Customer-driven supply chains: Trends and practices in leading Italian companies

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Abstract

This paper aims at understanding whether and to what extent companies are facing the challenge of improving their supply chains according to a customer-driven approach. Although the most recent supply chain management literature developed theoretical reflections and conceptualizations on the need for customer centricity in supply chain management, companies' practice does not seem to follow these prescriptions and the empirical research highlighted a frequent misalignment between market strategy and supply chain management processes. The aim of this paper is to bridge these two perspectives by answering two research questions. First, how are companies revising their supply chains, that is, what is the nature of the most recent projects concerning supply chain improvements? Second, to what extent are companies that invest in such projects prioritizing those specific projects that make a concrete alignment between market orientation and supply chain operating conditions possible? The paper reports and discusses the findings of an empirical investigation conducted among leading Italian companies or Italian subsidiaries of multinational companies. In particular, a two-step research was conducted, consisting of ten in-depth interviews and a survey. According to our study, Italian companies are revising their supply chains to provide prompt availability of the product in different (but coordinated) distribution channels. This led to the launch of projects related to Demand Forecasting and to Omnichannel strategy adoption. However, in most cases,

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the managerial and technological readiness of companies is not in line with the relevance of the challenges. Another area of improvement concerns projects aimed at adopting up-to-date technologies, mostly connected to the Industry 4.0 paradigm, to improve operational performance. In this case the major opportunities perceived by the companies relate to the adoption of Big Data Analytics in order to better understand market trends.

Keyword: customer-driven supply chain management, supply chain improvement, demand forecasting, omnichannel logistics, industry 4.0, survey.

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Introduction

This paper aims at understanding whether and to what extent companies are facing the challenge of improving their supply chains according to a customer-driven approach. Academic literature on this topic claimed that supply chain design and management should aim at giving clients what they need and expect in terms of product type and quantities, with the required service level (namely speed, dependability, completeness and flexibility of delivery). However, improvement initiatives in this field frequently fail due to a poor overall alignment between actual customers' needs and the operating conditions of supply chain processes, whose managerial and technological readiness is not always consistent with market requirements that are more and more demanding in terms of specificity and changeability. In other cases, supply chain improvement programs have led to disappointing economic outcomes because they are rooted in the willingness of functional managers to implement up-to-date practices and technologies, regardless of the customers' actual expectations and of the benefits that these initiatives can bring to the market with positive returns for the company. Although the most recent supply chain management (SCM) literature developed theoretical reflections and conceptualizations on the need for customer centricity in SCM, companies' practice does not seem to follow these prescriptions and empirical research highlights a frequent misalignment between market strategy and SCM processes. The aim of this paper is to bridge these two perspectives by answering two research questions. First, how are companies revising their supply chains, that is, what is the nature of their most recent projects concerning supply chain improvements? Second, to what extent are companies that invest in such projects prioritizing those specific projects that make a

concrete alignment between market orientation and supply chain operating conditions possible?

In this paper we discuss the findings of an empirical investigation conducted among leading Italian companies or Italian subsidiaries of multinational companies (MNCs). The paper is organized as follows. In Section 1 we introduce literature on customer-driven supply chains and then we focus on research that addressed the problem of alignment among supply chain processes and supply chain actors to get effective operational and market performance. In Section 2 the research questions and the adopted research methodology are reported. Section 3 presents and discusses the results of the two phases of the research: the qualitative study and the extensive survey. Section 4 contains a discussion of the results of the research and the final section develops the major conclusions, the limitations of the research and further research opportunities.

1. Literature review

In the operations and SCM literature, discussion on the planning of improvement projects had its cornerstone in Skinner's contributions (1969, 1974), which for the first time questioned whether manufacturing companies should focus solely on their productivity. On the contrary, according to Skinner, operational performance consists of a wider set of attributes that encompass not only cost effectiveness, but also fast and on time deliveries, product quality and manufacturing flexibility. However, due to the trade-offs among these performances, companies should adopt a "focused strategy" in which they strive to improve the single performance attribute that is the most consistent with their competitive model (Skinner, 1974). Subsequent contributions to this stream of research have further strengthened this concept, calling for the adoption of a "strategic fit" or "strategic alignment" approach in the planning of strategic objectives and improvement initiatives for operations and SCM departments (Sardana et al., 2016; Xiaosong Peng et al., 2013; Walter et al., 2013; Lu et al., 2011).

The literature on SCM eventually supported the need for an overall consistency between products' and market's features, on the one hand, and operational processes, on the other, and emphasized this concept through the development of ad hoc reference frameworks (Christopher, 2016, 2000; Fisher, 1997). In particular, literature debating the topic of customer integration into supply chain processes emphasized the need for the customer to be actively involved in the processes of value creation and value delivery that take place in the supply chain (Potter et al., 2015). The literature highlighted

that supply chain processes are a source of value creation and value delivery to customers and that customer satisfaction is tightly connected to the efficiency and effectiveness of a company's supply chain processes (Arajuo et al., 1999). In other words, the value processes taking place in the supply chain and within interactions in the supply chain can be most efficient and effective if they are enacted and focused on meeting customers' value expectations; therefore, a tight interaction between marketing and purchasing is also requested (Ivens et al., 2009; Guercini and Woodside, 2012).

Following this view, some authors initially stressed the need for demand-driven supply chains (Cousins et al., 2008). The notion is presented as an original business model capable of providing value in today's marketplace through the combination of the strengths of marketing (i.e. effectiveness) and SCM (i.e. efficiency) (Heikkilä, 2002; Santos and D'Antone, 2014). The demand-chain management approach was emphasized as a paradigm in the management literature and it transformed the comprehension of customer demand in actionable strategies and plans for all the firms involved (Langabeer and Rose, 2002).

More recently, the literature focused its attention on a customer-driven supply chain, thus, emphasizing the importance of addressing supply chain processes to the satisfaction of a single customer. This is especially important in business-to-business contexts where a few customers represent an important part of the company's market and each customer is to be handled and served following a customized approach (Hakansson et al., 2009; Hakansson and Snehota, 2017).

A company that implements a customer-driven supply chain can differentiate itself from its competitors' supply chains. The customer-driven supply chain perspective recognizes the inclusion of the customer inside the supply chain processes and views the customer not solely as the destination of supply chain processes but, mostly, as an activator of them, as well as being an active participant in value creation (Borgström et al., 2011). In particular, research showed that customer integration can be increased through tools such as customization and tailoring of products and services (Cristiano et al., 2000) as well as by shared information and flexibility that improve customer closeness (Morash and Lynch, 2002). It is underlined that marketing/sales and SCM capabilities and resources are to be aligned in order to achieve a customer-driven supply chain.

If we consider the studies cited above, it seems that a considerable number of conceptualizations and theoretical reflections were developed in the management literature. Despite this, empirical research on the topic is still limited and it does not envisage an extensive adoption of practices that implement suggestions in the literature.

This is probably because, although a customer-driven supply chain approach is acknowledged as a cornerstone in the formulation of SCM strategy and in the identification of operational improvement priorities, some barriers to its successful implementation have been reported. In particular, some literature highlighted the poor market orientation of operations and supply chain managers, whose improvement objectives are frequently based on a willingness to adopt up-to-date practices and technologies (Schonberger and Brown, 2017; Belvedere and Gallmann, 2014). This preference, which has been peculiar to operations managers for a long time (Dixon et al., 1990), is rooted in the possibility of achieving remarkable results across a wide set of functional performance attributes through the so-called *three-letter cures* (e.g. Total Quality Management – TQM, Theory of Constraints – TOC, Total Productive Maintenance – TPM, Optimized Production Technology – OPT etc.), which, however, are adopted regardless of the actual needs of the company's market strategy. By contrast, in the SCM literature a growing number of studies stressed the necessity to select improvement priorities on the basis of customers' value expectations. For example, due to the higher and higher volatility of modern markets and the increasing need for "responsiveness", scholars claimed that giving up operational efficiency to achieve the prompt availability of the product to meet clients' demand becomes necessary (Schonberger and Brown, 2017; Reichhart and Holweg, 2007; Holweg, 2005). However, most manufacturing companies still strive to reduce stock levels through lean management programs, even though they are engaged in responsive supply chains; instead, firms should pursue the prompt availability of the product to the client (Schonberger and Brown, 2017). This controversial attitude is further strengthened when performance measurement systems (PMS) are designed and used in an inappropriate way, misleading the decision-making process of supply chain managers and their perceptions of the priorities of the firm. As a matter of fact, control systems for SCM processes are more focused on productivity and cost-related indicators even in cases where the company pursues market objectives, which are related to speed, dependability and availability. In such cases, the decision-making process of functional managers and the selection of their improvement priorities will be based on a misleading set of indicators, which will jeopardize the overall alignment between the market strategy and operational improvement objectives.

On the basis of the above reported analysis, it can be claimed that the correct prioritization of improvement objectives in customer-driven SCM is still an issue that requires further investigation (Kirkham et al., 2014; Walter et al., 2013). Our paper's contribution is grounded on the empirical evidence of leading Italian companies.

2. Research questions and methodology

As already introduced, the aim of this study is to understand whether and to what extent companies are facing the challenge of improving their supply chains through a customer-driven approach; the most up-to-date literature reported this as an area of interest to be investigated in practice (Martinelli and Tunisini, 2019; Lambert and Enz, 2017; Schonberger and Brown, 2017; Christopher, 2016; Jüttner et al., 2007; Reichhart and Holweg, 2007; Christopher, 2000). In particular, we aim at answering the following research questions. First, how are companies revising their supply chains, that is, what is the nature of their most recent projects concerning supply chain improvements? Second, to what extent are companies that invest in such projects prioritizing those specific projects that make a concrete alignment between market orientation and supply chain operating conditions possible?

In order to address these research questions, we conducted an empirical investigation in 2017, made up of two phases. The first phase of research was a qualitative investigation conducted by interviews with experts and professionals. The second phase consisted of a survey of 600 companies that led to the collection of 64 usable questionnaires.

The first phase aimed at identifying those improvement areas in SCM that are perceived as the most relevant in the eyes of the companies. This step involved in-depth interviews with ten supply chain managers and opinion leaders. The former were selected from companies active in one of the following industries: fashion; consumer packaged goods; pharmaceutical; retail. The first three sectors were chosen due to the acknowledged relevance that SCM practices have for companies' competitiveness (Arora et al., 2017; Macchion et al., 2015; Narayana et al., 2014; Brun et al., 2008). The retail industry, the only non-industrial sector, was selected because of the possibility of observing cases characterized by a high degree of innovation in SCM solutions (Fernie and Sparks, 2018).

The opinion leaders were from outstanding institutions (as consulting firms and professional associations) focused on specific industries or professional practices related to SCM. The ten interviews lasted on average 1,5 hours.

Because the aim of this step of the research was to let the interviewees spontaneously identify the areas of concern that they considered the most relevant and strategic in the field of SCM, the interviews were conducted by first asking a broad question about the projects already undertaken or already planned for the next 3 to 5 years in order to soundly improve the processes

encompassed in SCM, from procurement to physical distribution. After a detailed discussion about current projects and future ones identified by the interviewees, we asked them to deepen the discussion by trying to classify such projects on the basis of the following "reasons why" of their implementation:

a) projects aimed at improving operational performance;
b) projects aimed at exploiting modern technologies;
c) projects aimed at implementing supply chain best practices (as vendor management inventory and collaborative planning);
d) projects aimed at coping with new market challenges and new distribution strategies;
e) projects aimed at meeting specific customers' value expectations.

These questions let the interviewees discuss not only their current and planned projects, but also those that, in their opinion, could be useful for the company. Focusing on such "nice to have" initiatives, we asked for an assessment about the likelihood of launching them in the next 3 to 5 years. The outcomes of the interviews were then analyzed by the authors in order to identify those areas of intervention that were more frequently mentioned. Then, we differentiated them into two broad categories:

- Projects launched, planned or whose future launch is very likely, which can be considered in line with a customer-driven approach to supply chain improvement. In this group we included projects "aimed at coping with new market challenges" and those "aimed at meeting specific customers' value expectations" (categories "d" and "e" in the above-mentioned classification).
- Projects launched, planned or whose future launch is very likely, which are mostly rooted in the willingness of functional managers to adopt up-to-date practices or technologies and to improve operational performance (categories "a", "b" and "c" in the above-mentioned classification).

The evidence from this step of the research is reported in Table 1 and discussed in Section 3.1. The first step of our research let us classify the completed, in progress or expected projects into three main categories:

1. Projects aimed at improving demand forecasting;
2. Projects aimed at pursuing an omnichannel strategy;
3. Projects aimed at adopting up-to-date technologies, mostly connected to the Industry 4.0 paradigm, to improve operational performance.

While the first two categories of projects were considered customer-driven initiatives, the last was attributed to the category of projects that are technology-driven or practice-driven.

On the basis of such evidence, we launched the second step of the research, which consisted of a survey focused on the three above categories of projects. For the constructs addressed in this study, to the best of our knowledge extant questionnaires are not available; thus, we developed a new survey instrument following the prescriptions of Forza (2002). To carry out the survey, we designed a questionnaire consisting of an initial section, aimed at collecting descriptive information on the respondent, the company and its supply chain. Then, for each of the three categories of projects identified in the first step of the study we proposed questions aimed at understanding:

- whether the company had already launched any improvement project or whether it planned to do so in the near future. In Appendix 1 an example of this typology of questions is provided;
- the importance given by the company to the levers necessary to achieve any improvement in the three categories of projects; a detailed list of various levers was provided to the interviewees. These levers were identified building on a review of the literature that addresses and on the outcomes of the interviews carried out in the first step of the research. These questions are reported in Appendix 2. Respondents had to provide their answer on a 1 to 5 Likert scale, where 1 was "not important" and 5 was "very important".

Sections 3.2.1, 3.2.2 and 3.2.3 provide a detailed description of the literature that we have built in order to develop the questionnaire items, and offer a description of the way in which we connected such items to extant contributions and to the outcomes of the first step of our study (Forza, 2002).

The questionnaire was sent through a web-based application to the supply chain or logistics managers of the 600 largest companies of the industries mentioned. We made two recalls at one month and at two months; we collected 64 usable questionnaires, with a redemption rate of 10%.

3. Empirical evidence

3.1. Evidence from the interviews

A summary of the evidence that emerged from the interviews is reported in Table 1, which 1 briefly describes the improvement initiatives outlined by the managers and opinion leaders, and classifies them according to their typology (i.e. customer-driven vs practice-driven or technology-driven).

As can be seen from Table 1, 17 projects were classified as having a customer-driven typology, while 15 projects were of a practice-driven or technology-driven typology. The top three areas of improvement most frequently mentioned concerned the implementation of an omnichannel strategy, demand forecasting, and the adoption of technologies and solutions related to the Industry 4.0 paradigm. The perimeter of most projects included all SCM processes, from sourcing to physical distribution, whose overall alignment is necessary to cope with new market trends and customers' emerging value expectations, which may involve a sound redesign of the operational processes.

Table 1 – Evidence from Interviews

	Customer-driven improvement projects	Practice or Technology-driven improvement projects
A. Opinion Leader, Fashion	1. Relocation of company's activities to be closer to the market and improve the sales&operations planning process 2. Insourcing to promptly respond to market demand and cope with demand volatility	3. Investing in digital transformation, especially to monitor customer's behaviors 4. Scouting of new professionals familiar with digital technologies
B. Italian company, Fashion	1. Adopting an omnichannel strategy and empowering e-commerce solutions 2. Enhancing supply chain collaboration with independent retailers in order to improve assortment and product availability from a better demand forecasting process 3. Leveraging social networks to better understand customers' behavior and improve demand forecasting	
C. Opinion Leader, Logistics		1. Investing in IT systems that can better support the sales&operations planning process 2. Investing in Industry 4.0 technologies that can improve warehouse activities, especially those which are more repetitive
D. Italian subsidiary of MNC, Packaged Consumer Goods		1. Investing in Industry 4.0 solutions, in particular "Internet of Things " (IoT) at the shop-floor level and in warehouse activities 2. Investing in automation at the shop-floor level 3. Involving suppliers in Lean Management programs
E. Opinion Leader, Procurement	1. Adopting an omnichannel strategy and empowering e-commerce solutions 2. Investing in Industry 4.0 solutions (namely digital ones) in order to better understand customers' purchasing behavior and better support the planning process	

		3. Improving social and environmental sustainability to address the increasing customers' awareness toward these issues 4. Insourcing to promptly respond to market demand and cope with demand volatility	
F.	Italian subsidiary of MNC, Pharmaceutical	1. Investing in Industry 4.0 solutions, in particular solutions enabling a real-time tracking of the products along the supply chain. These are necessary to guarantee the outstanding service level required by the customer and (in the future) to offer customized products to the clients	2. Redesigning the logistic network to increase collaboration along the supply chain
G.	Italian company, Pharmaceutical	1. Investing in in new technological solutions at the shop-floor level, to launch a new product family	2. Investing in digital solutions, in particular those enabling a real-time tracking of the products along the supply chain and preventing the distribution of counterfeited products
H.	Opinion Leader, Logistics & SCM		1. Investing in Transportation Management Systems (TMS), to improve the efficiency and the environmental sustainability of the delivery process
I.	Italian subsidiary of MNC, Packaged Consumer Goods	1. Adopting an omnichannel strategy and empowering e-commerce solutions 2. Increasing environmental sustainability of transportation to cope with customers' pressures in this regard 3. Adopting a decentralized logistic network to increase product availability	4. Investing in IT systems and digital technologies to promote the standardization of data collection and increase its timeliness 5. Adopting multi-modal logistic solutions, to increase the efficiency of transportation
J.	Italian subsidiary of MNC, Retail	1. Adopting IT systems to speed up the physical flow, to enable to adoption of an omnichannel strategy 2. Re-designing packaging to make it more suitable for an omnichannel distribution system 3. Increasing environmental sustainability through the adoption of circular economy solutions, to cope with customers' pressures in this regard	4. Investing in warehouse automation 5. Widening the use of sea transportation 6. Investing in Industry 4.0 solutions, as 3D printers, IoT and digital technologies for data collection along the supply chain

In particular, 5 customer-driven projects out of 17 referred to the improvement of their recently adopted Omnichannel Strategy, whose effectiveness mostly relied on the design and management of a physical distribution process able to deliver an outstanding level of service. In all interviews, the customer-driven nature of such projects was evident, since in all cases the choice to invest in this field was based on the fact that e-commerce is growing fast and that companies must be ready to face this challenge through an effective coordination of all distribution channels, both off-line and on-line.

Three projects out of five (namely, projects B.1, E.1 and I.1 in Table 1) connected the focus on an omnichannel strategy to the need to empower e-commerce solutions. In one case, the interviewee mentioned two projects (J.1 and J.2) aimed at adopting IT systems to speed up the physical flow and at redesigning the packaging to make it more suitable for omnichannel processes.

The challenge of coping with demand volatility and the related Demand Forecasting process, whose complexity is increasing due to the fragmentation of sales in a wider and wider product range and (now) in a multitude of distribution channels and delivery points, led to frequent improvement projects. In order to cope with this phenomenon, four customer-driven initiatives were mentioned during the interviews, which concerned the insourcing of production activities to shorten the supply chain and make it more responsive (projects A.2 and E.4), the adoption of collaborative practices with downstream players to get real-time information on sales to the final consumers (project B.2), and the use of qualitative information from social networks to better understand customers' preferences and purchasing behavior (project B.3). On top of these, two more projects were mentioned that referred to demand forecasting and its implications for production planning. They concerned the improvement of the Sales & Operations Planning (S&OP) process, which was discussed by two interviewees as a necessity determined by the increasing demand for responsiveness along the supply chain, in terms of products and time (projects A.1 and E.2). In one more case, an improvement initiative in the area of S&OP was mentioned as a technology-driven initiative, in that the project was discussed only from the viewpoint of IT systems, without explicit links to market trends (project C.1).

Finally, initiatives related to the Industry 4.0 paradigm, for example big data, robotics and automation, Internet of Things (IoT), digital transformation and IT systems, were mentioned 11 times. Only in one case was the project classified as a customer-driven project, since the interviewee explicitly claimed that this investment was aimed at coping with the launch of a new, customized product line (project G.1). In all other cases (projects A.3, C.2, D.1, D.2, G.2, H.1, I.4, J.4, J.6), these initiatives were presented as driven by the possibility of getting sharp improvements in operational performances, namely through the introduction of IoT and digital technologies that enabled real-time visibility of data along the supply chain, as well as the adoption of robotics and automation mostly at the shop-floor level and in warehouse activities. Interestingly, scouting new professionals familiar with digital technologies was also highlighted as a criticality to be addressed through ad hoc initiatives (project A.4).

3.2. Evidence from the survey

Data collected through the survey was received from 64 companies, 54% of which are industrial while the remaining 46% operate in the retail and distribution sector. Most of them can be classified as large companies. Indeed only in 26% of cases was an annual turnover of less than 100 million euros reported, the annual turnover of 31% of companies was in the range 101–500 million euros and in the remaining 41% of cases the turnover was higher than 500 million euros (in 2% of cases data was not available). This distribution is relevant, since we can claim that the evidence emerging from the survey was mostly based on the experience of medium to large enterprises, which are generally at the frontier of best practices implementation.

Focusing on the questions concerning the above-mentioned areas of improvement, at a first glance, it was confirmed that they were of major importance to the sampled companies. Figures 1, 2 and 3 report on the frequency of improvement projects in the three areas, classified on the basis of their current state. As can be seen, the frequency of the projects already completed is 26% for omnichannel strategy, 12% for demand forecasting and 11% for Industry 4.0 while the sum of ongoing projects and those "under consideration" is equal to 60% for omnichannel strategy, and 65% for both Demand Forecasting and Industry 4.0. These percentages witness the relevance of these topics not only among the interviewees, but also in the sample of the survey. It also appears that the implementation of an omnichannel strategy is a priority for most of the companies.

Going deeper into the analysis of the outcomes of the survey, some interesting results emerged from the answers provided by the companies regarding the levers and areas of implementation necessary to achieve any improvement in the selected area of intervention. This analysis is reported in the following sections.

Figure 1 – Frequency of improvement projects in omnichannel strategy by state of the project

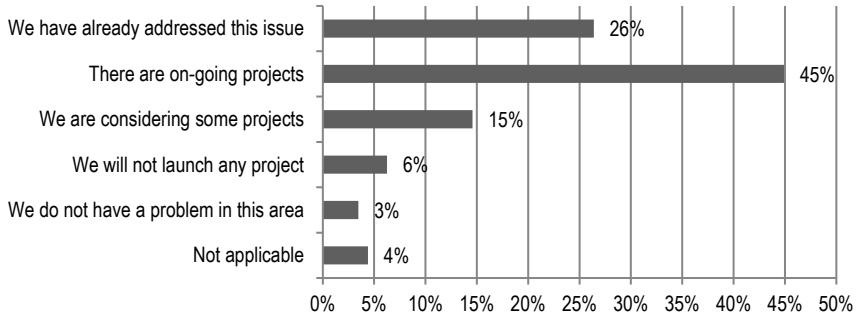


Figure 2 – Frequency of improvement projects in demand forecasting by state of the project

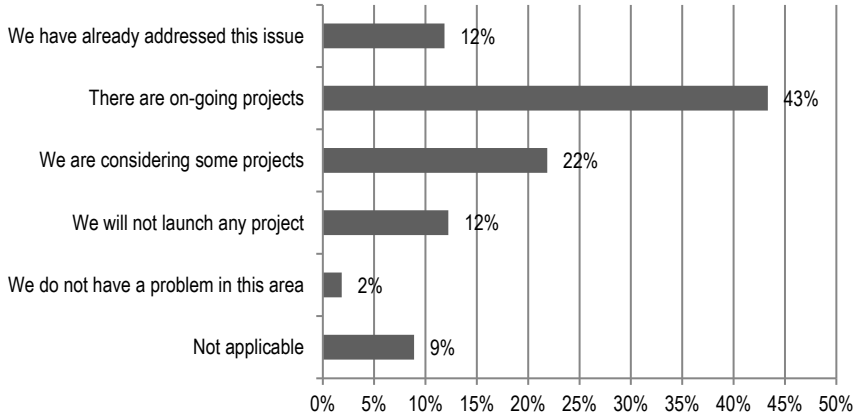
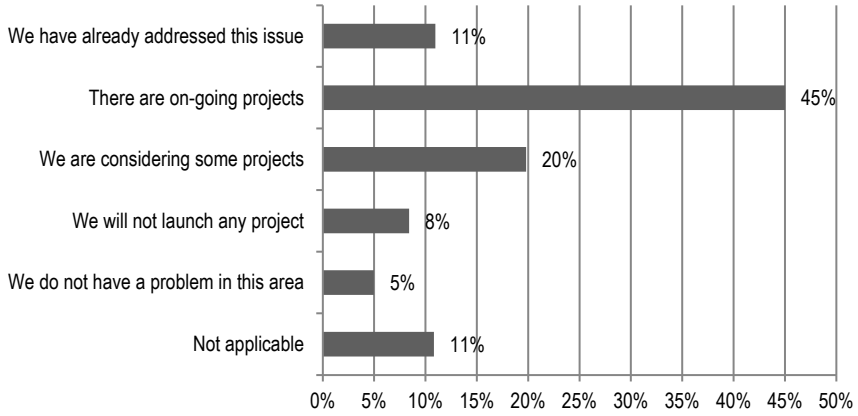


Figure 3 – Frequency of improvement projects in Industry 4.0 by state of the project



3.2.1. Omnichannel strategy

Concerning the implementation of the omnichannel strategy and its implications from the SCM viewpoint, our survey focused on those areas of concern that were most frequently mentioned during the interviews and that were consistent with the extant literature on this topic. In particular, we built on the contributions concerning the logistic implications of e-commerce, which pose new challenges to companies due to the high complexity of the physical flows

generated by on-line sales, especially for the home delivery process and the related "last mile logistics" and for the management of returns (Wang et al., 2018; Hübner et al., 2016a, 2016b; Ishfaq et al., 2016; Morganti et al., 2016; Savelsbergh and Van Woensel, 2016; Brynjolfsson et al., 2013).

We developed 12 statements (reported in Appendix 2), which covered three main areas of potential improvement for companies willing to adopt an omnichannel strategy, with a specific focus on e-commerce solutions. The first area referred to the issue of warehouse management and is covered through statements V1, V2 and V5 (Hübner et al., 2016a, 2016b; Morganti, 2016; Savelsbergh and Van Woensel, 2016). The second is specific to the redesign of the logistic network and to its implications for transportation management. Namely, through these statements (V3, V4, V7 and V9) we wanted to understand whether the number of logistic nodes was expected to increase or decrease due to the adoption of the omnichannel strategy, as well as the effect of the implementation of this strategy on transportation management and outsourcing solutions (Hübner et al., 2016a, 2016b). The other statements of this section were aimed at understanding whether the sampled companies were concerned with the need to increase the coordination of the different channels, and to revise the role of the traditional store in order to increase its suitability for the order fulfillment process and to make it consistent with the new needs of digital shoppers (Ishfaq et al., 2016; Brynjolfsson et al., 2013).

In order to investigate this issue, we carried out an exploratory factor analysis using principal components with Varimax rotation and retaining only factors with an Eigenvalue higher than 1 (Hair et al., 2006). Questionnaire items with loading factors higher than 0,5 for just one factor were retained. Then, we assessed the reliability for each extracted factor through Cronbach's alpha (Nunnally, 1978), which was considered acceptable with values higher than the conventional threshold set at 0.6 (Hair et al., 2006; Nunnally, 1978).

As can be seen in Table 2, the outcomes of the factor analysis mostly confirmed our subdivision of questionnaire items into three groups. Indeed, Factor 1 encompassed items referring to channel management issues and V3, which refers to the number of logistics nodes to be established when an omnichannel strategy is adopted. Factors 2 and 3 described, respectively, transportation management issues and warehouse management issues.

Table 2 – Factor analysis, Cronbach's Alpha and average values for Omnichannel strategy

Variables	F1 – Channel management and technologies	F2 –Transportation management	F3 – Warehouse management
V3	0,5515		
V6	0,5930		
V8	0,6188		
V10	0,8716		
V11	0,8100		
V12	0,7047		
V4		0,7395	
V7		0,7657	
V9		0,6005	
V1			0,7549
V2			0,7315
V5			0,8006
Cronbach's Alpha	0,812	0,641	0,681
Average values	3,51	3,98	4,23

Comparing the average values reported by each factor, it can be seen that Factor 1 reports a much lower value than the others. Indeed, the former is equal to 3,51, while the others are respectively 3,98 and 4,23. This evidence shows a higher interest toward operational levers connected to the implementation of the omnichannel strategy, namely those concerning the reorganization of warehouse lay-out and processes, followed by transportation management. On the opposite, more strategic and challenging areas of improvement seem to be overlooked, namely, the logistic network design, the coordination of on-line/off-line channels and the role of stores in an omnichannel environment.

3.2.2. Demand forecasting

We also developed a bundle of statements for demand forecasting on the basis of the extant literature on the topic, which were also confirmed by the outcomes of the interviews. These statements, which are reported in Table 3, can be divided into two subgroups. The first (statements from V13 to V17) were built on contributions peculiar to the SCM literature, which highlighted the relevance of information sharing, and internal and external integration in order to improve the overall logistic performance (Chen and Lee, 2009;

Gimenez and Ventura, 2005; Frohlich and Westbrook, 2001). Along the supply chain such integration can be achieved through the adoption of ad hoc practices (including collaborative forecasting), through the implementation of IT solutions that enable the acquisition and the analysis of data, and through vertical integration projects aimed at reducing manufacturing lead times, being closer to the market and better understanding of customers' behavior (Chen and Lee, 2009; Lee et al., 2000, 1997).

The second group (statements from V18 to V21) encompassed statements grounded in a more recent orientation in demand forecasting, according to which the use of qualitative and contextual information coupled with experts' knowledge about the market can increase forecast accuracy (Seifert et al., 2015; Kerkkänen and Huiskonen, 2014).

We performed the same statistical analysis for this case as in the previous section.

Looking at Table 3, it can be seen that three factors emerged from the analysis. The first one encompassed items related to the adoption of innovative approaches (involving new practices, technologies and media), as well as to the need for a downstream integration through the establishment of directly operated stores (DOS). The inclusion of this item in this factor can be explained by considering the synergies that can be achieved in the contextual adoption of big data analytics and DOS that enable the collection of data concerning customer purchasing behavior, on top of actual sales.

Table 3 – Factor analysis, Cronbach's Alpha and average values for Demand forecasting

Variables	F1 – Downstream integration and innovative approaches	F2 – Visibility of data along the supply chain	F3 – Internal collaboration
V17	0,7289		
V18	0,8012		
V19	0,7327		
V20	0,6214		
V21	0,6862		
V13		0,7511	
V14		0,7049	
V16		0,6445	
V15			0,8858
Cronbach's Alpha	0,7603	0,601	-
Average values	3,548	4,197	4,31

The second factor referred to the issue of visibility of data along the supply chain, while the third factor encompassed exclusively V15, which focused on the issue of internal collaboration among departments as a condition to improve sales forecast accuracy. Looking at the average values in Table 3, it can be observed that the highest is the one reported for Factor 3 (4,31), followed by Factor 2 (4,197). Far below these averages, the mean value reported for Factor 1 is 3,548. As in the case of omnichannel strategy adoption, this evidence demonstrated a focus of the sampled companies on the traditional approaches to demand forecasting, while the most innovative ones seemed to be overlooked.

3.2.3. Industry 4.0

Concerning the Industry 4.0 paradigm, we focused our investigation on the following areas (Kagermann et al., 2013; 2011; McAfee et al., 2012; LaValle et al., 2011):

- Robotics and digitalization;
- Internet of Things (IoT);
- Big data analytics.

Then, as for Omnichannel strategy and Demand forecasting, we conducted a statistical analysis, the outcomes of which are reported in Table 4.

Four factors emerged from the analysis. Factor 1, called "Smart products and Devices", is described by four questionnaire items, all referring to the use of technological solutions capable of collecting and communicating data through IoT. Factor 2 was called "E-commerce and customer behavior" because its statements describe an environment in which e-commerce is adopted and big data analytics is leveraged to understand market trends, customers' behaviors and to design the product offering accordingly. Factor 3 is described by a set of questionnaire items about the adoption of Big Data Analytics along SCM processes, from procurement to the final delivery of the product to the customer. Factor 4 encompassed a bundle of statements that described the application of automation and IoT solutions to production and warehouse management processes.

Looking at the average values reported in Table 4, it can be seen that differences among means are low, with a slight prevalence for Factor 2 "E-commerce and customer behavior" (4,023). This evidence is relevant in that, according to these outcomes, it seems that the sampled companies showed an outward orientation, which is peculiar to a customer-driven approach.

Table 4 – Factor analysis, Cronbach's Alpha and average values for Industry 4.0

Variables	F1 - Smart products and devices	F2 - E-commerce & customer behaviour	F3 - Big data & SC	F4 - Production & Warehouse management
V29	0,8465			
V30	0,7836			
V31	0,6575			
V32	0,7304			
V25		0,8184		
V36		0,7808		
V37		0,9025		
V38		0,7432		
V39			0,5792	
V40			0,5231	
V41			0,6902	
V42			0,8791	
V23				0,6482
V33				0,7274
V34				0,7352
V35				0,5586
Cronbach's Alpha	0,892	0,891	0,807	0,857
Average values	3,685	4,023	3,958	3,890

4. Discussion

The empirical study reported in this paper aimed at understanding whether and to what extent companies are facing the challenge of improving their supply chains according to a customer-driven approach. As widely discussed in the extant literature on this topic, an overall alignment between customers' value requirements and the operating processes of the firm is a condition for the effective design and management of the supply chain. However, as reported in the literature review, such a condition is not always met due to a lack of market orientation and knowledge of functional managers, their technical background and poorly designed PMS.

This study shows that the supply chain managers involved in our analysis are actually aware of the most relevant market trends that are taking place in

their sectors and of the urgency of improving supply chain processes accordingly, with a customer-driven approach. In particular, their main interest is mostly focused on the downstream side of their supply chain in terms of the adoption of an omnichannel strategy and on the improvement of the forecasting processes to better cope with the increasing number of digital shoppers and the higher and higher volatility of market demand. The radical change in demand and in the customers' buying behavior challenges the traditional methodologies adopted in demand forecasting and traditional marketing channels. As concerns the former, quantitative methodologies are considered necessary but not sufficient to achieve an effective prediction of demand and, as a consequence, to enact aligned operations and logistics activities. Opportunities given by big data analytics support effective predictive activities but they are to be associated with qualitative information collected and shared at different layers of the marketing channels and experienced in different departments of the company. As concerns the latter, omnichannel strategies combining online and off-line channels generate warehousing problems and require investments in logistics services both at the downstream and at the upstream levels. This evidence stems from both steps of our study: interviews and the survey. However, in this regard, the survey shows a weakness that could impair the effectiveness of any improvement project undertaken to cope with the above trends, which relates to the poor awareness of managers about the operational levers that must be used to achieve remarkable results, especially in the areas of omnichannel strategy adoption and demand forecasting.

This study also highlights another area of improvement perceived as relevant by both the interviewees and the sampled companies, which refers to the implementation of Industry 4.0 technologies. As already claimed in extant contributions, the risk underlying these types of technology-driven projects refers to the difficulty with which functional managers understand how such initiatives can result in enhanced customers' value. In this concern, Big Data Analytics is an exception. This is used not so much to improve operational performance but to enhance the ability to capture, understand and to satisfy customers' needs, especially when collected through e-commerce platforms.

Overall, the outcomes of this paper witness a positive attitude of supply chain managers toward market trends and toward a customer-driven approach in the identification of their improvement priorities. However, as the qualitative step of the research also highlighted, a stronger internal integration among departments could bring favorable results in terms of a higher success rate of the improvement initiatives. Indeed, supply chain processes encompass a wide variety of activities, from sourcing to manufacturing and

physical distribution, which are generally under the control of ad hoc managers. Supply chain professionals, even though aware of specific market trends and customers' needs, have to deploy their customer-driven projects into specific areas of intervention, which relate to the overall range of supply chain activities. In this regard, a stronger interaction with colleagues from procurement, production and logistics could lead to a deeper understanding of the internal determinants of the logistic service and of customers' value.

5. Conclusions

This paper aimed to contribute to the literature that emphasized the need for companies' improvement of customer-driven supply chains. In particular, we asked two research questions. First, how are companies revising their supply chains, that is, what is the nature of the most recent projects concerning supply chain improvements? Second, to what extent are companies that invest in such projects prioritizing those specific projects that make a concrete alignment between market orientation and supply chain operating conditions possible?

The qualitative and quantitative research that was conducted on Italian leading enterprises highlighted that companies, from any industry and business area, are aware of the need to establish customer-driven supply chains. Their approach is not only theoretical but it is accompanied by concrete actions that tend to translate this approach into practice. The three main areas to which companies addressed their investments in order to improve customer-driven supply chains were the implementation of omnichannel strategies and improvement of demand forecasting to enhance operational performance through the adoption of technologies that define the so-called Industry 4.0: robotics, IoT and big data analytics in particular. The paper has entered into the details of projects that have been considered the most important to get effective results by the Italian companies.

The paper reports in detail projects and areas of investments considered the most relevant to improve customer-driven supply chains. The qualitative study enabled us to set the boundaries to the major issues; the survey enabled detailed analysis of the ongoing projects.

A major limitation to the study is the limited number of respondents to the survey: 64 valid questionnaires from 600 invited companies. This can be partly explained by the length of the questionnaire that required 20 minutes to complete. A second limitation to the research is the lack of a strictly ho-

mogeneous profile of the respondents; we received replies to the questionnaire from logistics managers or from supply chain managers or procurement managers because of the companies' internal organization of supply chain activities.

A further development of the study could concern two main aspects. The first one is the need for an intra-organizational study suitable for capturing the various projects aimed at integrating the activities of marketing, sales and SCM departments. The second one refers to the ongoing projects, specifically leveraging on digital technologies. While the core of our research concerns the nature of the projects implemented by the companies, future research developments should investigate the actual achievements of such projects, their critical issues and the measure of the returns on the investments.

References

Arajuo L., Dubois A. and Gadde L.E. (1999). Managing interfaces with suppliers, *Industrial Marketing Management*, 28: 497-506.

Arora R., Haleem A. and Farooquie J. (2017). Impact of critical success factors on successful technology implementation in Consumer Packaged Goods (CPG) supply chain. *Management Science Letters*, 7(5): 213-224.

Baines T.S., Lightfoot H.W., Benedettini O. and Kay J. M. (2009a). The servitization of manufacturing: A review of literature and reflection on future challenges. *Journal of Manufacturing Technology Management*, 20(5): 547-567.

Baines T.S., Lightfoot H.W., Peppard J., Johnson M., Tiwari A., Shehab E. and Swink M. (2009b). Towards an operations strategy for product-centric servitization. *International Journal of Operations & Production Management*, 29(5): 494-519.

Belvedere V. and Gallmann F. (2014). The alignment among competitive strategy, operations improvement priorities and manufacturing and logistics performance measurement systems. Evidence from a case-based study. In: El Ouardighi and Kogan (eds.). *Models and Methods in economics and management science* (pp. 221-241). Berlin: Springer.

Bourne M., Neely A., Platts K. and Mills J. (2002). The success and failure of performance measurement initiatives. Perceptions of participating managers. *International Journal of Operations and Production Management*, 22(11): 1288-1310.

Brun A., Caniato F., Caridi M., Castelli C., Miragliotta G., Ronchi S., ... and Spina G. (2008). Logistics and supply chain management in luxury fashion retail: Empirical investigation of Italian firms. *International Journal of Production Economics*, 114(2): 554-570.

Brynjolfsson E., Hu Y.J. and Rahman M. S. (2013). Competing in the age of omnichannel retailing. *MIT Sloan Management Review*, 54(4): 23.

Chen L. and Lee H.L. (2009). Information Sharing and Order Variability Control Under a Generalized Demand Model. *Management Science*, 55(5): 781-797.
Christopher M. (2000). The agile supply chain: competing in volatile markets. *Industrial Marketing Management*, 29(1): 37-44.
Christopher M. (2016). *Logistics & supply chain management*. Pearson UK.
Cousins P., Lamming R., Lawson B. and Squire B. (2008). *Strategic Supply Management*. Upper Saddle River, NJ: Prentice Hall.
Dixon J.R., Nanni A.J. jr., Vollmann T.E. (1990). *The new performance challenge. Measuring operations for world-class competition*. Homewood: Business One Irwin.
Fernie J., & Sparks L. (Eds.) (2018). *Logistics and retail management: emerging issues and new challenges in the retail supply chain*. Kogan page publishers.
Fisher M.L. (1997). What is the right supply chain for your product?. *Harvard Business Review*, March-April, 105-116.
Forza C. (2002). Survey research in operations management: a process-based perspective. *International Journal of Operations & Production Management*, 22(2): 152-194.
Frohlich M.T. and Westbrook R. (2001). Arcs of integration: an international study of supply chain strategies. *Journal of Operations Management*, 19(2): 185-200.
Gadde L.E., Håkansson H. and Persson A. (2010). *Supply Network Strategies*. Hoboken, NJ: John Wiley & Sons.
Gimenez C. and Ventura E. (2005). Logistics-production, logistics-marketing and external integration: their impact on performance. *International journal of operations & Production Management*, 25(1): 20-38.
Guercini S. and Woodside A. (2012). A strategic supply chain approach: consortium marketing in the Italian leatherwear industry. *Marketing Intelligence & Planning*, 30(7): 700-716.
Hair J.F., Black W.C., Babin B.J., Anderson R.E. and Tatham R.L. (2006). *Multivariate Data Analysis*. 6th Edition. Upper Saddle River, NJ: Prentice Hall.
Håkansson H., Ford., Gadde L.E., Snehota I. and Waluszewski A. (2009). *Business in networks*. Hoboken, NJ: John Wiley & Sons.
Hakanssson H. and Snehota I. (2017). *No Business is an Island: Making Sense of the Interactive Business World*. Bingley: Emerald Group Publishing.
Hanson J.D., Melnyk S.A. and Calantone R.A. (2011). Defining and measuring alignment in performance management. *International Journal of Operations and Production Management*, 31(10): 1089-1114.
Harland C.M. (1996). Supply chain management: relationships, chains and networks. *British Journal of Management*, 7(s1).
Heikkilä J. (2002). From supply to demand chain management: efficiency and customer satisfaction. *Journal of Operations Management*, 20(6): 747-767.
Holweg M. (2005). The three dimensions of responsiveness. *International Journal of Operations & Production Management*, 25(7): 603-622.
Hübner A., Kuhn H. and Wollenburg J. (2016a). Last mile fulfilment and distribution in omni-channel grocery retailing: a strategic planning framework. *International Journal of Retail & Distribution Management*, 44(3): 228-247.

Hübner A., Wollenburg J. and Holzapfel A. (2016b). Retail logistics in the transition from multi-channel to omni-channel. *International Journal of Physical Distribution & Logistics Management*, 46(6/7): 562-583.

Ishfaq R., Defee C.C., Gibson B.J. and Raja U. (2016). Realignment of the physical distribution process in omni-channel fulfillment. *International Journal of Physical Distribution & Logistics Management*, 46(6/7): 543-561.

Ivens B.S., Pardo C. and Tunisini A. (2009). Organizing and integrating marketing and purchasing in business markets: An introduction to the special issue, issues and implications. *Industrial Marketing Management*, 38(8): 851-856.

Järvinen J. and Karjaluoto H. (2015). The use of Web analytics for digital marketing performance measurement. *Industrial Marketing Management*, 50: 117-127.

Jüttner U., Christopher M. and Baker S. (2007). Demand chain management-integrating marketing and supply chain management. *Industrial Marketing Management*, 36(3): 377-392.

Kagermann H., Lukas W.D. and Wahlster W. (2011). Industrie 4.0: Mit dem Internet der Dinge auf dem Weg zur 4. industriellen Revolution. *VDI Nachrichten*, 13.

Kagermann H., Wolfgang W. and Helbi J. (2013). *Recommendations for implementing the strategic initiative INDUSTRIE 4.0*.

Kerkkänen A. and Huiskonen J. (2014). The role of contextual information in demand forecasting. *International Journal of Information and Decision Sciences*, 6(2): 109-126.

Kirkham L., Garza-Reyes J.A., Kumar V. and Antony J. (2014). Prioritisation of operations improvement projects in the European manufacturing industry. *International Journal of Production Research*, 52(18): 5323-5345.

Lambert D.M. and Enz M.G. (2017). Issues in Supply Chain Management: Progress and potential. *Industrial Marketing Management*, 62: 1-16.

Lamming R. and Cox A. (Eds.) (1995). *Strategic procurement management in the 1990s: Concepts and cases*. London: Earlsgate.

Langabeer J. and Rose J. (2002). *Creating Demand Driven Supply Chains: How to Profit from Demand Chain Management*. London: Spiro Press.

LaValle S., Lesser E., Shockley R., Hopkins M.S. and Kruschwitz N. (2011). Big data, analytics and the path from insights to value. *MIT Sloan Management Review*, 52(2): 21.

Lee H.L, Padmanabhan V. and Whang S. (1997). Information Distortion in supply chain: The Bullwhip effect. *Management Science*, 43(4): 546-558.

Lee H.L., So K.C. and Tang C.S. (2000). The value of information sharing in a two-level supply chain. *Management Science*, 46(5): 625-643.

Lu D., Betts A. and Croom S. (2011). Re-investigating business excellence: Values, measures and a framework. *Total Quality Management & Business Excellence*, 22(12): 1263-1276.

Macchion L., Moretto A., Caniato F., Caridi M., Danese P. and Vinelli A. (2015). Production and supply network strategies within the fashion industry. *International Journal of Production Economics*, 163: 173-188.

McAfee A., Brynjolfsson E. and Davenport T.H. (2012). Big data: the management revolution. *Harvard Business Review*, 90(10): 60-68.

Morganti E., Seidel S., Blanquart C., Dablanc L. and Lenz B. (2014). The impact of e-commerce on final deliveries: alternative parcel delivery services in France and Germany. *Transportation Research Procedia*, 4: 178-190.

Narayana S.A., Pati R.K. and Vrat P. (2014). Managerial research on the pharmaceutical supply chain – A critical review and some insights for future directions. *Journal of Purchasing and Supply Management*, 20(1): 18-40.

Neely A., Adams C. and Kennerley M. (2002). *The Performance Measurement Prism: The Scorecard for Measuring and Managing Business Success*. Upper Saddle River, NJ: Prentice Hall.

Neely A.D., Gregory M.J. and Platts K.W. (2005). Performance measurement system design: a literature review and research agenda. *International Journal of Operations and Production Management*, 25: 1228-1263.

Nunnally J.C. (1978). *Psychometric theory.* 2nd Edition. New York: McGraw-Hill.

Petrillo A., De Felice F. and Zomparelli F. (2018). Performance measurement for world-class manufacturing: a model for the Italian automotive industry. *Total Quality Management & Business Excellence*, 1-28.

Reichhart A. and Holweg M. (2007). Creating the customer-responsive supply chain: a reconciliation of concepts. *International Journal of Operations & Production Management*, 27(11): 1144-1172.

Rymaszewska A., Helo P. and Gunasekaran A. (2017). IoT powered servitization of manufacturing – an exploratory case study. *International Journal of Production Economics*, 192: 92-105.

Santos J.B. and D'Antone S. (2014), Reinventing the wheel? A critical view of demand-chain management, *Industrial Marketing Management*, 43(6): 1012-1025.

Sardana D., Terziovski M. and Gupta N. (2016). The impact of strategic alignment and responsiveness to market on manufacturing firm's performance. *International Journal of Production Economics*, 177: 131-138.

Savelsbergh M. and Van Woensel T. (2016). 50th anniversary invited article – city logistics: Challenges and opportunities. *Transportation Science*, 50(2): 579-590.

Schonberger R.J. and Brown K.A. (2017). Missing link in competitive manufacturing research and practice: Customer-responsive concurrent production. *Journal of Operations Management*, 49-51, 83-87.

Seifert M., Siemsen E., Hadida A.L. and Eisingerich A.B. (2015). Effective judgmental forecasting in the context of fashion products. *Journal of Operations Management*, 36: 33-45.

Skinner W. (1969). Manufacturing – missing link in corporate strategy. *Harvard Business Review*, May-June, 47(3): 136-145.

Skinner W. (1974). The focused factorym *Harvard Business Review*, 52(3): 113-121.

Taylor A. and Taylor M. (2014). Factors influencing effective implementation of performance measurement systems in small and medium-sized enterprises and large firms: a perspective from Contingency Theory. *International Journal of Production Research*, 52(3): 847-866.

Vendrell-Herrero F., Bustinza O.F., Parry G. and Georgantzis N. (2017). Servitization, digitization and supply chain interdependency. *Industrial Marketing Management*, 60: 69-81.

Waller M.A. and Fawcett S.E. (2013). Data science, predictive analytics, and big data: a revolution that will transform supply chain design and management. *Journal of Business Logistics*, 34(2): 77-84.

Walter J., Kellermanns F.W., Floyd S.W., Veiga J.F. and Matherne C. (2013). Strategic alignment: A missing link in the relationship between strategic consensus and organizational performance. *Strategic Organization*, 11(3): 304-328.

Wang X., Yuen K.F., Wong Y.D. and Teo C.C. (2018). E-consumer adoption of innovative last-mile logistics services: A comparison of behavioral models. *Total Quality Management & Business Excellence*, 1-27.

Xiaosong Peng D., Schroeder R.G. and Shah R. (2011). Competitive priorities, plant improvement and innovation capabilities, and operational performance: A test of two forms of fit. *International Journal of Operations & Production Management*, 31(5): 484-510.

Appendix 1 – Example of questions on projects

What is the condition that mostly applies to your company as far as the following projects about omnichannel strategy are concerned?

	Not applicable	We will not launch any project	We are considering some projects	There are ongoing projects	We have already addressed this issue	We do not have a problem in this area
a) Use of the on-line channel						
b) …						

Appendix 2 – Questions on implementation levers

On the basis of your experience, what is the importance of the following levers of SCM necessary to implement an omnichannel strategy? (1 to 5 Likert scale, where 1 is "not important" and 5 is "very important")

Variable	Questionnaire item
V1	Improvement of internal warehouse processes (receiving, picking, etc.)
V2	Warehouse lay-out redesign
V3	Decentralization of the logistic network
V4	Adoption of TMS
V5	Adoption of WMS
V6	Redesign of the logistic service based on different products and channels typologies
V7	Product and packaging redesign to allow more efficient warehouse and transportation activities

V8	Ad hoc management policies of on-line and off-line channels to prevent cannibalization
V9	Adoption of outsourcing solutions for warehouse and transportation activities
V10	Store redesign to increase its logistic efficiency for return and delivery processes generated by on-line sales
V11	Adoption of in-store technologies (e.g. kiosk, interactive windows etc.)
V12	Differentiated assortment for on-line and off-line channels

On the basis of your experience, what is the importance of the following levers necessary to improve demand forecasting? (1 to 5 Likert scale, where 1 is "not important" and 5 is "very important").

Variable	Questionnaire item
V13	Adoption of collaborative forecasting with supply chain partners (suppliers and clients)
V14	Increase visibility of data along the supply chain (e.g. available stock at the client site)
V15	Increase internal integration among departments, to share market knowledge
V16	Adoption of IT tools that support demand forecasting
V17	Downstream integration along the supply chain through the creation of directly operated stores to understand consumer behavior
V18	Leverage social media to collect qualitative information about consumers' preferences
V19	Leverage market knowledge of sales personnel to improve demand forecasts
V20	Integrate quantitative forecasts with relevant qualitative information
V21	Use of big data analytics to predict sales

On the basis of your experience, what is the importance of robotics and automation in the following areas? (1 to 5 Likert scale, where 1 is "not important" and 5 is "very important").

Variable	Questionnaire item
V22	Production (e.g. robots)
V23	Warehouse (e.g. automated guided vehicles)
V24	Transportation (e.g. RFID)
V25	Sales (e-commerce)
V26	After sales (e.g. augmented reality)
V27	Procurement (e.g. marketplace, e-procurement)
V28	Transportation (e.g. drones)

On the basis of your experience, what is the importance of Internet of Things in the following areas? (1 to 5 Likert scale, where 1 is "not important" and 5 is "very important").

Variable	Questionnaire item
V29	Change the behaviour of the product depending on the environment (e.g. smart cartridges)
V30	Embed products with some sort of "intelligence" that enables servitization (e.g. pay-per-use tyres)
V31	Embed products with some sort of "intelligence" that enhances visibility along the supply chain (e.g. pallets with sensors)
V32	Use of in-store technologies to enhance interaction with the customer(e.g. beacons that interact with smart-phones)
V33	Use of IoT solution to monitor the operating conditions of production equipment
V34	Use of 3D printers for remote production (e.g. spare parts)
V35	Use of wearable technologies to increase employees safety

On the basis of your experience, what is the importance of Big Data Analytics in the following areas? (1 to 5 Likert scale, where 1 is "not important" and 5 is "very important").

Variable	Questionnaire item
V36	Understand consumer behaviour
V37	Product customization
V38	Market trends identification
V39	Predictive maintenance
V40	Improve sales forecasts
V41	Assess suppliers' risk
V42	Cut transportation costs
V43	Increase service level to the customer