



**Research Exposé:**

**The influence of digital transformation on horizontal  
and vertical collaboration for innovation in the  
Italian fashion industry**

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## **Abstract**

Fashion industry is a fast-changing environment. The so-called “Fourth Industrial Revolution” has started, and new disruptive technologies are already dramatically transforming all major industrial systems. Fashion industry is no exception.

Management and organizational scholars have paid increasing attention to the interconnections between digital transformation and innovation ecosystems in the last decade. However, this topic is still highly fragmented. Additionally, many researches have been made at the individual level but not at the organizational level. In this, digitalization plays a fundamental role, since it can influence and transform the nature of the company’s structure, by supporting coordination mechanisms and facilitating the interaction among the various actors.

This research projects aims at understanding the types of new technologies that further both horizontal and vertical collaboration among the different actors of the fashion fashion supply chain, the level of digitalization within a fashion supply chain, and the consequent benefits and/or disadvantages.

This study will focus on the fashion industry, being one of the markets mostly affected by the adoption of new technologies, and on the Italian market due to the fundamental role played by this country in the fashion industry.

The research will be conducted via semi-structured interviews. Supply chain experts of multinationals in the fashion industry will be interviewed, confident that their experience in the sector will shed a light on the process of digital transformation within Fashion Houses operating in the Italian market and on the related opportunities and threats.

*Keywords:* vertical integration, horizontal integration, supply chain, innovation, fashion industry, fashion houses, fourth industrial revolution, disruptive technologies.

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## List of Abbreviations

IoT	Internet of Things
AR	Augmented Reality
VR	Virtual Reality
SCOM	Supply Chain Operating Model
NGOs	Non-Governmental Organizations
R&D	Research & Development
3PL	Third-Party Logistics
AA	Advanced Analytics
AI	Artificial Intelligence
SC	Supply Chain
THs	Technological Hubs
IT	Information Technology
PRM	Partner Relationship Management
SCI	Supply Chain Innovation

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# 1. Introduction

## 1.1 Research Context and Scholarly Discussion

Most breakthrough innovations don't succeed in isolation. Such as most innovators don't succeed alone. Here it is when the concept of innovation ecosystem comes into play. They are considered dynamic, holistic, and collaborative structures where its community and environment are closely linked together and act as a unique entity. (Granstrand & Holgersson, 2020) Therefore, innovation in an ecosystem is given by the complex dynamics that take place between the different *actors* or *entities* whose goal is to enable technology development and innovation. (Jackson, 2011) And "*when they work, ecosystems allow firms to create value that no single firm could create alone*". (Adner, Match Your Innovation Strategy to Your Innovation Ecosystem, 2006)

By going into further details, it is important to have a detailed look at the closest partners to a business in its ecosystem, and to develop strong ties with *all* your partners, both those belonging to the same level of the value chain (horizontal integration), as well as those belonging to different levels (vertical integration). Thanks to these networks, risks can be balanced, and market opportunities can be expanded by combining the various resources belonging to different businesses in the same ecosystem. That's why when it comes to innovating, to understand how it may be implemented, and what would be the consequences, it is important to consider that specific business or company but also all the partners belonging to its ecosystem. (Granstrand & Holgersson, 2020)

Over the last decades, the rapid developments of the Internet and the information technologies have already brought to the beginning of the so-called "Fourth Industrial Revolution" or "Industry 4.0", thanks to the introduction of additive manufacturing, autonomous robots, Internet of Things (IoT) platforms, big data analytics, cloud computing, collaboration platforms, augmented reality (AR) and virtual reality (VR), and so on. These technologies act as disruptive innovators by changing the way things are designed, produced and serviced around the globe. In combination, they lead to more agile approaches and to the creation of value by connecting different players and machines in a new "digital thread" across the value chain. (Savastano, Amendola, & D'Ascenzo, 2018)

## *1.2 Research Gap and Expected Contributions*

Management and organizational scholars have paid increasing attention to the interconnections between digital transformation and innovation ecosystems in the last decade. However, we are still left with a highly fragmented understanding of this topic. (Appio, Frattini, Messeni Petruzzelli, & Neirotti, 2021). Additionally, much research has been made at the individual level but not at the organizational level. (Gao, Wu, & Ying Yang, 2022) In this, digitalization plays a fundamental role, since it “can influence and transform the nature of the company’s structure, by supporting coordination mechanisms and facilitating the interaction among the various actors”. (Annaswamy, 2022)

This research will contribute to the enhancement of academic studies on new digital technologies & innovation ecosystems (*academic*), to improve their relationships with their partners and their competitiveness (*practitioners - managers & supply chain experts*), to raise awareness on new digital technologies & innovation ecosystems (*policy makers*), and to better engagement thanks to digitalization (*society*).

## *1.3 Research Aim*

This study will focus on how digital transformation influences both horizontal collaboration and vertical collaboration for innovation in the fashion sector in Italy. In particular, the supply chain of multinationals operating in the fashion industry will be analyzed, by looking at the innovation ecosystem where they operate, and how new digital technologies might affect their relationship with partners as well as their competitive structure.

*Which types of new technologies are used at the different levels of a fashion supply chain? Does the use of such technologies improve collaboration between the different partners belonging to the supply chain? What is the level of digitalization within a fashion supply chain? What are the related advantages and/or disadvantages driven by the use of new technologies?* My research will aim at answering these questions thanks to the experience of supply chain experts of multinationals which have been working in the fashion field for a significant amount of time.

Finally, the research will focus on the fashion industry, being one of the markets mostly affected by the adoption of new technologies, and on the Italian market due to the fundamental role played by this country in the fashion industry.

#### *1.4 Theories*

This research would aim at analysing the use and the influence of new technologies in the relationships with partners both at the same level and different levels of the value chain by using the General System Theory, which will guide us through the study of the collaborative dynamics between partners in an ecosystem.

Alternatively, the Supply Chain Operating Model (SCOM) will be useful to provide further insights both on how does collaboration work in general (horizontal, vertical) and how does technology influence collaboration.

In general, this theory and model will help to support this research in its efforts to assess the ability to use new technologies to improve the relationship among partners within the supply chain.

#### *1.5 Chapters Overview*

The goal of the first chapter just presented, the introduction, was to explain the purpose of this study while also examining the context in which it is conducted and the gaps that it aims to fill. The second chapter, titled "Theoretical Framework," is divided into macro-areas, each of which aims to describe the major themes that are investigated during the research and the theory upon which it is built in more detail. Afterwards, the research approach and methodology will be discussed. This chapter will describe the sample, explain the research design, show the data collection procedures and the analysis of data. This research will then examine the results by describing the data coding process and the findings. Finally, the fifth chapter will cover the results' discussion and how they relate to the theory. It will also outline the primary implications and limitations of this study. The study will wrap up with a chapter of conclusions in the end.



## 2. Theoretical Framing

### 2.1 Innovation Ecosystem

Before moving into the more detailed analysis of the partners in the value chain, it is fundamental to talk about ecosystem and innovation ecosystem in particular, in order to lay out the foundations for more specific topics.

The notion of ‘ecosystem’ has been first introduced by Moore in the 1993. According to him, a company should be viewed not as a member of a single industry but as part of a *business ecosystem* that crosses a variety of industries. Here, companies *work cooperatively and competitively to support new products, satisfy customer needs, and eventually incorporate the next round of innovations.* (Moore, 1993)

From this definition, the term “innovation ecosystem” has been further developed, driven by a need for companies to combine a call for control of the different relationships with partners with a need for continuous innovation.

In particular, Adner and Kapoor argued that complex innovations tend to involve a series of actors, demanding changes not confined to the supply. (Adner & Kapoor, 2010) To address this process of joint value creation, several scholars proposed and developed the concept of innovation ecosystem.

Two authors strongly contributed to disseminating the term innovation ecosystem: Adner (2006), and later Adner again together with Kapoor (2010). (Gomes, Facin, Salerno, & Ikenami, 2016) However, they were not the only one.

Table 1: Definitions of Innovation Ecosystem

Article	Definition of Innovation Ecosystem	Main features
(Adner, 2006)	“[...] the collaborative arrangements through which firms combine their individual offerings into a coherent, customer-facing solution” (p. 02)	Risk management; coordination (work on critical bottlenecks).
(Carayannis & Campbell, 2009)	“[...] Innovation Ecosystem, where people, culture and technology, [...] meet and interact to catalyze creativity, trigger invention and accelerate innovation across scientific and	Co-existence; co-evolution; co-specialization; actors (government,

	technological disciplines, public and private sectors [...] and in a top-down, policy-driven as well as bottom-up, entrepreneurship-empowered fashion.” (p. 202–203)	university, industry and NGOs); clusters; networks.
(Adner & Kapoor, 2010)	“The ecosystem construct, as a way of making interdependencies more explicit, [...] have focused on understanding coordination among partners in exchange networks that are characterized by simultaneous cooperation and competition.” (p. 309)	Complementors; technological and behavioral uncertainties.
(Granstrand & Holgersson, 2020)	“the evolving set of actors, activities, and artifacts, and the institutions and relations, including complementary and substitute relations, that are important for the innovative performance of an actor or a population of actors” (p. 01)	Inclusion of competition, substitutes, and artifacts

## 2.2 The Fashion Supply Chain & Integration

The concept of supply chain first appeared in the early 1980. According to (Christopher M., 1998) supply chain management is defined as “the management of upstream and downstream relationships with suppliers and customers to deliver superior customer value at less cost to the supply chain as a whole”. Thus, this concept includes all the parties involved in the creation of finished goods, starting from raw materials, which are then available to be sold to the final customer. As a result, the goal of supply chain management is to manage interactions in a way that maximizes profits and goals for all the parties involved.

By devoting attention to the fashion industry, the supply chain is characterized by the following specific actors:

1. *raw material suppliers*, who are responsible for the provision of raw materials including both natural fibers (wool, cotton, silk) and synthetic and artificial fibers;

2. *the component networks*, who are responsible for the provision of components, such as the yarns and fabrics manufactured by textile companies, as well as leather components;
3. *the production networks*, made up of fashion houses and laboratories, including both their domestic and overseas labor suppliers;
4. *the distribution channel*, which includes the *export network* established by trade intermediaries and the *marketing networks* made up by online shops, outlets, retailers, franchising, and owned stores.

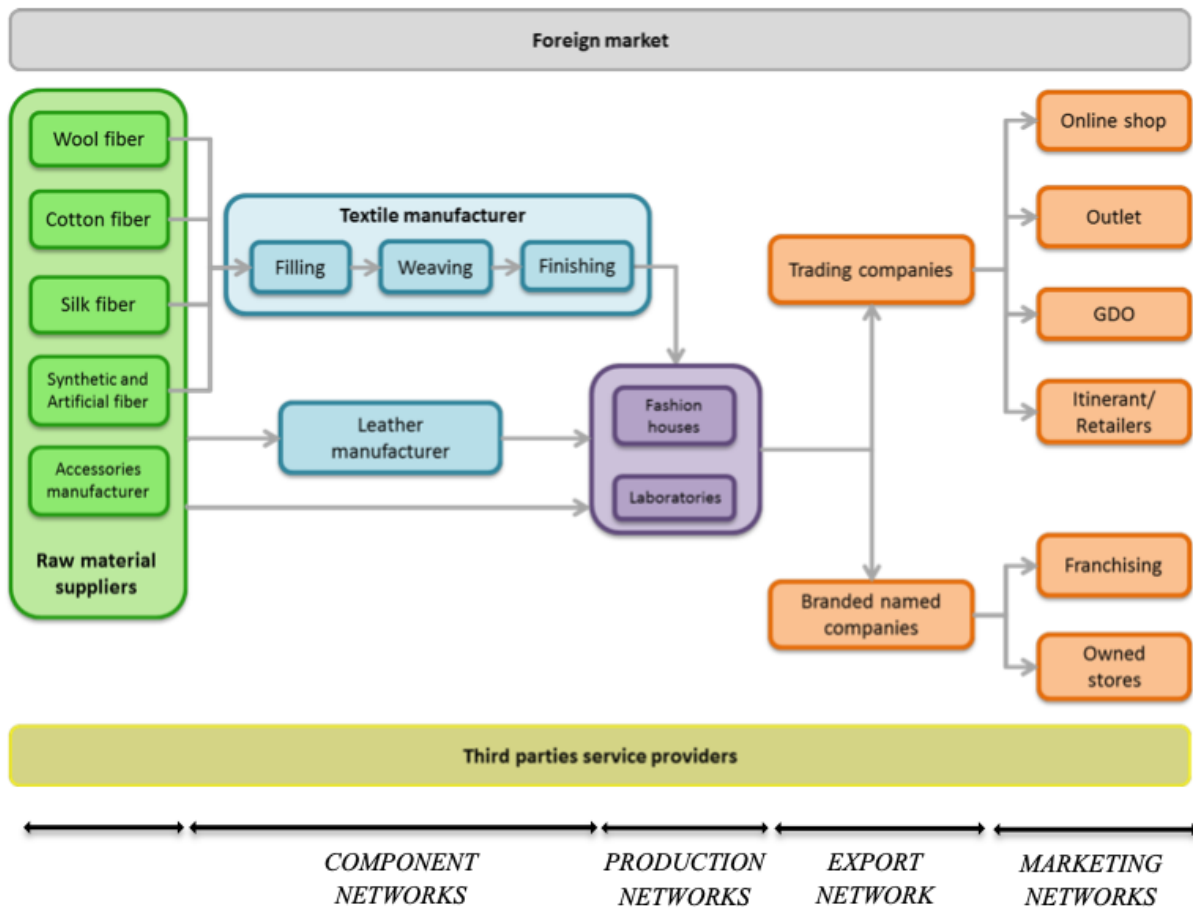


Figure 1: Structure of Fashion Supply Chain (Lucchiari & Mercurio, 2017)

### Vertical and Horizontal Integration

When dealing with the collaborative innovative efforts that take place between all the partners within a supply chain ecosystem, the concept of integration comes into play. There are two types of supply chain integration: ‘vertical integration’ and ‘horizontal integration’,

which refer to the relationship with partners at different level or at the same level of the value chain, respectively.

By going into further details, horizontal integration refers to integrating multiple businesses or organizations within the same industry, so it involves buying or cooperating with competitors.

In contrast, vertical integration refers to integrating different production stages within the same company, therefore it is more suitable to handle all the internal production aspects.

The importance of horizontal and vertical integration is confirmed in (Behr, 2018), by defining them as “necessary aspects for a successful digital value chain and organizational structure”.

*Table 2: Definitions of Vertical and Horizontal integration*

<b>Article</b>	<b>Definition of vertical/horizontal integration</b>
(Zhou, Liu, & Zhou, 2015)	Horizontal integration of the supply chain refers to the integration of resources and information systems along the value chain of product life cycle in order to achieve a seamless cooperation between supply chain companies.  Vertical integration aims at the connection between different hierarchical and aggregation levels along the value chain of the production lines, but also through other departments (e.g. the sales department or Research and Development, R&D).
(Tarver, 2022)	“A horizontal acquisition is a business strategy where one company takes over another that operates at the same level in an industry”.  “Vertical integration involves the acquisition of business operations within the same production vertical”.
(Moltz, 2022)	“Horizontal integration is when a business grows by acquiring a similar company in their industry at the same point of the supply chain”.  “Vertical integration is when a business expands by acquiring another company that operates before or after them in the supply chain”.

My research will take as a reference the first definition provided by Keliang Zhou, Taigang Liu, Lifeng Zhou which focus more on the dynamics between the different actors within the

value chain, while also considering the integration of resources, technologies, and information systems.

### 2.3 Industry 4.0 within the Fashion Supply Chain

According to (Christopher, Lawson , & Peck, 2004) “fashion is a broad term that typically encompasses any product or market where there is the element of style that is likely to be short lived”. This peculiarity makes the landscape of the fashion industry constantly subject to quick changes, especially due to digital breakthroughs and technologies. Disruptive technologies have the potential to totally alter how goods are produced, delivered, and tracked, therefore revolutionizing the whole supply chain. (Triskele, s.d.)

A survey performed by Inbound Logistics on 3PL companies has revealed that the most impactful and disruptive technologies in the supply chain are the Artificial Intelligence and machine learning at 68%, autonomous vehicles at 52%, Internet of Things (IoT) at 39%, and Blockchain at 35%.(Douglas, 2022) Additionally, according to Gartner (2022), more than 75% of large companies will be using, Advanced Analytics (AA), Artificial Intelligence (AI) and data science in supply chain operations by 2026. (Hippold, 2022)

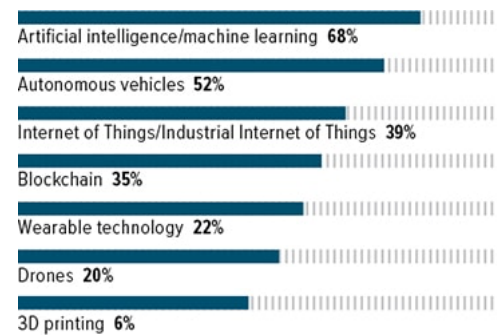


Figure 2: most disruptive technologies in the fashion supply chain

Digital technologies have the capacity to boost efficiency and bridge the gap between suppliers and brands, allowing the creation of a holistic, smarter, and integrated supply chain system. While in a traditional manufacturing environment, businesses typically operate independently with little to no communication, resulting in inefficiencies and duplications of effort; the Industry 4.0 enables the creation of a more holistic system where businesses are closely interconnected with one another and, therefore, they can share information and resources more efficiently. This set the basis for the adoption of a more agile/lean supply chain and efficient information management. In Industry 4.0, horizontal and vertical integration work together to create a more efficient and synergic system that can better respond to the shifting demands of the market. (Staff, 2022)

By going into further details, here below the main disruptive technologies and their advantages have been explained:

1. **Internet of Things (IoT):** thanks to the IoT ability to gather, share, and transmit data, employees have access to real-time information. In the supply chain context, IoT allows for every process, person, and product to be monitored from the beginning of the supply chain to the end .(Triskele, s.d.) Additionally, IoT will improve the information flow: thanks to the fast sharing of incoming data between employees and higher-level executives, there will be no need any more for conducting physically inventory counts. (Triskele, s.d.)
2. **(Advanced) data analytics and Data analysis:** Data analytics is the science of analyzing raw data to drive final conclusions about that information. (Frankenfield, 2022) Through the use of charts and graphs, supply chain data analytics and data analysis help providing a summary of all the relevant and reliable data, revealing patterns and generating insights, thereby giving a meaning to this huge amount of data. (What is supply chain analytics?)
3. **Artificial intelligence (AI) & Machine learning:** “Artificial intelligence is concerned with the development of computers able to engage in human-like thought processes such as learning, reasoning, and self-correction.” (Kok, Boers, Kusters, van der Putten , & Poel, 2009) Machine learning is an application of AI that allows systems to learn and improve from experience without being explicitly programmed, so it consists in developing computer programs that can access data and use it to acquire knowledge by themselves. (Selig, 2022). By applying AI and Machine Learning, the company can connect and correlate data from across their disparate systems for a real-time, end-to-end view of their supply chain and it can quickly see the status of critical orders and have a high degree of confidence in the information they are viewing. (IBM, 2019)
4. **Autonomous vehicles:** Without having a driver, a truck can operate 24 hours a day without stopping, allowing consumers to receive their orders faster.
5. **Blockchain:** Blockchain is a shared database where various parties in the supply chain input and verify information. It is useful to track and trace products from the raw material stage to the final customers stage and to record transactions.

All these innovative technologies allow for the creation of a smarter and integrated supply chain system, by offering tools to make the process more precise, more reliable and more affordable. The next fashion generation needs to understand the importance of embracing new technologies, understanding the science and engineering for new production methods

and recognize the potential to innovate in the designing of new systems and processes. (Triskele, s.d.)

#### 2.4 Theories' Overview

Supply chains are considered systems, being that they are made up of various components: people, organisations, technological infrastructure, information flows, flows of physical goods, and flows of intangible services. The creation of supply chains improves the flow of goods, services, and information from one organization to another for the advantage of the participants. (Caddy & Helou, 2007)

The *General System Theory*, therefore, will represent the starting point for my research. Two authors significantly contributed to this theory: Bertalanffy (Bertalanffy, 1950) and Weinberg (Weinberg, 1975). Bertalanffy defined a system as a complex of interacting elements which are open to, and interact with their environments. (Bertalanffy, 1950) Weinberg recognizes the complexity of a system and tries to find the best approaches to study and deal with such complexity. (Weinberg, 1975) Yet the vastness of this topic led to the application of this theory to specific fields. In particular, Caddy used this theory in supply chain and its management for better understanding of the supply networks. (Caddy & Helou, 2007) (Mishra, Kumar, & Garg, 2013) Additionally, Caddy has applied Yourdon's general systems principles of information systems to supply chains. (Yourdon, 1989) Caddy's study, therefore, discusses the application of general systems theory to supply chains and the management of supply chains, while keeping into consideration the changes and the increasing complexities and/or advantages due to the application of information systems to supply chains. In conclusion, this theory will be helpful during the interviewing process to understand how collaboration – both horizontal and vertical – works between participants to a group work. In addition, being that this theory considers also external factors, such as technological innovations, and recognizes their crucial role in shaping the evolvement of the relationship among partners, the study of the continual evolution of such interconnections will remain possible.

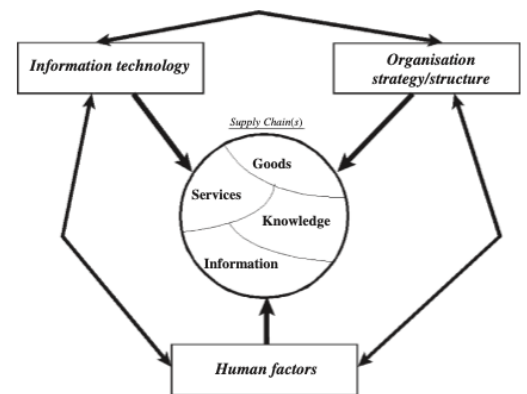


Figure 3: Generic Supply Chain Model

Alternatively, the *Supply Chain Operating Model (SCOM)* can help provide some insights on the influence of technology on the collaboration between participants in the ecosystem. This

model considers all substantial changes (the technological advances included) to the context in which supply chain operates. The recent phenomenon of the Fourth Industrial Revolution, together with its conceptual and technological advancements, has received much attention among practitioners' communities. As a consequence, well-established businesses have increasingly used digital technology to transform their supply chain (SC) operational models, in order to implement SC strategy and identify the key enabling variables that allow them to give value to consumers. (Hahn, 2019) This model will be useful to define the degree to which the different parties within an ecosystem are integrated with each other, as well as the technological absorption level within the company. (Johnson & Stevens, 2016)



### 3. Literature Review

The theoretical basis of this research has been obtained with online research only. The databases used have been Google Scholar, ResearchGate, Elsevier, ScienceDirect, IEEE Xplore, JSTOR, Emerald insight, SpringerLink, Wiley, ... . Additionally, also the common search engines, such as Google, have been used for the definition, meaning, and use of the most innovative terms in digital innovation. The queries have considered many key words and mixed them in different orders with the AND conjunction; they were: “Innovation Ecosystem”, “Fashion Industry”, “Fashion houses”, “Vertical Integration”, “Horizontal Integration”, “Disruptive Technologies”, “Technological development”, “Fourth Industrial Revolution”, “General System Theory”, “Partners”, “Collaboration”, “Digital Innovation”, “Supply Chain”, “Interdependencies”, and “Supply Chain Operating Model (SCOM)”. No exclusion criteria were used in the research on databases. Every paper found with such search criteria has been opened and quickly analyzed through “key words” search in order to understand whether it was useful or not. The final number of articles used for this research amounts to fifty nine so far. Follows a table representing the most important ones found for this research with a quick analysis of their content and proper references.

Table 3: Literature Review

	Reference	Content
1	Appio, F. P., Frattini, F., Messeni Petruzzelli, A., & Neirotti, P. (2021), “Special Issue Guest Editorial - Digital Transformation and Innovation Management: A Synthesis of Existing Research and an Agenda for Future Studies”, <i>Journal Product Innovation Management</i> , 4-20. <a href="https://doi.org/10.1111/JPIM.12562">https://doi.org/10.1111/JPIM.12562</a>	This paper highlights the necessity for further research on the linkages between innovation management and digital transformation. Here, ideas for further analysis about this topic are outlined.
2	Adner, R., & Kapoor, R. (2016), “Innovation Ecosystems and the Pace of Substitution: Re-Examining Technology S-Curves”, <i>Strategic Management Journal</i> , 37 (4),	This study aims at understanding the reasons behind disruptive technologies: why do some new technologies appear and replace older ones right away while others take years or decades to catch on? Which challenges must

	625-648. <a href="http://dx.doi.org/10.1002/smj.2363">http://dx.doi.org/10.1002/smj.2363</a>	be overcome by new technologies in order to supplant old ones? A framework has been developed to show the differences in the pace of substitution. This framework considers both the competing technologies as well as the external ecosystems in which they are created and applied.
3	Cantù, C., Ylimäki, J., Sirén, C.A. and Nickell, D.(2015), "The role of knowledge intermediaries in co-managed innovations", <i>Journal of Business &amp; Industrial Marketing</i> , Vol. 30 No. 8, pp. 951-961. <a href="https://doi.org/10.1108/JBIM-02-2014-0032">https://doi.org/10.1108/JBIM-02-2014-0032</a>	The aim of this article is to shed a light on the importance of knowledge intermediates, also known as technology hubs (THs). To meet the challenge of the fast pace of innovation, THs play a crucial role in the creation of smart alliances to develop innovation co-creation. In particular, this study will show how THs might assist and help firms in connecting with both horizontal and vertical networks.
4	Brettel, M., Friederichsen, N., Keller, M.K., & Rosenberg, M. (2014), "How Virtualization, Decentralization and Network Building Change the Manufacturing Landscape: An Industry 4.0 Perspective", <i>World Academy of Science, Engineering and Technology, International Journal of Mechanical, Aerospace, Industrial, Mechatronic and Manufacturing Engineering</i> , 8, 37-44. <a href="doi.org/10.5281/zenodo.1336426">doi.org/10.5281/zenodo.1336426</a>	The current article analyzes the related research streams and discusses the advancements of Industry 4.0 in the literature. The virtualization of the process- and supply-chain ensures efficient inter-company operations by giving all involved entities real-time access to product and production information. As autonomous systems interchange data throughout the whole value chain, company boundaries disintegrate creating a seamless experience. Thanks to the growing use of information and communication technologies, now advanced machine communication and rapid product innovation are made possible.

5	<p>Hagedoorn, J. (1993), "Understanding the Rationale of Strategic Technology Partnering: Interorganizational Modes of Cooperation and Sectoral Differences", <i>Strategic Management Journal</i>, 14(5), 371–385.</p> <p><a href="https://doi.org/10.1002/smj.4250140505">https://doi.org/10.1002/smj.4250140505</a></p>	<p>The importance of interfirm strategic alliances in (international) business seems to have increased. This study tries to better understand the driving forces behind corporate collaboration for innovation. In particular, the focus is both on the different motivations behind these partnerships as well as on the use of technologies for cooperation among different entities.</p>
6	<p>Pérez-Lara, M., Saucedo-Martínez, J.A., Marmolejo-Saucedo, J.A. <i>et al.</i> (2020), "Vertical and horizontal integration systems in Industry 4.0", <i>Wireless Netw</i> 26, 4767–4775.</p> <p><a href="https://doi.org/10.1007/s11276-018-1873-2">https://doi.org/10.1007/s11276-018-1873-2</a></p>	<p>New technologies advancements and industrial growth have brought to the beginning of the fourth industrial revolution. Therefore, companies have to adapt to new business management ways in order to survive.</p> <p>By linking all the activities within the organizational and business area to the computer systems and information management in the network, partners in the ecosystem can achieve more efficiency both in the vertical and horizontal flows.</p>
7	<p>Paola Bertola, Jose Teunissen, (2018) "Fashion 4.0. Innovating fashion industry through digital transformation", <i>Research Journal of Textile and Apparel</i>.</p> <p><a href="https://doi.org/10.1108/RJTA-03-2018-0023">https://doi.org/10.1108/RJTA-03-2018-0023</a></p>	<p>The ongoing shift of societies and economies toward new organizational paradigms characterized by an increase in digitalization and technological advances is at the center of the so-called "Fourth Industrial Revolution". While general frameworks describing the Industry 4.0 can be easily found, studies on the implementation tactics and their effects on particular local and sectorial systems have not been extensively studied. Consequently, this paper aims at focusing on the effect of</p>

		new technological development in the textile and apparel sector.
8	Zablah, A.R., Johnston, W.J. and Bellenger, D.N. (2005), "Transforming partner relationships through technological innovation", <i>Journal of Business &amp; Industrial Marketing</i> , Vol. 20 No. 7, pp. 355-363. <a href="https://doi.org/10.1108/08858620510628597">https://doi.org/10.1108/08858620510628597</a>	This research study aims at developing a model to explain whether and the extent to which downstream channel participants (such as retailers, wholesalers) are willing to adopt new technologies – defined as partner relationship management (PRM) technologies - that might enhance the efficiency and effectiveness of coordination with their channel counterparts (such as suppliers).
9	Ian N. Caddy, Mammy M. Helou (2007), “Supply chains and their management: Application of general systems theory”, <i>Journal of Retailing and Consumer Services</i> , Volume 14, Issue 5, pp. 319-327. <a href="https://doi.org/10.1016/j.jretconser.2006.12.001">https://doi.org/10.1016/j.jretconser.2006.12.001</a>	This theoretical paper discusses the application of General Systems Theory to supply chains and the management of supply chains. It starts by reviewing the history of general systems theory noting the significant contributions made by von Bertalanffy (1969) and Weinberg (1975). Then it goes more in details by applying this theory to the field of supply chain. Finally, by taking into consideration Yourdon (1989) and his application of general systems theory to the field of information systems, this paper shows how the supply chain dynamics take place and the effect of technological changes on it.
10	Johnson, Mark & Stevens, Graham. (2016), “Integrating the Supply Chain... 25 years on”, <i>International Journal of Physical Distribution &amp; Logistics Management</i> , <a href="https://doi.org/10.1108/IJPDLM-07-2015-0175">10.1108/IJPDLM-07-2015-0175</a>	This paper takes as reference an article wrote by Stevens in 1989 (Stevens, 1989) and re-visits it by taking into consideration the evolution of supply chains over the last years. A new model - the <i>Supply Chain Operating Model (SCOM)</i> – is therefore defined to

		explain these changes in the supply chain, such as the introduction of new technologies.
11	Gerd J. Hahn (2019), “Industry 4.0: a supply chain innovation perspective”, <i>International Journal of Production Research</i> , <a href="https://doi.org/10.1080/00207543.2019.1641642">https://doi.org/10.1080/00207543.2019.1641642</a>	The industrial sector has gone digital as part of the Fourth Industrial Revolution. The effects of Industry 4.0 on supply chain management are examined in this paper using the theoretical framework of supply chain innovation (SCI). Under this lens, it is possible to understand how established companies use digital technologies to transform their supply chain (SC) operating models.
12	Rupasinghe, Thashika. (2017), “Internet of Things (IoT) Embedded Future Supply Chains for Industry 4.0: An Assessment from an ERP-based Fashion Apparel and Footwear Industry”, <i>Journal of Supply Chain Management</i> , 6. <a href="https://doi.org/10.1016/j.procir.2020.02.231">https://doi.org/10.1016/j.procir.2020.02.231</a>	This research studies the use of new technologies in order to face competition and financing difficulties. The incorporation of new disruptive technologies is becoming necessary for the survival of companies. Most companies fail due to poor technological integration in their supply chain. This study focuses on the use of the Internet of Things (IoT). The main objective of this study is to enhance inbound and outbound operations through the use of Radio-frequency identification (RFID) technology and Business Application Programming Interface (BAPI) technology to better manage, optimize, and automate activities in an Enterprise Resource Planning (ERP) system.

## 4. Research Propositions

As previously mentioned, the objectives of this research are as follows: (1) the study of the introduction and use of new disruptive technologies for the improvement of collaborative efforts across all the different levels of the fashion supply chain; (2) the level of digitalization within the fashion supply chain; (3) the benefits and/or disadvantages of the implementation of these technologies.

The implementation of new technologies will further the collaboration at all the levels of the fashion supply chain, therefore helping in the creation of strategic technology alliances among partners within the value chain.

*Proposition 1:* The adoption of new technologies will have a positive impact on the vertical and horizontal collaboration for multinationals within the Italian fashion industry.

There is still poor evidence of actual implementation and adoption of e-business practices within the supply chain. (Cagliano, Caniato, & Spina, 2003) However, some new technologies are more used and common than others.

*Proposition 2:* The level of new technological adoption within the fashion supply chain is still not high. However, the three most common disruptive technologies applied within the context of the supply chain network are IoT, data analytics, and AI.

*Proposition 3:* The implementation of new disruptive technologies across the fashion supply chain will benefit businesses.

- *Proposition 3(a):* New technologies favor information sharing by providing real time data about the sales. This allows for better forecasts, helping to maintain the minimum level of necessary inventory and to decrease the bullwhip effect.
- *Proposition 3(b):* The business partner(s) can easily share knowledge by finding and creating shared models.
- *Proposition 3(c):* The business partner(s) can create an e-commerce to facilitate business partners transactions.

According to (Adner & Kapoor, 2010), the performance advantage from vertical and horizontal integration will increase over the course of the technology life cycle. This contributes to the thought that the more a company's decision-makers use a technology and the more they become experts in it, the easier will be to integrate the technology in the supply chain, obtaining therefore more advantages at the supply chain level.

*Proposition 4:* The technological integration process is not immediately visible within a fashion supply chain.

There is not an equal level of digitalization through all the different steps of the supply chain. The first steps are usually less digitalized than the last ones.

*Proposition 5:* The first steps of a fashion supply chain are less digitalized than the last ones.

## **5. Methodology**

The research design will be qualitative. This choice is driven by the complexity of the topic: a straightforward communication with people directly involved in the field will allow to have better insights on the topic, therefore reaching trustworthy conclusions which will be helpful for future research. Moreover, as it is still an unexplored field, there is little qualitative research. Therefore, qualitative research lent itself to be the most appropriate way to study this topic.

The target sample will consist of supply chain experts of multinationals which have been operating in the fashion sector in Italy for quite a significant time (at least 30 years), so that they have the necessary knowledge and experience of how the digital innovation process has evolved over the past years. Additionally, these corporate figures are considered to be the most knowledgeable on the topic of supply chain and its characteristics, as they possess sufficient knowledge, a broad view of the entire supply chain and can provide reliable arguments.

As mentioned above, multinationals in the fashion industry will be analyzed, as studies in this field are still at an embryonic level. Therefore, it will be necessary that the selected interviewees work or have worked in the fashion industry and within a multinational.

The choice of research location is linked to the researcher's personal network and the presence of many companies and stores operating in the fashion sector. Therefore, the application context will be represented by the Italian fashion market.

The data will be collected through semi-structured interviews. Some interviews will be carried out in person, while others will be online via video-call platforms (such as Zoom or

Skype). The interview will start with a set of predetermined open-ended questions, while the rest of the questions will depend on the answer of the respondent. The goal is to get a full understanding of what the interviewees have to say and to build the research on their answers. The length of the interviews will vary depending on the detail of the answers provided by the respondents, but they should last approximately 30-45min.

Finally, data analysis will be carried out through the “content analysis”, which aims to find patterns in qualitative content by identifying specific words, themes, or concepts. The tool that will be used for the content analysis is called MAXQDA, which is a software built for computerized analysis of data, texts, and multimedia for the qualitative research.

Thanks to this research, multinationals in the Italian fashion industry will become aware of how to use the new technologies in their favour to improve the relationship with partners in their ecosystem. Moreover, they will know how to deal with competition in an innovative ecosystem, helping start-ups to enter the market or already existing companies to improve their competitive advantage.



## 6. Expected Contributions

This research study contributes to a better theoretical understanding of the opportunities and challenges going along with the adoption of new technologies. Also, the results provide a better understanding of the boundaries and relationships that exist between partners at different levels of the value chain in the digital age. In particular, the analysis and discussion presented in this paper has benefits for academics, practitioners (managers and supply chain experts of multinationals) and for the society.

### *6.1 Scholarly Contributions*

For academics, this study will enhance academic studies on digital transformation & innovation. In fact, greater insight should lead to a more informed and consistent application of these concepts to the supply chain concept. Indeed, the emergence of digital transformation not only supports the development of innovation activities, but it also led to the use of more agile and lean approaches within the supply chain, which in turn will lead to new innovative ways of communicating among partners within the supply chain network. A major contribution of the present study is to analyze the role of digital transformation in contributing to the development of collaborative efforts within the supply chain. The connection of the flow of activities among partners to the distribution of innovation challenges across the network, brings with it clarification on the essential mechanisms of joint value creation, contributing therefore to the growing body of research on ecosystem strategy. (Gao, Wu, & Ying Yang, 2022)

### *6.2 Implications for Business, Society, and Policy Makers*

This study will support practitioners, in particular managers and supply chain experts, in raising awareness by offering a broader reflection about IT and digital transformation challenges on the part of supply chain experts working in multinationals. (Pelletier & L. Martin Cloutier, 2019) Professionals will be able to know how to exploit these disruptive technologies in their favor to improve their relationships with their partners within the supply chain. Different digital technologies and their combinations can influence the innovation processes and results of innovation during the digital transformation processes, therefore also influencing the dynamics both at the vertical and horizontal levels of integration. Greater insight should lead to better supply chain management practices at the operational level, in

the sense of more effective and efficient supply chains, but also at the strategic level, in the sense of more flexible and adaptable supply chains. (Caddy & Helou, 2007) Additionally, it will help professionals in the development of programs which support the digital shift across the fashion supply chain.

The application of this research results will help policy makers in raising awareness on new digital technologies & innovation ecosystems and in delivering better policies to regulate their use within partners in a network.

This study will also provide better and improved services for the society thanks to the introduction of more digitalized process within the supply chain operations of fashion businesses.

## **7. Chapters Overview**

Follows a provisional overview of the research division in chapters and sections.

Abstract

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Bibliography

Appendix

## 8. Work Plan

The following table represents the estimated work plan and will be constantly updated.

*Table 4: Work Plan*

<b>Time period</b>	<b>Activity</b>	<b>Stage</b>
1 <sup>st</sup> Sept. 2021 – 23 <sup>rd</sup> Oct. 2021	Research and Exposé	X
23 <sup>rd</sup> Oct. 2022	Exposé submission	X
24 <sup>th</sup> Oct. 2021 – 15 <sup>th</sup> Nov. 2021	Exposé adjustments, Interview design, and Research of interviewees	X
16 <sup>th</sup> Nov. 2021 – 15 <sup>th</sup> Dec. 2021	Interviews: delivery, translation, and transcription	
16 <sup>st</sup> Dec. 2021 – 30 <sup>th</sup> Dec. 2021	Data analysis and discussion of findings and results	
1 <sup>st</sup> Jan. 2021 – 10 <sup>th</sup> Jan. 2022	Thesis final developments	
11 <sup>th</sup> Jan. 2022 – 13 <sup>th</sup> Jan. 2022	Proofreading and final check	
13 <sup>th</sup> Jan 2022	Master thesis submission	
17 <sup>th</sup> -20 <sup>st</sup> Jan. 2022	Master thesis defense	

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