstandardized coefficient; [b] Standard Error; [c] Tollerance; [d]VIF; [e]White's Heteroskedasticity Test
*p-value <0.05 **p-value <0.01; ***p- value<0.001; #p-value>0,1; ## p-value>0,05; °F-value>0,1; °° F-value>0,05

Model 1 includes all the explanatory variables derived from the qualitative analysis. Importance of the Customer appears the only non significant explanatory variables. All other variables are significant, and the VIF and Tollerance of each variable give suitable results. The significance of the model, the absence of heteroskedasticity, the satisfactory results of the normality residuals test, and the high R^2 lead to a reliable model. Looking for the variables sign, all coefficients have signs alienated to the research hypotheses except one, Localization. The initial expectation was a negative sign for this exploratory variable, meaning the more the distance between firms' location and the market increases, the more reactivity decreases: the result obtained from the empirical verification is not alienated to the research hypothesis. That result may be interpreted as the attitudes of firms to satisfy reactively market generally none served, especially because the huge distance makes inefficiencies and inconveniences, and usually other firms act. Positive sign of localization means opportunities for developing own business

across diverse markets normally supplied by competitors, and hence reactivity expresses firms' behaviors in entering new markets.

Reactivity increases whether the number of Standard Components increases as well: standardization, interfacing, changeability, and modular product make higher reactivity rather than integral ones. Although the actual and diffused firms attitude is to externalize all activities do not belonging to the core, the empirical verification shows Centralized logistic is actually the strategy preferred respect to outsourcing. From the empirical analysis whenever the logistic is managed centrally the reactivity increases, therefore the internalization of this function influences directly and positively reactivity.

Although the implementation of an Information system requires a huge investment of cost and time, its installation is necessary for improving reactivity. Information system is the mean to survive and improve overall performance in quality, time and cost, hence it should be realized for increasing the Reactivity. Firms need to evaluate different tradeoffs. Over this point of view, because Information System is essential for satisfying the unexpected demand, a part of the investment required should be covered by the higher profits generated from unexpected demand. Since unexpected demand is sporadic, non predictable, firms need workers available for satisfying what requested. Reactivity becomes not only a performance to be measure or an attitude to be analyzed, but an orientation diffused across all firms. Only if workers espouse this orientation, firms may be reactive since unexpected demand does not give the time to recruit and train new human forces, and also in the case of long planning horizon, this strategy could result sub optimal and totally ineffective. Whenever workers are available for extra turn and timework reactivity may be reached. At the same way, the role of Unsaturated capacity is extremely important. There exists a trade-off between strategies in order to define the over capacity to install for satisfying the unexpected

demand, how much the management and the installation of over capacity cost, and what benefits firm could get. After resolving these trade-offs, the higher the unsaturated capacity, the higher the reactivity.

Since importance of the customer results not significant, firms do not distinguish between customers but all of them are important. Customer orientation emerges comparing together this result to that of localization: a firm is reactive whenever the distance between customers and firms is closed. Reducing the physical space from the customers, firms increase his own Reactivity. Finally, Innovative Product and Supplier's Turnover are significant and present negative sign alienated to the research hypotheses. In particular, the negative sign of Innovative Product shows that the higher the product innovation, the lower the reactivity. This appears quite obvious since firms cannot develop economies of scale and/or scope, the market is unpredictable, and the reactivity results very low. Whenever the supplier turnover increases, the relationships along the supply chain are not stable. High supplier turnover informs about frequent suppliers base changes, which do not allow firms to be reactive.

Models 2 and 3 were implemented distinguishing between short and long term decisions. In particular, all stable variables were used for Model 2, while the fix variables formed Model 3. Therefore, Model 2 encloses stable choices of Standard Components, Information System, Localization; Model 3 comprises long term decisions of Logistic, Unsaturated Capacity, Availability of Workers, Importance of the Customer, Innovative Product, and Supplier Turnover.

Model 2 accounts all the explanatory variable that could change over time, and hence influence and modify firm reactivity instantaneously. Also for Model 3 all the explanatory variables are significant except one, still Importance of the Customer. Nevertheless, the model is quite good, with an high R^2 and acceptable multicollinearity.

Comparing Model 3 to Model 2 appears that the influence of long time variables on reactivity is higher than the stable one. The stable variables enclosed in Model 2 are only three and explain the 38% of the variance. In Model 3 the variance explained is higher and equal to 49,1%. As Table 1 reports, these latter two models are acceptable in terms of heteroskedasticity. Since Model 1 has not traces of heteroskedasticity and the R^2 is higher, it is always better than Model 2 and 3.

Finally, as Importance of the customer is not significant, Model 4 replicates the analysis of Model 1 without considering this latter explanatory variable. This variable may be easily eliminate; correlations with other variables (see table 1), in fact, are not significant, moreover Tolerance and VIF give good result, meaning there are not relations or dependencies with other explanatory variables. Also the correlation with REA is very low (=0,001), hence Importance of the Customer does not explain the Reactivity. This last model has a R^2 almost equal to Model 1, since the variable eliminated does not play any role.

3.7 Managerial implications and motivations for Reactivity

After operationalizing Reactivity from a theoretical point of view, measuring it through an index of performance, exploring the current knowledge management by using structured interviews, and finally investigating amplitude and significance of the influencing variables, this research underlines the motivations for adopting and implementing Reactivity by examining its relationships with the firm's performance.

The reactivity index is a measure of performance showing how well the firm performs cost, quality and time under unexpected demand. Nevertheless, firms matter economic and financial beyond operative performance. The Reactivity index reflexes exclusively how firms work and perform operatively under unexpected demand, while firms pay

attention to economic and financial performance as well. Under this point of view, the Reactivity index appears "operations oriented" as it misses any links with the economical and financial indicators.

In order to embrace operational as well as economical performance, this research analyses the links between the reactivity and the firm's performance. The main purpose is to investigate whether performing Reactivity implies increasing economic performance. This analysis introduces another novelty in this stream of literature. Although several contributions propose the construct Agile, Lean, and Leagile as an appropriate mean for increasing competitiveness and improving performance, in realty their links are not been accurately tested. This weakness related to previous studies is due to the missing quantification of each construct. None research introduces a precise and defined indicator able to quantify the amplitude of the investigated phenomenon. Lean, Agile, and Leagile remain abstract concepts missing an own measure defining their boundaries. The reactivity index quantifies appropriately the reactivity, the empirical investigation of its relationships with the firm's performance highlights the related economical and financial benefits and therefore motivate managers and practitioners in adopting a reactive orientation.

An empirical analysis investigates the previous relationships. By using the same sample described early, regression modeling explores the influence of reactivity on firm's performance. In particular, the empirical verification uses three measures of economical performance: ROI, ROS, and ROA. These indicators characterize the dependent variables of the regression models, while the independent variables correspond to the Reactivity index as well as the single indicators ROT, ROC, and ROQ. Consequently, the empirical analysis shows mainly two models. The first

develops a simple regression analysis using each indicator of performance and the Reactivity index.

$$Performance=\beta_0+ \beta_1 Reactivity\ Index+ \varepsilon \quad (2)$$

The second works out a multiple regression analysis involving performance and the single indices of reactivity.

$$Performance=\beta_0+ \beta_1 ROT+ \beta_2 ROQ+ \beta_3 ROC+ \varepsilon \quad (3)$$

The empirical verification misses a regression analysis using as independent variables ROT, ROQ, ROC and the Reactivity index simultaneously. This latter, in fact, represents a combination of the three single index (see figure 1), therefore multicollinearity problems destroy the coefficient. Table 3 reports the correlations among those variables showing the high and significant correlations among Reactivity index and the others one.

Table 3 - Correlations between the Reactivity index and the other indicators

	ROQ	**ROC**	**ROT**
REA	0.769	0.775	0.673

Table 4 reports the results of the empirical analysis related to the previous regression models reported in (2) and (3).

Table 4 – Regression models of Performance and Reactivity Indicators

Dependent variable	Independent variable(s) and significance	Model 5	Model 6
ROI	Constant	-43.268	-9,669***
	ROQ	[a]***	(1,329)
	ROC	(3.523)[b]	
	ROT	0,255***	
	REA	(0,04)	
	Adjusted R^2	[0.642[c];	0,358***
	WHT [e] *(F-stat)*	1.559 [d]]	(0,024)
	Jarque-Bera	0,232***	[1,000;1,000]
	Test	(0,042)	0,639
		[0,669;1,495]	1,319°
		0,164***	2,226[##]
		(0,029)	
		[0,950;1,053]	
		0.655	
		1.915°°	
		4,273[##]	
ROA	Constant	-	-5,
	ROQ	25,608***	911***
	ROC	(1,267)	(0,452)
	ROT	0,130***	
	REA	(0,015)	
	Adjusted R^2	[0.605[c];	
	WHT *(F-stat)*	1.652 [d]]	0,196***
	Jarque-Bera	0,152***	(0,008)
	Test	(0,016)	[1,000;1,000]
		[0,629;1,589]	0,822
		0,093***	0,130°°
		(0,011)	0,058[##]
		[0,937;1,067]	
		0.815	
		1.833°°	
		1,984[#]	
ROA	Constant	-	-3,272***
	ROQ	15,689***	(0,433)
	ROC	(1,183)	
	ROT	0,077***	
	REA	(0,014	
	Adjusted R^2	[0,605;1,652]	0,122***
	WHT *(F-stat)*	0,100***	(0,008)
	Jarque-Bera	(0,015)	[1,000;1,000]
	Test	[0,629;1,589]	0,659
		0,057***	4,301
		(0,010)	2,482[##]
		[0,937;1,067]	
		0.664	
		1.741°	

	4,015[##]

[a] Standardized coefficient; [b] Standard Error; [c] Tollerance; [d]VIF; [e]White's Heteroskedasticity Test
[#]p-value>0,1; [##] p-value>0,05; ***p- value<0.001; °F-value>0,1; °° F-value>0,05

The empirical analysis reported in table 4 clearly illustrates the economical benefits from Reactivity. The Reactivity explains significantly the performance of ROI, ROA and ROS and therefore it represents a valid orientation in practical terms. For all models, the adjusted R^2 is quite satisfactory showing values always higher than 0,6. When regressing the performance and the Reactivity index alone, all models underline the importance of the Reactivity for increasing the economical performance. The Jarque-Bera Tests show suitable results for all models highlighting the normal distribution of the errors.

In order to explore whether the positive impact of Reactivity on performance concerns all the reactivity pillars simultaneously or only some of them, the empirical analysis in model 5 investigates the influence of each reactivity indicators on economic performance represented by the equations (3). The results evidence that ROQ, ROC, and ROT are equally important for increasing economical performance. Also for this analysis, the R^2 performs always satisfactorily presenting values higher than 0,6. The Jarque-Bera Tests as well as the White Heteroskedasticity Test display fit properly with the purpose of this research showing that the errors related to each model are the normally distributed, independent by the regressors and homoskedastic.

The empirical analysis suggests valuable managerial insights. Reactivity is not only a general orientation but explains the capacity of working under unexpected demand. It encapsulates, in fact, information concerning time, cost, and quality of a firm facing unexpected demand. Its improvement could be ineffective in global sense. The satisfaction of the unexpected demand may generate several inefficiencies in terms of cost, time, and quality, and the real benefits must be appreciated always in economical

terms. While the reactivity index alone underlines the capacity of performing adequately time, cost, and quality under unexpected demand, the economical benefits are totally disregarded. This lack forces the investigation through the relationships between reactivity and the economic performance. The empirical analysis shows that reactivity explains economical performance. Firm should be reactive for succeeding in unexpected environment. Reactivity represents a mean for improving economic and operative performance when unexpected demand occurs.

Finally, this research addresses the real needs of Reactivity by developing qualitative and quantitative analysis. The qualitative analysis is always concentrated on the structured interviews. Part 3 contains a question concerning the benefits obtainable performing Reactivity expressed in terms of competitive advantage and customer satisfaction. From the interviews, Reactivity emerges as a mean for improving both simultaneously. From a quantitative point of view, this research investigates the real needs of Reactivity. As this research individualizes the variables influencing the Reactivity and shows the economical benefits obtainable by it, one could criticize and complain against its real requirements. That is, one firm could invest directly for all the independent variables appeared in (1) and improving substantially the economical performance with total disregard of the Reactivity. In order to disconfirm this statement and consequently proof the real needs of Reactivity, this research develops an additional empirical analysis (see Table 5) showing the relationships between the variables listed and described in the session 4.2.2 and the economic performance always expressed by ROI, ROA, and ROS. Satisfying results of those regressions reveal scarce importance of Reactivity.

Table 5 – Regression models without any Reactivity Indicators

		Dependent Variables	
Independent	ROI	ROS	ROA

variables			
Constant	-48.525[a] ***	-21.301*** (3.978)	-29.679*** (4.998)
Standardized Components	(10.471)[b]	6.123***(1.266)	11.804***(1.591)
Centralized Logistics	21.776***(3.529)	[0.780;1.282]	[0.780;1.282]
Information System	[0.769[c];1.300[d]]	*2.109* (1.224) [0.778; 1.286]	*1.347* (1.538) [0.778; 1.286]
Unused Capacity	*4.760* (2.832) [0.823; 1.215]	3.212** (1.040) [0.833; 1.200]	4.170** (1.306) [0.833; 1.200]
Availability of Worker	3.551*** (0.972) [0,944;1.060]	0.929** (0.357) [0,940;1.064]	1.684*** (0.449) [0,940;1.064]
Localization	3,743* (1.610) [0.762; 1.312]	*1,070* (0.579) [0.789; 1.267]	2,252** (0.728) [0.789; 1.267]
Importance of the Customer	3.743** (1.119) [0.854; 1.171]	1.063* (0.453) [0.863; 1.159]	1.694**(0.569) [0.863; 1.159]
Product Innovation	*-0.445* (4.057) [0.963; 1.039]	*1.365* (1.485) [0.975; 1.026]	*-0.666* (1.865) [0.975; 1.026]
Supplier Turnover	*-2.823* (1.429) [0.672;1.488]	*-0.688* (0.519) [0.709;1.411]	*-0.893* (0.652) [0.709;1.411]
Adjusted R^2	*-0.330* (1.169) [0.797; 1.255]	*-0.778* (0.395) [0.805; 1.242]	*-0.992* (0.496) [0.805; 1.242]
WHT[e] (*F-stat)*	0.525	0.499	0.621
Jarque-Bera Test	2.131 10.514	2.580 1.184[#]	2.467 20.372

[a] Standardized coefficient; [b] Standard Error; [c] Tollerance; [d]VIF; [e]White's Heteroskedasticity Test
[#]p-value>0,1; [##] p-value>0,05; ***p- value<0.01; °F-value>0,1; °° F-value>0,05;

The econometric results obtained show the needs of Reactivity. The main part of the independent variables in (1) is not significant in explaining the firm's performance when disregarding the Reactivity. Table 5 represents those values in italic. Reactivity represents an orientation that firm should incorporate inside their strategy. When firm ignore Reactivity, only some of the variables described in session 4.4.2 are able to explain firm's performance. Under this point of view, this research presents a further novelty. While previous studies concerning Lean, Agile, and Leagile assume the needs of these orientations for attaining some targets, no researches investigate their real necessities by developing empirical analysis. This research shows the motivations and the needs of Reactivity both theoretically and practically. Reactivity represents a mean for improving simultaneously operative and economic performance under unexpected demand stimulating and motivating managers for its implementation.

3.8 Conclusion

This research operationalizes theoretically and applies practically the concept of Reactivity. The motivations for this study emerge from several gaps left by previous contributions on Agile, Leagile, and Lean. They introduce theoretical novelties in the literature but without providing useful tools for managers in order to apply practically these concepts, neither individualizing real and particular applications nor developing any empirical verification for making theoretical concepts more robust. This research enriches the literature operationalizing a new concept, developing contemporarily useful tools for managers and showing real applications as well as empirical verification.

Several theoretical gaps emerge from the literature in theme of reactivity. It is generally associated to time, with total disregard of any other indicator of performance. This lead to incorrectness of its operationalization and ambiguities when compared to

other constructs. Contrarily to Agility, Lean, and Leagile, Reactivity embraces unexpected demand and cost, time, and quality performance related to it. These two features characterize Reactivity against the other constructs. According to the literature and considering the emerged gaps, this research develops a definition of Reactivity totally new in the literature: "*A reactive firm satisfies unexpected demand by performing simultaneously in terms of cost, time, and quality".*

Reactivity fits with the definition of dynamic capability as the process to integrate, reconfigure, gain and release resources to match market changes (Eisenhardt and Martin, 2000). Reactive firms easily shift from traditional to unexpected environment. Whenever unexpected demand occurs, they adopt a first mover strategy since able to perform in terms of cost, quality and time unexpected requests against the competitors. Nevertheless, the temporary and sporadic nature of the unexpected demand allows to acquire this competitive advantage over short time-periods. This framework implies that unexpected demand generates hypercompetition. It occurs when a firm intensifies the level of competition in the marketplace by continuously generating new competitive advantage and destroying, neutralizing or making obsolete competitors' advantage. The hypercompetition is moreover characterized by competitive advantage under short time-periods (D'Aveni, 1994) so that, as a dynamic capability, Reactivity integrates, reconfigures, gains and releases resources to match market changes and face hypercompetition characterized by unexpected demand.

As Reactivity has found scarce agreements inside the literature, this research develops qualitative and quantitative analysis in order to explore practically how Reactivity is perceived by firms, whether they deal with the proposed definition, quantify the Reactivity throughout the Reactivity index, individualize the variables potentially influencing the Reactivity, explore the significance of the influence of each

variable, link Reactivity with firms' performance, and proof its real needs to managers and practitioners.

Three structured interviews reveal that the world of the firm does not perceive clearly the Reactivity. It results in fact mainly associated to performance of time. Nevertheless, the proposed definition has been well supported by managers in embracing unexpected demand and the related performance contemporarily. It is defined as an ambitious but realizable target due to the difficulties generated by the unexpected demand.

As practitioners deal with the proposed definition of Reactivity, the second novelty of this research concerns its measure through the Reactivity index. Previous researches introducing Agile, Lean, and Leagile do not propose any kind of measure for comparing firms' status and defining adequately the boundaries of each construct. Researchers and practitioners miss a unique and precise measure for quantifying, e.g., firm's Agileness. This lack forbids the comparison between firms in terms of Agility. The Reactivity index overcomes this obstacle by considering performance of cost, time, and quality when satisfying unexpected demand.

Qualitative and quantitative analyses have been simultaneously conducted for investigating the Reactivity. Under this point of view, this research presents another novelty since previous studies in this domain do not investigate any construct by mean of qualitative and quantitative analyses simultaneously. As emerged from the qualitative analysis, the variables influencing the Reactivity are: standard component, centralized logistic, integrated information system, unsaturated capacity, availability of workers, localization, importance of the customer, product innovation, and supplier turnover. Afterwards, the quantitative analysis has investigated the significance and the real influence of these variables on Reactivity. Each variable has been used as an explanatory variable for a multiple regression model, in which the dependent variable

has been the Reactivity Index. From the results of the empirical analysis, the variable importance of the customer is not at all significant. All the others play an important role in explaining the Reactivity. As it becomes the firms' target these variables should be adequately treated.

The Reactivity has an operative nature. It embraces unexpected demand and related performance with total disregard of the economical performance. Nevertheless, firms matter operative as well as economic performance therefore the Reactivity results lightly effective for characterizing both simultaneously. In order to avoid this limit, this research develops a quantitative analysis investigating whether performing Reactivity implies improving economical performance. These latter are measured through ROI, ROS, and ROA. Previous researches miss the quantitative investigation of the links between the constructs and the economic performance. The empirical analysis shows significant links between them, motivating and stimulating managers and practitioners to implement reactivity to enhance operative as well as economical performance under unexpected demand. Finally, this research tests the real needs of Reactivity by exploring the influence of the variables standard component, centralized logistic, integrated information system, unsaturated capacity, availability of workers, localization, importance of the customer, product innovation, and supplier turnover on firm's economic performance. This investigation is quite controversial to the purpose of the paper. It tests whether firms should implement a Reactive orientation or they can invest directly in some managerial practice for increasing economic performances. In this way, this research informs researchers and practitioners about the real need of Reactivity. The higher part of the previous variables are not significant in explaining economical performance, therefore revealing that firms need definitely Reactivity for improving both operative and economic performance under unexpected demand.

Although this research focuses the analysis of the Reactivity to firm, it may be easily extended to multitude of fields as i.e. supply chain, analysis of processes, supplier selection. The paper mainly concentrates on the operationalization of the construct. The existence of other constructs forces a careful analysis of this construct in order to underline the main differences with respect to the existing constructs as well as the main novelty contribute to the literature. As this research denotes the first step for introducing Reactivity in the filed of management, qualitative and quantitative analysis support its proposition and operationalization. It is a starting point for developing future researches and studies in this domain and for producing new theoretical contributions as well as innovative managerial practice. The integration between theory and practice misses frequently when introducing this issues, therefore this research develops a wide investigation elaborating new concepts and strategies, validating empirically, and extending all findings toward multitude of directions. This development helps consistently in creating new and original theoretical knowledge proposing new and effective solutions for managers and practitioners.

Conclusion

The actual world of business is characterized by numerous new facets that make traditional business management totally inadequate. Although organizations forecast possible situations and scenarios, as well as demand and stakeholders' strategies, unexpected events distort any standard planning and work. The present managerial tools used to face any unexpectedness fail as their implementation fits only with unpredictable and volatile events. Unexpected events such as terrorist attacks (e.g. 7/11in New York or 7/7 in London), natural calamities (Tsunami, floods) or contagious epidemics (SARS, Bird flu) change organizations' targets and modify the way of management. Moreover, the lauded concepts of Lean, Agile, and Leagile appear definitely inadequate to face such events. From a theoretical as well as a practical point of view, organizations need a new strategic concept filling the exiting gaps. From a practical point of view, managers and practitioners need more concrete directions to be undertaken when facing any unexpected events.

In order to contribute exhaustively to this research domain, this dissertation operazionalizes the construct Reactivity as operational dynamic capability enabling organizations to face adequately the unexpected demand without underperforming time, cost, and quality. Unlike previous research in Lean, Agile, and Leagile, this work uses both qualitative and quantitative analysis for a comprehensive operationalization as well as for a valuable contribution to theory and practice.

In the first chapter a comprehensive literature review highlights the main holes left by previous research when operationalizing some constructs. Precisely, none of the existing concepts deals with unexpected demand and performance. If the development of a new construct appears definitely needed, proposing a new one appears a big challenge. The literature of Operations and Supply Chain Management does not report any contribution introducing the issue, while numerous theoretical gaps underline a clear research need. Reactivity has been therefore operationalized as *the capacity to satisfy the unexpected demand improving the financial performance and without underperforming cost, time, and quality.* The satisfaction of the unexpected demand implies several operational changes. New processes and activities need to be implemented while the employees should be trained to be ready for any unexpected event. Managing an unexpected situation alters the operational standards thus lowering the performance of cost, time, and quality. A reactive organization is able to face any unexpected occurrence performing at least the standard operational targets and therefore improving the financial performance. We test this definition with structural interviews. Managers and practitioners are unconscious of the existence of such a operational dynamic capability that appears a high ambitious target. Nevertheless, the use of specific managerial practice may contribute positively to become reactive.

In this sense, this work contributes to the literature highlighting to managers and practitioners the strategies and policies helpful to achieve Reactivity. Previous research in Lean, Agile, and Leagile focuses on the theoretical developments while leaving wide gaps in practical terms. This dissertation develops a new construct thus contributing the actual research but also providing some practical insights. The two further chapters develop empirical research to derive prescriptions for managers.

The second chapter suggests which managerial practices should be undertaken in order to get Reactivity. Starting from the results of the qualitative analysis, this chapter investigates the contribution of each practice to build up the Reactivity. The result shows that using standard components, integrated ICT, having a centralized logistics activities, being as closed as possible to the customers, and performing low supplier turnover rate contribute to firms' Reactivity. In terms of effectiveness, Reactivity exerts a positive influence to both operational and financial performance. The empirical analysis tests whether Reactivity is an effective operational dynamic capability by evaluating its impact on operational as well as financial performance. The results highlight the needs of Reactivity as operational dynamic capability that allows a firm to achieve a competitive advantage in hypercompetition with positive impact in operational and financial terms.

The third chapter introduces the Reactivity index, which is an indicator of the global firm's Reactivity achieved in a given instant of time. While previous contributions in Lean, Agile, and Leagile miss a complete measure, the Reactivity index allows one to evaluate and weight the firm's operational dynamic capability. Fix and variable managerial practice affect the global Reactivity. Considering all of them simultaneously creates a robust evaluation tool. The global Reactivity exerts a positive impact on the operational performance of cost, time, and quality, therefore it may be seen as a benchmark to be reached in order to perform under unexpected demand. We investigate the effectiveness of those indexes as predictors of financial performance and it results that Reactivity provides a significant contribution to perform adequately from a financial viewpoint. We reinforce this analysis by evaluating the effectiveness of each managerial practice on financial performance disregarding totally Reactivity. None of the managerial practice appears alone able to increase financial performance, therefore Reactivity appears strictly needed in order to succeed.

This dissertation would represent a first development of the construct Reactivity. Further research may be developed in investigating Reactivity at the Supply Chain level. As Lean, Agile, and Leagile, also reactivity may be extended to the Supply Chain domain. It requires the integration of the Reactivity of all firms along the chain. Nevertheless, this is a secondary step that could never be done without operationalizing correctly and exhaustively the construct and differentiating it from the others. This was the main purpose of this dissertation. As the conceptualization at the firms level has been faced, future studies may be conducted not only to investigate the Reactivity of Supply Chains, but also to extend the concept to networks and global chains as well as go more in detail analyzing Reactivity of single processes.

This research presents indeed some limitations. The first is related to the sample selected. All firms belong to only one sector and to only one country. Future development could be conducted by selecting a heterogeneous firm sample that allows for a more robust result, as well as by investigating the industrial structure of different countries and highlighting their influence on Reactivity.

Appendix – The questionnaire

Our reactivity is influenced by the following managerial practice:

- Integrated information system
- Standardized components/parts of your product
- Centralized logistic
- Unsaturated capacity along the Supply Chain
- Availability of workers
- Stable Supply Chain relationships (suppliers turnover)
- Strategic localization
- Importance of the customer
- Innovative product

Our firm is able to produce at the standard production cost even when unexpected demand occurs.

Our firm is able to perform all the quality standard even when unexpected demand occurs.

Our firm is able to deliver a product on time even when unexpected demand occurs.

Your Reactivity contribute to:

- ROA
- ROI
- ROS

-

Note. Scales: 1, I totally disagree; 2, I do not agree at all; 3, I agree a little bit; 4, I agree to some degrees; 5, I agree relatively; 6, I agree significantly; 7, I agree totally

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