Chapter 8
Resilience in the Fashion Industry Supply Chain: State of the Art Literature Review

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Abstract In a complex and unpredictable world, nowadays classic risk management techniques are often nor sufficient neither adequate to face the occurring disruptive events. When black swans events (low probability—high impact events) take place, many supply chains are not qualified to tackle those happenings in an efficient way. A resilient approach can fill this expertise gap, providing the necessary know-how and mindset qualities to supply chain players in order to tackle those rising disruptions better. In particular, resilience is a key component in the fashion industry supply chain. In the last decades, many companies declined and retired, while several thrived. The resilience approach was one of the keys that divided successful firms from the unprofitable ones. This research provides a broad view of the literature review about resilience approach within the fashion industry supply chain. Furthermore, in ordimpact of possible disruptionser to assist academics and supply chain decision makers, this study will extensively show the state of the art of the current methodologies used to assess and measures resilience in one's supply chain.

8.1 Introduction

In order to survive in the present world turmoil, companies must seek to improve their processes, systems and technologies to be able to be dynamic and flexible to meet the ongoing changes in the market (Bevilacqua et al. 2017).

This is the case of fashion industry: an horizontal concept that crosses many sectors, like apparel, footwear, leather, jewelry, perfumes, and cosmetics (Brun et al. 2008).

Moreover, what characterizes the supply network of this industry is the complexity of the supply network: many actors are involved in production activities, hence the number of stakeholders is considerable (Macchion et al. 2015).

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Furthermore, several managers now decide to differentiate their product lines in order to build a sustainable future for their companies. Many companies, therefore, tend to carry out several product development projects (Ciarapica et al. 2016). This trend be found especially in the fashion sector (Dewi et al. 2015; Choy et al. 2009).

These phenomena result in the increasing pace of business globalization of the fashion sector. For example, the design process could be carried out in a country other than the ones where the garments are manufactured and sold (Čiarnienė and Vienažindienė 2014).

This strong connection built among these networks leads to the so called "domino effect" (Scheffer 2012), the easier propagation of disturbances due to the increased connectivity of companies and stakeholders—regardless of the physical distance between these subjects (Zhao et al. 2011).

This phenomenon increases the impact of possible disruptions that a company may suffer: in particular so-called black swans (high impact events) that can bring a company to its knees.

Supply chain policy makers have to face with the consequences of disruptions, hence they have to build a strategy to mitigate risks. To this purpose, they usually carry on risk management procedures. The more critical phase of this kind of process regards the risk assessment: indeed, it is always difficult to establish both the probability of an event and the severity of its happening. Unpredictable events-metaphorically referred as "black swan events"—represent risk management's greatest weakness: indeed, we are not able to prevent what we cannot predict.

A resilient Supply Chain can adapt itself to the uncertain environment and can allow supply networks to respond well to unexpected disruptions (Pettit 2008).

Resilience, as the "Oxford Advanced Learners Dictionary" states, *is the ability of a substance to return to its original shape after it has been bent, stretched or pressed.* This definition has been enriched by the contribution of many researchers, over the years. We can cite, for instance, Christopher and Peck (2004), who defined resilience as '*the ability of a system to return to its original state or move to a new, more desirable state after being disturbed*'; while Ponomarov and Holcomb (2009) stated that the essence of Supply Chain Resilience (SCR) is *designing supply chains to incorporate event readiness, provide an efficient and effective response, and be capable of recovering to their original state or even better post the disruptive event.*

Even if resilience is becoming a prerequisite for companies operating in this sector (Pal et al. 2014), to our knowledge there is little research about this topic applied into the fashion sector.

The purpose of this research is to conduct a literature review that can lay the basis for an extensive research into the fashion supply chain resilience.

The paper is structured as follows: in Sect. 8.2 we present our research process. In Sect. 8.3 we show the main results of this literature review. Section 8.4 provides an insight of the research state-of-the art by providing a list of main factors influencing Supply Chain Resilience cited among the literature cited in this paper.

Fig. 8.1 Research approach adopted

8.2 Research Approach

In order to conduct a literature review of works concerning supply chain resilience in fashion industry, the research approach represented in (Fig. 8.1) has been developed, according to the suggestions provided by Webster and Watson (2002).

Firstly, we selected the most relevant scientific and academic databases to extract the extant literature contributions. We decided to query EmeraldInsight, IEEExplore, ScienceDirect, Scopus, and Google Scholar.

Then, we defined the Research Field we would conduct our research into: we focused into the 10 most relevant to our research: Business Management and accounting, Chemical Engineering, Decision Science, Economics, Econometrics and finance, Energy, Engineering, Mathematics, Social Science.

As final step, we defined the search keywords in order to mine relevant papers related to our target industry. We divided this keywords into two categories: industrial sectors (Fashion, Textile, Apparel, Footwear, Leather, Jewelry, Perfumes and Cosmetics) and topic (Resilience, Risk Supply Chain, Disturbance and Disruption).

The research of existent literature was then performed as follows: topics, industrial sectors and research fields summarized in Table 8.1 were combined together through a Cartesian product (Eq. 1), in order to carry out all the possible tuples, and each of the obtained foursome was inserted into the selected databases.

$$U = A \times B \times C \times D \tag{1}$$

Equation 1: Cartesian Product

A total of 2000 foursome queries were conducted.

The following step consisted of filtering the results, with the aim of improving the relevance of the selected literature: publications prior to 2004 were excluded, but this did not cause a loss of generality. Indeed, according to (Kamalahmadi and Parast 2016b), the concept of supply chain resilience was not widely developed earlier.

Moreover, only articles written in English were taken into account. In order to verify whether the sample could have been enlarged and if any other relevant work should have been included in our literature survey, even references of the selected articles were analyzed.

Table 8.1 Industrial sectors, topics, research field and databases analyzed for the current literary review

A	B	C	D
Database	Research field	Industrial sector	Topic
Sciencedirect	Business	Fashion	Resilience
Scopus	Management and accounting	Textile	Risk
Google Scholar	Chemical engineering	Apparel	Supply chain
IEEE	Decision science	Footwear	Disturbance
Emerald Insight	Economics	Leather	Disruption
	Econometrics and finance	Jewelry	
	Energy	Perfumes	
	Engineering	Cosmetics	
	Mathematics		
	Social science		

After having identified the research sample, each paper was deeply reviewed and analyzed: any work that did not pass the last check was excluded from the analysis.

This procedure allowed us to shed the light on the current attitude in applying methodologies to measure supply chain resilience in the fashion, textile and apparel industry.

8.3 Results

As noted in previous sections, there is little research concerning resilience applied to fashion industry, hence the aim of the current work addresses this research gap.

The research approach described in section III and adopted in order to carry out the current literature review resulted to be very efficient. Indeed, several articles were analyzed and 73 of them were found to be relevant according to the predetermined criteria. Even though our search excluded publications prior to 2004 (Kamalahmadi and Parast 2016b), none of the selected papers was published before 2004. The upper time bound, instead, was posed to March 2017, hence any other work edited after that month was not considered.

As we can infer from Fig. 8.2 and according to Cetinguc et al. (2017), in 2014 a peak in publications (12) concerning supply chain management, risk management and fashion industry was registered. Even in 2008, 2015 and 2016 there was a considerable amount of paper production, respectively 11, 10 and 9 works. Since we only consider publications of the first quarter of 2017, we can hypothesize that, by the end of the year, the number of edited paper will considerably increase.

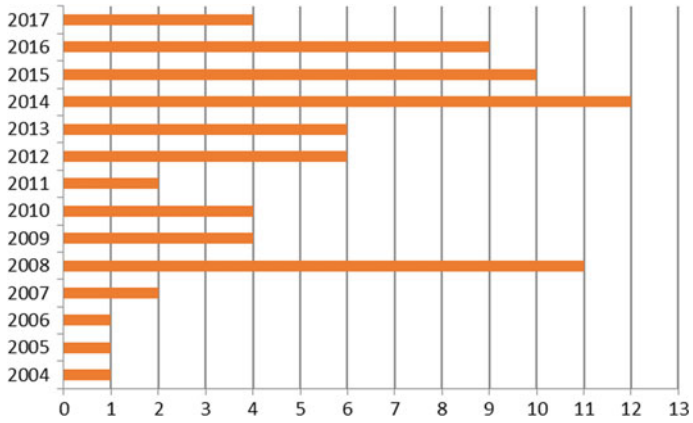


Fig. 8.2 Publications per year

During the analysis, the main topics of the reviewed works were classified into four clusters, as reported in Fig. 8.3. In order to deeply understand the classification considered, we define Supply Chain Management according to Mentzer et al. (2001): "the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole". Moreover, we considered Risk Management as the main topics of those works describing models, methods or conceptual frameworks to cope with Supply Chain Risk. It was found that 13 articles concerned Supply Chain Management and 14 were about Risk Management in fashion industries. However, the most common topic regards Factors influencing Fashion Supply Chains (45 papers), that is the set of decisions, pros and cons to take into consideration during the creation of a Supply Chain. Just one of the 73 papers included in the analysis did not belong to this classification (Cetinguc et al. 2017). Indeed, it regards a literature review on publications trends on Fashion industry and Supply Chain Management.

A further analysis was conducted to evaluate the approach applied in each paper: in particular, we were interested in differentiating within the case study approach and other techniques. As presented in Fig. 8.4, 15 (21%) out of the 74 articles were case studies.

8.4 Factors Influencing Supply Fashion Supply Chain Resilience

For the next phase, a more thorough research was conducted: we refined once more the results, in order to find and study the main factors influencing Fashion Supply Chain Resilience. Among the 73 papers analyzed for this literature review, indeed,

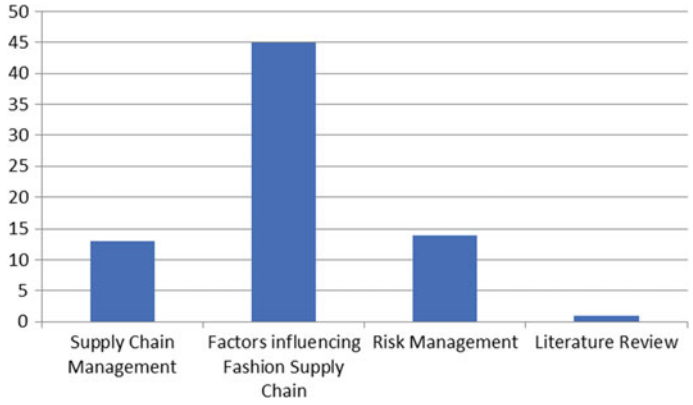
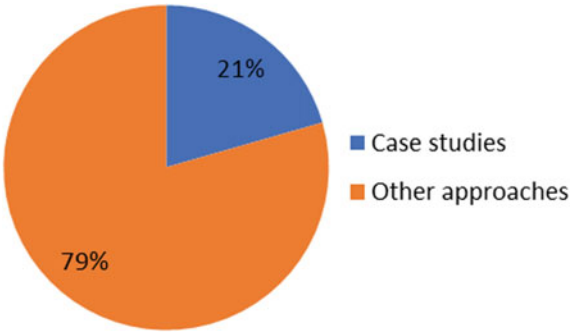


Fig. 8.3 Paper classification by topic

Fig. 8.4 Paper classification by methodology approach



we considered only the 45 articles presenting Factors influencing Fashion Supply Chain Resilience as a main topic and then we selected the 26 more relevant ones.

8.4.1 Factors Research

The first step consisted in the compilation of the raw factors table (see Table 8.2), in which we listed all the factors mentioned in the 26 papers selected: we can note that several authors evidenced the presence of common factors influencing fashion supply chain.

In particular, demand variability or uncertainty and customer needs and preferences are cited in almost all the selected papers as critical factors for the development of a robust supply chain. Considerations about product variety and life cycle are reported in the half of the selected articles.

Even competitors' behavior were found to have a relevant impact on supply chain resilience, according to nine out of the 26 authors. Moreover, SC characteristics such

Table 8.2 Factors within each paper

Source	Factors	#
Turker and Altuntas (2014)	Highly competitive market, pressure on costs, globalization, changes in market customer base, lean SC strategies, just-in-time sourcing	6
Li et al. (2014)	Pollution, over-consumption of energy, uncertainty of consumers' choices, environmental problem, regulatory capacity of governments, SC collaboration, SC visibility	7
Macchion et al. (2015)	Market competition, fragmentation of production activities, geographical dispersion, demand unpredictability, globalization, counterfeits	6
Mehrjoo and Pasek (2014)	Consumers' preferences, product variety, short product life cycles, perishability of products, demand highly volatile and uncertain	5
Venkatesh et al. (2015)	Globalization, complexity of SC, economic events, no SC coordination, infrastructural breakdown, delay in lead time, inaccurate forecasting, customer dissatisfaction, risk due to security and safety, financial risk	11
Čiarnienė and Vienažindienė (2014)	Volatility of demand, outsourced production, SC complexity	3
Caniato et al. (2012)	Environmental impact, time-based competition, high competitive pressures, short products life cycle	4
Li et al. (2016)	Industry eco-unfriendly, financial crisis, demand changes (due to environmental concerns)	3
Dewi et al. (2015)	Short product life cycle, competitive market, uncertain market demand, rapid change of customer needs, wide variety products, complex SC, long SC, lack of organizational structure, poor project management skills	9
Vaagen and Wallace (2008)	Globalization, increased levels of competition, short product life cycles, demanding customers, product variety, market uncertainty, excess inventory and stock-outs	8
Martino et al. (2016)	Wide product variety, short product life cycle, highly unpredictable demand, impulsive demand	4
Martino et al. (2015)	Market uncertainty, consumer behavior uncertainty, competitors' initiatives, many actors between company and market, lack of information from wholesalers, no interaction into the SC, forecasting error, poor virtual integration, long production LT, delays in LT, returns of entire lots in case of defects, many competitor, poor brand recognition abroad, lack of eco-design, long SC, waste production	16

(continued)

Table 8.2 (continued)

Source	Factors	#
Şen (2008)	Short product life cycles, high product variety, volatile demand, demand forecast ability, flexible production, SC collaboration	6
Hakan and Pal (2013)	Economic crises, financial performance, lack of alternate high-quality suppliers, low price competition, low flexibility in inventory management	5
Wang et al. (2012)	Volatile demand, loss of reputation risk, intense competition, global supplier selection, vendor selection problems, supply and demand coordination, terrorism, labor strikes	8
Chow et al. (2015)	SC visibility, SC cooperation	2
Li et al. (2015)	Financial crisis, fashion industry is a source of pollutants, risk of damage to brand evaluations, more volatile demands, Sustainability improve firms' image	5
Abylaev et al. (2014)	Low flexibility, low adaptation, economic shock, lack of raw materials, strikes, dependency of political changes, higher protectionist measures, selective embargo, tariff barriers, favorable international trade	10
Mehrjoo and Pasek (2016)	Deterioration, obsolescence, seasonality, technology progress, governmental regulations, environmental effects, uncertainty in demand, high product variety, increased customer expectations, more global competitions, complex SC, longer SC, short product life cycles, low predictability, high level of impulse purchases, high levels of price competition, delivery delays	17
Ait-Alla et al. (2014)	Demand uncertainties, rapid product obsolescence, production planning model	3
Guercini and Runfola (2010)	Knowledge sharing	1
Choy et al. (2009)	Short life cycles products, erratic customer preferences, impulsive purchasing, improving the information access	4
Marmo (2010)	Dust explosion	1
Pal et al. (2014)	Economic recessions, global trade conditions, financial fluctuations, legislation, changing customer requirements and demands, lack the necessary skills to pursue long-term strategies, continuity strategies, flexibility in strategic decision making	8

(continued)

Table 8.2 (continued)

Source	Factors	#
Escalona Orcao and Ramos-Pérez (2015)	Complex and extensive trans-national networks, unpredictable demand, efficient logistics	3
Shen et al. (2014)	Short life cycles products, SC coordination, Information sharing	3

as coordination, visibility, complexity and visibility plays a vital role in the evaluation of the resilience of the supply chain itself.

8.4.2 Concept Taxonomy

Analyzing the selected papers, a wide number of different factors was extrapolated. The aim of the current section is to classify them into clusters of concepts, according to already existent literature. Moreover, a combination of Delphi method and Cognitive Modelling Group criteria were applied to enhance and confirm the validity of the analysis.

In order to increase the relevance of this study, experiences and knowledge contributions from both the academic world and from fashion industry were considered to be fundamental. To this purpose, two academics whose main research field was Supply chain management and three Supply Chain managers participated to this classification. Their first task consisted of analyzing the factor list and to cluster them, with the aim of creating an effective list of concept to be included into the cognitive map.

A second phase regarded the discussion between these experts, in order to reach global approval. After 3 iterations of Delphi analysis, the classification was approved: 28 concepts (see Table 8.3) were considered sufficient to explain factors influencing Supply Chain, and to guarantee a clear comprehension of the analysis.

8.5 Conclusion

In every industry, management should be aware of their capacities, difficulties and priorities. An efficient information management in any organization can provide consistent advantages and create important financial and business benefits (Bevilacqua et al. 2015). Thus, combined with the application of Resilience concept to the Supply Chain Management can provide a guide survive to competitors' pressure. Indeed, through the understanding of the resource state and of their strengths, firms should recognize their potential expansion areas. Furthermore, an actual competitive advantage can be created considering not only strengths and positive aspects towards rivals,

Table 8.3 Concept taxonomy

#	Concept	Description	Factors
C1	Lean production characteristics	All practices connected to lean production	Lean SC strategies, just-in-time sourcing, excess inventory and stock-outs, low flexibility in inventory management, production planning model
C2	External financial risk	Risks linked to the financial sector in which the SC operates	Economic crisis (x6)
C3	Internal financial risk	Risks linked to the financial situation of the enterprises	Financial risk, financial performance, financial fluctuations
C4	Market volatility	Uncertainties linked to market developments	Customer dissatisfaction (x2), uncertainty of consumers' choices (x7), demand unpredictability (x9), demand changes (due to environmental concerns), product variety (x6), impulsive demand (x2)
C5	Market competition	Rivalry amongst players operating in the sector	Highly competitive market (x9), global competition, low price competition (x2)
C6	Market position	Status of a company or its products in specific markets	Poor brand recognition abroad, loss of reputation risk, risk of damage to brand evaluations
C7	Risk management culture	All of the risk management branches: prevention techniques, risk evaluation, reduction of action plans to face sudden disturbances	Lack the necessary skills to pursue long-term strategies, continuity strategies, flexibility in strategic decision making
C8	SC visibility	Knowledge of the state of the operations along the supply chain	SC collaboration (x5), SC visibility (x2), many actors between company and market, lack of information from wholesalers, poor virtual interaction, supply and demand coordination, knowledge sharing (x2)
C9	SC vertical integration	Degree of insourced operations	Outsourced production
C10	Deliberate threats	Intentional attacks aimed at disrupting operations	Risk due to security and safety, terrorism

(continued)

Table 8.3 (continued)

#	Concept	Description	Factors
C12	Government restrictions	National policies that apply to all sectors of free trade	Higher protectionist measures, selective embargo, tariff barriers, favorable international trade, global trade conditions
C13	Loss of infrastructure	Physical loss of infrastructures: productive plants, etc.	Infrastructural breakdown, dust explosion
C14	Materials flow interruption	Interruption of the normal flux of materials or final products	Delay in lead time (x3), returns of entire lots in case of defects, deterioration
C15	Manpower availability	Availability of human resources to carry on normal activities inside the SC	Labor strikes (x2)
C16	Energy sources availability	Availability of energy sources to carry on normal activities inside the SC	Over-consumption of energy
C17	Political economy	Level of intervention of public bodies on economy with the aim of modifying the macroeconomic system to reach the objectives	Regulatory capacity of governments, dependency of political changes
C18	Institutional policies	Formal restrictions regarding products in the fashion sector	Governmental regulations, legislation
C19	Organization	Human resource structures, policies, skills and culture	Lack of organizational structure, poor project management skills
C20	Technology dependence	Degree of dependence to external players	Technology progress
C21	Flexibility in sourcing	Ability to quickly change inputs or the mode of receiving inputs	Flexible production, lack of alternate high-quality supplier, global supplier selection, low flexibility, low adaptation, lack of raw material, efficient logistics
C22	Flexibility in order fulfillment	Ability to quickly change outputs or the mode of delivering outputs	vendor selection problems, low flexibility, low adaptation, efficient logistics
C23	SC length	Refers to how many players are parts of the SC	Long SC (x3)

(continued)

Table 8.3 (continued)

#	Concept	Description	Factors
C24	Degree of centralization of asset and/or facilities	Degree of concentration of supply chain assets	Fragmentation of production activities, geographical dispersion
C25	Sustainable development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs	Environmental impact (x4), eco-friendly impact, lack of eco-design, waste production, fashion industry is a source of pollutants, sustainability improve firms' image
C26	SC complexity	Degree of complexity of the SC	Globalization (x4), SC complexity (x4), Complex and extensive trans-national networks
C27	Fast supply chain	Quick response supply chain structure	Short products life cycles (x5), perishability of products, time-based competition, obsolescence (x2), seasonality
C28	Counterfeits	Presence, in the market, of original product imitations	Counterfeits

but also weaknesses and potential threats: having a global view of the environment will help management to objectively evaluate risk and to prevent issues.

A global supply chain should provide high levels of collaboration between the different tiers. Moreover, a strong connection between and within firms belonging to the Supply Chain plays a vital role in the managing disruptions and difficulties related to the un-foreseeability of the environment.

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