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A Comparison Between the Main Drivers and Effects of Dynamic Supply Chain Concepts

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Abstract

Nowadays, the supply chain (SC) represents the way to adapt business organizations to unpredictably changing scenarios. No organization can control nor manage the drivers that lead to such changes: moreover, they need to follow them.

The purpose of this paper is to provide two broad conceptual contributions. On the one hand, its purpose is to clarify the most commonly used terms and definitions. On the other hand, it tries to highlight the actual differences between drivers and effects of each SC-feature.

In particular, this paper aims to present a robust literature review and a chart that summarizes the key points at stake. The goal here is to provide a pragmatic way of avoiding any misunderstanding connected when dealing with such concepts. This paper starts by defining two primary research questions: (1) "How do adaptability, flexibility, agility, lean, and leagility differ in the SC context?"; and (2) "Considering the SC main features, which are the differences among the various drivers that push companies to implement them in order to get the desired effects?". Based on a detailed analysis of the current literature review, a set of final definitions of lean, agile, leagile, flexible, and adaptable SC is then provided. This research also offers a broad view of how different features relate to distinct effects when they are implemented into business strategies.

However, this literature review does not focus on a specific SC sector. The implementation of SC features in different industries slightly differs from one another. Moreover, implementation issues of SC features vary from country to country and depend on the work culture of the organization and the geographic location within the country. Hence, the results of this study would benefit from the differentiation between industries and geographical areas.

Keywords: Lean, Agility, Leagility, Adaptability, Flexibility, Supply Chain Management

Introduction

During the last years, the global economic environment has created higher pressures over the SC than ever before. Many factors are destabilizing the global SC's dynamics normally used to provide a baseline for growth. Financial markets' volatility, oil demand fluctuations, emerging markets, and geopolitics disruptions are just some of the many dynamics in the current global turmoil (Gligor et al., 2015; Ellram and Cooper, 2014). Authors have always been interested in identifying the future needs of the SC with theories and features' definitions to determine the "*most appropriate*" approach to face the change. A consistent number of researchers agree on "adapting" the SC to the context instead of "*paralyzing*" it in its position. While defensive strategies might not cope with the change, flexible ones gradually improve the company's ability to (i) predict future scenarios and (ii) implement the change (Srivastava, 2017). Organizations should achieve a dynamic nature through their relevant SCs to acquire competitive advantages in their respective industries (Kisperska-Moron and DeHann, 2011; Lee, 2004; Wiggins and Ruefli, 2002; MacMillan and Tampoe, 2000). Therefore, to survive the current global turmoil, a new set of features is strictly requested. As of today, the SC represents the most appropriate vehicle to adapt organizations to unpredictable scenarios (Tummala and Schoenherr, 2006). For example, "*Lean SCs*" was used as a definition in 1990 by Womack and Jones (1990) to describe how Japanese Toyota Motor Corporation managed to overtake American General Motors in the automotive sector. The authors of the book "*The Machine*

that Changed the World" clearly explained how to eliminate wastes from operations to maximize the overall efficiency and deal with an ever-increasing volatile market. "*Agile SCs*" is another definition that has been used over the past 20 years, though it has not received as much conceptual development "lean". "Agility" has a clear different emphasis from that of "lean", being "*the means through which the SC can adapt to the changing needs of the market*" with a focus on external dynamics (Christopher 2000; Jain et al., 2008). Several contributions were published to merge the concepts of "*agility*" and "*lean*". The "*Leagile SCs*" should provide the best way to design and implement a system that meets the need to be lean (*efficient and waste-free*) and agile (*fast and flexible to the needs of the market*) (Naylor, 1999; Kisperska, Moron and De Hann, 2011; Jorieke et al., 2016; Ciccullo et al., 2018). Other authors have developed theories by identifying "*agility*" and "*flexibility*" as key features in a SC in order to cope with unpredictable changes related to uncertain environments (Goldman et al., 1995; Yusuf et al., 2003; Baramichai et al., 2007; Purvis et al., 2014; Fayezi et al., 2017). Other researchers have underlined how "*adaptability*" in SCs would represent a core aspect to monitor the surrounding scenarios and fit into it (Giannoccaro, 2015). For example, as industries and markets change faster, rapid SCs need to meet new needs and features to constantly remain competitive (Reeves and Deimler, 2011, Stevenson and Spring, 2007, Chiang et al., 2012). Although the study of SC features is a broad topic of research, a review of operations and management literature reveals common misunderstandings. Indeed, each article seems to describe one SC feature as the best way to answer to market needs, to eliminate waste, and to improve business performances (Singh and Pandey, 2013). This creates confusion among academics and practitioners as to the strategies and techniques to be employed for fitting complex and volatile organization and market needs. The present paper intends to fill the research gaps by providing a full understanding of any and all SC features (*"adaptability", "flexibility", "agility", "lean" and "leagility*"), in order to clarify how each feature is able to cope with different developments of the surrounding scenario. Moreover, the current literature lacks a comparison among the main SC features. Indeed, such features are mainly developed and analyzed as "*separated concepts*". It depends on time/space contextualization as well as a lack of a comparison that would allow us to define and clarify their differences in terms of drivers and effects. Hence, the authors are ordered by drivers, implementation methods, and gained effects. This manuscript provides a comparison and a contextualization to define what kind of SC better fits the changes in the scenario. The propositions developed as part of this paper have significant implications for both theory and practice. Theoretically, the study corroborates the importance and relevance of clarifying and distinguishing SC features based on their drivers and effects. Practically, by understanding how these factors condition each other and how the differences between drivers have different effects on each SC feature, managers can learn about the counterparts on SC and revisit their assumptions and plans for improved decision making. Therefore, this paper is structured as follows: after this Introduction, Section 2 provides a framework for a defined literature review methodology. Section 3 and Section 4 describe the first two passages of a structured review, by exploring, explaining, and justifying either the choices or the exclusion related to the adopted criteria. In Section 5, the results of the study are presented to report the state-of-the-art: "*lean*", "*agility*", "*leagility*", "*adaptability*" and "*flexibility*" are explained as concepts, underlining their properties in our context. Finally, in Section 6, a panel of summarized conclusions is provided to mark the influence of speed on changes, results, and predictability.

A Systematic Literature Review Approach

The literature review represents the primary step within the overall research process. Thus, it is usually placed at the outset of the research project (Seuring and Gold, 2012). Indeed, selecting, reading, and evaluating literature is an ongoing core activity of research that offers the chance to map, consolidate, and evaluate the intellectual territory of a specific field. A related aim is to identify the knowledge gaps to be filled in order to develop the existing body of knowledge further.

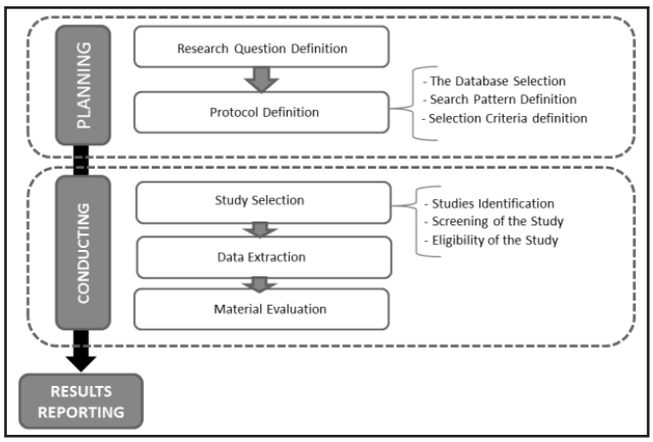

Fig. 1: Methodology Used for the Structured Literature Review

(Tranfield et al., 2003; Saunders et al., 2009). Hence, a Structured Literature Review (SLR) is conducted to have an overall view of the main set of features. Unlike a traditional narrative literature review, a "*systematic review*" reduces the researcher's bias concerning the inclusion or exclusion of studies. It also clearly communicates how the review is performed (Denyer and Neely, 2004), allowing for a high level of transparency. The three macro phases have been reported together with all the steps in Fig. 1. These steps help to identify and select the most relevant studies as the core set of articles for data synthesis and analysis.

Review Planning Phase

The planning phase is an essential one, as it helps to set up the foundations for the entire research. Further steps can be appropriately developed and provide rigorous results under qualitative and quantitative perspectives, only if the settled rules are valid and consistent. No articles examined herein have avoided this stage, although they differ in their methods of implementation.

Defining the Research Question

The main aim of a Systematic Literature Review is first to address the content of SC features by explaining, clarifying, and discussing related paradigms from current literature. Then, the researches analyze the drivers and the effects of SC features. Moreover, it is interesting to highlight how they differ in terms of speed of change, predictability of results, and main scope. Also, it is meaningful to evaluate how to relate different SC to strategy factors, such as cost, quality, delivery, innovation, flexibility.

Therefore, scopes and objectives refer to the following research questions:

RQ1 - How do adaptability, flexibility, agility, lean, and leagility differ in the SC context?

RQ2 - Considering the main SC features, what are the differences between drivers, implementation methods, and gained effects for each one of them?

Protocol Definition

The development of the protocol implies making decisions "*a priori*" to perform a specific search. This phase determines the review's quality and success: bad or superficial choices make it unreliable and inaccurate. A definition of the protocol is mainly fulfilled by three (3) steps: (i) Database Selection; (ii) Search Pattern Definition; and (iii) Selection Criteria Definition (*as represented in Fig. 1)*.

According to Seuring and Gold (2012), a paper's literature sample comprises English speaking peer-reviewed literature, review papers and books covering the period from 1990 to 2018. Indeed, peer-reviewed journal articles represent a primary mean of communication among researchers. Selected databases for this paper included major databases and library services such as Emerald (*www.emeraldinsight.com*), Springer (*www.springerlink.com*) and Scopus (*www.scopus.com*).

A definition of "*keywords*" represented another critical step. Keywords are essential to highlight how many literature review papers do not explicate the reasons which led to defining the string used for designing the queries. A panel of experts has been established with the suggestions of Steinmacher et al. (2015) and Evans et al. (2014) to define the research keywords. This panel featured three (3) academics and four (4) logisticians (*operating in the transport sector and manufacturing industry*). Experts leveraged related experiences in the search field to define the "*search term*", paying attention to the specific objective of the study.

Moreover, considering that this approach is based on the experience of experts, it could be defined as not rigorous. It was possible to avoid this issue by following

the PICO (*Problem Intervention Comparison Outcomes*) system. This process was initially used for research in the healthcare field to answer clinical problems (Huang et al., 2006). PICO was then adapted for SLR, as suggested by Schardt et al. (2007). The identified keywords in this phase of the SLR are summarized in Table 1, which also reports synonyms.

Table 1: List of 3 Macro Phases And Related Activities

Phase	Activities	
Planning	- Research Question Definition	
	- Protocol Definition	- The Database Selection
		- Search Pattern Definition
		- Selection Criteria definition
Conducting	- Study Selection	- Studies Identification
		- Screening of the Study
		- Eligibility of the Study
	- Data Extraction	
	- Synthesis of Data	
Results Reporting		

First, the keywords have been used independently according to Esposito and Evangelista (2014) and Mooren et al. (2014); second, they have been combined in order to have more complex search expressions. Following the example of Riboldi and Vinhas (2014), the Boolean operators "AND" and "OR" have been used for this case. These logical connectives allow combining more concepts in the same search, by expressing: (i) in case of "OR" the possibility of obtaining good results for at least one term; and (ii) in case of "AND", the need to hold them all. An example is reported in Table 2.

Table 2: Keywords and Synonyms Defined for the SLR

Keyword	Synonyms
Lean	
Agile	Agility
Leagile	Leagility
Flexible	Flexibility
Adaptable	Adaptation, Adaptability

The last step concerns the determination of criteria for inclusion and exclusion before going over to the selection stage. The selected criteria have been summarised in Table 3, mentioning references used for each of them.

Table 3: An Example of Search Expression Definition

Keywords	Lean, Agile, Adaptable, Adaptation, Adaptability
Search Expression	"Lean" ***AND*** "Agile" ***AND*** ("Adaptable" ***OR***"Adaptation" ***OR*** "Adaptability")

Review: Activity Framework

As previously mentioned, the review-conducting phase is the most "practical", and its stage of selection is analyzed.

Selecting Studies

This phase has been carried out according to the dictates of the protocol developed in the planning phase. At the end of this step, a total of 2889 publications have been found. Publications have been split into 26 categories that represent the intersections of the concepts of "*lean*", "*agile*", "*leagile*", "*flexible*", and "*adaptivity*" (Table 5). The first 8 categories (C1, C2, C3, C4, C5, C6, C7, C8) represent 70,4% of the total while 29,6% of the identified categories do not have any publications.

Table 4: List of the Selection Criteria Defined by the Experts

Criteria	Specificactions	References
Language	Italian and English	Steinmacher et al., 2015; Goldman et al., 2014; Liu and Miller, 2014; Louw and Deary, 2014
Publication Period	1990-2015	Deckx et al., 2014; Chai et al., 2013; Esposito and Evangelista, 2014
Elimination duplicate publications		Moore et al., 2014; Bertazzoli, 2013; Camera di Commercio Lucca, 2007
Publication category	Peer-reviewed, books, editorials, conferences	Potier, 2014; Brambilla, 2014; Janik et al., 2014
Online availability of the full text		Steinmacher et al., 2015; Hoffmann et al., 2015
Relevance for the revision purpose		Kuruppu and Willie, 2014; Gates et al., 2014; Roll et al., 2011

The absence of publications comparing the main SC features (*lean, agile, leagile, flexibility and adaptability*),

as shown in Table 4 ID C24, highlights the importance of this study.

In the screening phase, publications were filtered to reduce the size of the set according to the selection criteria.

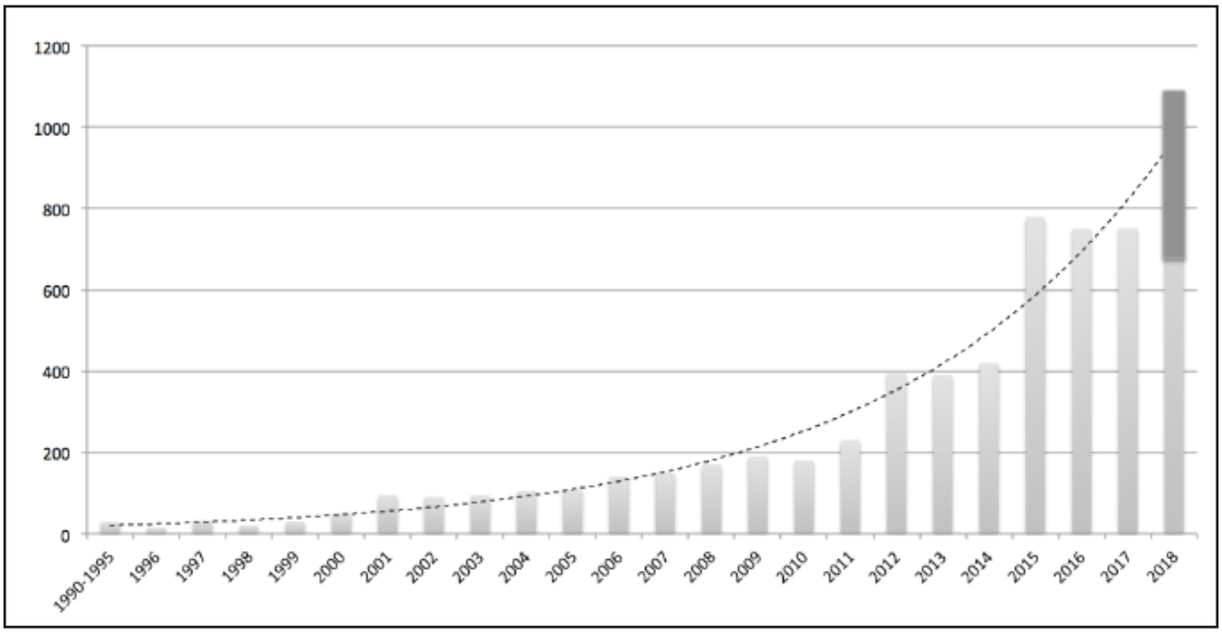

Fig. 2: Distribution of the Publications in the Selected Years Range [1990 ; 2018]

Fig. 2 highlights that the most prolific period for scientific production ranges from 2004 (*with 105 articles*) to 2017 (*with 752 articles*). It is essential to point out that, during the first eight (8) months of 2018, there are 730 publications. For this reason, marked in light grey, an estimate of possible publications for the entire year has been provided: approximately 1094 articles. Moreover, Fig. 3 below shows the distribution of the publications from 1995 for each analyzed topic. It is also interesting to notice how flexibility (F) has been considered an essential dimension of SC performance since the beginning of the '90s, whereas leagile, agile, and adaptability have started to catch on since 2012, reaching a peak during the last 3 years. Currently, when facing a volatile market, companies must make fast changes to respond to the end costumer's changing needs adequately. For such reasons, an "*agile*" production is undoubtedly more efficient than a "*lean*" one. This is also evident by the interest shown in the research. Indeed, comparing the curves for the "*agile*" production (A) and the "*lean*" production (L), the former is the most analyzed topic of the two.

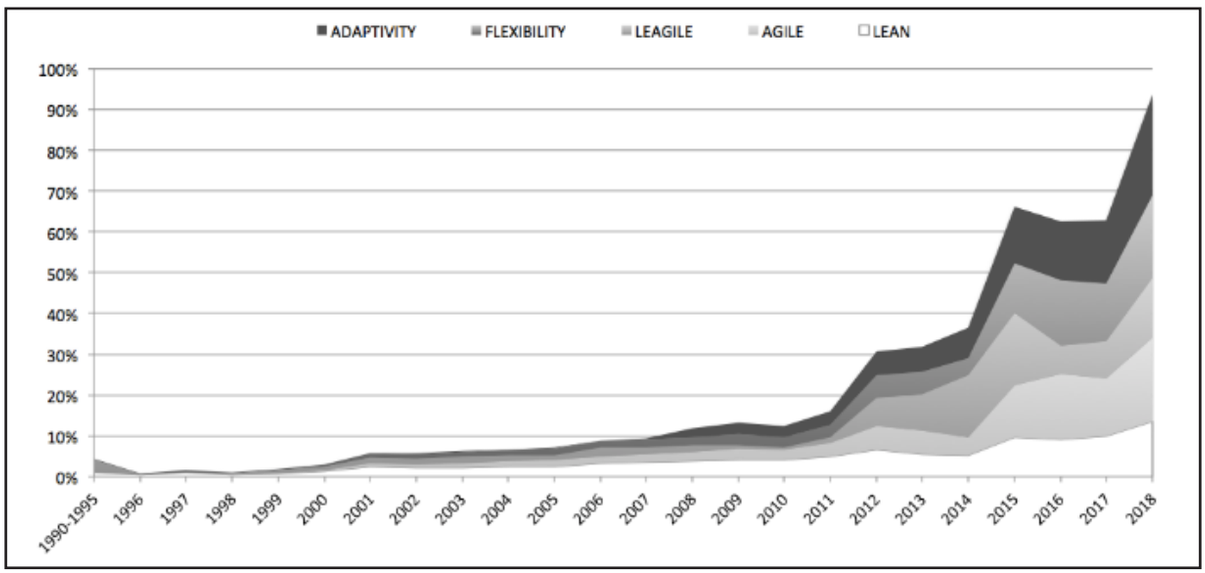

Fig. 3: Distribution of the Publications Related to Different Topic, in the Years Range [1990 ; 2018]

Data Extraction

After a first scan, a more accurate selection was needed. Different processing steps might be taken to ensure that the identified papers deal with the topics to be addressed. The papers contained in the sample provide alternative approaches for their identification: abstracts, keywords, and selected journals. Indeed, some literature review focuses just on selected journals based on their ranking to try to assure the highest quality, and this approach represents a complete state-of-the-art (Karen and Spens, 2006). Even if this makes it easier to assess all related papers on a certain topic, it might, therefore, miss relevant papers in other journals (Seuring and Gold, 2012). Hence, the selection step has been carried out by reading titles and abstracts and thereby decides whether the literature was relevant. After filtering, the publications' set sized to 319 publications. This set has been analyzed in terms of journals of publication (Table 5). Table 5 shows that 80% of these publications are distributed in 9 journals. The most important is the "*International Journal of Production Economics*" with 18 publications. Moreover, 4% of the publications were published in books.

Table 5: List of Defined Categories (*categories without publications)

ID	TOPIC	SYMBOL	ID	TOPIC	SYMBOL
C1	lean ∩ adaptivity	L ∩ AT	C14	agile ∩ flexible ∩ adaptivity	A ∩ F ∩ AT
C2	lean ∩ flexible	L ∩ F	C15	lean ∩ flexible ∩ adaptivity	L ∩ F ∩ AT
C3	lean ∩ agile ∩ flexible	L ∩ A ∩ F	C16	lean ∩ leagile	L ∩ LA
C4	agile ∩ flexible	A ∩ F	C17	lean ∩ agile ∩ adaptivity	L ∩ A ∩ AT
C5	agile ∩ leagile	A ∩ LA	C18	lean ∩ agile ∩ flexible ∩ adaptivity	L ∩ A ∩ F ∩ AT
C6	lean ∩ agile	L ∩ A	C19*	agile ∩ leagile ∩ adaptivity	A ∩ LA ∩ AT
C7	flexible ∩ adaptivity	F ∩ AT	C20*	agile ∩ leagile ∩ flexible ∩ adaptivity	A ∩ LA ∩ F ∩ AT
C8	leagile ∩ flexible	LA ∩ F	C21*	lean ∩ leagile	L ∩ LA ∩ AT
ID	**TOPIC**	**SYMBOL**	**ID**	**TOPIC**	**SYMBOL**
C9	agile ∩ leagile ∩ flexible	A ∩ LA ∩ F	C22*	lean ∩ leagile ∩ flexible ∩ adaptivity	L ∩ LA ∩ F ∩ AT
C10	lean ∩ agile ∩ leagile	L ∩ A ∩ LA	C23*	lean ∩ agile ∩ leagile ∩ adaptivity	L ∩ A ∩ LA ∩ AT
C11	lean ∩ agile ∩ leagile ∩ flexible	L ∩ A ∩ LA ∩ F	C24*	lean ∩ agile ∩ leagile ∩ flexible ∩ adaptivity	L ∩ A ∩ LA ∩ F ∩ AT
C12	lean ∩ leagile ∩ flexible	L ∩ LA ∩ F	C25*	leagile ∩ adaptivity	LA ∩ AT
C13	agile ∩ adaptivity	A ∩ AT	C26*	leagile ∩ flexible ∩ adaptivity	LA ∩ F ∩ AT

Evaluation of the Materials

At the end of data extraction, the 319 publications have been further filtered to reduce the overall size of materials. At such point, the panel of experts evaluated the obtained set by reading the paper, identifying the most pertinent articles and assessing their validity, transparency and reliability (Seuring and Gold, 2012) also considering the research questions. De-contextualization and theory-led abstraction of the analysis outcomes allowed for a certain degree of generalization for the findings and, hence, external validity (Avenier, 2010). Furthermore, transparency and replicability of the research design are ensured by careful documentation of the entire research process. Finally, inter-subjectivity of data analysis (*largely dealing with latent content deserving interpretations: Duriau et al., 2007*) was pursued by "*discursive alignment of interpretation*". Thus, upon removing papers not in line with the selection criteria, the final set was comprised of 75 studies. Therefore, the final and specific set of publications has been restricted to 74 studies (*71 articles and 3 publications on books*). Such articles have been studied to address the research questions, and the relevant results are presented and discussed in Section 5 below.

Results of the Reporting Phase

RQ1: How do Adaptability, Flexibility, Agility, Lean and Leagility Differ in the SC Context?

When it comes to SC features, misunderstandings are common. This section provides clarifications, especially concerning some adjectives commonly associated with SC.

Adaptability

The word "adaptive" is defined as follows: "*showing or having a capacity for or tendency toward adaptation*" (Merriam Dictionary, 2014). During the '90s, it was considered as the ability to change self-competencies to be considered "*dynamic*" in volatile and uncertain environments. Therefore, "*adaptivity*" is the organization's ability to follow externally changing contexts. In time, the meaning of "*adaptivity*" regarding SC management has evolved so that SCs have been framed as "*complex adaptive systems*" (*CASs*) (Bozarth et al., 2009; Choi et al., 2001; Pathak et al., 2007; Surana et al., 2005). The notion of CAS has its roots in the biological sciences (Gell- Mann, 1994), and refers to a system that emerges over time into a coherent form and adapts itself without any singular entity deliberately managing or controlling it. A "*complex adaptive system*" in a SC refers to a set of interconnected buyers and suppliers and their relational patterns, which arise over time into coherent forms through localized interactions and adapts and organizes itself without any singular entity deliberately controlling it (Choi et al., 2001; Treville et al., 2004). "*Adaptation*" is one of the key properties of a CAS, meaning that the system can spontaneously self-organize itself with no central control, assuming new structures (*configurations*) over time characterized by enhanced fitness in the environment. Giannoccaro (2015) follows the literature trend of framing SC as a "*complex adaptive system*" (*CAS*). The author identifies an "*adaptive*" SC as a set of firms (*agents*) performing activities and interconnected among each other by material and information links, which adapt and co-evolve with the external environment without any entity driving this process. The author also highlights how the learning processes in enterprises and the development of new knowledge (*e.g., modifying processes and strategies*) play a critical role and represent fundamental capabilities to build the "*adaptive*" SC. Moreover, the author states that the design of an "*adaptive*" SC depends on the level of product complexity and environmental turbulence. Indeed, each SC structure is appropriate for different products based on their demand characteristics (Stavrulaki and Davis, 2010). SC adaptability is defined as the ability of the firm to make SC design changes that are far more radical and long-term than changes pursued under the notion of SC agility in the wake of sensed opportunities (Eckstein et al., 2015; Aslam et al., 2018). In conclusion, an "adaptive" SC has the internal ability to adapt itself to external shifts, due to predictable trends and unpredictable uncertainties. In particular, it can change the business environment conditions the company lives in completely. Hence, being "adaptive" consists of monitoring scenarios in order to always be prepared to change as fast and "on time" as possible. It follows and meets the shift, adapting to it through actions (*even without the certainty of obtaining the foreseen results*) and preserving the ability to change again suddenly, whatever industry SC is in or whatever happens in the business environment.

Agility

The concept of "agility" has been developed over the past twenty (20) years, and it refers to very particular features that an organization should have. As a first remark, "*agility*" within the context of SC has been broadly suggested as "*the means through which the SC is able to adapt to the changing needs of the market*" (Sharp et al., 1999; Christopher 2000; Jain et al., 2008; Van Hoek et al., 2001, Towill and Christopher, 2002). "*Agile*" supply –where small volumes of high margin, short life cycle innovative products are offered – is increasingly carried out through a complex global SC network (Pearson et al., 2010). Introducing the "time" dimension, the conceptualization of "*agility*" has improved, and is then defined as follows: "*the capability of the SC and its members as a whole to rapidly align the network and its operations to dynamic and turbulent customer requirements*" (Ismail and Sharifi, 2006). It shall be noted that other definitions of "agility" have been provided, such as "*a dynamic alliance of member companies, the formation of which is likely to need to change the frequency in response to fast-changing markets*" (Luo et al., 2009). In particular, the Agile Manufacturing (AM) paradigm is fast instilled in modern organizations.

AM assists an organization to evolve products and services quickly and economically in response to the customers' dynamic demands (Vinodh et al., 2013; Baramichai et al., 2007). Hence, to decrease the overall internal risk, "*agility*" is a kind of rapid internal flexibility, defined as follows: "*agility is the ability of a SC to rapidly respond to changes in market conditions and customer demands thereby enabling the attainment of*" (Gligor, 2013). Though the concept has been developed over the years, it has recently been clearly defined as follows: "*Agility is the capability of the firm, internally, and in conjunction with its key suppliers and customers, to adapt or respond in a*

speedy manner to a changing marketplace, contributing to agility of the extended SC" (Vinodh, 2010). Yet, for the purposes of this paper, the recent definition of Fayezi et al. (2017) provides the most pertinent definition of "*agility*" as "*strategic ability that assists organizations rapidly to sense and respond to internal and external uncertainties via effective integration of SC relationships*" (Fayezi et al., 2017). The increasing importance of using an "*agile*" SC entails a focus on the selection of supply partners. Not only this increases the importance of the partner selection itself, but also (*and in particular*) the significance of considering both quantitative and qualitative, operational and strategic criteria within this decision-making process (Wu and Barnes, 2010). These dynamic capabilities enable knowledge creation and dissemination, as well as continuous modification of organizational processes in response to environmental changes. They can lead to differences in the performance of firms, even if firms are similar in terms of resources and capability endowments (Teece et al., 2016).

Lean

In recent years, significant interest has been shown in the idea of "*lean manufacturing*", as developed by Toyota Motor Company (Womack et al., 1990). Such concept became more widely used with the formalization of "*lean thinking*" in five (5) distinct pillars (Womack and Jones, 1994). The entire path to be followed for developing a "*lean enterprise*" was provided only later, extending the "*lean*" philosophy to the entire company (Womack and Jones, 1996). With respect to the SC context, given that "*leanness*" eliminates all non-value adding processes, a "*lean*" SC is defined as "*the SC where lean concepts about waste elimination are applied internally entirely, including both downstream than upstream processes*" (Womack et al., 1990; Naylor et al., 1999). More recently, according to Yang et al. (2011), "*lean*" production is a systemic method for eliminating waste within a manufacturing process through a set of synergic work practices (Dileep and Chemmannur, 2014). "*Lean*" also considers waste created through overburden and waste created through unevenness in workloads. Under a client perspective (*i.e., the perspective of those who consume a product or service*), "*Value"* is any action or process that a customer would be willing to pay for. Essentially, "*lean*" is centered on making obvious what adds value by reducing everything else (Singh and Pandey, 2015). A key driver for a correct full implementation is thus represented by a vertical and integrated education and training about "*lean concepts*" to the whole organization on all levels (Laureani and Antony, 2012) and all areas. Hofer et al. (2012) highlight that, given the multiplicity of "*lean*" production practices, a relationship between "*lean*" production and financial performance exists. Specifically, this set of operations improves the plant performances by implementing both downstream and upstream processes, but the full implementation might be hard to set due to several reasons – above everything, lack of clear vision and a plan to follow (Jadhav et al., 2015). Interestingly, some authors (Dues et al., 2013; Wichaisri and Sopadang, 2017) show that "*green*" practices can help companies in becoming "*leaner*". In fact, "*lean*" and "*green*" can boost their full potential and bring greater benefits when implemented jointly rather than separately. Indeed, the combined use of them focuses on cost reduction and increased flexibility through the continuous elimination of waste across SC. Other authors highlight the negative impact of lean practices on sustainability performance due to more frequent not full truckload transportations to the point of consumption (Martínez-Jurado and Moyano-Fuentes, 2014) or its detrimental impact on sustainability if not supported by other lean practices (Longoni et al., 2013). Companies should also consider that some Lean practices have a controversial impact on sustainability performance (such as more frequent, not full truckload transportations to the point of consumption). This implies the need for a company embracing the lean paradigm to reconsider the choice of heavily relying own JIT, considering what potential detrimental effect on environmental and social performance might arise and which contingencies to rely on to overcome these pitfalls (Carvalho et al., 2017).

Leagility

After Naylor's pioneering work on "*leagility*", several publications appeared and followed the concept of merging "*agility*" and "*lean*" to achieve total flexibility within SC. Thus, "*leagility*" could be defined as "*the combination of the lean and agile paradigms within a total SC strategy by positioning the decoupling point so as to best suit the need for responding to a volatile demand downstream yet providing level scheduling upstream from the marketplace*" (Naylor, 1999; Mason-Jones et al., 2000; Kisperska-Moron and DeHann, 2011;

Ciccullo et al., 2018). In the scope of this paper, a "*lean-agile*" SC strictly follows the definition provided by its pioneer Naylor in 1999, even if further developments have been then made in several different contexts. "*Leagility*" concepts have been extended upstream and downstream along with the production environment. For example, sourcing and vendor processes can represent two (2) additional contexts, where adding decoupling points along the whole stream helps the company to adapt to business uncertainties. *"Leagility*" has been hence described to create and manage an actual Flexible SC Network (Purvis et al., 2014). Sourcing and vendor are not the only processes interested in the application of "*leagility*"; concerning quality, for instance, a new Quality Function Deployment (QFD) has been developed through the multiplication of the decoupling points across the key-steps along with the methodology. Enabling alternatives and prioritizing the enablers, QFD's contribution to managing decision-making can be high and tactical, by evaluating risks and opportunities coming from the business environment (Haq et al., 2014). The concept of "*risk mitigation*" strongly affects the Project Management's context: "*leagility*" has developed into the most used methodology to build alternatives through the multiplication of the decoupling points so to overthrow business uncertainties (Demir et al., 2014).

Moreover, during the last years, traditional models (Lee, 2002) supporting the definition of the established lean and agile SC paradigms have been replaced by an integration between established SC paradigms and sustainability. The relevance of sustainability within the company's strategy represents the baseline to set the level of effort required. Different authors proposed different approaches to integrate sustainability in a leagile SC (*or the contrary*) (Piercy and Rich, 2015; Martinez et al., 2016; Kumar et al. 2016). When companies want to embrace sustainability, they must be sure they have laid the right foundations by leveraging lean or agile practices. Yet, companies should also be aware that practices might be beneficial in terms of environmental impact, but not applicable in all contexts (*e.g., opting for a geographically concentrated supply based in contexts in which global sourcing is strategic)* (Carvalho et al., 2017).

Flexibility

In SCs, materials are shifted sequentially from one partner to the other. Companies have understood that and, to be very responsive to customer demands, all partners in the chain must be able to respond to change. Such a concept is reinforced in SC measurement literature and defined as "*flexibility to meet particular customer needs*". It has been viewed as an important strategic performance metric (Gunasekaran et al., 2002; Gligor, 2013). Therefore "*SC flexibility then becomes the capability of promptness and the degree to which the SC can adjust its speed, destinations and volume in line with changes in customer demand*": such definition underlines the need to totally satisfy the client's demands (Prater et al., 2001; Lummus et al., 2003). Again, "*flexibility in SC is achieved by reducing cycle time implementing a pulled based replenishment process*" (Garber and Sarkar, 2007). Hence, "*SC flexibility is defined as the kind of SC directly able to impact a firm's customers (flexibilities that add value in the customer's eyes) and are the shared responsibility of two or more functions along the SC, whether internal (marketing, manufacturing) or external (suppliers, channel members, the whole environment) to the firm*" (Gligor, 2013).

The aforesaid latest view on "*flexibility*" has been developed by a survey conducted in Germany among a discrete number of Procurement and SC managers. This study marked the relevant role acquired by the SC function related to knowledge management: products and processes that rise complexities add critical aspects into a business environment that is already widely alerted by external pressures. In such a context, a "*flexible*" SC can regulate both internal and external mechanisms, mitigate risks, and catch business opportunities (Blome et al., 2013). The need for a "*flexible*" SC is mentioned in another study aimed at classifying several different contexts where "*flexibility*" shifted from a plus to a structural need. Facing external pressures is not the only target to be met by a "*flexible*" SC: rising demand-oriented productions (*Make to Order –MTO*) add internal criticalities to a system where it is more and more important to settle down a tactical plan. "*Flexibility*" then enables the organization to adapt and change its structure to every kind of path, driven by qualitative and quantitative aspects (Esmaeilikia et al., 2014). "*Flexibility*" has thus become an important SC feature in every multi-tier kind of business. Various network layers represent shared processes where the need to be "*flexible*" assumes a core role in a company's success. Also, more than any other sector, the Automotive Industry represents an industrial context hard to live in. "*Flexibility*" is therefore necessary for several industry environments, from delivery to sourcing, and SC shall be the function granted with a core role to drive the company

towards a "*flexible*" ability and adapt itself to the business environment (Thomè et al., 2014).

Considerations from RQ1

To answer RQ1, a comparison between all considered SC features (*"adaptability", "agility", "lean", "leagility" and "*flexibility*"*) has been provided in Table 6 below. It highlights that all the features above aim at improving business performance, even if the impact on the related number of publications might be different. In particular, the implementation of downstream and upstream processes allows increasing plant performances, both financial and organizational. In recent years, due to the economic and financial crisis, companies have tried to obtain high levels of performance by investing in new SC approaches (*see* Fig. 3 *above*). It is possible to note that many publications range from 2008 to 2018. Moreover, changes in the markets are faster than ever and must be taken into account to achieve high levels of performance. Thus, it is important to rapidly align the network and its operations to the dynamic and turbulent market requirements (Vinodh et al., 2013; Thomèet al., 2014). Indeed, a distinction between "*adaptability*" and "*agility*" could be provided exactly under the view of the time-concept. Indeed, an "*agile*" SC can quickly react to unexpected or rapid shifts in supply and demand, while an "*adaptable*" SC can adjust its design to meet structural shifts in markets (Lee, 2004). "*Agility*" adds only the speed component to "adaptability": it allows entities to adapt quickly to changes. "*Agility*" is not a necessary condition for "*adaptability*"; however, "*agility*" does facilitate quicker adaptation (Gligor, 2013). Moreover, in Table 6 below, a link between "*Quick response*" and "*Risk Mitigation*" is highlighted and compared in terms of impact, specifically considering the "*Agility*", "*Lean*" and "*Leagility*" approaches. The occurrence of fast changes in a globalized market can imply high risks. For instance, as mentioned by Blome et al. (2013), rising complexities in products and processes add critical aspects to a business environment widely alerted by external pressures. In this respect, combined adoption of "*agile*" and "*lean*" paradigms - in other words, a "*leagile system*" -is required (Haq et al., 2014; Ciccullo et al., 2018). Furthermore, SC must implement flexible processes in order to adapt its structure to changes in the business environment (Thomè et al., 2014). Focusing on the "*lean*" approach, the need to successfully integrate external supply and internal processes is a critical aspect. Engaging suppliers on a collaborative and strategic level, manufacturers can unearth hidden opportunities for "*Muda*" reduction and enlist suppliers to help them improve their business margins and their competitive advantage. In turn, suppliers will better understand what is expected, how they can consistently deliver on this and what they gain in return (Yang et al., 2011; Hofer et al., 2012). Nevertheless, this is possible only if there's a connection between all SC actors and synergistic work practices are applied internally *(including both downstream and upstream processes*). What has been said above is one of the main aspects of the "*lean*" approach. Indeed, the implementation of synergic work practices allows building a structure that performs interconnected activities among SC features by material and information links. Thus, such a strategy can lead to an "*adaptable*" network that is capable of co-evolving together with the external environment (Choi et al., 2001; Treville et al., 2004).

Table 6: Most Relevant Journal Defined by SLR

Journals & Books	N.papers	%	%∑
International Journal of Production Economics	18	24,3%	24,3%
Journal of Operations Management	15	20,3%	44,6%
Expert Systems with Applications	12	16,2%	60,8%
European Journal of Operational Research	5	6,8%	67,6%
Industrial Marketing Management	5	6,8%	74,3%
Journal of Cleaner Production	2	2,7%	77,0%
Computers & Industrial Engineering	1	1,4%	78,4%
Procedia CIRP	1	1,4%	79,7%
Journal of Manufacturing Systems	1	1,4%	81,1%
Other journals (11)	11	14,9%	95,9%
Books	3	4,1%	100,0%

RQ2: Considering the Main SC Features, What are the Differences Between Drivers, Implementation Methods, and Gained Effects for Each One of Them?

This section analyzes the external forces that might influence the extent of "*lean*", "*leagile*", "*agile*", "*flexible*" and "adaptable" thinking in organizations and

the expected effects of them into SC. A summary of this has been provided with Table 7.

As a result, the aim will be to provide guidelines that show under what circumstances certain operative capabilities should be pursued and how this affects SC performances. Yet, to properly analyze the SC features, it is crucial to know why companies need their implementation. Comparing the literature on "*lean*", "*leagile*", "*agile*", "*flexible*", and "*adaptable*" SCs, drivers and effects were investigated and differentiated due to their relevant characteristics. The main differences between drivers and effects of SC features are outlined and described, respectively, in Table 8 and Table 9.

Table 8 and Table 9. have been reported at the end of the paper.

Lean

The main factor that would cause organizations to undergo "*lean*" improvements or speed up their existing "*lean*" improvement efforts is certainly market pressure. Indeed, new markets are continually emerging in different areas of the world and are determining more complex ways to satisfy the need for closeness to customers, in terms of product-service specificities (Boyle et al., 2011). Moreover, there is substantial pressure to reduce product costs. Indeed, firms following a cost-leadership strategy normally try to obtain the lowest costs in their environment, offer good prices to clients and obtain profits (Arnas et al. 2013; Boyle et al., 2011; Hopp and Spearman, 2004). However, a "*lean*" business unit should not only focus on lower costs. Other factors influencing the pace of Lean in organizations include the existence of benchmarking or competition between plants, a declining market for their key product, a high threat of import substitution, pressure from marketing, sales, etc. (Wang and Cao, 2008, Boyle et al., 2011; Arnas et al., 2013). Hence, the main drivers can be defined as follows:

- Pressure to reduce product costs;
- Responsiveness to customer requirements;
- Competition between plants;
- Market pressure.

The "*lean*" ideas, tools, methods and practices are quickly growing into the different portions of SC due to their important effects such as decrease of costs, higher quality, just-in-time supply (Behrouzi and Wong, 2011) and saving in waiting and transportation time (Chen et al., 2013). The "*lean*" implementation allows reducing the level of input resources in the system for an assumed level of output (Lewis, 2006; Chen et al., 2013). A focus on environmental sustainability issues reveals the synergies between the "*Lean SC*" and "*Green*" strategies; furthermore, "*lean*" SCs facilitate the implementation and spread of green principles and practices among SC and a consequent progress in the chain's environmental performance, in terms of waste decrease, too (Folinas et al., 2013; Hajmohammad et al., 2013; Martínez-Jurado and Moyano-Fuentes, 2014; Wichaisri and Sopadang, 2017). But Lean does not match perfectly with sustainable performance in every context. The main obstacle appears to be the distance. While lean SCs typically have lower emissions due to reduced inventory levels (Chalotra, 2013), the frequent replenishment at every point in the provision stream tends to increase the emissions. As distances increase along the SC, it is quite possible for lean and green to conflict, leading to trade-offs as well as additional opportunities for optimization (Carvalho et al., 2017).

Thus, the main effects can be defined as follows:

- Improvement in Environmental Performance
- Waste Decrease
- Cost Decrease
- Higher Quality
- Just-in-Time Supply
- Efficiency Improvement
- Time-Saving

Leagile

The main factor that would push organizations to implement a "*leagile*" SC is certainly market pressure. Indeed, "*leagility*" aims at responding to changes (*either predictable or unexpected*) in appropriate ways and due time, also by exploiting and taking advantage of changes as opportunities. In other words, "*where demand is volatile, and customer requirements for variety is high, the elimination of waste becomes a lower priority than responding rapidly to the turbulent marketplace*" (Harrison and Van Hoek, 2005). Therefore, the main driver is the volatility of the environment, making waste reduction only a secondary target. In this respect, based on the study of Harrison and Van Hoek (2005), the direct effect of "*leagile*" is obtaining a Suitable in

volatile environments and the Implementation of rapidity. Moreover, to underline the combination between the "*lean*" and "*agile*" features, a preliminary remark shall be made. With its current set of tools, "*Lean*" is not able to tackle the increasing demand for customer-specific products by itself, and such circumstance favors organizations that are moving towards an "*agile*" production philosophy, being it considered more suitable to handle customer-specific requirements with flexibility and responsiveness (Desai et al., 1999).

Hence, the main drivers can be defined as follows:

- Competitive market pressure;
- Uncertain environment;
- Sense of Responsiveness;
- Service Level Oriented;
- Pressure to reduce product costs.

Moreover, regarding "*leagile*" effects, in addition to Suitable in volatile environments, cost-effectiveness should be considered. Hence, "*leagility*" represents a mixed (*heterogeneous*) SC with "*lean*" and "*agile*" characteristics: its demand is unpredictable and volatile, it has medium product variety, and its main driver is service level (Salvi et al., 2014). Hence, the main effects can be defined as follows:

- Cost-Effectiveness;
- Suitability in volatile environments;
- Implementation of Rapidity.

Agile

The main driving force behind "*agility*" is change (Gligor et al., 2013; Tseng and lin, 2011). Nowadays, change is occurring at a much faster rate than ever before. Turbulence and uncertainty in the business environment have become the main causes of failures. The number of changes and the types of change, as well as its specifications or characteristics, cannot be easily determined (Tseng and Iin, 2011). Indeed, Braunscheidel and Suresh (2009) defined SC's agility as a second-order construct that is formed by the first-order dimensions such as demand/response, joint planning, customer responsiveness, and visibility. SC agility is a dynamic capability that refers to a company's ability to provide increased responsiveness and yield higher profitability if exploited properly. Thus, it is a resource to fall back upon in turbulent times (Aslam et al. 2018). In order to summarize the numerous literature studies that have tried to define drivers of an "*agile*" SC (Braunscheidel and Suresh, 2009; Roh et al., 2012, Gligor et al., 2013, Thilak et al., 2015; Do Rosário et al. 2016, Ciccullo et al. 2018) the four (4) needs due to general areas of change as defined by Tseng and Lin (2011) have been considered and are reported:

- Need for responsiveness;
- Efficiency and effectiveness of an enterprise in reaching its goals;
- Changes in customer requirements caused by demands for customization, increased expectations about quality and quicker delivery time;
- Need for quickness/speed.

Therefore, cost-efficiency and customer effectiveness are useful effects to implement "agility" into SC (Gligor et al., 2014) and Product Customization and Short Lead Time are meaningful effects of "*lean*" and "*agility*" (Singh, Sohani, Marmat, 2013; Al Samman, 2014).

The main effects can thus be defined as follows:

- Cost Efficiency;
- Customer Effectiveness;
- Lead Time Oriented.

Adaptability

"*Adaptability*" refers to the sense of adapting the organization to unpredictable environments, through several features that represent a suitable set of drivers as provided by an extensive literature review work, finally grouped by the main aspects in the business environment (Routroy et al., 2015). Every single driver entails a different impact on the considered industry: technology innovation refers to sectors marked by a strong sense of adoption in order to wave the business (Beck, 2012), as much as other industries are mainly moved by an operative sense of adaptation (Flumerfelt et al., 2012). Indeed, most companies do not realize that, in addition to unexpected changes in supply and demand, SC also faces near-permanent changes in markets. Those structural shifts usually occur because of economic progress, political and social changes, demographic trends and technological advances. Unless companies adapt their SC, they will not stay competitive for very long (Lee, 2004). In the previous lines, Lee explains the whole sense of "*adaptability*"

into SC: if "*leanness*" is a must-capability, "*agility*" is not a plus-capability anymore. Unpredictable shifts in the business environment lead to a context without the manageability of the company. Because SC Agility and Adaptability are developed and renewed in response to changes in customer demand, these two constructs have been positioned as dynamic capabilities that result from the firm's ability to reconfigure firm-level and SC-level resources. (Eckstein et al., 2015; Aslam et al., 2018). Hence, the main drivers can be defined as follows:

- Technology adoption;
- Responsiveness to business environments;
- Responsiveness to customer requirements;
- Changes in social factors;
- Changes in economic factors;
- Responsiveness to environmental factors;
- Design flexibility;
- Creation of fast response;
- Infrastructure reconfigurability and Operations flexibility;
- Service level oriented;
- Competitive market pressure.

Therefore, riding the change is the skill that enables the company to survive, preserving the competitive advantage in the business in a reasonable amount of time. Hence, the main effect can be defined as the capability to meet structural shifts in the market.

Flexibility

The adoption of a "*flexible*" SC is often a strategy or a tool to cope with increasing environmental uncertainties and turbulence (Martin and Holweg, 2011). Moreover, other external factors that cause organizations to undergo "*flexible*" improvements are the increasing complexity in SC growth, such as customer requirements, competitive environment, shorter product lifecycles and change in the industry standards. Moreover, SC companies form strategic alliances, engage in mergers and acquisitions, outsource functions to third parties, adopt new technologies, launch new products/services and extend their operations to new geographies, time zones and markets (BCG, 2006; PricewaterhouseCoopers, 2006; Underwood et al., 2011; Serdarasan, 2013). Flexibility in transportation, for example, is perceived as a double-edged sword. On the one hand, it can be used to reduce environmental impact by choosing among different lot size deliveries (Shibin et al., 2016). In addition to this, even the increasing product variety stimulates the adoption of flexible manufacturing. Flexible manufacturing, through improved manufacturability of customized products (*i.e., throughput time reduction and faster deliveries to end customers*) enables green product design (Shibin et al., 2016; Ciccullo et al., 2018). In this context, being more customer-centric and responsive makes the difference. Responsive SC management (SCM) is different from traditional SCM in that the former aims at increasing customer bases and long-term profitability through agile demand planning, whereas the latter has focused heavily on increasing cost-saving opportunities through improved efficiency in outsourcing, production planning and logistics processes (Roh et al., 2014). The main drivers can be defined as follows.

- Customer-centric;
- Responsiveness to Business Environments;
- Competitive environment;
- Customer requirements;
- New strategic alliances;
- Engagement in mergers and acquisitions;
- Outsourcing of functions to third parties;
- Adoption of new technologies;
- Launch of new products/services;
- Enlargement to new geographies, time zones, and markets;
- Shorter product lifecycles;
- Market uncertainties and turbulence;
- Change in industry standards.

"*Flexibility*" applied to SC can significantly improve the latter's expected profits and financial performance (Benton, 2010; Hu et al., 2013) and can mitigate risks (Fang and Li, 2015). Some authors even believe that "*flexibility*" can improve SC performances as a whole (Sushil, 2012). Moreover, the effects of knowledge transfer (*both inside and outside of the company*) on SC's flexibility have been investigated, and it was verified that processes of internal and external knowledge transfer are important enablers of "*flexibility*" (Blome et al., 2014). Accordingly, the solutions in the reviewed cases aim at improving efficiency and responsiveness through

pull-based replenishment, information sharing, and centralized logistics operations (Bag and Surajit, 2014). These changes resulted in reduced inventories across SC, reduced lead times, and improved customer service levels as intended. Hence, the main effects can be defined as follows:

- Competitive performance;
- Improvement of expected profits;
- Improvement of SC performance as a whole;
- Risk reduction.

Considerations based on RQ2

SC features are grouped into seven (7) categories, based on their drivers, as shown in TABLE 8 below. In detail, the defined categories consider aspects such as the need for system improvements, system responsiveness, and the system's capability to respond to environmental uncertainties. For a deeper understanding, the categories are listed as follows:

- *Context Variability*: Market uncertainties and turbulence; change in industry standards; change in social factors; change in economic factors; uncertain context.
- *Responsiveness*: Need for responsiveness; new strategic alliances; responsiveness to business environments; responsiveness to customer requirements; responsiveness to environmental factors; creation of fast response; responsiveness to business environments; outsourcing of functions to third parties; a sense of responsiveness; responsiveness to customer requirements.
- *Customer Requests*: Shorter product lifecycles; customer requirements; customer centric approach; Service level oriented.
- *Resilience*: Flexibility; design flexibility; infrastructure re-configurability and operations flexibility;
- *Need for System Improvements*: Adoption of new technologies; launch of new products/services.
- *Cost Reduction*: Pressure to reduce product costs.
- *Competitive Context*: Need for quickness/speed; efficiency and effectiveness of an enterprise in reaching its goals; competitive market pressure; extension of operations to new geographies, time zones, and markets; competitive environment; engagement in mergers and acquisitions; competition between plants.

As a first remark, Table 7 makes it evident that the competitive environment is a common driver that could push companies to improve their performances and apply one of the SC features previously defined (*"adaptability", "agility", "lean", "leagility" and "flexibility")*. Yet, adopting the right SC Strategy also means understanding the context in-depth: therefore, adopting a "*lean*" system means aiming at different deliveries compared to Companies adopting an "*agile*" approach. And it depends on the context, as explained in the paragraph below. For example, with a "lean" strategy, it is possible to notice that the aspects connected with environmental flexibility (*Resilience, Responsiveness, and Context Variability*) are almost absent. Indeed, "*lean*" concepts work well where demand is relatively stable and hence predictable and where variety is low. Instead, where demand is volatile, and customers request for variety is high, a much higher level of "*agility*" is required. In other words, if the expected results are reducing wastes and the environment is relatively stable, a "*lean system*" might be the right approach to gain deliveries.

On the other hand, in the case of a volatile business context, for example, where demand variety is high, an "*agile*" approach might be the answer to face uncertainty. Results are so not the same at all, and they have been given by different approaches, led by different results to achieve. Therefore, continuing on the example, according to Womack et al. (1990), most "*lean*" programs focus on reducing waste and non-value adding activities, emphasizing performance improvements in the areas of cost efficiency, conformance, quality, productivity and reduced inventory and throughput time. Indeed, plants have many problems in managing external relationships with suppliers and distributors, as well as end customers. Yet, the "*lean*" approach might work enough, and it depends on which aim the Company intends to achieve. Once they gained efficiency and productivity with a "*lean approach*", other targets might be achieved: the upcoming goal might be represented on how to integrate external supply and internal processes successfully. Indeed, companies might gain new competitive advantages because of their related development, due to their growth by internal and external drive (Narasimhan et al., 2006).

The necessity of cost reduction could drive even "leagile" applications. In this case, however, context variability and responsiveness are added variables. Indeed, the

advantages of becoming "*lean*" can be compromised when demand fluctuates, custom order increases, or simply a balanced workload cannot be achieved (Wan and Chen, 2009). In contrast, for the "*agile*", "*flexible*" and "*adaptable*" performers, cost reduction doesn't seem to be the main priority: business context requires different targets to be achieved. Indeed, they exhibit performance capabilities that reflect the service emphasis that Christopher and Towill (2001) and Fayezi et al. (2017) grouped in the ability to change in fast contexts. Remaining on the example, such performers need to have: (i) superior abilities in terms of "*flexibility*"; (ii) shorter lead time for new product development; (iii) reduced system changeover time; and (iv) an efficient scaling up and down of operations (Narasimhan et al., 2006; Shankar, 2015). Another interesting comparison might be about how to relate "*adaptability*" and "*agility*". While an "*adaptable approach*" represents an evolved SC able to adjust itself to the external context, an "*agile approach*" is the answer to customer demand fluctuation (Gligor, 2013). Therefore, "*Context Variability*" factor (*market uncertainties and turbulence; change in industry standards; change in social factors; change in economic factors; uncertain context*) and "*Customer Orientation*" are the main differences in drivers between "*agile*" and "*adaptable*". Thus, continuing on the example, while "*adaptability*" enables the company to meet unpredictable shifts in the market, with no way to manage them, "*agility*" refers to the company's ability of being responsive to a set of constraints (*demand/offer change, for instance*) through its operations (Lee, 2004). It is so possible to properly exclude "*agility*" as the SC feature that allows adaptation to the context – meant as unpredictable in its variability.

On the other hand, the need for a "*flexible*" SC encompasses almost all the requirements of both "*adaptability*" and "*agility*". Companies must achieve the external and internal ability to shift to changes caused by unmanageable and non-predictable forces, under an end-customer point of view.

The main effects of the application of the considered SC features are summarized in Table 9 below. They can be grouped and listed as follows:

- *Cost Efficiency*: Cost Effectiveness, Decrease of Costs;
- *Time-Saving*: Just-in-Time Supply, Lead Time-Oriented, Implementation of Rapidity;
- *Improvement of Sc Performances*: Improvement of Expected Profits, Competitive Performance, Efficiency Improvement, Improvement in Environmental Performance;
- *Service Quality*: Risk Reduction, Higher Quality, Waste Decrease, Customer Effectiveness.

Categories are defined by analyzing common factors between the identified effects.

Finally, due to increasing social demand for environmental sustainability, companies are embracing the strategic relevance of environmental management practices for competitive advantage, in addition to an overall reduction of costs. For this reason, by combining some principles of "*lean*" and "*flexibility*", it is possible to improve the business performances (Sushil, 2012), reducing costs and make the company able to shift rapidly. According to Lewis (2006) and Chen et al. (2013), "*lean*" implementation leads to a reduction of the level of input resources in the system for an assumed level of output, while "flexibility" is the key to reduce variability. Hence, an efficient production leveling (*in terms of volume and mix*) eliminates overproduction and reduces the costs and the variability of a turbulent demand (Deif and El Maraghy, 2014). Yet, as asserted by Benton (2010) and Hu et al. (2013), combined "*lean*" and "*flexibility*" applied to SC can significantly improve the latter's expected profits and financial performance, as well as minimize the risks: this might represent the new level of challenge in modern SCs (Fang and Li, 2015).

Conclusions

This paper offers two (2) broad conceptual contributions. First, a clarification of the most common SC features has been provided. Secondly, this research provides a concise explanation of how the actual differences between drivers generate distinct effects for each SC feature. Globalization completely changed the World in-depth, creating global and dynamic rules. In this perspective, a new set of matters has been defined, such as a global scale of competition in terms of opportunities and threats. Companies need new concepts of dynamism and innovation: lifecycle and other related concepts have changed. To a certain extent, volatility became stability, and conditions usually defined as "*abnormal*" are now a sort of "*new standard*" to be dealt on a global scale. So, in the current global turmoil, a new set of SC features is needed. Nowadays, through SC, it is possible to adapt the organization to unpredictable changes of scenario due to drivers that no organization can control or manage in advance.

Therefore, the paper provides a literature review and a chart that summarizes SC key-points to present a pragmatic way to eliminate any kind of misunderstandings. Indeed, final definitions of "*lean*", "*agile*", "*leagile*", "*flexible*" and "*adaptable*" have been supported concerning SC, upon a deep understanding of the existing literature.

Answering to RQ1 needed a wide formulation: if, on the one hand, it is crucial to be aligned to the network and its operations upstream, on the other hand, the same need downstream is also a key-matter to meet turbulent market requirements. In this, "*adaptability*" and "*agility*" assume different meaning in the SC context, under a "time perspective": while an "*agile*" SC has the ability to quickly react to unexpected or rapid shifts in supply and demand, an "*adaptable*" SC can adjust its design to meet structural shifts in markets (Lee, 2004). "*Lean*", "*Leagility*", and "*Flexibility*" have different perspectives on the SC. A "lean" SC points the attention to the waste elimination and the related integration of all upstream and downstream processes existing along the chain. Synergic work practices allow to build a structure able to be also "adaptable" and "flexible" to rapid change, but in a "lean" SC the whole attention is on process synchronization together with no-value-added process elimination. While "*flexible*" SC assumes a complex meaning in the SC context, a "*leagile*" SC differs for its formulation's simplicity according to Naylor's definition in 1999. Therefore, "*a "leagile" SC is able to manage and combine lean together with agile features, by a different position of its decoupling point, in order to better respond to volatility of markets*". "*Flexible*" SC assumes a different meaning instead. As reported in the paper through detailed literature, the storyline of "*flexibility*" into SC has been complicated and cumulative in terms of related meaning. Therefore, after more than 10 years of formulations, researchers agree in defining a "*flexible*" SC as the organization's ability to adapt and change its structure to every kind of scenario, driven by qualitative and quantitative aspects. As introduced previously in the document, a clear definition for each SC feature is provided in TABLE 7: the tool opens the discussion to answer RQ2 definitively. Drivers and practical implications for each SC feature are many, and the document reports a structured job in the provided literature review. Discussing the SC drivers, the related classification is formulated by listing all papers' contents, in order to underline common patterns and to define what a feature implies in terms of the related impact, after the SC definition. Therefore, after the remarks related to each SC feature provided in TABLE 7, the research focuses on defining guidelines to each SC trait, as summarized in TABLE 8 reported at the end of this paragraph. Thus, an "*agile*" SC has itself drivers included in the "*adaptable*" SC, which embraces itself a broader contextualization due to the inclusion of many more different factors coming from unpredictable external events. Yet, an "*adaptable*" SC is not focused on the driver of cost reduction, one of the core aspects of a "*lean*" SC as introduced in the previous paragraphs. Also, if a "*leagile*" SC includes the "*lean*" SC's guidelines and more principles connected to the context volatility, a "*flexible*" SC has the same set of drivers of the "*adaptable*" SC, even if the concept of "*flexibility*" includes itself qualitative aspects, not listed as a "driver", but essential for the definition of the related SC. Differences among "*adaptability*", "*agility*", "*lean*", "*leagile*" and "*flexible*" features are more evident in the practical implications for each related SC, as provided in TABLE 9 introduced at the end of this paragraph. An "*adaptable*" SC has the aim of Time Saving, through scenario formulation and a resilient plan in order to adapt itself to the structural shift of the whole context; at the very same way, an "*agile*" SC focuses on the Service Quality together with Cost Reduction and Time-Saving. Practical implications are mainly related to the ability to provide quick and smart solutions that help the Company shift together with the change of the environment in order to meet demand. Introducing the concept of Performance Improvement, a "*leagile*" SC concentrates on the ability to make the company as much faster and, at the same time, able to perform better and better under a quantitative perspective. Related practical implications are about decoupling multiple points to control with minimum stock in order to reduce cost, save time, and improve business performance indicators. Yet, a "*lean*" SC, in a wider comparison to all the other SC features, has the widest range of practical implications: Time Saving, Cost Reduction, Performance Improvement are still underlined as a point of attention, but in addition to this, Quality of Service is highlighted as another key aspect to follow. Related practical implications are common in the whole industrial World from the well-noted TPS and the "*Lean Thinking*": Value Stream Mapping, 7 Toyota MUDA and the concept of Kaizen are only a few among dozens of valuable applications aimed at reducing wastes and improving quality of service.

Finally, a "*flexible*" SC makes it possible to meet performance improvement and service quality, but there is no focus on related costs of practical solutions. This observation is one of the main aspects that led the authors to the conclusion that very few Companies define themselves as "*flexible*" in the literal meaning of the word.

Table 7: Supply Chain Features, Comparison Between Definitions, Main Aspects and Related Weight on the Total Number of Publications

Sc Features		Main Definition Dynamic Capabilities	MAIN ASPECTS							
			Connection Between Sc Actors	Self-Organization	Quick Response	Elimination/ Reduction Waste	Synergic Work Practices	Performance Improvement	Risk Mitigation	
Adapt-ability	Organization's ability to acclimate to several types of external environment shifts		XXX	X	XX			XX		
Agility	Organization's ability to answer to internal aims concerning the quick reaction to unexpected or rapid shifts in supply and demand		X			XXX			XX	X
Lean	Organization's ability related to waste's elimination; this kind of effort has to be applied internally entirely, including both downstream than upstream processes			X			XXX	X	XXX	
Leagility	Organization's ability to combine the lean and agile paradigms within a total supply chain strategy					XXX	XX		X	X
Flexibility	Organization's ability to respond both to an internal set of functions (market-ing, manufacturing) and to an external one (suppliers, channel members, the whole environment) related to the same firm, in order to satisfy the customer in a total way			XX		XX			X	XXX

Explanation:

-"X" to each Supply Chain feature having an impact on less than the 40% of the total number of publications in our Database

-"XX" to each Supply Chain feature having an impact from 40% to <=80% on the total number of the related publications in our Database

-"XXX" to each Supply Chain feature having impact in >80% on the total number of the related publications in our Database

Table 8: Comparison Between the Main Drivers of the Supply Chain Features

Sc Features	Context Variability	Competitive Context	Responsiveness	Customer Requests	Resilience	Need Of System Improvements	Cost Reductin
Adaptability	X	X	X	X	X	X	
Agility		X	X		X		
Lean		X		X			X
Leagility	X	X	X	X			X
Flexibility	X	X	X	X	X	X	

Table 9: Comparison Between the Main Effects of the Supply Chain Features

Sc Features	Cost Efficiency	Time Saving	Improvement Sc Perrfomances	Service Quality
Adaptability		X		
Agility	X	X		X
Lean	X	X	X	X
Leagility	X	X	X	
Flexibility			X	X

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