



## LEAN AND AGILE SUPPLY CHAIN MANAGEMENT CONCEPTS IN THE ASPECT OF RISK MANAGEMENT

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**ABSTRACT.** Lean and agile supply chain managements, as well as the hybrid forms (leagile supply chains), are popular and relatively widely discussed in literature. However, there are some disputes concerning differentiating these types of the management from tools and instruments such as outsourcing, single sourcing, quick response, standardizing principles and postponement. The above-mentioned concepts are discussed in a positive light as tools for achieving a competitive advantage of supply chains. A recently introduced term SCRM (Supply Chain Risk Management) emphasizes the importance of the risk management in supply chains also due to the ability to achieve a competitive advantage of those chains in which a risk is identified, estimated, managed and controlled. Therefore, it seems to be of benefit to look for the relationships and dependencies between these concepts (some references were made to the author's own research). A significant part of the papers concerns the identification of risks related to the above-mentioned instruments of supply chain management. However, the concepts of lean and agile management are often discussed due to the fundamental determiners of the functioning of a supply chain such as the nature of the demand, the character of goods and the total lead-time. According to the author, the discussed concepts could be viewed concerning supply chain risk management. It could facilitate the choice of a supply chain strategy based on the risk analysis. Several case studies were included to support the presented considerations.

**Key words:** risk, supply chain risk management, lean supply chain, agile supply chain.

The basic criteria for the evaluation of supply chains are leanness, ability to react and flexibility [Ciesielski 2001, Pfohl 1999]. The emergence of "lean" supply chains is a result of the use of relationships between the quality and costs - two factors that affect the competitiveness. The other ones are: time, price, speed, customer satisfaction, productivity, diversity and technology. The quick response ability refers to the reaction to changes of the demand and depends on the level of the cooperation and the integration within the supply chain. However, the flexibility allows adapting the logistic system of the company to mutable environmental conditions by using the time factor. Another factor should be also taken into account in today's analysis of the supply chain - the risk. Emphasizing the importance of the risk, the terms "vulnerable" or "resilient" supply chains or SCRM (Supply Chain Risk Management) are begun to be used. It should be pointed that, in addition to the vulnerability, the supply chain needs proper selection of five "V" elements such as: value, velocity, variability and visibility [Closs 2004]. The three most important determinants of the functioning and the development of global (as the most popular) supply chains are: the product's characteristics, the nature of the demand and the total replenishment time [Christopher, Towill 2002]. The identification of factors influencing the supply chain and its attributes leads to the designation of main decisions in supply chains, which should help to increase the competitiveness, as well as to have its reference to the risk, which always existed but only recently has gained the high importance, especially for supply chains [Ritchie, Brindley 2005]. The conclusion can be formed from the analysis of the literature and research

reports that SCRM is the essential element of business, particularly in the supply chain and hence the attempt was made to analyze the concept of the supply chain management, also because of the risk, they are related.

The own researches were conducted in reference to the results of Aberdeen Group, which among other, were related to the perception of the relationship between tools for the supply chain management and the increase of the risk level. Such instruments were mentioned as: centralized distribution, reduction of suppliers' base, centralized production, reduction of stock level, outsourcing, single sourcing, JIT (Just In Time), VMI (Vendor Managed Inventory), LCCS (Low Cost Countries Sourcing). The respondents were asked to decide if there are relationships between above-mentioned factors and the risk level or not or if they do not have an opinion on that subject.

Table 1. Dependencies between selected instruments for supply chain management and the risk level  
Tabela 1. Zależności między wybranymi instrumentami zarządzania łańcuchem dostaw a poziomem ryzyka

percent of response [%]: instrument of supply chain management	„There is a dependency”	„There is no dependency”	„I have no opinion”
centralized distribution	61	19	20
reduction of suppliers' base	73	6	21
centralized production	45	27	28
reduction of stock levels	73	8	19
outsourcing	66	19	15
single sourcing	64	9	27
JIT	69	6	25
VMI	54	10	36
LCCS	54	8	38

Source: own work

The majority of respondents confirm the presence of the indicated dependency, so it seems to be relevant to make the risk analyze of the concepts: lean, agile, leagile and tools of supply chain management connected with them. However those relationships are quite complex, the risk can increase in case of using one tool and decrease for the other one. Therefore, the situation can be quite complicated when a few tools are used simultaneously. Therefore, the first task should be to systematize the knowledge of concepts, strategies and tools of supply chains and only then to attempt to conduct the risk analysis.

Supply chains and supply chain management change and evolve mainly under the pressure of the competition. Generally, the existing activities of supply chain management aim at the cost reduction by using instruments for their leanness (lean management concept) or at higher service level by higher flexibility (agile management concept).

The realization of the operation better than competitors may be performed by providing the same or comparable products but at a lower price. It is so called the cost leadership. The lean management shows the methods to reduce the costs and to sell cheaper than the competitors do. The application of the lean concept enables to reduce the logistic costs, generally by eliminating any loss in the supply chain (so called muda). It could be: the designing of efficient operations, the reduction of stocks levels, the flow time's reduction, lower use of resources, lower employment, and elimination of doubled without added value actions. The achievement of these objectives is possible by the use of such methods as: JIT, continuous improvement, time compression, no-stock production, TQM. Lean supply chains allow obtaining the advantage on markets, where the demand is relatively easy to predict and plans and schedules, prepared on basis of demands forecasts, are precisely realized. The benefits of the implementation of the lean management are obvious, but it can be also concluded, that

the more efficient operations are connected with the higher risk, because of higher attention to costs matters and therefore the difficulties in coping with unforeseen events [Waters 2002a]. The agile management is an alternative approach.

Agile management consists in carrying out the activities connected to strategy of the diversification, to deliver the product, the consumers cannot find elsewhere. The quick response to changes in the demand is most important. This activity in logistic operations involves the use of flexible and agile operations to provide an excellent service level of final customer [Waters 2002b]. It could be measured as: the ratio of products delivered to ordered, the quantity of mistakes made during the sorting process, the ability to "cancel" the orders, the percentage of orders fulfilled in 100% in accordance with requirements, the size of damage, price reduction due to failure to meet delivery times, easiness to prepare the goods in accordance with order, etc. This strategy allows reacting to unforeseen events such as short delivery delays, changes in demands as well as natural disasters. It should be pointed out. That from the perspective of the supply chain, each problem related to logistic indicators, could be due to various reasons. For example, the delayed delivery to the customer may be a result of an improperly functioning logistics but also of wrong demand forecasts, production problems, road works, traffic jams, strikes of the carriers and many other reasons. Usually the logistics providers are blamed for errors in various parts of the system [Waters 2002c]. The agility is especially important when product life cycles become shorter, market demands change more rapidly and the demand becomes more sensitive. It is also the best way to satisfy more demanding clients because of a lower risk of unsatisfying of the customers, lower risk of lost orders and too slow response. However the agility has its own risks, e.g. it needs the free spaces to secure the flexibility of the operations and it causes the reduction of the productivity. The table 2 shows the characteristics of efficient and flexible supply chains taking into account the strategy of production and replenishment.

Table 2. The characteristics of lean and agile supply chains in strategic aspect  
Tabela 2. Cechy wydajnych i elastycznych łańcuchów dostaw w aspekcie strategicznym

supply chain characteristics	Lean	Agile
superior objective	meet the foreseeable demand in the most efficient and therefore the cheapest way	respond quickly to changes in demand in order to reduce the shortage of supply, price reductions and obsolescence of goods
market success factors	quality total delivery time availability	quality cost total delivery time
the most important element of competitive advantage	cost	availability
the strategy in the orders' area	to shorten the cycle of the fulfillment of the orders and if it is possible, without increasing costs	boldly invest in methods to reduce the cycle of the fulfillment of the orders
suppliers' selection strategy	the superior criteria for selection should be: the price and quality	the superior criteria for selection should be: speed, flexibility and quality
stocks keeping strategy	to shorten the cycle of the inventory rotation and to minimize the stock levels in whole supply chain	to allocate the important buffer stock of semi- and final products
strategy in the area of product designing	to design products regarding the cost reduction and increasing of production productivity	to use the modular designing to postpone the phase of the diversification of the product
production strategy	to keep high level of production capacity utilization	to keep the surplus of buffer production capacity

Source: M. L. Fisher, 2005, Mason-Jones, Rachel, James B. Naylor, Denis R. Towill, 2000

Lean and agile management are simultaneously opposing and complementary and therefore recently the hybrid concept of supply chain is adopted to use. This hybrid concept is called "leagile"

[Christopher, Towill 2001] or "league" [Goldsby, Friffis, Raoth 2006]. The classification of the hybrid concept can be performed according to products, the demand type and the type of the postponement. In the first case the Pareto principle (80/20) is used to divide the products into the group manufactured in accordance with lean management (20% of assortment items, make-to-stock production, central stock management, use the benefits of scale effect) and with agile management (20% of assortment items, make-to-order production, the usage of a quick response for the demand). The second approach takes into consideration the nature of the demand. The lean concept can be successfully used in case of the stable demand. It enables to increase the productivity of operations by applying a continuous flow. In the case when the demand changes due to promotional or seasonal periods, the concept of the agile management is the better solution. The third approach refers to issues of the delay and the customization. The concept of lean management is used for basic unfinished products until they reach the decoupling point. The concept of agile management is used for the part of the chain "after" the decoupling point, in the process of the product individualization, which is the adding the characteristic elements to the base form of the product for the specific order. The decoupling point is a border between two options. The first one is the model based on forecasting, the make-to-stock production strategy, used for standardized products, the demand of which can be easily estimated. The second one is the model of the production based on the customer order only, so called make-to-order production strategy and concerns the modular and personalized products. This strategy means to postpone the final completion of the product (e.g. assembling, labeling, attaching accessories, packaging) until the customer order is received. The final fulfillment of the order e.g. attaching the accessories and introducing small changes, could take place even in a retail store.

It can be concluded that development of further types of supply chain strategies is the effect of changes occurring in their environment. The lean supply chains were sufficient until the cost reduction process was sufficient but in the further steps the market requirements started to increase as well as the competitors started to adapt this strategy too and therefore the agile management began to be a desirable one. However, it turned out, that the same criteria (like delivery speed or low cost) are not important at the same level for every product and the supply chain must be adopted accordingly. In some cases the lean management is the better solution, in others the agile management is the best one and hence the use of hybrid strategies. The various attributes that should be considered in each case are shown in table 3.

Table 3. Attributes of traditional, lean, agile and hybrid supply chains  
Tabela 3. Atrybuty tradycyjnych, wyszczuplonych, elastycznych i hybrydowych łańcuchów dostaw

supply chain \ attributes	traditional	Lean	Agile	Leagile
demand	unpredictable	predictable	unstable (undulant)	unstable and unpredictable
products	standard	functional	personalized	personalized
the major share in the total supply chain costs	physical costs and marketability costs	physical costs	marketability costs	physical costs and marketability costs
elimination of waste	low priority	basic	desirable	arbitrary
quality	market winners	market qualifiers	market qualifiers	market qualifiers
cost	market winners regarding costs	market winners	market qualifiers	market winners
web integration	not existing	desirable	necessary	mandatory
virtual integration	low priority	desirable	necessary	mandatory
information decoupling	not existing	beneficial	necessary	desirable
postponement	not existing	not required	necessary	desirable
product's concept	producer's	producer's	producer's and consumer's	producer's and consumer's
measures of quality	the percentage of defective products	the percentage of defective products	customer satisfaction	customer satisfaction
legal sanctions for the supply	not big	enclosed in long-term contracts	order's loss	order's loss
the ability to absorb risk in the supply chain	moderate	low	high	moderate

Source: M.N. Faisal, D.K. Banwet, R. Shankar, 2006

The common characteristics of lean and agile supply chains are: shortening of the lead time (as a result of the eliminating of losses in case of lean management and as a result of the ability to quick response to changes in demands in case of agile management), cost reductions, the best service level and the integration with suppliers and customers. The globalization has a definite influence on the development of the supply chain. It is connected with the use of such management tools like: offshoring, LCCS as well as the increase of clients' requirements, the lengthening and the increasing complexity of supply chains. The globalization is also given very often as the primary factor causing the increase of the risk in the supply chain. The risk may be related to each of the attribute mentioned in the table 3. Each concept of supply chain management has both undoubted benefits and threats. So perhaps, the goal of supply chain management should not be the implementation of the next strategy - SCRM, but to make aware of the threats, which can be caused by already used strategies and taking them into the consideration, especially that in practice companies indicate many risk management tools, which are also the tools of supply chain management.

For example, by the application of the JIT tool, representing a strategy of lean supply chain, some risk is reduced (e.g. surplus stock maintenance) but the other one can be increased - in case of small delay, accident, breakdown or changes in the demand, the whole supply chain is stopped. Managers, who use JIT, usually focus on the benefits and are not aware of threats, which increase the vulnerability of the supply chain. Furthermore, the JIT production system provides the flexibility to the company, where it is implemented but only while meeting certain conditions and not necessary to suppliers of that company. It requires also the close coordination at various production stages, either within the company or outside between supplier and customer [Schary, Skjott-Larsen 2002]. It is important to consider both the advantages and disadvantages of every solution chosen for the implementation. Toyota Motor Company is a good example of such situation. There was a fire in 1997 in one of its suppliers (Aisin Seiki Co.). The deliveries were organized in JIT system; the majority of assembly rooms had stock of "valve p" only for four hours. This part was not expensive but produced only by one supplier (single sourcing) [Bozarth, Handfield, 2007b]. Some experts predicted that after such a blow, Toyota would not rise for several weeks, but the production was restored after five days. Almost fifty lines producing brake valve existed in plants of thirty-six producers. According to Kosuke Ikebuchi, General Director of Toyota, the system was effective because "the company maintains a balance between the efficiency and the risk".

Similarly, the use of VMI or single sourcing may expose the company to the risk, for example, of too high dependence on one supplier. In 2001, UPF Thomson, the solo supplier of chassis frames for Discovery, the popular model of Land Rover, stopped the deliveries of financial reasons. The company UPF-Thomson became suddenly insolvent. Land Rover used to receive the deliveries of frames two days in advance to the production schedule. The lean inventory and JIT system caused that any disruption in the flow of components had an immediate impact on the Land Rover company, because this company relied on single sourcing, based on the fact, that the relationships between partners were longtime and solid (since 1950). However, these relationships were changed suddenly when UPF-Thomson was taken over by KPMG. Finally, Land Rover was forced to take over part of debts of its provider (16 million pounds) to keep it in the financial liquidity and the ability of continuously deliveries of chassis, since it had not foreseen this risk factor [Sheffi 2005].

Currently, supply chain leaders consciously apply certain strategies taking into account the risk management. For example, United Technologies Corporation introduced in 2003 a new system of the risk management in the supply chain, which was a combination of lean management and risk management among its 23 000 suppliers. The focus was put onto four elements [Walters 2007]:

- Leaders of transformation operations - to train, improve and carry out the cooperation with suppliers in order to introduce the basic lead management and risk management in companies of first-order suppliers and to encourage them to extend those rules in companies of their suppliers (second-order ones).
- System of performance indicators of suppliers - in order to establish standard measures of quality of supplies for the group of 3 000 critical suppliers.

- Supplier alert service - United Technologies verifies information on the financial indicators, market indicators and from other sources to estimate the potential risk to its suppliers. The company uses this element to monitor the financial and operational condition of above 80% of their suppliers.
- Leanness estimation - if the supplier alert service detects the risk, it informs the leaders of transformation operations, and they, in turn, analyze the operations of suppliers and introduce the improvements.

The company claims, that this system improved the stock rotation by 28% and decreased the costs caused by poor quality by 32% as well as allowed the routine identification of the risk associated with suppliers and to mitigate this risk before it influenced the business activities. The nature of a company business indicates the ability to achieve competitive advantage by lean supply chain management but the company is aware of risks and therefore the risk management is also implemented.

Similarly, the other tools of supply chain management can be analyzed. The assessment of lean and agile supply chain management concepts allows concluding, that the tools used in these systems can help to reduce the risk level. For example, the kaizen concept indicates many activities, which are to help continuous improvement and belong to risk reducing operations. It means, they reduce the probability of a disruption in the flow of goods or information, losses caused by unnecessary operations, without added values and quality problems. Similar functions can be performed by such tools as: judoka, andon, 7W, Ishikawa diagram, Pareto, autonomation, 5 times why?, TPM (Total Productive Maintenance), SMED (Single Minute Exchange of Die), 5S (Seri, Seito). Although there are many of them, still there is no clear answer, what to do in case of an occurrence of a specific risk factor [Svensson 2000].

The companies, which focus their activities on how to respond to the risk (that means they deal with its consequences) refer more often to agile strategy. For example, HP recognizes that the cost reduction could potentially increase the level of the risk and emphasizes that the greater flexibility of supply chain is associated with the flexibility, which is understood as time needed to introduce the changes as well as abilities to adapt, which depends on the size of changes, which are to be implemented. The SCRM should take into account the abilities of the reaction by the suppliers, therefore the company builds its supply chain strategy in such way to be able to react to the risk. It is enabled by [Verstraeta 2009]:

- Partnerships strategy with suppliers - to exchange the information and ensure the safety of the supply. The "flexible contracts" can serve as an example - suppliers have the possibility to change, to some agreed extend, the conditions of the contract, concerning the quantity and quality of delivered goods and services,
- Supply chain visibility - scenarios planning as a base for the modeling of supply chain is used to identify the specific incidents and to understand the "behavior" of the chain,
- Use of simulations for the operation optimizing,
- Settled response scenarios consistent with established timeframes.

HP also emphasizes that the instability may be an opportunity, not necessarily the risk. However, it is possibly if the company can answer some questions: Will my competitors suffer from the same reason? How quickly have we to response to this problem? Can we present ourselves as having control over an "unwanted" even? What will be the cost of ignoring the problem or of a delay in the response to the problem? If the company will be able to and have the means to obtain answers to these questions, it can achieve a competitive advantage.

It should be noticed, that there is not only one strategy of the risk reduction in the supply chain. Moreover, the risk reduction strategy is not always the one, which is adopted. One may choose one of four main risk strategy e.g. transfer (insurance of freight, transport and infrastructure, penalty fixed by the contract), retention (preparation of funds to cover potential damages, preparing the scenarios for unforeseen events, such as strikes, blockades of border crossing points), reduction and limitations (quality control of goods and processes, selection of suppliers and subcontractors, research of

suppliers' market for searching the potential suppliers) or avoiding of the risk (hang-up of investments).

There are several interdependencies between activities performed within the supply chain management, e.g. selection of its strategy and risk to which they are related. The managers should know, which tools, methods or supply chain management strategies are the most effective one, taking the possible big or small risk under the consideration. The table 4 shows the examples of interdependencies in risk reduction strategies for such threats as: disruption, delay, wrong forecasts, fluctuations in prices of raw materials and components, risk of not obtaining the arrears, inappropriate - too low or too high - stock level, inadequate production capacities in comparison to demands. The similar analysis could be made for each tool of lean and agile management and risks.

Table 4. Risk level for combination of decisions for supply chain and risk  
Tabela 4. Poziomy ryzyka dla kombinacji decyzji dotyczących łańcucha dostaw i ryzyka

risk factor \ decision in supply chain	disruptions	delay	wrong forecasts	supply	arrears	production capacities	inventory
to increase production capacity		↓		▽		↑	▽
to increase stock level	▽	↓		▽		▽	↑
to have different suppliers for the same goods	↓			▽		▲	▽
to increase the speed of reaction		↓	↓				↓
to increase flexibility				▽		↓	▽
to aggregate the demand			↓			↓	↓
to increase the effectiveness							▽
to increase the customer quantity					▽		

▽ - reduces the risk, ▲ - increase the risk, ↓ significantly reduces the risk, ↑ significantly increases the risk

Source: S. Chopra, M.S. Sodhi, 2004

The presented supply chain management concepts have strong relationships with such trends as: bigger importance of reducing the stock levels, mitigation of the risk of an economic slowdown (the uncertainty of prices of raw materials, salaries, rates of exchange, financial risk of suppliers), shortening the supply chain (more and more U.S. manufacturers rebuild supply chains by eliminating factories in distant countries), increasing the visibility of supply chains and products safety (increasing the safety standards, even Chinese authorities decided to control the quality of products and their safety [www.e-logistyka]). The majority of challenges indicated in the report show the relationship with the risk management. The companies will have to take into account the risk management in their supply chain strategies. Therefore, the analysis of supply chain management concepts in the context of risk could be useful.

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## KONCEPCJE WYSZCZUPLONEGO I ELASTYCZNEGO ŁAŃCUCHA DOSTAW W ASPEKCIE ZARZĄDZANIA RYZYKIEM

**STRESZCZENIE.** Popularnymi i dość obszernie opisywanymi w literaturze koncepcjami zarządzania łańcuchem dostaw są koncepcje wyszczuplonego (lean) i elastycznego (agile) zarządzania łańcuchem dostaw, a także ich formy hybrydowe (leagile). Nie ma jednak spójności w rozróżnieniu ich od instrumentów i narzędzi, między innymi takich jak: outsourcing, single sourcing, quick response, reguły standaryzacji i opóźnienia (postponement). Koncepcje te są opisywane w pozytywnym świetle, jako narzędzia wspomagające osiągnięcie przewagi konkurencyjnej łańcuchów dostaw. Od niedawna wprowadzono pojęcie SCRM (Supply Chain Risk Management) - zarządzania ryzykiem w łańcuchu dostaw, podkreślając przy tym duże znaczenie zarządzania ryzykiem dla łańcuchów dostaw - również ze względu na możliwość osiągnięcia przez łańcuchy, w których zidentyfikowano, oszacowano, zarządzano i kontrolowano ryzyko przewagi konkurencyjnej. Warto więc zastanowić się co łączy wymienione koncepcje i czy występują między nimi zależności (tu odniesiono się do pewnych wyników badań własnych). Znaczna część opracowań dotyczy identyfikowania ryzyk związanych z wyżej wymienionymi instrumentami zarządzania łańcuchem dostaw. Natomiast koncepcje lean i agile management często rozpatruje się ze względu na podstawowe determinanty funkcjonowania łańcuchów dostaw, takie jak natura popytu, charakter produktu, całkowity czas uzupełnienia. Zdaniem autorki wskazane koncepcje można również rozpatrywać w aspekcie możliwości radzenia sobie z ryzykiem przez łańcuch dostaw. Mogłoby to przykładowo ułatwić wybór strategii łańcucha dostaw właśnie w oparciu o analizę ryzyka. Rozważania wsparto krótkimi analizami przypadków.

**Słowa kluczowe:** ryzyko, zarządzanie ryzykiem w łańcuchu dostaw, szczupły łańcuch dostaw, elastyczny łańcuch dostaw.

## KONZEPTE VON LEAN UND AGILE LIEFERKETTEN IN BEZUG AUF RISIKOVERWALTUNG

**ZUSAMMENFASSUNG.** Die Konzepte von Lean- und Agile-Lieferketten, wie auch ihre Mischformen (leagile) sind sehr oft in der Literatur diskutiert. Allerdings gibt es einige Meinungsverschiedenheiten wie sollen sie von solchen Werkzeugen und Instrumenten wie Outsourcing, Single Sourcing, schnelle Reaktion, die Regeln der Standardisierung und Verschiebung unterschieden werden. Diese Konzepte werden in einem positiven Licht beschrieben, als das Werkzeug um Wettbewerbsvorteil von Lieferketten zu erreichen. Letztens wurde ein Begriff von SCRM (Supply Chain Risk Management) eingeführt - die Risikoverwaltung in der Lieferkette. Bei dieser Gelegenheit wurde die Bedeutung von die Risikoverwaltung betont, auch wegen die Möglichkeiten der Wettbewerbsvorteil von diesen Lieferketten, in denen wurde das Risiko identifiziert, geschätzt, verwaltet und kontrolliert, zu erreichen. Es scheint eine Überlegung wert zu sein, um die Beziehungen und Abhängigkeiten zwischen diesen Konzepten zu suchen (einige Referenzen wurden auf den Forschungsergebnissen von dem Autor gemacht). Ein bedeutender Teil der Studien betrifft die Identifizierung von Risiken im Zusammenhang den oben genannten Instrumente der Lieferketteverwaltung. Allerdings sind die Konzepte der Lean- und Agile-Verwaltung oft wegen der fundamentalen Determinanten der Funktionsweise der Lieferkette wie die Art der Nachfrage, den Charakter von Waren und die Durchlaufzeit untersucht. Nach Ansicht des Autors könnten die genannten Konzepte auch in Bezug auf die Gelegenheit um das Risiko in der Lieferkette zu behandeln. Zum Beispiel könnte es die Wahl der Lieferkettestrategie auf der Grundlage der Risikoanalyse erleichtern. Die kurze Fallstudien wurden vorgestellt um die Überlegungen zu unterstützen.

**Codewörter:** Risiko, Risikoverwaltung in der Lieferkette, Lean Lieferkette, Agile Lieferkette.

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