
2.1 Supply Networks, Segmentation and Categorisation

2.1.1 Supply Networks

What is a supply network and why are they so important for companies and business managers? Supply networks allow us to look at the big picture, giving us a better understanding of the flow of materials and information (Dust 2009). Often organisations focus only on their organisation, that means what they produce or provide and not what the end customer receives. Looking at a supply network enables firms to look at the overall movement of materials and information from start to end customer, allowing organisations to see the value in creating partnerships. The value in working together to ensure the best possible value is provided to the end customer. **Supply chain networks** describe the flow and movement of materials and information, by linking organisations together to serve the end customer. **Supply networks** are networks of suppliers that add value to a process, product or service. A **supply network** is a pattern of processes carried out at facility nodes and over distribution links, which adds value for customers through the manufacturing and delivery of products. It comprises the general state of business affairs in which all kinds of material (work-in-progress material as well as finished components) are transformed and moved between various value-added points to maximise the value added for customers. One of the strategic aims in supply management is the establishment resilient supply networks. A resilient supply network effectively aligns its strategy, operations, management systems, governance structure and decision-support capabilities so that it can uncover and adjust to continually changing risks, endure disruptions to its primary earnings drivers and create advantages over less adaptive competitors. Moreover, it has the capability to respond rapidly to unforeseen changes, even chaotic disruption. The resilience of a supply network is the ability to bounce back and, in fact, to bounce forward with speed, determination and precision. In recent studies, resilience is regarded as the next phase in the evolution of traditional, place-centric enterprise structures to highly virtualised, customer-centric

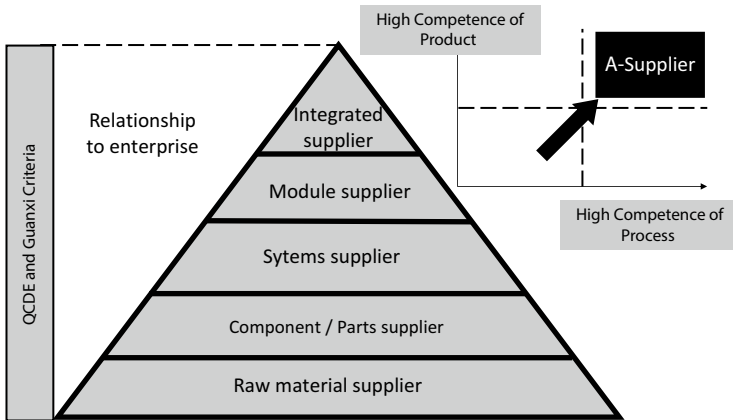


Fig. 2.1 Supply management pyramid (Adapted from Helmold 2011)

structures that enable people to work anytime, anywhere. Resilient supply networks should align their strategy and operations to adapt to risks that affects their capacities. There are four levels of supply chain resilience. First is reactive supply chain management. Second is internal supply chain integration with planned buffers. Then comes collaboration across extended supply chain networks. Finally is a dynamic supply chain adaptation and flexibility. “Network” describes a more complex structure, where organisations can be cross-linked and there are two-way exchanges between them; “chain” describes a simpler, sequential set of links (Harland et al. 2003). In order to understand a supply chain network, we need to understand what a supply chain is. A supply chain is a series of processes linked together to form a chain. Figure 2.1 shows the hierarchy of supplier networks from raw material supplier, component/parts suppliers, systems supplier and module suppliers to the integrated supplier networks. Another definition for integrated suppliers is “keiretsu” supplier, a definition which comes from the Japanese paradigm of working with suppliers.

2.1.2 Raw Material Supplier

A raw material supplier produces and supplies materials or substances used in the primary production or manufacturing of a good (granulate, liquids, steel, aluminium, etc.). Raw materials are often natural resources such as oil, iron and wood. Before being used in the manufacturing process, raw materials often are altered or refined (adding value) to be used in different processes. Raw materials are often referred to as commodities, which are bought and sold on commodity exchanges around the world. Raw materials are sold in what is called the factor or commodity markets, some even at stock exchanges (London Metal Exchange, LME). This is because raw materials are factors of production along with labour and capital. Raw materials are so important to the production process that the success of a country’s

economy can be determined by the amount of natural resources the country has within its own borders. A country that has abundant natural resources does not need to import as many raw materials and has an opportunity to export the materials to other countries. Raw materials are utilised to make components or parts.

2.1.3 Component/Parts Supplier

A component or part is a part or simple subassembly, system or subsystem, that (1) is required to complete or finish an activity, item or job, (2) performs a distinctive and necessary function in the operation of a system, or (3) is intended to be included as a part of a finished, packaged and labelled item. Components are usually removable in one piece and are considered indivisible for a particular purpose or use. Commonly, items of very small or insignificant cost are not considered components. Component or part suppliers usually have only capabilities to produce a part according to a specified drawing (build to print). The next layer describes the systems supplier network and systems supplier.

2.1.4 Systems Supplier

A systems supplier has the equipment, facilities, methods, competency, capabilities and resources deployed to design, produce and manage a subsystem for the customer's module or integrated suppliers (e.g. subsystem of wheel sets for a bogie, electrical cabling system for the total electrical system, entertainment system for the dashboard and audio system). The systems supplier is usually not yet a direct supplier to the customer (tier-1) as he supplies a subsystem to the module or integrated supplier network. A module supplier can be the tier-1 supplier to the end customers, assembling the subsystems and components to a module. A module supplier can do this based on the specification of the customer's design or have their own design capabilities in-house. If the module supplier's production, logistics and design systems is linked to the customer's design, logistics, supply management procurement and production, the supplier can be defined as integrated (module/systems) supplier. Many Japanese companies are using well-connected suppliers (also called keiretsu).

2.1.5 Integrated Supplier/Keiretsu Supplier

The keiretsu supply network (Japanese: integration, order or system of suppliers) represents a means of mutual security, especially in Japan, and usually includes large manufacturers and their suppliers of raw materials, systems and components (Ahmadin and Lincoln 2001; Freitag 2004). Keiretsu networks have received much attention in the European automotive and transportation sector through the success of Japanese companies such as Toyota, Hitachi and other conglomerates in

achieving improved customer service, better inventory control and more efficient overall channel management (Freitag 2004). Keiretsu, which is a form of Japanese business network, shares many of the goals of SCM. The concept of keiretsu supply networks was introduced by Toyota in the mid-1980s (Imai 1986; Ohno 1990) and transferred to affiliates and suppliers outside Japan (Kalkowsky 2004). Keiretsu networks often include partial ownership of the respective supplier. Control relationships between pairs of firms represent a form of bilateral exchange. The school of keiretsu may lead to broad functional and cultural changes for those companies which use the system (Freitag 2004). Keiretsu networks with financial and commercial connections develop quasi-administrative ties through cross-shareholding, as stated by Ahmadjian and Lincoln (1997, 2001). Keiretsu networks have two sides: (1) *horizontal relationships* based on mutual support and (2) *vertical structures* based on asymmetric exchange and control between financial firms and industrial firms. In various articles and books, Liker explains the Toyota way and the principles of keiretsu supply networks (Liker 2004). Many OEMs and their suppliers have meanwhile adopted this system (Liker and Choi 2005). For all suppliers and suppliers' network, the ultimate goal is to become A-classified supplier, the highest of product know-how and the highest competency of process knowledge and capability. The supplier pyramid is a useful tool for supplier segmentation and commodity segmentation.

2.1.6 Supplier and Commodity Segmentation

Segmentation in line with the process and product of the supply pyramid is allocating resources to the creation of value-adding relationships in the own company. Porsche classifies suppliers into three groups:

1. **Preferred Suppliers (A-Supplier)**

Supplier with high product, high process competency and value-adding relationship

2. **Alternative Suppliers (B-Supplier)**

Supplier with high product, process competency, but with looser relationships

3. **Benchmark Suppliers (C-Supplier)**

Supplier with medium product, process competency, relationship must be developed

2.1.7 Strategic Supplier and Material Segmentation (Portfolio Analysis)

Strategic supplier and commodity strategies are a suitable tool in supply management to secure supply of standard, leverage, shortage and strategic materials (Hofbauer et al. 2012). The combination of supplier and commodity segmentation

Table 2.1 Strategic supplier classification

Materials	Standard suppliers	Shortage suppliers	Leverage suppliers	Strategic suppliers
Strategic/scarce materials			Value-adding alliances/partnerships	
Leverage materials			Full usage of market potential	
Shortage materials	Secure availability through long-term agreements			
Standard materials	Utilise competition			

has been developed by Eyholzer et al. (2002) and is a useful tool to define suitable supplier/material strategies for the combinations as shown in Table 2.1.

- **Strategic suppliers/materials**
- **Leverage suppliers/materials**
- **Shortage suppliers/materials**
- **Standard suppliers/materials**

2.1.8 Strategic Materials/Components

Strategic materials can be defined as special materials which are important and key to the own production of an enterprise. Siemens and Bombardier Transportation produce car bodies by themselves; however, aluminium and stainless steel or steel profiles and extrusions are strategic for the production and quality of the end product.

2.1.9 Leverage Materials/Components

Leverage materials can be defined where the supply side is characterised by many companies which offer the materials. The automotive industry is characterised by more than 10–20 different suppliers, which deliver entertainment products (poli-polistic market).

2.1.10 Shortage Materials/Components

Shortage materials can be defined as materials that are scarce on the market. Scarcity represents a problem to any supply management organisation and needs the right establishment of strategies.

Table 2.2 Commodity segmentation

Commodity	Commodity interiors	Commodity electrical	Commodity mechanical	Commodity systems
Sub-commodity	Dashboard	Harness	Aluminium	Brake system
Sub-commodity	Seats	E-drive	Steel	Transmission
Sub-commodity	A, B and C pillars	Starters	Stainless steels	E-drive system
Sub-commodity	Others	E-box	C-parts	Others

Own figure, Helmold (2013b)

2.1.11 Standard or Catalogue Materials/Components

Standard materials are materials that can be bought on the market. Often standard goods are catalogue products like screws, C-parts, etc.

Table 2.1 defines strategies for the supplier/material combinations. For the leverage and strategic suppliers with strategic materials, it is recommended to establish long-term and value-adding partnerships. For the second combination of strategic/leverage suppliers and leverage materials, it is suitable to fully exploit the market potential. For shortage materials, it is recommended to secure supply and availability by long-term contracts and partnerships. In this context, it is also possible for companies to vertically integrate (via joint ventures, investments, acquisitions) and to produce shortage material themselves.

Standard materials with a high extent of competition do not represent a threat to the own company. Here, it is possible to take advantage of market competition.

The **commodity segmentation or category management** means to divide the major material categories into subgroups, categories or segments, which are definable, accessible, actionable and profitable and have a growth potential. The major objective of categorisation or segmentation is the standardisation of suppliers and supply process and to get the optimum benefit by bundling volumes in each category. Table 2.1 shows the example of an automotive company in terms of segmentation (Table 2.2).

2.1.12 Value and Competitive Advantage of Supplier Networks

Supply networks compete as well as individual organisations, and, increasingly, it is the supply chain that brings competitive advantage to many enterprises. In turn, according to Porter (1985), it can be seen as being the cost leader, the value leader or having a hybrid strategy; the following table shows the comparison of the three categories. The cost leading supply management concept is described by Emmett and Crocker (2009) as lean, the value-focused concept as agile supply networks and supply chains. In present days, the new school is combining lean and agile aspects and is called in this context value-creating supply concept (Helmold 2013) (Table 2.3).

Table 2.3 Value-creating supply management characteristics

Cost leadership (do it at better cost) competitive	Value creator (do it at optimum cost). Adaptable, flexible, lean	Differentiator (do it better) agile
Standard products	Standardised base variants; customised end products	Customer designed products/ services
Standard offering		
Production push	Pull system over entire value chain	Market pull, production with low mechanisation
Mass production		
High inventory levels at suppliers; inventory low	Optimum inventory levels over the entire supply chain	Flexible inventory
Productivity and efficiency in production output	Creativity and innovation based on value-adding needs and requirements	Focus on creativity and innovation
Stable planning	Synchronised planning over entire supply chain	Flexible planning
Lowest cost possible; cost optimisation permanently	Value for money approach	Innovations driving cost levels; variant launches offer cost reductions
Lead time reduction from suppliers	Joint innovation with supply networks	Maximum innovation response/ service with cost constraints
Minimum waste in own production	Short lead times and optimum response time including supply networks	Short lead times/quick responses
Many suppliers secure good service level	Optimum service level	Maximise service

Own figure, adapted from Emmett and Crocker (2009)

2.2 Supply Management Manual and Process

2.2.1 Supply Management Manual or Handbook

A procurement or supply manual is designed as a practical learning solution and manual to help procurement and supply management people in their daily tasks and operations. It will contribute to increased knowledge of the function throughout the organisation. As a common reference, it aims to provide unity and direction to all teams around the globe. The first version of the BT Procurement Manual was, for example, released in 2011, updated in 2015 and approved in 2016.

A supply manual is an ideal tool to explain:

- **Organisation and reporting lines**
- **Supply management processes**
 - **Tender stage**
 - **Project launch and ramp-up**
 - **Serial production**
 - **After sales**

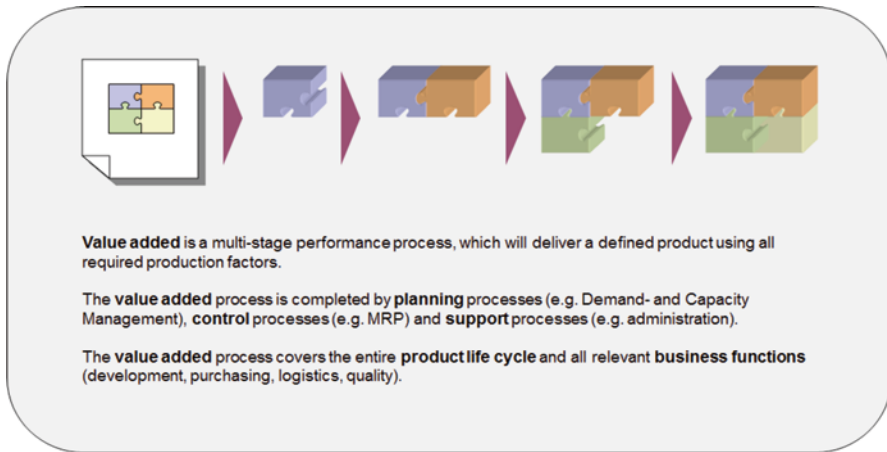


Fig. 2.2 Supply management: value-adding processes (Adopted from Dust 2009)

- **Quality process (e.g. production approval process)**
- **Supplier development process**
- **Supply risk management**
- **Interfaces to supply management**
- **Career path**

As many supply management organisations evolve constantly, it is crucial to update the supply manual in order to reflect all the changes. Developed companies such as Siemens, Ford Motor company or Porsche use online supply manual portals, whereas some companies still use paper versions.

2.2.2 Operational Supply Management Process

Apart from the strategic role of supply management, there are many operational activities to secure the supply of products from supply networks. Figure 2.3 shows the operational tasks of supply management. These tasks consist of operational activities such as informing the supply networks and suppliers about the demand and capacity requirements of their customers via a smart and intelligent ERP system. The long-term capacity demands as well as the medium- and short-term demands are crucial for the integration of the supply base into the own production to meet customers' needs. Supply management has to make sure that the suppliers are tooled up to make the necessary quantity of goods required. These goods have to be ordered, too. Orders have to be placed and goods have to be called off to arrive on time at the customer. Once the goods arrive, the goods have to be received and stored. In some areas, suppliers' products are stored in advanced warehouses or vendor management inventory warehouses. The processes have to focus on value-adding activities as shown in Fig. 2.2. Apart from the material flow, supply management has to ensure a sustainable green and reverse logistics together with the suppliers.

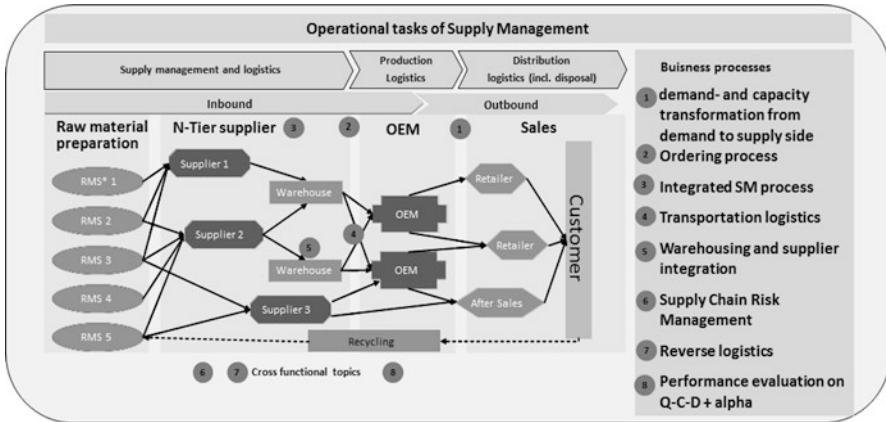


Fig. 2.3 Operational supply management processes (Adapted from Dust 2009)

Value adding can be defined as a multistage performance process of the upstream supply chain management by using and combining all required production factors. There can be more than thousands of suppliers, warehouses or distributors involved, especially in highly specialized industries like automotive, railway or aerospace (Helmold, 2013). It is important in this context, that all activities are synchronized and aligned to have a smooth material and information flow (Helmold, 2013). The Fig. 2.3 shows a complex network of stakeholders throughout the entire supply chain. The chart displays the operational tasks of supply management within the entire value chain from inbound to outbound processes. Whereas the inbound activities are focused on the supply of goods and products of suppliers (supply side), the outbound actions are related to the customer side (demand side).

Apart from the material flow, supply management has to ensure sustainable green and reverse logistics together with the suppliers. Last but not least, the operational roles and responsibilities include the cross-functional performance evaluation on a Q-C-D + alpha basis as highlighted previously. The supply management core process consists of the procurement and receipt of products and goods. There are many different definitions on what the supply management process consists of. The most simplified model divides the supply management process into five steps as shown below:

- 1. Demand is generated; need for demand is defined.**
 - (a) Demand request, demand approval and budgetary information.
 - (b) Demand request is passed on to supply management.
 - (c) Supply manager checks demand request with commodity and supplier strategy.
- 2. Execute the demand request in line with the supply management strategy.**
 - (a) Demand request, demand approval and budgetary information.
 - (b) Demand request is passed on to supply management.

- (c) Supply manager checks demand request with commodity and supplier strategy.
- 3. **Supplier selection in line with supply management strategy.**
 - (a) Request for quotation (RFQ) is sent out to selected suppliers.
 - (b) Quotations are obtained from suppliers.
 - (c) Supply manager creates offer evaluation and selects preferred supplier.
 - (d) Preferred supplier results shared with demanding function/department.
 - (e) Supplier is selected based on joint decision based on Q-C-D-E criteria.
- 4. **Supplier selection and purchase order (PO).**
 - (a) Supplier selection involves further negotiations.
 - (b) Issuing purchase order (PO).
 - (c) Tracking receipt of goods/products.
- 5. **Purchase order completion (POC).**
 - (a) Receiving goods and confirming quality
 - (b) Receipt of invoice
 - (c) Payment in line with invoice
 - (d) Confirmation of payment

Critics stress that supply management processes have become more complex and that other aspects or steps such as risk management and supplier development have to be integrated.

Concerning the **supply management process** of supplying products, there are several definitions from several authors available (Dust 2009; Hofbauer et al. 2012; Emmett and Crocker 2009). Dust (2009) emphasises that the supply management process must include a more holistic view and that such process must include an escalation and risk management layer.

Other **supply management process** models highlight the different steps from the demand analysis put to the paid invoice for the delivered products (Emmett and Crocker 2009). In accordance with the models of the authors Hofbauer et al. (2012) and Emmett and Crocker (2009), the following model has been derived including 12 phases (phase 0 to phase 11). Moreover, the process steps of the initial analysis of the quotations (5a.), delivery/receipt of goods (9a.) and the processing and usage of products in the own company (10a.) have been supplemented by supply improvement measures (9b. and 10b.).

2.2.3 Organisation (Establish)

Any supply process must start with the right organisation as shown in Fig. 2.4. Section 7 of this book will outline types and forms of supply management organisations and the segmentation of suppliers and products. Organisationally all authors stress that the supply department should be the single point of contact to the suppliers.

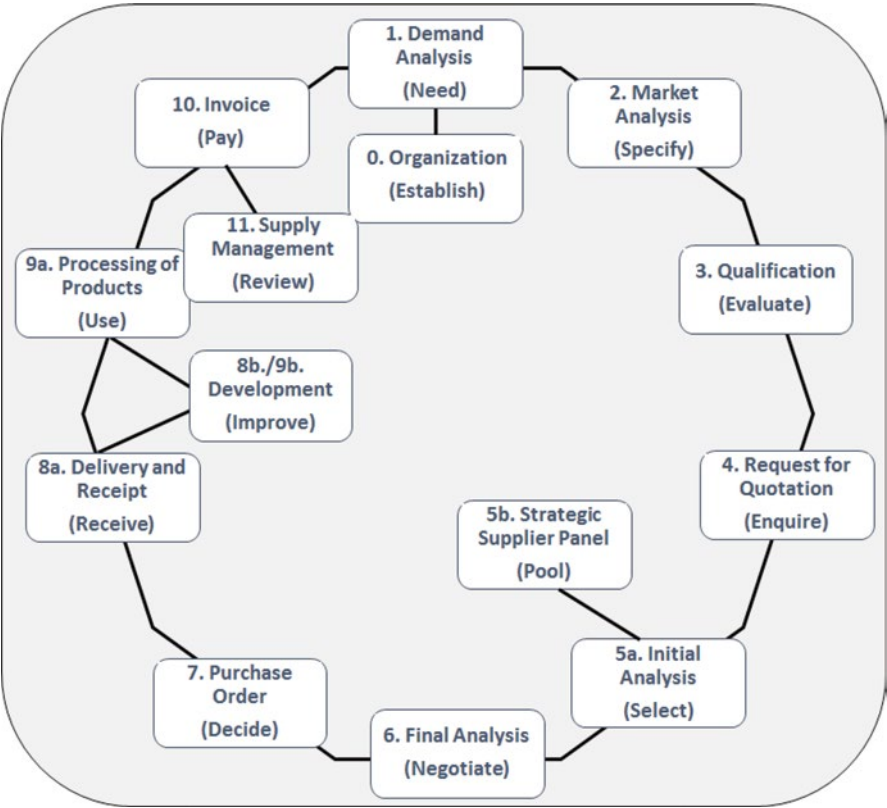


Fig. 2.4 Supply management process. Own figure, combining supply process steps (Adapted from Hofbauer et al. 2012; Emmett and Crocker 2009)

2.2.4 Demand Analysis (Needs)

Initial requisition is the process of recognising the demand. The demand may initiate from a simple requisition covering a standard product, right through to a complex project where a more thorough analysis will be performed. In all cases the need is what has to be satisfied (Emmett and Crocker 2009).

Many companies use sophisticated demand planning systems, such as ERP, MRP or SCM systems.

2.2.5 Market Analysis (Specify)

After determination of a need to buy a certain product, the supply management process initiates the analysis of who can supply this specific product and thus satisfy the demand.

2.2.6 Qualification (Evaluate)

Product and service specifications will need to be identified in liaison with the user (requisitioner). Specifications are a description of what the requisitioner is demanding in terms of fit, form and function. This is therefore a critical stage within the supply management process as the needs have to be communicated properly. Based on the right specifications, the supply manager can identify and qualify the right suppliers for this product or service. Emmett and Crocker (2009) recommend in this stage to:

- **Provide information on available supply**
- **Provide a supplier appraisal**
- **Identify risks on suppliers and minimise risks**
- **Identify risks on products and minimise them**
- **Qualify suppliers through audits, assessments or evaluation models**
- **Identify where standardisation is possible**

2.2.7 Request for Quotation (Enquire)

After qualification and evaluation of suitable suppliers, the enquiry process can start. The enquiry is also defined as “request for quotation (RFQ)” or “tender”. Many companies have standardised periods for the submission of quotations varying from 2 weeks to 3 months. In this context, standardised RFQ sheets as shown, for example, in Appendix 1 can help to simplify the assessment of the incoming quotations.

2.2.8 Initial Analysis (Select)

After submission of quotations, the supply management department will evaluate the quotations in terms of Q-C-D-E plus alpha. In many cases the supply management department draws up a short list of two to three suppliers including a proposal for the source selection. Such offer evaluation is also standardised in many companies, applying offer evaluation tools (OET) electronically or in paper form.

After the first screening and short list, the negotiations and discussions with suppliers start. Negotiations include also the clarification of unclear points.

2.2.9 Final Analysis (Decide)

After clarification of all issues, the supplier is selected in the final selection phase. Many companies here combine Q-C-D-E plus alpha criteria in a numeric supplier selection tool as described before. Some companies also use a Supplier Selection Board, in which cross-functional departments join the selection process. Moreover,

decisions are normally made by including the supply management department and the requisitioner jointly. The supply manager should have a veto right as guardian of the supply management process as recommended by Helmold (2013).

2.2.10 Invoice (Pay)

After final and successful processing of the supplied products, the products can be paid for in line with the agreed payment terms. Many companies have payment terms of 30 or 60 days after receipt of goods. Extended payment terms help the own company to improve the cash situation.

Cash management is nowadays becoming more and more important in organisations. In this regard, supply management is a contributor to profitability of any enterprise. Chinese, South Korean and Japanese companies sometimes have payment terms exceeding 90 or 120 days.

2.2.11 Purchase Order (Decide)

With the selection of the supplier, the supply management has to issue the purchase order to the supplier. The purchase order must always reflect the quotation in order to legally comply. The PO process is the responsibility of the supply management including the control of delivery, receipt and lead time of products. The PO has to state aspects such as the price, place and specification criteria of the purchased product. If the supplier accepts the PO, a contract agreement has been legally created.

2.2.12 Delivery (Receipt)

The supply management process includes the confirmation of dispatch, transit time and receipt of goods. In global supply such as China, it is especially important that the lead time of goods is taken into account. Helmold emphasises the need to have a tool which incorporates important information, in order **to make sure that the goods from China arrive at the requisitioned time**. These aspects are:

- **Production start of products at suppliers including the assessment of capability (supplier and product)**
- **Dispatch of goods**
- **Delivery of goods including the right mode (goods in transit)**
- **Arrival of goods at destination port/location (port, airport, train station)**
- **Customs clearance**
- **Arrival at customer warehouse**
- **Delivery to own production process**

Chapter 9 outlines the different modes of transportation from China to Europe including the Eurasia train networks.

2.2.13 Processing of Products (Use)

On arrival and storage of goods at the own company, the goods can be processed. Raw materials can be refined or used, components can be assembled to systems or modules and systems can be processed to final products. This is a critical process. The supply management function has to make sure that all Q-C-D-E plus alpha criteria are met; if not the supply management function must trigger the nonconformity and claim process.

2.2.14 Supply Management (Review)

The last step is the supply management controlling (Beschaffungs controlling) as defined by Hofbauer et al. (2012). The review should include the criteria in terms of Q-C-D-E plus alpha and tackle questions like “Was the product supplied on time?”, “Does the product meet the specified criteria?”, “What can be improved for future deliveries?” and “Are there any future deliveries which will positively or negatively impact the price?”.

The supply management process, which is defined in **lean philosophy of supply management as 7R principle**, is described within the objectives in the next section.

2.3 Supply Management Objectives

Supply management objectives have various definitions in literature (Dust 2009; Emmett and Crocker 2009; Hofbauer et al. 2012; Helmold 2011, 2013). All objectives have in common, that they focus on managing the supply base appropriately. Operational objectives have a short-term focus, whereas strategic have a long-term scope. In the lean supply methodology, objectives can be summarised as the seven R rights under the consideration of “total cost of ownership” (TCO).

The TCO principles will be outlined later in Chap. 5 of this book. Objectives can be operational and strategic objectives. In some books, authors focus on five rights, without naming people and price (Emmett and Crocker 2009). Figure 2.5 summarises the operational and strategic objectives for supply management according to Helmold (2011).

The objectives in Fig. 2.5 can be regarded as complimentary to the 7R objectives. The seven rights, which are the major objectives according to the lean supply management philosophy, can be defined as:

1. **Right products**
2. **Right quality**



Fig. 2.5 Operational and strategic objectives (Adapted from Helmold 2011)

3. **Right time**
4. **Right quantity**
5. **Right location**
6. **Right people**
7. **Right cost**

The **right product** refers to the right specification and requirements by the demanding customer. The products must have the required dimensions, layout, material, colour, etc.

The **right quality** means the clarification of all requirements in terms of quality and improvement measures to have the optimum quality levels. Quality is normally measured by hard factors such as nonconformities, field rejects or defects at receipt (0 km defects).

The **right quantity** is the placing of a specific order quantity triggered by internal and customer demands. Supply management has to transfer the customer and company demands to the supply networks.

The **right time** means that products ordered have to be at the buyer's place in time, neither too early nor too late. Supply management has to recognise suppliers' lead times. The lead time for any product starts from the order until the physical receipt of goods at the ordering party.

The **right location** can be defined as the place, where the products are required. Shipment of products from China to Europe take more than 8 weeks, so that that the right location is closely linked to the lead time of products.

The meaning of **right people** extends current definition of the five rights (Emmett and Crocker 2009; Helmold 2011) in line with the modern and lean philosophy of the new paradigm of supply management. Suppliers in global markets need to have the right sales people, project managers and operators to meet the requested criteria.

Project managers must have sufficient language skills and operators must be trained to produce good-quality parts. People are becoming in a changing and global trade situation more and more important.

Any product needs to have the **right cost** level; otherwise, it will not be demanded and bought. Chapter 5 will outline the lean concept in order to create the optimum cost levels of any product. Supply management objectives can be classified into operational and strategic objectives as shown in the figure below. Operational and tactical objectives have a short-term character, whereas strategic objectives are long-term related.

Operational objectives emphasise the actual situation in terms of Q-C-D-E. In contrast to operational objectives and the short-term focus, strategic objectives focus on medium-term and long-term supply management goals including the development of the company's own supply management capability.

Emmett and Crocker (2009), Dust (2009), and Helmold (2011) define, besides the seven rights, the objectives of supply management as follows:

- **Management of the relationship to suppliers to achieve the KPIs between supplier/customer**
- **Managing partnerships in order to have the optimum combination of the seven rights**
- **Managing all supply and purchases through defined and approved supply management processes**
- **Liaise with all suppliers and all departments to achieve the optimum outcome**
- **Continuous improvement by introducing lean principles to the suppliers**
- **Looking for new ways of partnering including jointly financial investments in technologies, projects or alliances**
- **Anticipating supply disruptions and establishing an alert system**

Strategic objectives seek to ensure to manage the supply management process on a long-term basis and the supply base efficiently and effectively: identify opportunities where the procurement team adds true value, evaluation and selection of suppliers based on sound ethical norms and standards:

- **All purchases of products must go through the approved supply management processes.**
- **Engineering and other functional inputs are part of this process and must comply with the supply management process.**
- **Contractual agreements will be performed with the involvement of supply management leading a cross-functional team.**
- **Increased use of sourcing teams, consisting of several functions.**

2.4 Supply Management Tools

2.4.1 Roles and Responsibilities: RACI Chart

A responsibility assignment matrix or also known as **RACI matrix** or **ARCI matrix** or **linear responsibility chart** (LRC) describes the participation of various roles and responsibilities in completing actions or deliverables for a process in **supply management**. It is especially useful in clarifying roles and responsibilities in cross-functional, subfunctional or departmental projects and processes in the supply management discipline. In the previous chapter, we learned that supply management is the overriding function to combine disciplines from upstream towards downstream supply chain management. RACI and ARCI are abbreviations derived from the four key responsibilities most typically used: responsible, accountable, consulted and informed.

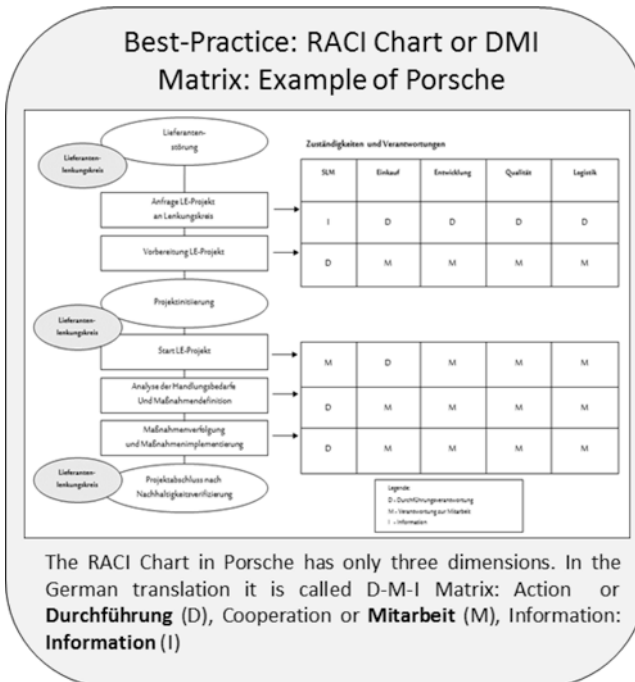


Responsible (R)

Those who do the work to achieve the task. There is at least one role with a participation type of responsible, although others can be delegated to assist in the work required.

Accountable (A)

The one ultimately answerable for the correct and thorough completion of the deliverable or task, and the one who delegates the work to those responsible. In other words, an accountable must sign off (approve) work that responsible provides. There **must** be only one accountable specified for each task or deliverable.



Consulted (C)

Those whose opinions are sought, typically experts in the specific subfunction, and with whom there is two-way communication.

Informed (I)

Those who are kept up-to-date on progress, often only on completion of the task or deliverable and with whom there is just one-way communication.

Very often the role that is accountable for a task or deliverable may also be responsible for completing it (indicated on the matrix by the task or deliverable having a role accountable for it, but no role responsible for its completion, i.e. it is

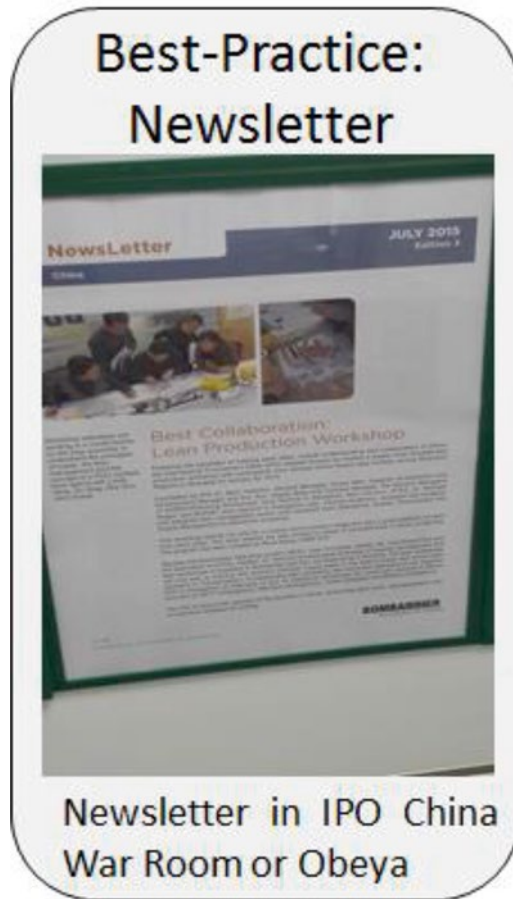
implied). Outside of this exception, it is generally recommended that each role in the project or process for each task receive, at most, just one of the participation types. Where more than one participation type is shown, this generally implies that participation has not yet been fully resolved, which can impede the value of this technique in clarifying the participation of each role on each task. There is a distinction between a role and individually identified people: a role is a descriptor of an associated set of tasks and may be performed by many people, and one person can perform many roles. For example, an organisation may have ten people who can perform the role of project manager, although traditionally each project only has one project manager at any one time; and a person who is able to perform the role of project manager may also be able to perform the role of business analyst and tester.

2.4.2 War Room or Visualisation Centre (Obeya)

A **Visualisation Centre, war room** or **Obeya** (from Japanese 大部屋 “large room” or “war room”) refers to a form of lean supply management used in Asian and more in Western companies (including Toyota) and is a component of innovative supply management. It was particularly used for visualisation of lean manufacturing issues of the Toyota Production System before being used for a broader scope of supply management issues. During the product and process development, supplier selection and selection strategy of the supply, all individuals involved in managerial planning meet in a “great room” to speed supplier management, communication and decision making among functions. This is intended to increase transparency, speed up communication and reduce “departmental silo thinking”. It will also improve on methods such as e-mail and social networking. The *Obeya* can be understood as a team spirit improvement tool at an administrative level. Conceptually akin to traditional “war rooms”, an *Obeya* will contain visually engaging charts and graphs depicting such information as programme timing, milestones and progress-to-date and countermeasures to existing technical or scheduling issues. Setting up a specially designed and dedicated “war room” where work groups can collaborate with a minimum of distraction is one of the best steps a business owner can take to improve the group’s focus and productivity. As evidence, a University of Michigan study found that productivity was two-to-four times higher in businesses requiring work groups and teams to work together in a dedicated common area instead of collaborating virtually from behind closed office doors or in private cubicles. The key to achieving the same result for your business lies in properly configuring and setting up a collaborative war room environment:



- First conduct a war room needs analysis. Identify the team or teams that will use the room, why and how often. List common and specialised equipment that work groups will need. For example, a design team that operates from a war room exclusively and permanently has significantly different needs than two or more management teams using the room for strategy planning 1 or 2 days each week.
- Designate the room to use as a dedicated war room. A good choice is an unused conference room or office with enough surface area to accommodate the team and equipment that a war room requires. If the room is included in a regular schedule for other uses, remove it from the list. Install locks on the doors to make sure both the room and the confidential material within it are secure. Get a “do not disturb” sign to ensure the team is not interrupted while war room sessions are in progress.
- Cover the walls with as many whiteboards as you can. War room teams—especially design teams—use whiteboards for everything from story diagrams to research notes. Support a variety of work modes by furnishing the war room with moveable furniture. Flexible furniture such as rolling desks, stackable chairs and rolling whiteboards make war rooms reconfigurable. This is useful when the team needs open space as well when team members require desks. Provide good overhead lighting as well as portable task lighting fixtures.



- Promote optimal productivity by supplying the best technology your business can afford. This includes laptop computers with webcams, wireless Internet access, a high-quality conference phone and one or more wall-mounted plasma screens. A ceiling-mounted projector, overhead projection equipment and laser pointers are also important. Install and maintain a well-stocked office supply cabinet as well. The war room has the following functions:
- Obeya is Japanese for “big, open office”.
- Created by Toyota for managing the lifecycle of an idea or problem and governing what happens.
- Allows everyone involved to have a single place to discuss and view status. Highly visual but simple—main tools are paper, post-it notes, markers and examples of issues and solutions.
- Everything in the room is team generated and agreed (very important): management, people doing, people impacted and suppliers.
- Enforces a way of thinking, acting and speaking by using CAP-Do: Check Act Plan Do.

- Virtual in nature, so, for instance, Obeya linked to boards in the server, HR and service desk areas.
- Becomes the main communication room: daily, weekly, etc.
- Governance and reporting is simplified to help control time, costs, errors and bottlenecks.
- KPIs for critical control points but no more than three to five overall (this may sound crazy but it works).
- Two colours for status reporting: green you are ok and red you are not (no ambiguous amber).
- Easily fits into the ITIL or COBIT cycles of change, release, problem, etc.
- It is a “living” room so as things change, noted down and agreed by all.
- You use the room daily to plan, discuss and escalate, but you go to the areas involved to learn, introduce, help and align.

2.4.2.1 Information in a War Room for Supplier Management

The war room should be an open room for all employees. Idea generation and brainstorming activities can be promoted by putting blackboards, flipcharts or whiteboards into the room. The war room can have all kind of information necessary to manage the supply base such as:

- **Visions and Missions**
- **Objectives and Targets**
- **Strategic Initiatives**
- **Organisation**
- **Employee Satisfaction Surveys**
- **Announcements**
- **Newsletters**
- **Internal Supply Policies**
- **Supply Base Strategies**
- **Supplier Panels**
- **Commodity Strategies**
- **Supplier Development Tool Box**
- **Map highlighting Supplier Locations**
- **Customer Information**
- **Code of Ethics**
- **Project Plans and Milestones**
- **Advanced Planning and Quality Planning (APQP)**
- **Lean Projects and Workshops**

2.4.2.2 Use and Frequency of Usage

The war room can be used regularly or for specific project meetings. As in production environments, supply management teams can have their daily/weekly meeting inside the war room to discuss the most important issues, milestones, etc. Meetings require a fixed agenda, a fixed time start/ end and a facilitator. The action deriving from the meeting should be added to an action plan including due dates and responsibilities. This action plan can also be made visible in the war room.



Key Performance Indicators (KPI) can be visualized through a visualization centre.

Picture 1: Bombardier War Room

Picture 2: Dr. Marc Helmold and Midas President



2.4.2.3 Daily Stand-Up Meetings and Sit-Down Meetings

The war room in the IPO in Shanghai had daily stand-up meetings in order to discuss aspects of China-related supplier management. These meetings were literally done standing in the Gemba or in front of the white board, then going around team member by team member discussing what they plan on accomplishing that day, any roadblocks and lessons learned or challenges they'd like help with. This stand-up meeting should be done first thing in the workday and should be reasonably short, maybe 45–60 min. These meeting should be short, but done regularly. The dailyness of the meetings will add a dimension of regularity and progress and enables frequent communication. Couple these scheduled meetings with informal meetings as needed for overprocessing or over-scheduling. The war room can also be used to explain strategy, organisation, projects and supply base to customers. Customers can be shown in a quick way the supply strategy and objectives for their specific projects.

2.4.3 Supplier Evaluation

Supplier evaluation is the systematic assessment of existing or new suppliers on the basis of certain categories. A supplier evaluation must be:

- A preventive and proactive system
- A KPI-based methodology

- **An anticipating (sensoric) model**
- **A holistic and cross-functional assessment**
- **A standardised process**
- **An integrated supply base approach**

These categories can be performance of the delivery, price evolution, production capacity, quality of management, technical capabilities and service (Helmold 2011). Once there is a mechanism in place to periodically collect performance data from suppliers, the next step is to review the performance data. Ideally, the format that the data is in should lend itself to comparison and analysis. The data should also be in a format that can be quantified and scored. Many companies use a supplier evaluation or scorecard for this. Moreover, data from different types of assessments such as internal surveys, external surveys and site visits should be incorporated into the analysis. Since most large organisations have many strategic suppliers and lots of data, it is almost impossible to obtain, organise and review data from assessments effectively on a large scale without automation or software. When evaluating supplier performance data, the two things to look for (besides the obvious) are large changes in the performance metrics and overall trends. By identifying trends, a company can make projections about where the performance data will be in the future and can take action accordingly. Downward trends and deterioration in performance can signal a problem. Moreover, an abrupt change in performance metrics might signal an imminent problem. However, there could be another explanation. In this case it makes sense to obtain more data from the supplier and to dig deeper to find the source of the problem. It may be a one-time anomaly or it could be something more. Monitoring supplier performance proactively can ensure that exceptions to policies are tracked and personnel and resources are assigned to address the problem quickly. Alerts and notifications can provide up to the minute information to company personnel letting them know of changes in supplier performance (Fig. 2.6).

Having a system that can take the assessment/scorecard data and can output it in a report or other format is helpful because members of the team can all access and review the information quickly and easily. The performance evaluation of Daimler shown in Fig. 2.5 is an example of a supplier evaluation. For part C the performance is very bad, so that immediate actions have to be taken. Once there is sudden drop in supplier performance or a downward trend, it is important to take action quickly. Quick action can reduce the risk of disaster and significant loss and gives the company the ability to take steps to prevent bad outcomes. Some actions that can be instigated include communicating with the supplier, conducting further evaluations, developing an improvement plan or finding an alternative supplier. The actions taken may depend on many factors. These include the supplier's past performance, level of current performance, strategic importance, possible damages and overall risk. One of the first things to do is to contact the supplier and find out what went wrong and why. The results of the performance assessment should be provided to the supplier and can create a basis for discussions (Fig. 2.7).

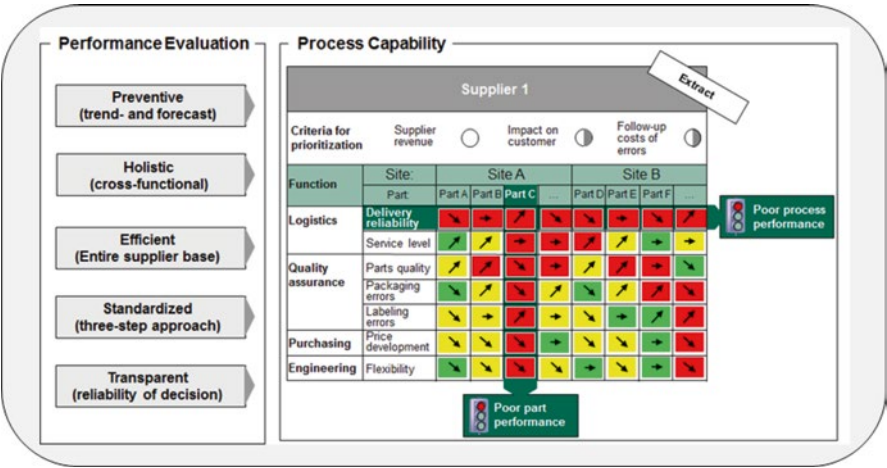


Fig. 2.6 Evaluation example (Adapted from Dust 2009)

The poor performance could have been the result of something outside of the supplier’s control. It could have been a problem with process, personnel, a supplier or something else. By communicating with the supplier, personnel can determine the cause of the problem and try to work with the supplier to make changes to bring the supplier performance back into compliance with the contract or with company policies. If the vendor does not have a good explanation or understanding of why the problem occurred, this may be a sign of trouble. Once the causes of a problem or set of problems have been identified, the next step is to devise a supplier improvement plan. The plan should be specific to the problem, should involve both company personnel and supplier personnel and should involve a timeline for addressing the problem or bringing the performance into compliance. This process should also be a collaborative process and should be aimed at improving the overall supply chain. Even if a supplier’s performance is acceptable, the company may wish to invest time and resources in developing suppliers and improving supplier performance. If the problem is too severe, cannot be fixed in a timely manner or poses too great of a risk, the company may wish to stop doing business altogether with the supplier. This means that the company should carefully find an alternative source of supply and, if possible, reduce its reliance on the supplier in question. Emmett and Crocker (2009) and Dust et al. (2010) also propose using such criteria for evaluating the performance of suppliers. Interestingly, the interviews revealed that many companies have created subcriteria of Q-C-D-SF according to their own needs. Regarding the question of how often manufacturing companies in the European transportation industry measure supplier performance, what they do internally with the data and how they communicate the results to suppliers, several different answers were given. In the best case, data was updated on a weekly basis and made available to suppliers through a web-based tool. Concerning the evaluation of supplier performance, all interviewees outlined three to four categories, like traffic lights:

Panasonic		Supplier Evaluation Period: 2 nd half FY08 PAS Europe			Date: Page: 1 of 1
Prepared by (plant / site and name):					
Company Name:					
Contact Person:					
Phone no.:					
Fax no.:					
E-mail:					
	Criteria	Importa max point	Assess- ment	Assess- ment	Remarks (e.g. for supplier / actions)**
QUALITY	IQC Lot out ratio	5	0	0	
	0km rejects	5	0	0	
	Actual PPM vs. QTA	10	0	0	
	Initial Response	3	0	0	
	8D completion	3	0	0	
	Repetition of failures	5	0	0	
	R/E, A/I (C suppliers);	1	0	0	
	Certificate of conformity	1	0	0	
	In-process and OQA data	1	0	0	
	Improvement plan	1	0	0	
	Quantity 8D reports per	5	0	0	
	Subtotal	40		0	
COST	Cost Discipline	10	0	0	
	VE activities	10	0	0	
	Communication and Co-	5	0	0	
	Subtotal	25		0	
DELIVERY	On time delivery	20	0	0	
	Logistic non conformities	5	0	0	
	VMI (consignment stock;	5	0	0	
	Co-operation (on time	5	0	0	
	Subtotal	35		0	
TOTAL		100		0	
Additional Adjustments	Missing ISO 9001 (minus 5 points)				
	Missing ISO 14001 (minus 5 points)				
	ISO/TS 16949 certified (plus 5 points)				
	Critical customer quality problem (minus 40)				
Grand total				0	Result / Class: ?
**) Remarks:					
Copies to: Supplier, Purchasing PASCZ/f		Date/Signature		Date/Signature (GM	
*) Based on list "Supplier Evaluation Criteria's"					

Fig. 2.7 Supplier evaluation: example of Panasonic Automotive (Adapted from Helmold 2011)

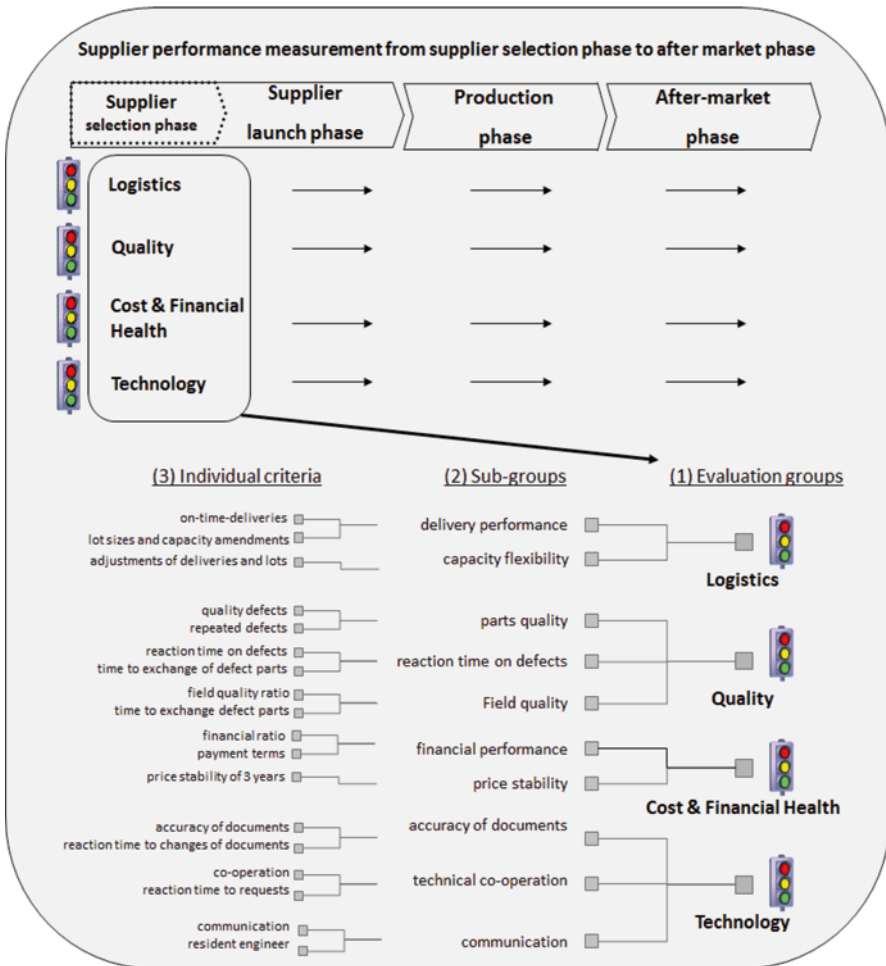


Fig. 2.8 Supplier evaluation conceptualisation (Adapted from Helmold, 2013 and Dust, 2009)

- **Category one (green):** acceptable with minor deviations and without conditions
- **Category two (yellow):** acceptable with conditions
- **Category three (red):** not acceptable (Fig. 2.8)

In category one (green), the evaluation is approved and accepted with minor deviations. In category two (yellow), the evaluation is accepted with conditions. Conditional acceptance means that any subsequent action plan has to be approved by the supply management department. If a supplier shows severe deficiencies and is categorised three (red), the evaluation is not accepted. This can mean that a new supplier is not allowed to supply parts. In cases where category three is measured during serial production, specific supply management actions (e.g. management

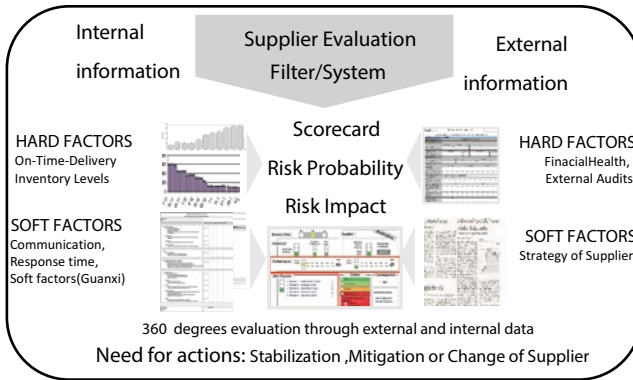


Fig. 2.9 Evaluation criteria including hard and soft factors (Adapted from Dust 2009)

escalation, supplier audits, dual-sourcing) might be the consequence. Some of the challenges associated with supplier evaluation may be mitigated by the use of appropriate tools. For simple projects, a spreadsheet can be used. But as evaluations become more complex or more frequent, data management and data integrity issues become significant. Web Electronic RFP/Tendering systems are often used for initial selection projects. Some products provide functionality for combining both initial selection and ongoing evaluation and benchmarking.

Without few exceptions, there is no evaluation model which considers the maturity and level of relationship with suppliers (Helmold 2014). Figure 2.9 shows in the soft factors the possibility to include the Guanxi relationship factor into the evaluation. The doctoral thesis “Establishing a best practice model of supplier relationship management (SRM) for multinational manufacturing companies in the European transportation industry” makes suggestions for this aspect (Helmold 2014). There is also an MBA thesis available, which includes the assessment of the Guanxi for supply management in China (Lee 2015). Wider, within established supply management evaluation methodologies, the Carter 10C’s model is an internationally recognised approach (Emmett and Crocker 2009). This model looks at aspects which should be evaluated before contracting and as part of the ongoing supplier performance appraisal. The ten categories can be summarised as the following:

1. **Capacity (does the organisation have the capacity and capability to deliver the order?)**
2. **Competency (is the organisation, its people or its process competent?)**
3. **Consistency (does the organisation produce a consistent output?)**
4. **Control of process (can the organisation control its process and offer flexibility?)**
5. **Commitment to quality (does the organisation effectively monitor and manage quality?)**

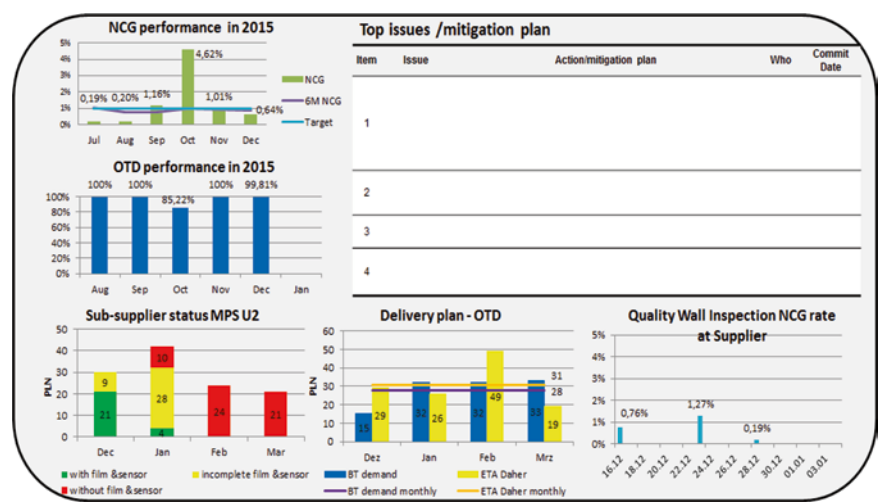


Fig. 2.10 Supplier dashboard/cockpit (Adapted from Helmold 2011)

- 6. Cash (has the organisation got a strong enough financial base?)
- 7. Cost (is the product or service offered at a competitive price?)
- 8. Culture (are the supplier and buyer cultures compatible?)
- 9. Clean (is the organisation ethical, funded legitimately and doesn't engage child labour?)
- 10. Communication efficiency (does the organisation have support technology of information integration?) to support collaboration and co-ordination in the supply chain.

2.4.4 Supplier Dashboard and Cockpit

A supply or **supplier dashboard** (or **cockpit**) provides management with an at-a-glance awareness of the status of certain performance indicators such as inventory and **supply** operations. Thus, it is possible to respond to challenges before any incident is happening. The supplier dashboard (Fig. 2.10) is showing key operational indicators and trends like NCG, OTD, outgoing quality and sub-supplier performance. Indicators can vary from case to case.

A supplier dashboard or supplier cockpit (see Appendix 4) is a one-page summary of the supplier's critical performance indicators as shown in the example above. The dashboard is supposed to give managers a quick overview of deteriorations and status on quality, delivery or other critical issues. It enables the supply manager to take immediate actions based on a graphs or a colouring.

2.4.5 Supplier Balanced Score Card (BSC)

The Supplier Balanced Score Card (BSC) tracks a limited number of key metrics of suppliers. Normally key or critical suppliers are measured. These metrics should be closely aligned to the company's strategic objectives (Emmett and Crocker 2009). To appreciate the procurement performance of the business, you require key performance indicators for assessment. This baseline may be based on previous performance. However, it is essential to use a procurement balanced scorecard KPI for an effective evaluation. A balanced scorecard KPI example, which you can use to effectively measure your procurement performance, is mentioned below:

1. **Reduction in Cost:** This is the total sum of funds saved due to cost reduction on yearly basis. This BSC balanced scorecard measures the contribution of the procurement branch towards the monetary achievement of the establishment.



2. **Managed Spend and Total Spend.** Total spend is the funds utilised annually by the organisation for the purchase of products and services excluding the remuneration to the staff concerned. Managed spend is the total amount controlled by the procurement branch. The ratio of the two funds in this balanced scorecard example measures the level of confidence that the organisation has in the branch.
3. **Cost Savings and Managed Spend.** The ratio of this key performance indicator evaluates the effectiveness of procurement branch with reference to their assignments.
4. **Procurement Operating Cost and Managed Spend.** Procurement operating cost is the expenditure borne by the business for the establishment of the procurement branch. The cost comprises pay, cost of facilities, software, equip-

ment, etc. Managed spend is the total amount controlled by the procurement branch. Their ratio is a key performance indicator.

5. **Return on Investment.** To determine the return on investment, it is essential to determine the return. It implies the amount by which savings surpass the cost incurred on operations. This KPI determines the cost-effectiveness of the procurement branch.
6. **Seller Defect Percentage.** Defect percentage of the seller can be determined by dividing the quantity of substandard items by the complete number of purchased items. This KPI quantifies the purchase quality of the procurement branch.
7. **Client Contentment.** The customers are requested to provide feedback regarding the procurement performance and offer recommendations if they desire. When several organisations employ similar techniques, degree of satisfaction can be identified. This KPI determines the ability of the procurement branch to satisfy their clients.
8. **Lead Time for Procurement.** The normal duration required for procurement, starting from submission of requisition, issue of purchase order and receipt of products from the seller. This KPI is useful to determine efficiency of the procurement branch.
9. **Obtaining Feedback from Sellers.** Progressive procurement organisations vigorously request opinion from sellers that is directed towards saving in costs and increase in progress. Such ideas are tracked and measured periodically.
10. **Productivity in Purchasing.** Number of purchase orders, and their cost, issued over a specified period of time.

The measurements usually cover four to six areas:

1. **Supplier quality data:** Nonconformity ratio, response time on enquiries, flexibility towards engineering changes, etc.
2. **Financial and cost data:** The cost of manufacturing, warehousing, transportation, inventory procurement process, etc.
3. **Logistics data:** On-time delivery, completion of lots, response time on call offs, etc.
4. **Engineering data:** Provision of engineering data, design to manufacturing proposals, value engineering ideas, etc.
5. **Compliance data:** Number of sub-supplier compliance checks, audit result in code of ethics audit, etc.
6. **Generic data:** Existence of quality management system and score of audits

While the BSC approach is not specifically designed for supply management, it does give a good guidance for the core measures and metrics. The central idea is to focus on key metrics that have real meaning for the own organisation.

2.5 Supply Risks: Macro and Micro Risk Management

Supply disruptions are defined by Kleindorfer and Saad (2005) as “**unplanned and unanticipated events that disrupt the normal flow of goods and materials within the supply chain**”. They distinguish between co-ordination risks and disruption risks. Supply chain complexity is described by Adenso-Diaz et al. (2012) as “the sum of the total number of nodes and the total number of forward, backward and within-tier material flows” in the upstream supply chain network. Such complexity has a huge impact on supply chain reliability and supply chain stability. The overall recommendation made in several papers is to reduce the number of suppliers, since supply chain complexity increases the risk of disruption (Christopher and Peck 2004). Adenso-Diaz et al. (2012) highlighted the definitions of various authors, using a variety of criteria: (1) function (Harland et al. 2003), (2) type of risk (Spekman and Davies 2004), (3.) drivers of risks (Chopra and Sodhi 2004) and (4) likelihood of occurrence (Cox and Townsend 1998). While the literature on supply management and risk management is growing, there is no organised structure regarding the sources of causal factors for supply chain risks and supply disruptions. Several papers show that supply disruptions can lead to high monetary recovery cost, waste and sharp decreases in sales as pointed out in one of the previous sections by Haslett (2011), Jing (2011) and Grant (2010). Aside from findings in literature, other sources such as field research, internal reports and interviews display that supply disruptions have severe impacts on companies in the analysed European transportation industry. Supply disruptions and their associated risks have been classified in the literature using a variety of criteria, e.g. function (Harland et al. 2003; Christopher and Peck 2004), type of risk (Spekman and Davis 2004) and drivers of risk (Chopra and Sodhi 2004). Hendricks and Singhal (2005) pointed out that enterprises without operational slack and redundancies in their supply chains experience negative stock effects. They also revealed the tremendous impacts of supply chain disruptions on stock price performance and shareholder value. Causal factors for supply disruptions are automatically associated with risks in the supply network, as stated by Zsidisin (2003), Tomlin (2006) and Wieland and Wallenburg (2012). Several authors outline incidents in which supply disruptions caused production standstill or temporary stops in manufacturing companies in the European industry (Tomlin 2006). Other authors refer to capacity management in terms of supply disruptions as being a crucial risk factor for supply chain discrepancies. Due to such risks, specific measures are necessary in terms of overcoming potential supply disruptions caused by supplier capacity shortages (Hittle and Leonard 2011). Mitigations and preventive measures can take the form of diverse capacity management, back-up equipment or alternative manufacturing locations, as recommended by Hittle and Leonard (2011). In his paper, Tomlin outlines a few examples of supply disruptions which occurred in March 2000, e.g. lightning caused a fire that shut down the Philips semiconductor plant in Albuquerque, New Mexico, for 6 weeks, leading to a shortage of components for both Ericsson and Nokia. According to *The Wall Street Journal*, company officials say Ericsson lost at least \$400 million in potential revenue when the company revealed the damage from the fire for the first

time publicly last July; its shares tumbled 14% in just hours (Latour 2001). In February 1997, a fire in a Toyota brake supplier plant led directly to a 2-week shut down of 18 Toyota plants in Japan, with a resulting cost of \$195 million (Treece 1997). Fires, of course, are not the only cause of disruption. Hurricane Mitch caused catastrophic damage to banana production in several parts of Central America in 1998. It took many growers over a year to recover, leading to a prolonged loss of supply for Dole and Chiquita (Griffy-Brown 2003). An earthquake in Taiwan severely disrupted the supply of essential components to the personal computer industry in the lead-up to the 1999 holiday season. Bombardier faced in 2012 missing capacities of important suppliers for windows, doors and other modules, leading to a delay of finished trains to the customer. As a consequence, the customer imposed high penalties against Bombardier and the image was harmed by news and media (Bombardier 2013). The flood in the Philippines in 2012 caused supply shortages in leading manufacturing companies in Europe, leading to a reduction of production output (Bombardier 2012). Other companies such as BMW were hit by recall actions of 1.3 million vehicles in 2012, which were caused by supplier defects (Schwartz et al. 2012). The same company had to reduce production due to missing supplies as the suppliers' facilities were hit by an earthquake in Italy in 2011.

It is useful to compare the supply chain strategies of companies and their resulting ability to cope with some of the above-mentioned disruptions. Zsidisin (2003) and Rao and Goldsby (2009) created models which can be used by managers to measure and assess the vulnerability of their company and supply chain in relation to the associated risks. Typology may also provide avenues for future research and thus guide practitioners in the management of their supply chain risk portfolio. Such a classification is a useful tool for supply chain managers in differentiating between independent and dependent variables and the mutual relationships which would help them to focus on those key variables that are most important for effective risk minimisation in a supply chain (Nishat and Ravi 2006). Zsidisin typologised causal factors for supply disruptions into different categories—high, medium and low risk—based on managerial perception (Zsidisin 2003). Other authors besides Zsidian have build on this typology and outlined causal factors for supply disruptions as follows, which comprise the following (Tomlin 2006; Nishat and Ravi 2006; Rao and Goldsby 2009; Wieland and Wallenburg 2012):

- **Capacity shortages**
- **New product launches**
- **Disaster issues (e.g. earthquake, flood)**
- **Lack of supply chain transparency**
- **Labour-related issues (e.g. strike)**
- **Constraints on market capacity**
- **Pricing instabilities**
- **Quality discrepancies**
- **Transport issues**
- **Product transfers to sites or plants**
- **Inflexible production capacities**

Senior managers outlined during interviews of the doctoral thesis of Dr. Marc Helmold gave many examples of each category (listed above), and several authors (Aberdeen Group 2006; Gürtler and Spinler 2010) stressed the fact that upstream supply chains have become more complex and global, thus exposing them to more risks and increasing their vulnerability (Bothard et al. 2009; Helmold 2013). The systematic literature review as well as the interviews carried out by Helmold showed the following reasons for supply disruptions as the major root causes:

- **Natural disasters**
- **Technical misinterpretation**
- **Insufficient design maturity**
- **Capacity constraints**
- **Fragile supply chains**

Interviews were carried out with supply managements and China experts from companies with a large footprint in China, e.g. BMW, MAN, Siemens, Mitsubishi or Panasonic. Management in supply management from these companies pointed out that supply chain managing has been subject to various changes in last 20 years as markets opened up and free trade areas were created (Aberdeen Group 2006; Roland Berger Strategy Consultants 2012).

The globalisation, international supply, outsourcing of noncore competencies, reducing buffer levels throughout the chain by JIT concepts and fierce competition of supply networks are some of the more common trends in supply management. The major aim of the supply management function will be to cope with these trends and to improve competitiveness by reducing cost across the entire supply chain (Helmold 2013). Interviewees of leading companies in their industry sector like Bombardier, Siemens or ZF highlighted that the successful implementation of connected, digital and lean supply networks will be the key success factor for securing competitiveness of their organisations in 2030. The general manager of a former railway maker subsidiary outlined that it could rely on the global supply management Network as part of the railway maker. Nowadays, as the subsidiary become independent, the supply management activities are carried out autonomously but the former subsidiary is still working with the international supply networks. It could thus establish a robust and international supply management organization which can cope with the requirements and global challenges (Helmold 2013). As global supply chains become more complex, they are automatically more vulnerable to supply disruptions. This is, firstly, because globalisation and the increasing length of the supply chain and material flow lead to more risk factors. In addition, the impact of disruption spreads through the entire network much faster because of lower buffer stocks and single sourcing (Fig. 2.11).

In the past, before globalisation, many risk factors (e.g. currency exchange rate fluctuations, social instability and even natural disasters) were considered to be local or regional events, a point which was stressed by the interviewees. However, with increasing global sourcing, they are not local anymore; they easily influence the manufacturing process of companies located thousands of miles from the origin of risk. All interviewees indicated that their organisations were faced with supply

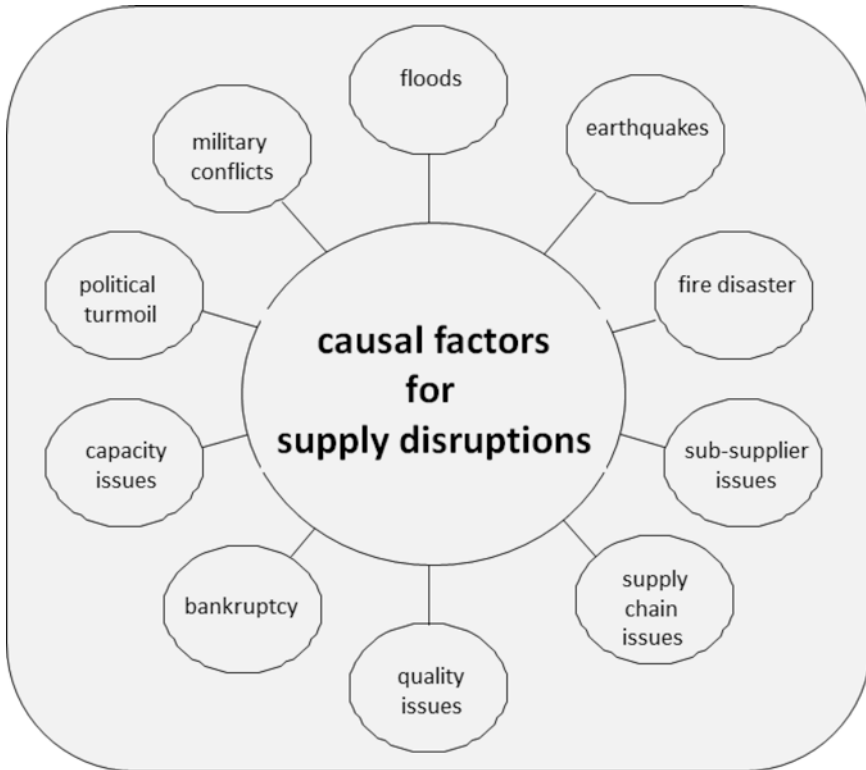


Fig. 2.11 Causal factors for supply disruptions (Adapted from Helmold 2013)

disruptions through natural disasters such as the earthquake and tsunami of Fukushima (Japan) in 2010 or the flood on the Philippines in 2012. For some companies, the Arab Spring caused temporary shortages in 2012, especially regarding products from Tunisia and Morocco. Bombardier receives modules from Bahrain, which was also affected by the Arab Spring. Fortunately, no shortages or supply disruptions occurred because the modules were delivered by air freight (Bombardier 2012). The mentioned supply disruptions are the same as those identified by Helmold in his systematic literature review; however, senior managers did not explicitly classify the supply disruptions. Increasing globalisation in international business presents another significant challenge. Manufacturing companies in the European transportation industry have to cope with longer lead times and, consequently, greater uncertainty in their extended supply chains. As a result, another problem has appeared in the risk profile of global companies, namely, risks associated with sub-suppliers, the supply chain and logistics. Many supply management experts from best-in-class companies in the automotive and railway industry pointed out that their tier-one suppliers also outsource many value-adding activities, thus exposing themselves to greater risks with regard to sub-suppliers. Besides globalisation, the outsourcing of activities on tier-one, tier-two or tier-three supply levels has added several new risks to the supply chain.



2.6 Proactive Versus Reactive Supply Management

Several authors have outlined factors that help to select the appropriate supply management strategy to anticipate and prevent supply risks with respect to internal or external context factors (Christopher and Peck 2004; Blackhurst et al. 2008). On the operational management of how to manage supply disruptions, not much literature is available. The question of determining the right actions how to anticipate and to avoid supply disruptions has given in industry and academia a very broad perspective. Moreover, a question exists on the question of how deep into the tier levels of the supply chain network to involve the management of supply activities (Gürtler and Spinler 2010). Gürtler and Spinler outline strategic supply risk management areas, which need periodical assessment and tactical actions which need continual measurements as shown in the figure below (Helmold 2013; Gürtler and Spinler 2010) (Fig. 2.12).

While certain context factors can affect the supply chain negatively, choosing appropriate strategies can help to overcome these effects. In this respect, the view is supported that supply chain strategies and supply management (i.e. the implementation of strategies to manage both everyday and exceptional risks along the supply chain based on continuous risk assessment with the objective of reducing vulnerability and ensuring continuity) can be seen as being a “two-sided coin” (Jüttner and Maklan 2011). As it will be demonstrated, both proactive (i.e. robust) and reactive (i.e. agile) supply chain strategies reduce the vulnerability of global supply chains and are in that way necessary. There is, however, a lack of research about how and to what extent a structured SCRM approach that involves the identification, assessment, controlling and monitoring of possible risks within the supply chain (Christopher and Peck 2004) fosters improved agility and robustness and, in turn, better performance. Especially the

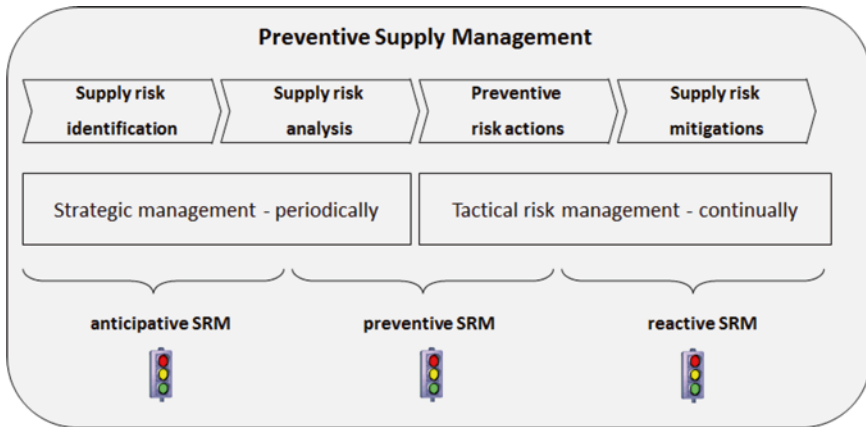


Fig. 2.12 Strategic and tactical supply management (Helmold; Adapted from Gürtler and Spinler 2013, 2010)

need for corresponding empirical work has been pointed out by several authors (Gürtler and Spinler 2010). Academics and practitioners emphasise that the anticipation, prevention and management of supply disruptions necessitate the proactive involvement of suppliers from a very early stage and common effort to improve supply chain visibility and supplier quality (Gürtler and Spinler 2010). The early involvement of suppliers can result in major benefits in terms of supply chain stability. Authors agree also that SRM activities should be based on collaboration (Aberdeen Group 2006). Several authors elaborate on the need for an early warning system (sensoric system) in order to establish a trend on supplier performance (Dust 2009; Gürtler and Spinler 2010; Dust et al. 2011; Christopher 2005). In line with a mechanism to evaluate suppliers from the supplier selection stage up to the end of the life cycle of a product (Dust et al. 2010), such supplier evaluation has to cover criteria in terms of quality, cost, delivery performance (logistics), financial health and technical performance as recommended by Emmett and Crocker (2009) and Blokdijk and Emero (2008).

The definition of criteria for such supplier evaluation system is dependent on the company's supply chain set up. The figure below shows that the aforementioned main criteria have been classified into subcategories. The company Porsche has probably one of the most advanced supplier management systems in the automotive industry. Through Porsche Consulting, Porsche is also transferring these principles to other companies. Porsche is quantifying and managing potential supply chain risks effectively and preventively in order to be successful over time with the phases as shown below:

- **Fahrzeugentwicklungsprozess—Development Process**
- **Kunde-Kunde-Prozess—Mass Production or Serial Process**
- **Kundenbetreuungsprozess—After Sales Process** (Fig. 2.13)

It is a proactive and cross-functional approach by various functions. When dealing with suppliers, there are substantial risks and potential for disaster in the form

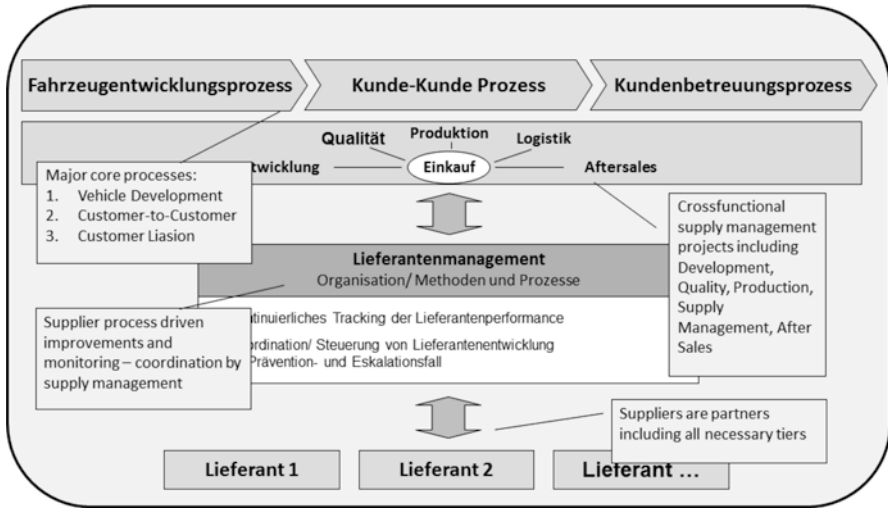


Fig. 2.13 Supplier measures during the value chain process (Adapted from Helmold 2011)

of bankruptcy, environmental problems, delivery failure, lack of materials, poor performance or product defects. Most organisations recognise that these risks exist, but do not take sufficient steps to manage them effectively. While it is true that the level of risk cannot be reduced to zero and all disasters cannot be prevented, there are still many steps an organisation can take to mitigate these supplier risks as shown in the Porsche example. One important and cost-effective step is to monitor and manage the performance of suppliers proactively, periodically and cross-functionally. By measuring and monitoring supplier performance on an ongoing basis, companies can realise some significant benefits. First, companies can avoid costly and potentially devastating supply disruptions. Second, companies can reduce overall risk to other adverse scenarios such as defects, environmental problems or safety issues with a supplier's process, materials or products. Third, companies that implement successful supplier performance management programmes will be better able to spot problems early and begin to implement corrective actions before the problem becomes a major issue that affects the bottom line. These benefits are easily quantifiable. If a company knows that there are usually 100 supply disruptions during a year and each disruption costs an average of \$100,000 dollars, the monetary benefit of preventing even some of these disruptions would be in the millions each year. The benefits to a company with an effective supplier performance management programme do not only encompass risk mitigation or prevention of problems. There are also positive benefits. One benefit is improved collaboration between suppliers that can lead to better co-ordination, thus enabling the company and supplier to better meet the company's business objectives. Another benefit that can arise is increased efficiency and productivity for the organisation as it interacts with its suppliers. In addition, a good supplier performance management system can also let suppliers take initiative to perform tasks such as updating their information to

ensure that everything is current. It can also improve invoice accuracy and reduce expenses. This prevents errors and can make it easier for suppliers to do business with the company.

2.6.1 Goals and Strategy of Evaluation

These objectives should be tied to the overall company strategy and the goals for the organisation. Without an alignment between a supplier performance management programme and the goals and strategy of the company, the programme will be at best ineffective and may result in wasted resources. The goals of the programme should also be tied into the overall spending of the company and should consequently reflect the company's spending and strategic priorities. This means that areas of greater spend and/or greater strategic focus for the company should receive more attention and focus in the programme. In addition to being aligned with overall company strategy, the objectives for the programme should also not be vague or nebulous. They should be clearly defined, specific, and measurable and should include a timeline. They should also be written down and there should be no doubt about what the objectives and the key measurements that define success are within the organisation. The programme should designate the key people that will be involved in the programme and should specify the resources required. These things will be required to obtain buy in and support of senior management. It may also make sense to try the programme with a select group of suppliers to gain experience, make adjustments and quantify results before rolling it out to other suppliers.

2.6.2 Areas of Evaluation and Focus

The areas that a company chooses to measure and manage and the criteria used will be a direct result of the company's goals and strategy and the objectives for the supplier performance management programme. There are a wide variety of areas of supplier performance that may be measured. It is important to select the ones that are most important for the organisation. Common areas that companies choose to measure include financial health (risk of bankruptcy, liquidity, sales, etc.), operational performance (quality, lead times, customer services, etc.), contract compliance, business processes (defect prevention, inspections, etc.) and overall cost. There are other metrics that may be important to a particular company. These metrics should be defined as key performance indicators (KPIs). Another factor that should influence the choice of evaluation methodology includes the type of suppliers that a company has. In the supplier performance management programme, it is important for company personnel to focus on the higher value and more strategic suppliers since these suppliers contribute the greatest amount of risks. It often doesn't make economic sense to include low dollar value, one-time business or nonstrategic suppliers in this type of programme. By grouping these top suppliers together and examining the company's relationships with them, some common

attributes will become evident. These attributes of the relationship can be used to develop the areas and metrics with which to measure. It is also important to work with the suppliers when developing these metrics and areas of focus. Some of the companies that are best at examining supplier performance continually interact with their suppliers, communicate with them frequently and use a mutually agreed upon system of metrics. This is a more collaborative approach with suppliers and ensures that supplier know what is expected of them. They can also make business plans and take steps to meet the goals and objective that were set for them. The suppliers are also acutely aware of whether or not they have performed well or have performed poorly.

2.6.3 Method of Evaluation

Once a company has decided what it is going to evaluate, the next step is to establish how it will evaluate the performance of the supplier. There are many ways to do this and some are more costly, time-consuming and resource intensive than others. By quantifying the level of risk and the projected benefit of a method of evaluation, company personnel can determine the most appropriate method or combination of methods that should be used. Some methods that companies commonly use to evaluate and measure supplier performance include:

- **Site visits by cross-functional teams**
- **Supplier audits (process, special process or product audits)**
- **Paper supplier questionnaires**
- **Web-based supplier questionnaires**
- **Organising existing data**
- **Internal questionnaires**
- **Requiring external certifications**
- **Developing own certifications**
- **Third-party reviews**
- **Phone call with a supplier**
- **Independent ratings**
- **Contacts with other supplier customers**

Companies must also decide how and when to use these methods. It is important that some of the least costly methods are performed frequently in order to obtain updated risk assessments and scorecards. If performed correctly, this will also help the company to stay aware of important developments before they become a problem. Some of the more costly methods such as site visits should be performed less frequently. However, for important, high-risk suppliers, site visits are an important tool and make it easier to accurately assess the supplier's ability to perform. Other reviews and certifications can provide a company with an additional level of comfort with the supplier business and processes.

2.7 Suppliers' Days and Supplier Portals

Suppliers' days are one suitable tool for improving and maintaining a good relationship to suppliers. Supplier relationship management (SRM) is the systematic, enterprise-wide assessment of suppliers' assets and capabilities with respect to overall business strategy, determination of what activities to engage in with different suppliers and planning and execution of all interactions with suppliers, in a coordinated fashion across the relationship life cycle, to maximise the value realised through those interactions. The focus of supply management is to develop two-way, mutually beneficial relationships with strategic supply partners to deliver greater levels of innovation and competitive advantage than could be achieved by operating independently or through a traditional, transactional purchasing arrangement.



A good forum for maintaining relationships of supply networks is a suppliers' day, in which all or a number of suppliers to come together. This forum enables the buying side (customer) to present organisational news, strategy updates and

strategic items of interest. In parallel the evening time can be used for networking. Companies such as Daimler, Porsche, Deutsche Bahn, Bombardier and Siemens have regular **suppliers' days**. Suppliers' days typically take place once or twice a year, or depending on the project or situation, also based on important milestones (start of a project, serial production, ramp-up, after sales, etc.).

2.7.1 Supplier Portal

For the day-to-day business and B2B communication and relationship, many customers such as Siemens, Daimler, Porsche and BMW use **supplier portals**, to which the supplier can be connected online. Portals in supply management contain possible information such as:

- **Quality data**
- **Cost and financial data**
- **Delivery and logistics data**
- **Engineering information**
- **Financial Information**
- **Sustainability requirements**

Portals in supply management are one of the innovative new technologies introduced during the dot com er, but unlike marketplaces, exchanges and other failed concepts, portals successfully gained widespread adoption in many supply management departments. In fact, portals have been both a disruptive and transformative force in the supply networks and chain. Below are the listed major benefits of supplier portals for a good customer-supplier relationship. A few of the benefits enabled by the introduction of supplier portals include:

- **Broader Supplier Enablement**—Portals enabled a new tier of suppliers to automate routine supply chain execution transactions such as purchase orders, shipping notices and commercial invoices. EDI had gained a critical mass of usage among larger companies. However, smaller businesses often struggled to find the resources, budget and in-house expertise to implement EDI. Portals filled the white space in the market quickly. Anyone with a PC and an Internet connection could connect to a portal with minimal training and investment. As a result, the barrier to entry for e-commerce was lowered enabling tens of thousands of small suppliers to interact with customers electronically.

Best-Practice: Siemens Supplier Portal

Overview of Siemens Supplier Portal

- Principles of supply chain management
- Requirements for suppliers
- Identifying risks and implementing measures for improvement
- Know-how transfer and competence building
- Resource efficiency, climate protection and regulatory requirements in the supply chain

Principles of supply chain management

The principal goal of supply chain management (SCM) at Siemens is to ensure the availability and quality of the materials we require to serve our customers also considering innovation strength and sustainability of our suppliers. We aim to strengthen our competitiveness by achieving substantial savings in our purchasing volume. In fiscal 2014, Siemens' purchasing volume amounted to approximately €37 billion, which equaled roughly half of our total revenue. Our primary strategies for achieving savings in purchasing include: Siemens-wide managed volume, Sourcing from emerging markets and E-sourcing. The successful restructuring of our SCM function since the end of fiscal 2013 led to a substantial decrease of the cost for the SCM organization, driven by optimizing towards a less complex setup and process improvements. Going forward, we will continue with reshaping the SCM function in alignment with Vision 2020 to support the new Siemens organization structure overall. We also continue to strengthen Siemens' innovation power by benefiting from the innovative strength in our supplier network. In May 2014, we held our "1st Siemens Supplier Innovation Day," the first event of its kind on Siemens corporate level. With this event, we established a platform for regular dialogue with our top innovative suppliers at the CEO level. With this dialogue, we aim to increase our innovation capabilities, realize shared growth potential and ensure long-term cost leadership. Sustainability requirements – as a guiding principle for our supply chain management – are an integral part of all relevant supplier management processes – such as supplier selection, supplier qualification and evaluation, and supplier development. <http://www.siemens.com/about/sustainability/en/core-topics/suppliers/management-and-facts/index.php>, 1st February 2016.

- **New Business Process Automation**—Portals enabled a new group of business processes such as strategic sourcing, collaborative design and demand planning to be automated. Historically, these processes occurred over the phone, via e-mail correspondence or in face-to-face meetings. Due to their complex nature, these supply chain practices were too sophisticated to automate through machine-to-machine transactions. By moving these processes online, portals reduced not only the cost of these transactions, but the latency of information sharing and the barriers to adoption.
- **Supplier Self-Service**—Portals offer a lens into the buyer's ERP system. Inquiries that would need to have been conducted via a time-consuming game of phone tag could instead be performed with just a few mouse clicks. For example, a high percentage of the call volume to accounts payable organisations is from collections personnel in the supplier organisation attempting to determine when an invoice will be paid. Portals offer the ability for suppliers to perform self-service inquiries online whenever they need to know the status of an expected payment.
- **Collaborative Processes**—Portals provide both supplier and buyer with a single, shared view of data. Historically, personnel from buyer and the supplier each viewed data in their own business applications which were hopelessly out of

sync. With portals both supplier and buyer share a common view of data such as performance scorecards. The newfound visibility enables the two parties to collaborate on corrective actions to improve overall supply chain performance. Dispute resolution is another process which benefited from the shared view on a portal.

- **Change Management**—Supply chains are constantly changing. Buyers open up new distribution centres, manufacturing plants and retail stores, which change routing guides. As business process re-engineering occurs, new and improved forecasting, purchasing, labelling, shipping and invoicing procedures are introduced. Portals provide an online resource for buyers to communicate changes to contact details, routing guides and business processes to the supplier community. Historically, these changes had to be communicated to each supplier through direct mail, phone conversations or vendor conferences.

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