

Key Factors For Success

How Risk Management Can Safeguard Your Product Supply

Supply Chain Risk Management – The aggravated world-wide financial crisis has led to an intensive discussion about risk management at the capital markets. But how does risk provisioning appear in supply chain management? When talking about supply chain risk, consideration should not be limited to tangible damage. Normally, the intangible consequences such as loss of customers by far exceed the tangible ones. In extreme situations, companies at a whole can be put on risk when not carefully preparing for supply discontinuities. This is the reason why supply chain risks need to be proactively addressed.

Take for example natural disasters such as the hurricanes Katrina and Ike who disrupted the entire chemical production in the Texas (U.S.) area. Insurances can cover the loss in capital assets or sales but what about the loss in market share?

Anticipate Risks: Whatever Can Happen, Will Happen

Our first example comes from a project that was incidentally triggered by disruption of inland navigation: During the hot summer of 2003, barge transport capacities on the river Rhine were limited for several weeks due to low water. A constraint in successfully managing this situation was the large quantities to be transported: This did not allow to entirely change the transportation mode from barge to rail car or truck. A post-incident analysis to avoid similar situations for the future quantified that the Rhine level on average impacts the barge utilization during almost 20% of the year, with an averaged 15 days severely impacted. Apart from measures for future risk



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mitigation such as pre-compiled action plans, the project results unveiled the importance and opportunity of an anticipatory risk management.

Consider The Complexity

Bayer's recent investments into world-scale production plants provide a comprehensive set of examples for supply chain risk management by design. The first one is the raw material supply: Large volume materials are delivered by ship to a jetty and then transported via pipeline to Bayer's production plants. Various possibilities for supply disruptions have been identified including typhoons, fog, varying ship sizes affecting the number of ships to be discharged, multiple customers served by the same jetty operator etc. The risk in such a complex situation cannot be measured by just summing up the single risks identified – they can strengthen as well as compensate each other. In our project, we felt the discrete-event simulation to be the method of choice to consider the various dependencies and quantify the probability of supply shortages. The simulation results served as input to calculate sufficient buffer capacities.

Scoping: The Key for Success (and Failure)

Our third example again originates from Bayer's recent investments. It deals with the need to continuously deliver the finished goods to the customers: The production yield of world-scale plants with 200–300 kilotons annual capacity cannot be extensively stored prior to delivery. Of course, this aspect was covered by each of the engineering projects individually, but what about the big picture?



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The finished goods of all plants together have to be handled on site and pass through one gate. And beyond, the trucks share one road to the regional road network with all the trucks coming out of the large-scale plants of other international investors. The number of players to be considered in this project is an excellent example why to be careful when narrowing down the scope of a risk management project: It might happen that important interdependencies are shielded.

A Non-Trivial Exercise: The Optimal Setting of Safety Stocks

The examples given so far deal with the set-up of supply chains and belong to strategic or tactical aspects of supply chain design. The final one comes from day-to-day supply chain operations. In several projects, we were faced with multi-echelon supply chains consisting of more than 10 production and storage levels – a common scenario in chemical industry. In each production step, the yield can be both a finished good delivered to customers and an intermediate serving the next step as raw mate-

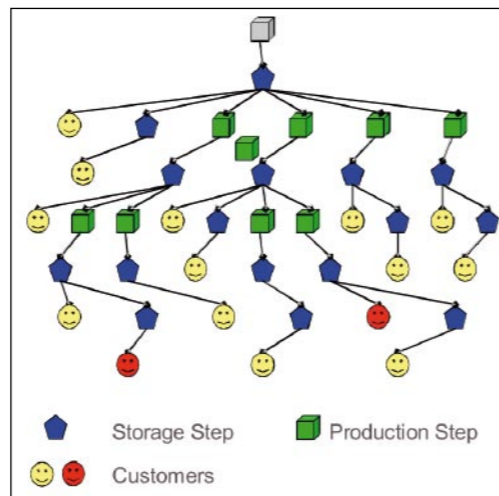


Fig. 1: Schematic view on a multi-echelon supply chain. In the chemical industry, the stages can easily exceed a number of 10.

rial. Safety stock calculation is therefore further complicated. In this context, a typical management target set at project start reads: "Hedge the risks of a production breakdown of two weeks and simultaneously maintain the given service level of 99%." Thorough analysis of the project we are referring to, quickly revealed that the safety stock was held on several stages of the internal supply chain. The total safety stocks should have allowed covering an eight week production outage but unfortunately, service level violations were experienced for several customers during a shortage situation. They were caused by a wrong positioning of the safety stocks on the various supply chain stages – an observation that fits well to our experience: In multi-echelon supply chains often over-hedging occurs if the hedging strategy does not follow a holistic approach. Of course, determining the optimal height and positioning of the safety stock is a non-trivial exercise. But advanced inventory optimization tools can help to cope with that task (fig. 1).

Supply Chain Risk Management (SCRM)

Based on the project examples given above the question occurs how they fit together from a greater perspective. Today, supply chain risk management is still often a patchwork. However, to make it a powerful asset requires a comprehensive supply chain risk management process that includes

- a systematic approach for risk identification;
- an objective evaluation of risk probability, costs of damage, and costs of hedging; and
- to anticipatory accept the identified risks ("It will happen

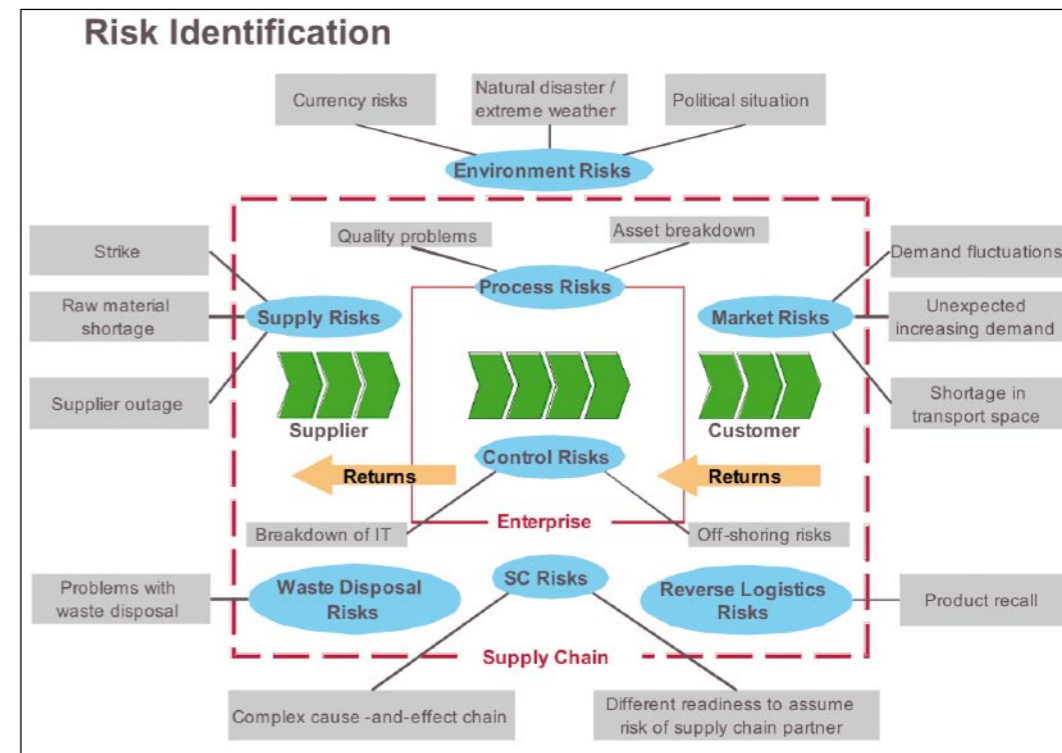


Fig. 2

(Source: W. Kersten et al. (2008), Bayer)

eventually!") by adopting appropriate measures in supply chain design.

SCRM: The Bits and Pieces Are already There

Do we have to start from zero when setting up a supply chain risk management process? The

processes (source, make, deliver, return) and classifies the risk into several categories (blue boxes). Those can then be further detailed to a company's needs and experience. Once completed, the schema allows to identify which aspects are already covered by other risk management processes in the

what straightforward. On the other hand, the determination of the probability of occurrence is the real challenge. Fortunately, even for this task tools are already available. They include mathematical methods such as extreme value theory, statistical/discrete-event simulation and markov chains.

Summary

In the chemical industry examples for supply chains risk management can be found across the entire supply chain starting from raw material supply to delivery of goods and covering both design and operational aspects. Experience however reveals that risk management activities are often incident-driven rather than following proactive a holistic approach. Companies establishing a supply chain risk management process professionally balance reliability and risk of product supply. Furthermore, they will in the long-term benefit financially through the optimal management of current assets.

"The determination of the probability of occurrence is the real challenge."

good news is one can rely on existing experience: As mentioned in the introduction, risk management is an established process in finance and controlling due to legislation. This allows a loan when it comes to the overall set-up of the SCRM process including process definition, organization structure, and roles and responsibilities.

Risk identification can start based on fig. 2. The diagram leans on the key supply chain

company and which ones have to be included into the SCRM scope.

Risk evaluation is typically done setting up a matrix that couples the possible extent of damage with the probability of occurrence. Multiplying these two factors gives a number that is used to prioritize the risk management activities. Provided that the risk is known, the calculation of the costs of damage is mostly laborious but some-