AGILE versus RESILIENT SUPPLY CHAINS: COMMONALITIES AND DIFFERENCES

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Abstract
The paper presents basic reasons for searching of new supply chain management concepts. It highlights agile and resilient supply chains as main contemporary concepts, defines them and identifies their key drivers. The aim of the paper is to compare these concepts, to determine the basic commonalities and differences and to specify them into the area of agile and resilient capabilities and their building.

Keywords:
Agile supply chain, resilient supply chain, change, disruption

1. INTRODUCTION
Leaness is currently the leading approach to supply chain management. The main principle of lean supply chains is elimination of any part of the system that does not bring value (it is wasting) [1] – costly inventory, excessive capacities, duplicate suppliers, distribution elements or transportation. The primary objective is to achieve a highly efficient supply chain (cost minimization) and to satisfy the demanding requirements of customers (competitive level of services). However, the concept of lean supply chain is closely linked with a relatively steady business environment. This is in contrast with the following trends: globalization, outsourcing, centralization, IT-dependence, complex product and service, deficit of information, specialized factories, volatility of demand, technological innovations [2, 3].

The way out of this situation is an effort aimed at searching for new concepts that would provide suitable complement (not replacement) to the paradigm of leaness. The concept of agile and resilient supply chain represents one of the main directions in this area. The aim of the paper is to compare these concepts, to determine the basic commonalities and differences and to specify them into the area of agile and resilient capabilities and their building.

2. AGILE SUPPLY CHAIN
In the last decade, agility has been one of the key concepts discussed by many authors. Christopher defines agility as an ability of an organization to respond rapidly to changes in demand both in terms of volume and variety [4]. Sheffi emphasizes the unpredictability of changes – agility is the ability to respond to unanticipated changes [5]. Sharifi and Zhang focus their attention not only on the changes in demand (market), but on all the changes in the business environment – agility is the ability to cope with unexpected changes, to survive unprecedented threats of business environment, and to take advantage of changes as opportunities [6]. Charles et al. point out the short-term character of the changes, and they distinguish between agility and adaptability – while agility is being able to deal with and take advantage of uncertainty and volatility, adaptability is rather used for more profound medium-term changes [7]. And finally, Chinnaiah and Kamarthi remind that virtually anything can be changed if cost is not a constraint, but change at any cost is not a viable solution [8].
That is why, for further research work, the agility of the supply chain will be defined as the ability of the supply chain to react very quickly, but at acceptable cost, to short-term, unexpected and significant changes in the business environment in order to satisfy customer requirements.

The above presented definitions make it clear that the key driver of agility is the change in the business environment. Although changes are a permanent part of the business environment, nowadays, they come quicker, their impact is greater and their predictability is worse. The classification of the changes under consideration is shown in Fig. 1. Generally, the changes can be divided into two groups – the changes in the competitive environment (especially customers, suppliers, competitors) and the changes in the general environment (politics, economics, society, and technologies).

To achieve agility, the necessary capabilities must be created. Their construction can make use of appropriate principles and ways (see Fig 2). The definition of these capabilities and principles / ways will be discussed in the next part of this article.

3. RESILIENT SUPPLY CHAIN

Resilience of supply chains has been researched for a relatively shorter time, in comparison with agility. Christopher and Peck define resilience as the ability of a system to return to its original state or move to a new, more desirable state after being disturbed [10]. Similar definition of resilience is presented by Sheffi and Rice – resilience is the ability to bounce back from a disruption [11]. For further research work, the resilience of the supply chain will be defined as the ability of a supply chain to return to its original state in case of its serious disturbance.
The key driving force in case of resilience is disruption. According to Christopher and Peck, the disruptions in a supply chain (the risk of their creation) can be classified into the following categories: internal to the firm (process and control risks), external to the firm but internal to the supply chain network (demand and supply risks) and external to the network (environmental risks) [10] (see Fig. 3). Disruptions are related not only to forward logistics flows, but to reverse ones too [13].

Any significant disruption will have a typical profile in terms of its effect on company performance. The nature of the disruption and the dynamics of the company’s response can be characterized by the following stages [11] (see Fig. 4): (1) Preparation, (2) The disruptive event, (3) First response, (4) Initial impact, (5) Full impact, (6) Recovery preparations, (7) Recovery, and (8) Long-term impact.

Similarly as in the case of agility, to achieve the resilience of a supply chain, the necessary capabilities must be created. It is important to use suitable principles and ways in order to build these capabilities (see Fig 5). The definition of these capabilities and principles / ways will be discussed in the next part as well.

4. COMPARISON OF BOTH CONCEPTS

The comparison of these two concepts clearly shows their gradual convergence. The basic similarity is primarily resulting from the fact that both of these concepts deal with short-term, serious and unexpected events (see Fig 6). This also makes them different from classical risk management which works mainly with events with large probability of occurrence and large impact.

The change of environment is the driving force of agility, which can be represented by threats or opportunities. On the contrary, the driving force of resilience is disruption that can originate in the supply chain or the business environment. A comparison of both concepts
can be made in the form used in Fig 7 A. The Figure shows that agility does not solve the internal supply chain events and, vice versa, resilience focuses especially on the negative events of the business environment. However, Sheffi argues that serious disruptions in the supply chain also bring unexpected opportunities [14]. Based on that assumption, agility becomes a capability of the resilient supply chain (see Fig 7 B).

![Agility vs Resilience Diagram](image)

**Fig. 7** Comparison of agility and resilience

If there is an intersection of the two concepts, it can be assumed that there will be mutual overlaps also in the capabilities and the ways leading to their building. That is why there can be recommended their integrated implementation into the supply chain management, which will lead to achieving synergy effects, both during the implementation of the two concepts, and during the subsequent management of the supply chain. A resilient supply chain without agility capabilities will suffer a greater loss of performance in the early stages of the disruption profile, which will unnecessarily prolong the recovery of the chain. On the contrary, an agile supply chain without resilient capabilities will still be able to respond quickly and effectively to the threats and opportunities of the business environment, but the resulting disruptions will have a relatively large negative long-term impact. The ideal situation occurs when agile capabilities are used to minimize the initial impact of external disruption and, consequently, the full impact is quickly eliminated thanks to the resilient capabilities.

The recent introduction of prohibition in the Czech Republic due to the illegal production and sale of dangerous alcohol can be considered as an example of such a disruption. The prohibition was related to spirits with alcohol content higher than 20%. The prohibition posed a great threat to manufacturers of that alcohol, and the companies reacted differently at the early stage. The more successful companies quickly moved their main sales abroad or produced special limited editions of beverages with low alcohol content. Less successful companies filled their production warehouses and opted for a radical decrease of production. On the contrary, for producers of spirits with alcohol content of less than 20%, the prohibition represented an unexpected opportunity (especially for producers of beer and wine). However, prohibition meant a severe disruption of standard processes realized within the framework of the supply chain management for all companies, which led to a negative long-term impact. The producers of spirits with higher alcohol content suffered losses caused by the ban on sales of their products in the Czech Republic (and later in the European Union), while the producers of spirits with a lower content of alcohol had problems to satisfy the drastically increased demand.

5. AGILE AND RESILIENT CAPABILITIES AND THE METHODS OF THEIR BUILDING

The conclusions of two recent studies can be used to compare the agile and resilient capabilities. The agile capabilities are summarized by Charles et al. [7] and the resilient ones by Pettit et al. [15]. The principles and ways of their building can be compared using the work of Christopher at al., who defines agility as a direct
part of the resilient supply chain [10, 16]. Given the scope of the article, Table 1 shows only the names of capabilities and principles / ways for the purpose of comparison. A deeper research of their significance can bring even more important interconnection of both concepts.

Table 1 Agile and resilient capabilities and principles / ways

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<th>Agile principles/ways [16]</th>
<th>Resilient principles/ways [10]</th>
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As the key commonalities of these two concepts can be considered:

- Flexibility – it is base for agile and resilient supply chain building.
- Visibility – many sophisticated methods is used to acquire and analyse internal and external information [17, 18].
- Collaboration – minimally through sharing information [19], preferably through collaborative planning, forecasting and replenishment (CPFR) [20].

6. CONCLUSION

The objective of this article was to compare the concepts of agile and resilient supply chain. Given the existence of mutual overlaps, it can be recommended their integrated implementation in the supply chain management, which will lead to achieving synergy effects, both during the implementation of the two concepts, and the subsequent management of the supply chain. Further research will be focused on creating a single integrated concept of supply chain management, which will be examined using simulation techniques on a model of a supply chain from automotive industry in its most vulnerable part, i.e. on the supply side.

ACKNOWLEDGEMENTS

The work was supported by the specific university research of the Ministry of Education, Youth and Sports of the Czech Republic No. SP2012/42 and by Internal Grand Agency of ŠKODA AUTO, a.s. No. IGA/2012/3
LITERATURE


