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# Procurement Strategies in Multi-Layered Supply Chains

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## 1. Introduction

Procurement departments of almost each and every organization must take on ever more challenging projects in order to overcome deficiencies in other areas of the business. Optimizing supply structures and processes, connecting from the customers' demands through all the tiers of the supply chain and finding reliable suppliers in low cost countries contribute to compensate diminishing returns on assets and on revenue. Well balanced prudence has to be applied to cope with supply chain complexity, stimulate supplier innovation, enhance operational security, and consider the social and environmental impact of the supplier in sourcing decisions. Addressing issues like these requires a high level of talent and commercial acumen, and the challenges reach beyond that of the organizational supply nexus. They have ended up in transforming the traditional way of sourcing into a network of collaborative action, into an "extended enterprise model" commonly referred to as a *supply chain*. The following definition is offered by the Massachusetts Institute of Technology (MIT), quoted by Metz (1998): "...a process-oriented, integrated approach to procuring, producing, and delivering end-products and services to customers. It includes sub-suppliers, suppliers, internal operations, trade customers, retail customers, and end-users. It covers the management of materials, information, and funds flows."

Supply chain management, then, involves the effective planning and execution of activities and processes across the entire value chain. This requires new levels of involvement by materials suppliers, service providers (e.g., freight/transportation and warehousing services), and even distribution customers and resellers. Numerous research and publications have been made on how this is put into operation (see, e.g. the WebSite of Supply Chain Council, <http://supply-chain.org>, an organization that was organized in 1996 and now has closer to 1,000 corporate members worldwide). However, as with any operational decision-making, supply chain optimization must be preceded by strategic decision-making. The foremost issue is about the objectives which are to be attained by establishing or joining a supply network, and from there, strategic planning will evolve. So the first set of questions would be about those objectives, about how they relate to the mission of an organization altogether and how this ends up in formulating and implementing strategies.

### 1.1 Supply chains and their strategic objectives

By joining a supply network a business wishes to benefit from synergies and high performance. But, looking inward, the foremost and highly critical issue is the need to align business objectives and supply management objectives.

Every company's supply management strategy fits somewhere within supply-side strategic objectives (acquiring business through massive channeling of goods into the market) and demand-side strategic objectives (acquiring business through attracting pre-identified buyers): For example, WalMart aligns with the supply-side strategy since their goal is clearly to be a *low cost provider*. A company with a goal to be the *market share leader* would align itself with a demand-side strategy (an example would be CISCO's market share in virtual private networks which has been achieved through selective marketing). And a business strategy focused on market share leadership is not very much compatible with a supply management strategy which focuses on supply-side strategic objectives (Littleson 2008).

From there, by taking into account the customers' and suppliers' viewpoints, a company will define its *core competencies and core processes* based on the strategic objectives of its supply management, and it will choose its suppliers and sub-suppliers accordingly, and thus, these definitions will have an effect on the overall supply chain. Hence, on the strategic level, the decisions that are made with regard to the supply chain will reflect the overall corporate strategy that the organization is following, and they will cover the whole breadth and depth of the supply chain. This includes product development, customers, manufacturing, vendors and logistics, because all those areas involve procurement. So, e.g., a company will have to identify the customers for its products and services in line with its strategic decisions on the products to manufacture, and when decisions are made to define the manufacturing infrastructure and the technology that is required, the decisions may lean towards using subcontracting and third party logistics. Also, as environmental issues influence corporate policy to a greater extent, this may have an additional influence on strategic supply chain decisions.

Coming back to the supply-side and demand-side options, leveraging the total company's purchases over many businesses can allow company management to select strategic global suppliers who offer the greatest discounts, or it can lead to a well balanced vendor portfolio which directly relates to the customers' demands. From another angle, the supply-side option takes account of supply-uncertainties, and the demand-side option takes account of demand-uncertainties (Lee 2002). This aspect will be dealt with in detail in section 5. Right now we will only deduce that from this perspective, two major functions can be derived for the supply chain: One is to secure efficient procurement throughout the various levels ("tiers") in which the goods flow upstream from vendor to vendor; this is the *physical function* of a supply chain, and it will dominate if supply uncertainties prevail. The other function is to ensure that the variety of products demanded by the customers reach the marketplace in response to where and how the customers wish; this is the *market mediation function* (Fisher 1997).

Another important strategic decision is about choosing the adequate logistics function, which might be key to the success of the supply chain. This would relate to optimal order fulfillment, the design and operation of the warehousing and distribution center network and transportation modes (see, e.g. Murray 2008). These high level decisions can be refined, as required, to reach the specific needs of the company at the lower levels which allow for

tactical and operational supply chain decisions to be made. The intensity of this link between strategic objectives and operational actions depends on the volume and complexity of factors to be reconciled, and supply chain managers today face an unremitting challenge to their capabilities in this regard. Guidance is required to translate a set of objectives into adequate operations, and the best way, possibly, can be found by transforming strategic objectives into performance metrics. Connecting objectives and metrics (“How will I measure the outcome of my strategy?”) is one of the most crucial tasks in strategic planning. We will demonstrate this in various sections of this chapter. And once the metrics have been determined, numerical targets must be set. In the context of any collaborative issue, be it a network or just intra-company co-operation, a qualitative strategy map and the corresponding metric compound must be built firstly. Then, what follows, is adopting quantitative techniques such as system dynamics simulation and optimization in order to take managers through the stages of strategy formulation, action evaluation and decision making.

### 1.2 Formulating a set of strategies

Corporate strategic planning is a continuous and crucial activity. In order to formulate appropriate business strategies, the top management and strategists must have a clear understanding of the company’s strengths and weaknesses, the opportunities and threats it is facing, the purposes of the business, as well as the objectives to be achieved. Strategy formulation is an essential part of all management systems. When we look at a widely accepted framework, the *Comprehensive Strategy Management Model* proposed by David (2007), we find that generating the possible strategies for a firm plays a dominant role („Strategy Formulation Analytical Model“, see David, op. cit.).

Generating the possible strategies for an organization (a firm, an administrative institution or a supply network) sets out from the internal and external characteristics of this organization. Strategy formulation involves:

- Developing a vision and mission
- Identifying the organization’s external opportunities and threats
- Determining the organization’s internal strengths and weaknesses
- Establishing long-term objectives
- Checking on alternative strategies
- Choosing the particular strategy/strategies to pursue.

Many strategy-formulation techniques are available to assist in developing strategies. They can be integrated into a three-stage decision-making framework as shown below:

Stage 1 of the strategy formulation framework uses the EFE Matrix, IFE Matrix and CPM Matrix tools to summarize the basic input information needed to formulate strategies:

*External Force Evaluation (EFE) Matrix* summarizes and evaluates the key economic, social, demographic, environmental, political and technological factors that would have the highest impacts to the organization both as positive opportunities or negative threats. It also records how the organization intends to respond to the key external factors.

*Competitive Profile Matrix (CPM)* presents major competitors and the organization’s relative strengths and weaknesses in relation to the competitor’s position.

The *Internal Factor Evaluation (IFE) Matrix* summarizes and evaluates the major strengths and weaknesses in the functional areas of a business.

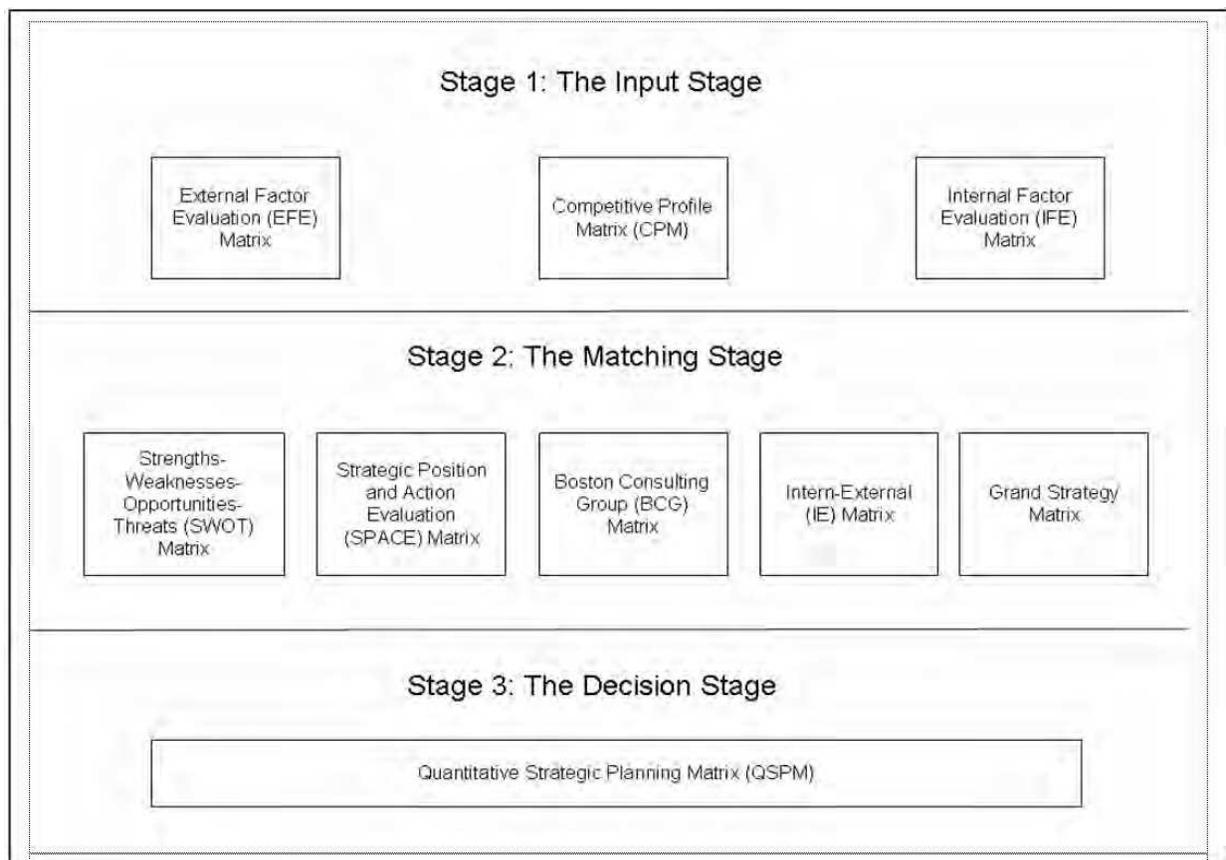


Exhibit 1. Strategy Formulation Model (Source: David 2007)

Stage 2 is the Matching Stage. It focuses on generating the alternative strategies through the matching of key internal and external factors. Key techniques used in stage 2 include the Strengths-Weaknesses-Opportunities-Threats (SWOT) Matrix, the Strategic Position and Action Evaluation (SPACE) Matrix, the Boston Consulting Group (BCG) Matrix, the Internal-External (IE) Matrix, and the Grand Strategy Matrix.

The *SWOT Matrix* helps the strategists to develop four types of strategies, i.e. SO, WO, ST and WT strategies. SO strategies use an organization's internal strengths to take advantage of external opportunities. WO strategies aim at overcoming internal weaknesses to take advantage of external opportunities. ST strategies use an organization's strength to reduce the impact of external threats. WT strategies target to reduce internal weaknesses and avoid external threats.

The SPACE a Matrix a is matching tool. It presents a four-quadrant framework indicating whether aggressive, conservative, defensive or competitive strategies should be taken by a given organization. The four quadrants represent Financial Strength (FS), Competitive Advantage (CA), Environmental Stability (ES) and Industry Strength (IS), and the respective strategy types for each quadrant would then be the appropriate recommendations for the organization. The SPACE Matrix complements the SWOT technique by providing further qualifications to the SO, ST, WO and WT strategies.

The BCG Matrix graphically presents the differences in the portfolio of an organization in terms of relative market share position and industry growth rate: Business units with a high relative market share with high industry growth rate ("*Stars*") are the best long-run opportunities for growth and profitability, and therefore they should receive substantial

investment. Units which have a high relative market share but compete in slow-growth industry generate cash in excess of their needs ("*Cash Cows*"). *Question Marks* units have a low relative market share but compete in a high-growth industry. Their cash needs are high and their cash generation is low, and the organization will need to consider either to invest to grow this business or to sell it. Units which have a low relative market share position and compete in a slow-growth industry ("*Dogs*") might need to be liquidated, divested or trimmed down through retrenchment.

The *Internal-External Matrix* expands the concept of the BCG Matrix and provides a categorization of business development strategies into „*grow and build*“, „*hold and maintain*“, and „*harvest or divest*“.

Finally, the *Grand Strategy Matrix* applied in stage 2 is based on two evaluative dimensions: competitive position and market growth, and it allows for strategy formulation attaining market penetration/ market development and product development, or vertical/horizontal integration or concentric diversification, etc.

Stages 1 and 2 furnish a prioritized list of strategies. In stage 3, the *Quantitative Strategic Planning Matrix* determines the relative attractiveness of various strategies based on the extent to which key external and internal critical success factors are capitalized upon or improved. The relative attractiveness of each strategy is computed by determining the cumulative impact of each external and internal critical success factor.

This enumeration of techniques may suffice as a brief introduction for a reader who is not acquainted with the conceptions of strategic management. For an in-depth research the reader may be referenced to the “classical” texts by e.g. Mintzberg and Quinn (1998) and by Hamel and Prahalad (1994.) A more recent overview is Johnson, Scholes and Whittington (2008), and regular updates appear on <http://strategicmanagement.net>. In accordance with the purpose of this book chapter, the authors wish to advise that literature on strategic management to a large extent focuses on the marketing side of business. However, many rationales which embrace this end of an enterprise can easily be related to the supply side of an organization. If we take, for example, the Boston Consulting Group Matrix which originally applies to a product portfolio of an organization in terms of relative market share position and industry growth rate, the matrix perspectives may very well be versed to a “portfolio of supply items” or a “portfolio of technologies” or a “vendor portfolio”. The terms for the correspondent analysis might remain <market share> and <growth rate>, but they might be altered into other criteria like <supply risk> and <product complexity> or <supplier capabilities> and <competitive position>. Which criteria to choose is a question of which result is expected from the analysis. Thus, portfolio analysis becomes a generally applicable tool that combines two or more dimensions into a set of heterogeneous categories for which different (strategic) recommendations are provided (Gelderman 2003). An example will be given in section 3.1.2 below.

So what can be accomplished by formulating strategies? We have seen that a broad array of informational input is used and selected for analysis and for filtering out the relevant impact factors. This in itself provides a broad set of determinants by which to guide (supply) decisions. Also, as can be seen from the three-stage model delineated above, strategy formulation creates awareness and provides systematic problem solving approaches for all levels of decision making. And, with regard to procurement, strategy formulation will help to secure that supply strategies always correlate to the overall business strategies of the organization.

### **1.3 Correlating supply strategies and overall business strategies: An example from the automotive industry**

Strategy development for the supply function must be pursued in close association with other functions. For instance, market entry choices will affect procurement strategies, and the determinants would be market maturity, complexity of logistics, import tax tariffs, ability to develop suppliers, etc. Furthermore, when devising a strategy, the tactical and operational levels must be taken into consideration. This is best done by proceeding along a line of analytical inferences which set out from market criteria, resource allocation and process determinants: The strategic level designs the supply network, reflecting the investigation of broad based policies, corporate financial plans, competitiveness and the intensity of adherence to organizational goals. Connecting to resource allocation and process determinants in the design phase will secure stable implementation, and the range of strategic alternatives provided by the analysis will thus be rooted in what is achievable. Exhibit 2 gives an illustration of the procedure.

The column in Exhibit 2 which is marked "Criteria" lists some patterns which are exemplary for the automotive industry, but they can be generalized very easily; the column marked "Characteristics" shows a choice of values for each of the characteristics. The values which label the characteristics will determine the structure of a specific strategy. For example, in a fast growing market with low import tariffs and low logistics cost where the manufacturer may establish an import ownership, and customs clearance is efficient, the strategy will tend to set up a local assembly and ship the components completely knocked down ("CKD") even if the requirement for local content is medium. This strategy design will then involve decisions on the levels of resource allocation and of business processes, and these must be apparent at the time of the strategic decision already. The analytical model presented here (Yu Song 2009) will warrant that the need for those decisions becomes apparent.

### **1.4 Implementation of strategies**

Strategy formulation, whichever is their impact on creating awareness and providing systematic problem solving approaches, does not guarantee success. Managers and employees must be motivated to implement those strategies, and they must get technical support from top level executives. This would include establishing annual objectives, devising policies, allocating resources, altering an existing organizational structure, restructuring and reengineering, revising reward and incentive plans, etc. Strategies can only be implemented successfully in organizations which handle their goods and services production and marketing properly, which have access to the working capital they require, and which use an effective and efficient information system. These functional issues must also be addressed during the implementation phase.

The leading technique for implementing strategies is the Balanced Scorecard. While the Balanced Scorecard approach as developed by Kaplan and Norton (1992) was not specifically designed for the Supply Chain, the idea that metrics be closely aligned to a company's strategic objectives does very well apply to the ambience of procurement: The central focus is on targets measured by key performance indicators that monitor if an objective has been reached. Thus the level of strategic decision-making and day-to-day business results get intrinsically interconnected. The metrics to be set will help to measure the performance of supply processes, warehousing and delivery from various viewpoints ("perspectives"), including customer satisfaction and financial outcomes, giving the key

managers a guidance for optimizing the overall supply chain and the business unit procurement. A typical metric pack includes such Key Performance Indicators as Defects Per Million Opportunities, Inventory Months of Supply, Claims percentage for freight costs, On-time pickups, Transit time, On Time Line Count, Customer Order Promised Cycle Time, etc.

Criteria	Characteristics				
	Introduction	Development (fast growth)	Stable growth	Maturity	Introduction
Market trend for the end product					
Local content ratio	No requirement	Low	Medium	High	
Import tax tariff	No requirement	Low	Medium	High	
Local logistics costs	Much cheaper than export country		More expensive than export country	No big difference to export country	
Import OEM ownership structure	Wholly Foreign Owned		Joint Ventures	Independent 3rd party	
Customs clearance efficiency	Low		Medium	High	
Factory organization	Controlled by the parent company		Controlled by the export company	Controlled by the import company	
Integrated logistics chain control	Centralized by the parent company		Centralized by the export company	Centralized by the import company	
Autonomy of the planning	Locally independent		Centrally coordinated	Centrally controlled	
Manufacturing technology	Parent company		Export company	Import company	
Product variants	Few		Medium	Many	
Target market for finished products	Domestic only			Domestic and export	
Frozen period (time in which plans remain unchanged)	Short		Medium	Long	
Complexity of product shipped by exporter	Vehicle	Module structure	Component structure	Single items	
Packaging from exporter	Vehicle oriented		Module oriented	Component oriented	
Warehousing before export	Consolidation			No Consolidation	
Inventory transparency	Transparent			Not transparent	

Exhibit 2. Determinants for correlating supply strategies and overall business strategies  
Source: Song, Yu 2009.

The use of a well designed and balanced “metric pack” often leads the applicant to just install a measurement system (which is definitely a valuable intent) instead of also connecting each of the metrics to a strategic goal. So, for instance, if the metric is “Defects Per Million Opportunities”, the strategic goal behind the metric must be to reduce the defects, and it must be connected to an approach of how to achieve this reduction. Similar contexts can be shown for each and every of the various indicators. The following four tables (adapted from Bhagwat and Sharma 2007) display which indicators can be applied to a supply chain’s four perspectives “Finance”, “Customer”, “Internal Business” and “Learning”. This should serve to guide the reader towards contemplate which objectives and which approaches they represent.

Performance metrics for the financial perspective	Performance metrics for the innovation and learning perspective
Customer query time	Supplier assistance in solving technical problems
Net profit vs. productivity ratio	Supplier ability to respond to quality problems
Rate of return on investment	Supplier cost saving initiatives
Variations against budget	Supplier's booking in procedures
Buyer-supplier partnership level	Capacity utilization
Delivery performance	Order entry methods
Supplier cost saving initiatives	Accuracy of forecasting techniques
Delivery reliability	Product development cycle time
Cost per operation hour	Flexibility of service systems to meet particular customer needs
Information carrying cost	Buyer-supplier partnership level
Supplier rejection rate	Range of products and services
	Level of customer perceived value of product

Exhibit 3. Supply Chain Metrics fitted into the perspectives “Finance” and “Innovation & Learning” of a Balanced Scorecard. Source: Bhagwat and Sharma 2007.

Performance metrics for the internal business perspective	Performance metrics for the customer perspective
Total supply chain cycle time	Customer query time
Total cash flow time	Level of customer perceived value of product
Flexibility of service systems to meet particular customer needs	Range of products and services
Supplier lead time against industry norms	Order lead time
Level of supplier's defect free deliveries	Flexibility of service systems to meet particular customer needs
Accuracy of forecasting techniques	Buyer-supplier partnership level
Product development cycle time	Delivery lead time
Purchase order cycle time	Delivery performance
Planned process cycle time	Effectiveness of delivery invoice methods
Effectiveness of master production schedule	Delivery reliability
Capacity utilization	Responsiveness to urgent deliveries
Total inventory cost as:	Effectiveness of distribution planning schedule
Incoming stock level	Information carrying cost
Work-in-progress	Quality of delivery documentation
Scrap value	Driver reliability for performance
Finished goods in transit	Quality of delivered goods
Supplier rejection rate	Achievement of defect free deliveries
Efficiency of purchase order cycle time	
Frequency of delivery	

Exhibit 3a. Supply Chain Metrics fitted into the perspectives “Customer” and “Internal Business” of a Balanced Scorecard. Source: Bhagwat and Sharma 2007.

These tables are shown here not only to illustrate the wide range of performance metrics in a supply chain; they shall also demonstrate the wide range of strategic objectives that supply chain management may entail. If we take just one metric out of each perspective: Customer query time, which appears in the “Finance” and in the “Customer” perspectives, would

certainly measure how far a numeric goal, e.g. "Reduction by 20 %" has been met, i.e. if there is progress on the way to reach this goal (the "strategy"). There is a financial outcome as there is less cost involved with solving queries, and there is an outcome in customer satisfaction. And when we look at "Supplier assistance in solving technical problems": there will as well be an underlying strategy, e.g. early supplier involvement, which also carries financial effects. Lastly, "Total Supply Chain Cycle Time" in the internal business perspective has cost effects, cash flow effects and definitely customer satisfaction effects. So we can see the "cause and effects" chain that protrudes the set of objectives and of strategies. Each of them contributes to the overall objective. We will now examine this further; section 4.4 will come back to the use of the Balanced Scorecard for strategy implementation.

## 2. Dissecting the overall supply chain objective

Establishing a supply chain provides better procurement of inputs and better use of resources as compared to standalone solutions. But what is meant by "better"? The Supply Chain Council has estimated that most companies and organizations can realize the following performance benefits from improved supply chain management [Supply Chain Council, 2000 (<http://www.supply-chain.org> )]:

- Increase forecast accuracy by 25-80%
- Reduce inventory levels by 25-60%
- Reduce fulfillment cycle time by 30-50%
- Lower supply chain costs by 25-50%
- Upgrade fill rates by 25-30%
- Improve delivery performance by 16-28%

In the essence, what is accomplished is an elimination of what is called the „bullwhip effect“: The amplification of order variability as one goes upstream in the supply chain is drastically reduced.

But we have to go beyond the "visible effect". In order to achieve the improvements outlined above, an institutional achievement has to be effectuated. Thus, the overall supply chain objective is made up by a set of determinants which may be divided into two groups: Defining scope and attributing tasks.

### 2.1 Defining scope (determination of width and of tiers)

Defining the scope of the network will be a primordial task and it should start with the end-customer requirements and work back through each element of the chain, assessing the value-added activities and the resources required at each stage of goods transfer (or service activity). This analysis should look at the alternatives for redeployment of resources to better optimize the value chain and thereby reduce overall costs and build up speed. This optimization will often include plans for insourcing/outsourcing, inventory management plans (e.g., supplier-managed inventory), supplier management and partnering, e-procurement strategies, and third-party logistics providers.

The traditional arms-length, win-lose approach that many companies have taken with their suppliers will simply not deliver the required results. What has to be called for is a more integrated, win-win relationship, taking a more sophisticated and segmented approach to buyer-supplier relationships. There will always remain some suppliers with whom a traditional buyer-seller relationship will suffice. However, for more critical commodities

and services, higher-level relationships will be required. These could range from conventional preferred supplier agreements to sophisticated, multi-year partnering arrangements with value-added activities included, such as inventory management systems, technical support, and even technology co-development programs. For a better understanding of the various arrangements, and following Pyke and Johnson (2003), we categorize the supplier relationships into five different types:

*Buy-the-market relationship.* Buy-the-market relationships are transaction-based relationships with a focus on price. They are often used to choose the low-cost seller of reliable, standard products, where little variations in performances between different sellers are expected.

*Ongoing relationship.* When the product performance, such as the quality, may differ among competing sellers, ongoing relationship is the type of relationship with a deeper and broader interaction that provides experience about the performance and, thus, is the better relationship in such situations.

*Partnership.* A partnership is an even closer relationship than an ongoing relationship with the aim of choosing the best performance of the product via closer interaction and improving the performance of a product through information sharing.

*Strategic alliance.* Beyond the goal of improving product performance, strategic alliances provide a sharing of risk and trust at a level that allows extensive cooperation in strategic business areas and product development - from engineering and marketing to production planning, inventory and quality management - without the fear of negative effects of information sharing such as espionage.

*Backward integration.* Buyers integrate the production of bought product components back into their production process, if relationships are extremely complex, uncertainty is high, and the products have key strategic significance. This is actually no relationship in the classical meaning anymore and only mentioned here for the matter of completeness.

Each of these relationships<sup>1</sup> will require an adequate supply strategy. There are four parameters which shape the design of any of the strategies. They are

- Contract: The type of contract used, its length, and the specification detail.
- Information sharing: The intensity sharing of information about supply chain and buyer characteristic, such as actual demands and forecasts.
- Interaction and culture: The interaction between buyer and seller and the difference in company cultures.
- Trust: From the many definitions of trust we might choose Hagen and Choe (1998): „...the expectation that the promise of another can be relied on and that - in unforeseen circumstances - the other will act in a spirit of cooperation with the trustor“. Trust is hard to measure in terms of numbers, but, with regard to supply chains, we might see some determinants for trust. One would be the strategic importance of the purchased component: If the component is critical to competitive differentiation or involves proprietary know-how, a close alliance will only be entered with highly reliable sellers. Another determinant is the number of sellers (suppliers) that can provide the component or service: A low number of sellers (extreme: only one seller) will drive the firm towards closer relationships, and it will have to check on trustworthiness. A third

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<sup>1</sup> Another aspect of the relationships in a supply chain will be dealt with in section 3.4.2.1

determinant would be the complexity of the interfaces of the component to be acquired with the rest of the final product(s) and of the logistics involved. Complex interactions between components can be better handled in trusted alliances.

All these parameters and determinants will induce the composition of the supply chain. The next step would be to decide on which tasks will be attributed to which member.

## 2.2 Attributing tasks and performance objectives

A crucial definition in modeling a supply network is about which tasks would have to be performed by which of its members, how those tasks would be performed and how they would interconnect. One criterion is effectiveness, the other one is costs. Costs should be evaluated on a basis of total cost of ownership (TCO) of the tasks being performed. TCO, in this meaning, goes beyond the price paid for materials and services at each stage and includes all other meaningful elements of cost involved in acquiring, transforming, and delivering the materials or services to the next stage in the chain: inventory carrying costs, quality costs, late delivery costs, warranties, and other factors.

One other part of supply chain planning is the information systems required to integrate all the partners in the chain. From first-generation dedicated EDI systems the way would lead to web-based tools and portals for forecasting, demand balancing, inventory replenishment, order entry and tracking, account management and other information to execute a supply chain. "Execution" here means putting the agreed-upon plans into action and establishing the management-review- and tracking-systems which ensure that cost goals and operational requirements for the chain can be met. In this context, the following reasoning has been laid down, interestingly enough, by the US Department of Defense which is part of one of the largest supply chains in the world (Department of Defense Reliability Analysis Center 2004):

*"This division of work requires some non-traditional thinking in terms of the relationships between an organization and its suppliers. In the extended enterprise model, suppliers and distribution customers become the arms and legs of the product or service provider. The extended enterprise model requires a well advanced operational integration of the value chain. Information flow is especially critical to the success of the supply chain. Consequently, a well-planned, integrated information system strategy is a critical element, and the SCM software industry has gone aggressively after this market requirement.*

*Fully integrated suppliers can support a variety of lean manufacturing activities, such as kanban and automatic replenishment systems, vendor-managed inventory systems, and outsourced subassembly operations. A further, logical development of these concepts is the recent rise of third-party logistics (3PL) or lead logistics providers (LLPs) who offer a fully integrated logistics outsourcing approach that can include inventory management, warehousing, freight & transportation, cross-docking, kitting & kanban, and outbound distribution services on an optimized basis.*

*Supply chain partners are also frequently engaged in technology co-development and new product development activities. In this context, integration of supplier reliability, maintainability, and supportability capabilities into the new product development process becomes a key enabler and should occur in the earliest phases of the product development program.*

*Key suppliers should be members of the cross-functional product development team in order to best leverage their organizations capabilities to reduce costs and cycle times. In most cases these key suppliers can contribute effective ideas and capabilities for reducing materials costs, design fabrication costs, logistics costs, and manufacturing cycle times."*

What we have here is nothing less than an appeal to change the mindset. And this holds true for governmental and for business organizations: "The biggest obstacles to achieving optimized supply chain management solutions will likely be overcoming traditional mindsets concerning buyer/supplier relationships and cost-effectively establishing the required information systems networks between different organizations in the chain" (Miller 2002). So when the minds of managers have grown into what is implied by a "collaborative mindset" and when the appropriate objectives have been mounted, the next step will be to fine-tune into the pertinent strategies.

### **3. Procurement strategies: Classifications in a "standalone" perspective**

Strategists in any business will always set out from a perspective that positions their organization in a situation of independence. This is a natural starting point, as it allows them to develop coherent plans and actions for penetrating and skimming markets, for product research and design, recruitment and human resource management, manufacturing and purchasing patterns etc. Incorporating inter-organizational relationships into the deliberations would at first sight disorder the coherence of business planning, because one may very rightly presume that the plans and actions of third parties lie beyond the reach of corporate planning. The changes in scope and impact of procurement which took place in the last 30 years have contributed to alter this way of thinking, and relationship management has moved into the focus of how businesses can improve performance. Still, procurement strategies can best be understood if we set out from a "standalone" perspective. Collaborative issues and the issue of interconnecting the tiers of a supply chain will be examined afterwards.

#### **3.1 Traditional procurement strategies classification**

Procurement strategy development can be distinguished along three lines (Soellner, Mackrodt 1999). They represent the objectives of

- achieving total cost leadership
- positioning the company favorably in the value chain
- creating growth opportunities.

From there, four streams to deal with the strategy problem in supply management can be identified (Hess 2004): Sourcing concepts, portfolio approaches, process approaches and task-focused approaches. These concepts will be further described within the following paragraphs.

##### **3.1.1 Sourcing concepts**

Sourcing concepts are providing combinations of sub-strategies. The goal of the combination is to find a suitable procurement strategy that provides the most beneficial target contribution with utmost synergetic effects (Koppelman 2004). A typical example of a sourcing concept can be found in Arnold (1996) who has developed the so-called sourcing toolbox. The sub-strategies are defining elements like: number of suppliers, configuration of sourcing object, sourcing area, etc. All sub-strategies are consisting of at least two alternatives. The selection of the most suitable alternative and combination of all sub-strategies' alternatives can be done case by case or representative for typical repeatable

sourcing decisions. One advantage of the sourcing-toolbox is the possibility to add or delete elements to adapt it to a specific purpose of strategic decision-making.

### 3.1.2 Portfolio approaches

Kraljic (1983) was the first to develop a comprehensive portfolio model for procurement. Together with his matrix, which is exhibited below, he proposed an approach for defining the supply strategy with four steps: Phase 1 is intended for classification of the supply item by using the dimensions profit impact and supply risk. Phase 2 focuses on market analysis with an evaluation of the bargaining power of the suppliers in comparison to the own strength as a customer. During the strategic positioning of phase 3 the purchasing portfolio matrix is created by positioning the strategic items defined during phase 1 alongside the two dimensions of company strength and supplier strength. Result of phase 3 is an allocation of the item and supplier combination within one of three risk categories to be found in the purchasing portfolio matrix. For all three risk categories Kraljic (1983) recommends specific strategic thrusts. Phase 4 is dedicated to the development of detailed action plans to address the risk and all strategic concern appeared during strategy development.

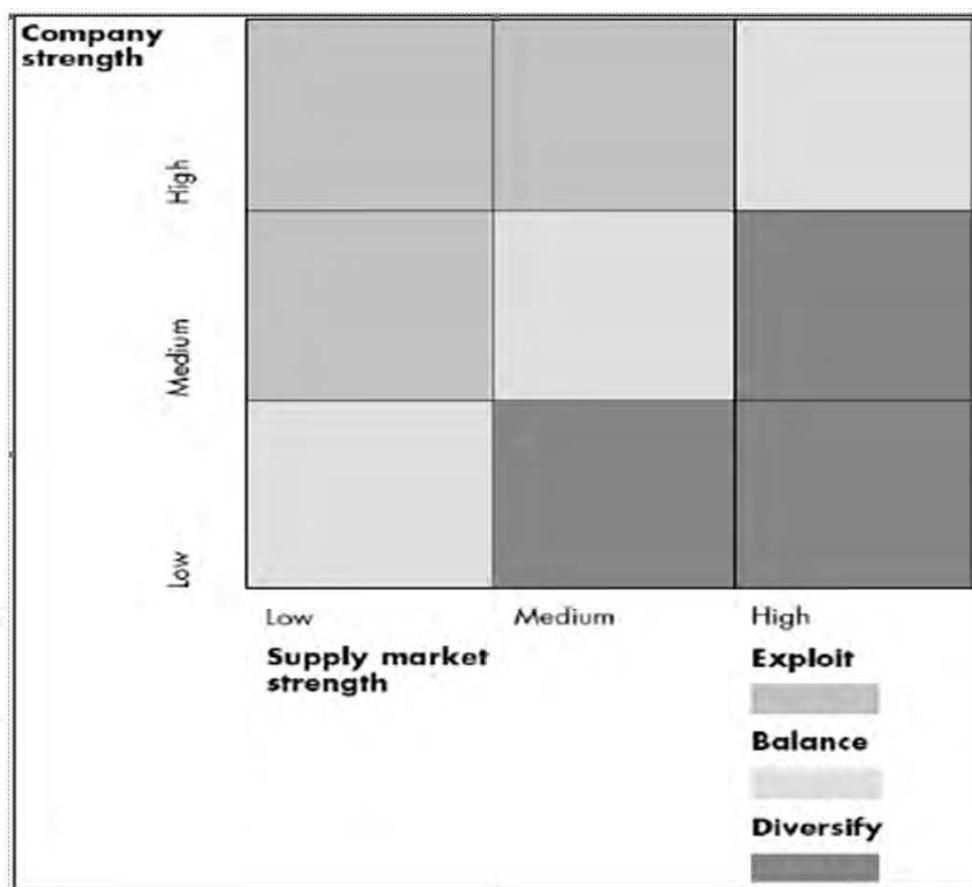


Exhibit 4. The Purchase Portfolio Matrix. Source: Kraljic 1983.

Extensive research work has been conducted in the field of purchasing portfolios both on further developing the portfolios with different dimensions and on analyzing the practical applicability of Kraljic's model. Geldermann, Van Weele (2003) investigated cases and experiences of practitioners with application of portfolio analysis and recommended to see

the filling of the matrix not as the main scope of work. In their conclusions they identified Kraljic's model as providing a basis for strategic discourse during a strategy formulation process and pointed out that these in-depth discussions are the most important part of the analysis. There are critics also which exhibit that the reality differs from the model, e.g. Hess (2008). But he also admits that the portfolio approach is a common practice, due to its usefulness for first orientation purposes.

### 3.1.3 Process approaches

A typical characteristic of the portfolio analysis is the development of generic strategies once the supply requirement has been positioned within the portfolio. Process approaches should provide an alternative to this method of using standardized recommendations or generic strategies. The main focus of process approaches lies on defining the required activities to identify and structure internal and external potential for success. The alignment to superordinate strategies has to be assured. A thoroughly established method includes decision field structuring, effective arrangement of process steps, estimations for time durations and it would consider the required approval steps. To support analysis and decision making it will make use of analytical frameworks, checklists, decision-making tools, means to coordinate the different instruments, etc.

As strategic processes do not consist of automated workflows, accomplishments do not come automatically. Executives will have to watch the motivation level of employees and prepare means to monitor compliance. Motivation and compliance gain importance with increasing requirement of cross-functional coordination as goals and objectives of the various functions involved are in many cases naturally opposing. A sophisticated process approach will therefore address the requirement of cross-functional coordination from the outset. Even the most sophisticated method can not overcome challenges inherent to strategic planning processes. We know that cost estimations related to strategic measures are often difficult to impossible and that the valuation of strategic measures' impact is not feasible immediately and directly.

Among the many different process approaches spanning from strategic alignment up to implementation guidelines the authors want to mention the examples of Koppelman (2004), Appelfeller, Buchholz (2005) or Laseter (1998). Hess (2008) intended to provide a systematic framework by combining methods for particular procurement tasks, sourcing concepts, portfolio approaches and a Procurement Balanced Scorecard and called it the "15M-Architecture". It turns out to be the most comprehensive process method consisting of 4 strategic building blocks with 15 modules.

### 3.1.4 Task-focused approaches

Methods focusing efforts on specific tasks are providing sets of activities in the majority of cases for a dedicated team for a pre-defined timeframe. The rationale behind this way to handle a problem can be seen in the different requirements of strategic problem solving compared to the standard operational workload in procurement. Additionally the specific tasks are often related to extensive cross-functional coordination and are not fitting into existing lines of responsibility. We find among the topics in task-focus examples like supplier relationship management, global sourcing or e-procurement.

Successful completion of tasks are often requiring dedicated teams with special training that can operate with organizational autonomy towards this single objective. Thus, an immediate

reorganization can be avoided as the additionally required capacity is provided by the team members. Arnold, Morgan (1994) state that for a similar strategic question the main design challenges to be addressed would be:

- the type of vision to dominate the design of the project
- project's extent of separation from or integration into the existing system
- assurance of sustainability of the approach.

Among the disadvantages that might come along with these approaches are potential narrow views within the team that lead to short-term measures without considering long-term effects and sustainability. Other weaknesses can be found in organizational aspects, as the relationship with the existing organization may not evolve positively and conflicting goals might lead to hostility. In general, separation of activities does not foster synergy creation and can lead to discontinuities in information flow.

A common way to benefit from a task-focused approach led by a dedicated project team and to additionally create a sustainable implementation is to start with the project and to perform organizational changes based on experiences from the pilots (Arnold, Morgan 1994).

### **3.1.5 Value-focused approaches**

From a competitive standpoint, it may seem to the market leaders that the widespread use of competitive sourcing techniques and tools has eroded the major advantage that it gave pioneers in the 1990s. A.T. Kearney's 2008 "Assessment of Excellence in Procurement Research" (A.T. Kearney 2008) found that the savings gap between leader- and follower-companies had shrunk by half just since 2004. So, since value derived from sourcing cost savings will not be enough in the coming years, a new approach is required. This would be to use the supply base as a resource to both supplement and complement the company's resources and to employ this combined capability to improve overall company competitiveness by creating additional value for both customers and shareholders (Monczka, Blascovich, Parker and Slaight 2011). Increased emphasis is to be laid on value goals (i.e. beyond cost) and the supporting data/information collection and analysis. These include the requirements of the ultimate customers that will impact what is purchased, the dynamics of the supply market and specific supplier capabilities. Overall, the breadth and depth of the data collection and analysis increases significantly. For example, the linkage between customer and company business, product and technology strategies must be clearly understood. Understanding where value is created in the supply network is critical as is the detailed application of value mapping tools, supplier and network optimization, supplier needs analysis, product design complexity and so forth.

### **3.2 Connecting the procurement strategy approaches to synergy creation**

The very nature of procurement strives to accomplish advantages through acquiring goods and services for which the supplier possesses a competence which is higher than that of the buyer. The goal, thus, is increased performance, and it is achieved through synergy. Synergy and performance objectives are closely interrelated. Stahl/Mendenhall (2005) name four basic categories of synergy: cost reduction, revenue enhancement, increased market power, and intangibles. The most relevant strategic objectives in a buyer-supplier relation in this regard will lie with avoiding the build-up of fixed cost and fixed assets elements by increased utilization of existing assets, with distribution optimization, and with overall

economies of scale. Investment synergies and management synergy will also get a high rank, as will transfer and balancing of assets. Closer to performance, standardization and techniques of know-how-transfer will play a major role in target setting. Hence, the process-focused and task-focused approaches for formulating and implementing procurement strategies will gain momentum.

The following exemplary procurement strategy frameworks are appropriate to support requirements of synergy enhancement. Among the concepts to be exhibited are: Strategic sourcing, commodity strategy, supplier management, supplier relationship management, supply chain management or co-development with suppliers. Coming back to the categorization of Hess, the sourcing concepts are described here with components originating from Koppelman (2004), with a model of process approach that was developed by Laseter (1998), and with the Global Sourcing concept of Trent/Monczka (1991).

### 3.2.1 Introducing the commodity level

According to Koppelman (2004), there are certain elements which have to be employed on both the level of the overall purchasing strategy and the commodity level and which are based upon the following set of generic strategies:

- Product strategies
- Sourcing strategies
- Communication strategies
- Service strategies
- Cost strategies

For synergy creation, the following elements are to be considered in Product strategies:

- Co-development
- Platform concepts / standardization
- Zero-defect concepts

The following elements are to be considered in Sourcing strategies:

- Insourcing vs. Outsourcing,
- Supplier Concepts (multiple vs. single),
- Object Concepts (system-modular-unit),
- Replenishment Concepts (stock vs. just in time delivery),
- Area Concepts (global-domestic-regional),
- Subject Concepts (individual vs. collective)

The following elements are to be considered in Communication Strategies:

- Information exchange acceleration
- Intensifying of competition
- Know-how-transfer

The following elements are to be considered in Service Strategies:

- Support
- Outsourcing services
- Outsourcing waste management
- Intensifying inspection

The following elements are to be considered in Cost Strategies:

- Minimum price
- Fair price
- Average market price

This enumeration of elements should serve to illustrate the wide range of considerations that are intrinsic in shaping an individual set of strategies for an organization. The decision-makers will have to carefully select the proper elements and to reach an adequate balance.

### 3.2.2 "Balanced Sourcing"

The term "Balanced Sourcing" has been introduced by Laseter (1998) based upon practical cases and research of Booz Allen Hamilton. The model considers a broad perspective as the procurement function and the supply base are considered to have connections to almost all business processes. The method suggests to establish a balance between cost savings initiatives and cooperative relationships with suppliers.

Applying "Balanced Sourcing" to the entire extent defined by Laseter (1998) would mean to transform the organization from the transactional approach to a cross-functional strategic management. This transformation comes in parallel with the development of six organizational purchasing capabilities. Three of these capabilities are universally applicable to any company and represent core processes of the procurement strategy: (a) Modeling total cost, (b) Creating sourcing strategies and (c) Building and sustaining relationships. The other three capabilities have been defined to be different ways towards competitive advantage: (d) Integrating the supply web, (e) Leveraging supplier innovation, and (f) Evolving a global supply base.

The "universal" capabilities are core processes of general practicability in supplier management and strategic sourcing, and Laseter (1998) advises that companies should select from the other three capabilities the most suitable one or two. Due to the scope of these three, application of all three would remain for the largest companies with most advanced strategic procurement organizations. But all the capabilities resonate throughout any supply chain. The capacity of evolving a global supply base has been refined in many ways. If properly applied, the synergy potential of global sourcing ranks highest amongst all as will be seen from what follows.

### 3.2.3 Global sourcing

Evolving a supply network into a global supply base, in the perspective of Laseter (see above), is certainly a differential capability as it will eventually lead to competitive advantage. Adding another perspective will bring us back to the strategic issue. This is about the motives to evolving a global supply base. Wildemann (2006) enumerated the following motivations to start global sourcing:

1. Realization of cost savings by capturing factor cost differences
2. Securing availability of purchased goods
3. Reduction of existing dependence on suppliers or supply markets
4. Natural hedging of revenues and currency fluctuations
5. Addressing local content requirements
6. Spreading sourcing risks like insolvency risk or risk of shortfalls in production
7. Optimization of deliveries within the international manufacturing footprint.

If we investigate motivations not only from a procurement standpoint but with the supply chain view we can distinguish between the two main intentions (1) Following an overall expansion strategy of the firm into new global markets and supporting it with procurement activities and (2) pursue global sourcing to improve competitiveness of domestic operations. If we further investigate item (1) we find that especially in businesses with a high

requirement for variety and volatile demands localized sourcing to reduce in-bound lead-times represents the means to sustain supply chain agility (Christopher 2010). The localization of components should focus primarily on those items that generate the differentiation of the final product. An adaption of the product to changing customer needs is more easily achievable as adjustment of delivery schedules for the differentiating components can be realized within shorter periods of time. In case no. (2), if procurement motivations are dominant, the selection of commodities for global sourcing will depend primarily on the selected source of competitiveness the company intends to improve. Bogaschewsky (2005) summarizes the drivers more general into: cost reduction, quality improvement, increased flexibility and shorter development times.

At this point the authors want to emphasize their understanding of global sourcing and refer to the definition of Trent, Monczka (2003, p. 26): "Global Sourcing involves proactively integrating and coordinating common items and materials, processes, designs, technologies, and suppliers across worldwide purchasing, engineering, and operating locations". The Five-Level-Model as per Exhibit 5 below positions global sourcing in comparison to international purchasing approaches. We can observe an international approach at level III already, but what makes the difference to a global sourcing initiative is the organizational integration. A level IV strategy is characterized by a global coordination and integration of all procurement organizational units and top management supports and promotes the global approach. A real cross-functional integration across global locations is the main differentiator in a level V strategy. One of the most challenging tasks to accomplish on the global scale is the integration of R&D together with new product development activities (Trent, Monczka 2003).



Exhibit 5. The Five-Level Model of Global Sourcing. Source: Trent and Monczka (2005), p. 28

Trent, Monczka (2005) identified seven broad characteristics of global sourcing excellence in the most successful companies within their empirical research. The detailed description of these characteristics has been delivered and provides insight to the correlation of opportunities for purchasing synergy creation and global sourcing excellence factors. If we refer to the model of Rozemeijer (2000) whose dissertation concentrated on synergy creating activities in purchasing, we recognize the following correlations:

Benefits from an integrated, cross-locational and cross-functional approach will not only be found at the most successful companies. Positive effects will materialize if an organization is

Opportunities for Purchasing Synergy	Characteristics of Global Sourcing Excellence
1. Jointly negotiated contracts	Rigorous and well-defined processes
	Methodologies of measuring savings
2. Frequently shared functional resources	Executive commitment to global sourcing
	Supportive organizational design
3. Frequent exchange/sharing of information	Availability of needed resources
4. Frequent exchange/sharing of knowledge	Integration through information technology
	Structured approaches to communication

Exhibit 6. Correlation between opportunities for purchasing synergy and characteristics of global sourcing excellence. Source: authors' design based upon Rozemeijer (2000), p. 231, and Trent/Monczka (2005), p. 30.

prepared to recognize that a global sourcing approach has to integrate all core functions of the enterprise. The following list (from Trent/Monczka 2003, p.32) gives an overview of the main benefits where an influence has been observed:

- Better access to product technology
- Improved supplier relationships
- Common access to process technology
- Improved sharing of information with suppliers
- Lower purchase price/cost
- Shorter ordering cycle times
- Better management of total supply chain inventory
- Higher supplier responsiveness to buying unit needs
- Standardization or consistency to the sourcing process
- Early supplier involvement during new product/service/development
- Higher material/component/service quality
- Improved delivery reliability
- Improved environmental compliance
- Greater appreciation of purchasing by internal users
- Lower purchasing process transactions costs
- Higher user satisfaction with the purchasing process

The main characteristic of this list is that most of its elements not only refer to advantages for *all* members of a supply network (unlike many other lists which only cover benefits for a single firm), but that they can also be expressed in measurable targets. Still, what we need up on that, is an outlook which focuses on the collaborative perspective of a supply chain. This will be given in the following section. The outset would be that true supply chain superiority does not come by emulating the best practices of others. Rather, it flows from leveraging a strategic framework and deeper set of guiding principles that lead to competitive advantage (what has been called the “competitively principled” supply chain by Lapede (2006)).

### 3.3 Collaborative procurement strategies: Setting upon uncertainty, complexity, and free riders

#### 3.3.1 Reducing uncertainty

For a systematization of strategies that appertain to the whole of a supply chain, it is useful to remember that collaboration in a supply chain generally reduces uncertainties. With regard to the sources of the uncertainties and the ways to reduce them, we can again set out from demand-side and supply-side strategies: The first type of uncertainty reduction strategies aims at reducing the demand uncertainties, such as avoiding the bullwhip effect, by using, among others, collaborative replenishments. Supply uncertainty reduction strategies aim at reducing or even avoiding uncertainties concerning the continuous upstream. Examples of such strategies are the exchange of information (starting with product development and continuing with the mature and end-of-life phases of the product life cycle) and the use of supplier hubs (in order, e.g., to reduce the risk of break-downs in manufacturing lines). We can match this perspective with two other viewpoints (Lee 2002). One is the character of the goods channeled through the supply chain: they can either have long life-cycles and satisfy needs that do not change much over time ("*functional products*"); these products will be fast movers and produce low inventory and stock-out cost and low profit margins. Or they can have short life-cycles and an unpredictable demand ("*innovative products*"); these produce high inventory and stock-out cost and (possibly) high profit margins. The second viewpoint is that of supply process stability: We may distinguish between a *stable process* and an *evolving process*: The first one is based on a mature technology and on mature manufacturing techniques, in the other one those characteristics change rapidly and experience is limited. Putting all this into a grid we get four quadrants (Exhibit 7):

Each of the quadrants represents a distinctive composition of a supply chain. Lee (2002) connects these compositions to four distinctive collaborative strategies:

*Efficient Supply Chains* utilize strategies aimed at creating the cost efficiencies in the supply chain. All these strategies aim at minimizing non-value-added activities, deploying scale economics and optimization techniques, and establishing information linkages for demand, inventory, and capacity exchange.

*Risk-Hedging Supply Chains* utilize strategies that hedge the risks in the supply chain. These are strategies aimed at pooling and sharing resources in a supply chain so that the risks in supply disruption can also be shared.

*Responsive Supply Chains* utilize strategies aimed at being responsive and flexible to the changing and diverse needs of the customers, such as mass-customization (with order accuracy) and build-to-order techniques.

*Agile Supply Chains* utilize strategies aimed at being responsive and flexible to customer needs, while the risk of supply shortages or disruptions are hedged by pooling inventory or capacity resources. The strategies that are used here range from the risk-hedging to the responsive supply chains.

Due to the differences in the goals and strategies of the four models, the value and competitiveness of a supply chain different must be determined by a diverse set of measures. Generally speaking, for efficient and risk-hedging supply chains, measures such as plant capacity utilization and inventory turns of the whole supply chains may be adequate. For responsive and agile supply chains, a measure, such as the product availability, may be more appropriate (Paulitsch 2003). This aspect will be further evaluated in section 6 below.

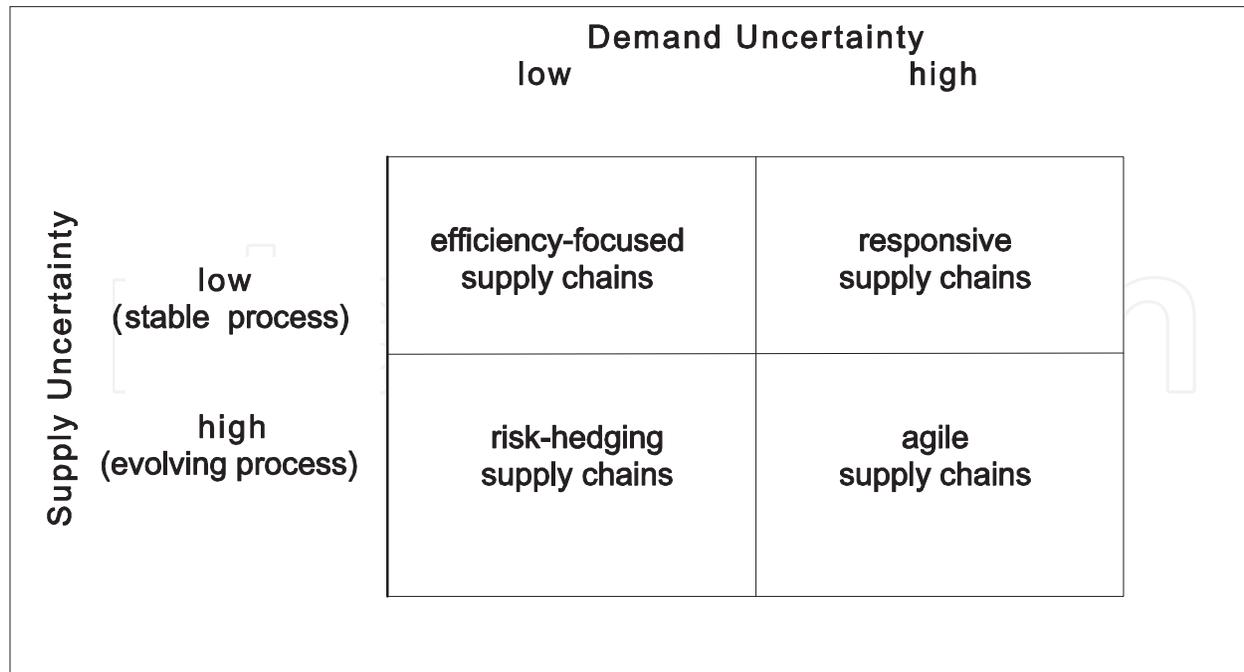


Exhibit 7. Supply chain strategies for different products and process types. Source: Lee 2002.

There is another aspect deriving from the classification into “efficiency seeking”, “risk-hedging”, “responsive” and “agile”: The stronger members have to assist those members whose resources are limited, and altogether they will defend the objectives against “pirates” who want a free ride without providing any contribution. Those opportunists often hide behind the complexity of the system, so providing transparency is one means to fight them.

### 3.3.2 Overcoming complexity

Supply chains are complex systems. Their complexity is expressed in volatility, uncertainty, numerousness, variety and a dynamic environment. These complexity parameters determine the structural configuration and the relationship between the elements of the supply chain, and the effects resulting from the system's complexity are reflected in the indicators used to monitor network performance. There are five basic strategies for dealing with the effects of complexity: Accepting, managing, reducing, preventing and transferring. Two examples of complexity management will be given below (from Kersten 2010). One relates to effects on direct cost (Exhibit 8), the other one to effects on overhead cost (Exhibit 9).

According to Kersten (2010), the five different strategies would be characterized as follows:

- The “Accepting Complexity” strategy reactively adapts the organization to what is predetermined through external requirements. The complexity effects on the company are compensated by going back to traditional, less sophisticated supply chain management.
- The “Reducing Complexity” strategy objective is to simplify and optimize structures, products or processes, diminishing the numerousness of elements and their connectivity.
- The “Managing/Controlling Complexity strategy” proactively handles the existing structure of business processes in the most effective way to ensure their reliability. For this, the variety of process outputs and the predictability of process results are reconsidered.

Complexity Parameters	Area of cost impact	Type of Strategy	Actions
Variety	Procurement Warehousing Handling	Reducing	Centralizing supply requirements, supplier development and certification, consolidating international supplier base, reconfiguring warehouses regionally, focusing on fewer product types.
Numerous- Ness	Purchase prices, transportation Suppliers' finan- cial health	Reducing	Consolidating purchasing volumes, consolidating suppliers, consolidating warehouse operations, using alternative modes of transportation based on volume requirements.
Volatility	Direct materials (including fuel)	Accepting/ Managing/ Reducing/ Transferring	Charging surcharges based on fuel prices and distances/ Improving reliability of operations Optimizing operational costs of procurement
Uncertainty	Labor Transportation Suppliers' financial health	Managing/ Reducing	Improving forecasts with suppliers, cooperating with suppliers to improve their operations Consolidating supplier base
Dynamic Environment	Global sourcing Shifts in customer demands	Accepting/ Reducing	Downsizing organizational structure / Cutting supplier base, closing facilities and offshoring operations.

Exhibit 8. Complexity management strategies for direct cost impacts. Source: Kersten 2010.

- The "Preventing/Avoiding Complexity" strategy anticipates future complexity within existing structures or processes by improving awareness of how complexity is generated.
- The "Transferring/Exporting Complexity" strategy sidesteps complexity by transferring them to other players in the market.

There is a similarity, at least in the denomination, of complexity strategies and risk management strategies: Accepting, managing, reducing, preventing and transferring also indicates the range in which risk is handled. As can be seen from the tables, quite a few of the actions which are listed here would also show up in a list of recommendations regarding risk management. A few other remarks on risk management will be given in section 5.

### 3.3.3 The "defensive" perspective: Looking inward

Transparency and a reduction of complexity will not alone suffice to defend the supply chain against free riders. The "real-term-solution" will have to start with securing access to and use of information. There is a wide consensus on the idea that the information systems integration is a must, and this makes it even more difficult to restrict access. The task

Complexity Origin	Type of Strategy	Actions
Organization	Reduce	Outsourcing of operations, reducing product lines, restructuring by regions, consolidating operations and purchase volumes.
	Prevent	Implementing new IT and other technologies; automation
	Manage	Setting supplier close to overseas production sites, increasing supplier base, global sourcing, standardizing parts catalog, increasing frequency of deliveries.
External Environment	Reduce	Cutting of operations and licensing of production.
	Prevent	Introducing model variety, implementing corporate responsibility standards
	Manage	Diversifying supplier base and developing suppliers' competitiveness.
	Accept	Charging fuel surcharges, downsizing organizational structure and diversify operations' location.
Structural Interface	Transfer	Conducting price increments in transportation and warehousing services and products.
	Reduce	Consolidating shipments, consolidating operations and technology improvements in transportation.
	Prevent	Using intermodal transportation, sourcing locally and expanding operations internationally.
	Manage	Diversifying supplier and customer base.
	Accept	Increasing inventory and order frequencies, delaying production phases, building buffer stock and shifting transportation modes.

Exhibit 9. Complexity management strategies for overhead cost impacts. Source: Kersten 2010.

requires sophisticated system administration, and it requires trust. When we look at the traditional vision of the supply chain, demand flows down the chain (from each “node” which represents a trading partner to the next “node”, which is the downstream trading partner) and products are moved in the opposite direction (see Exhibit 10 below). The effect of free riders taking advantage of access to the system can be compared to what results from instability of information: Delay times, distorted demand signals, and poor visibility of exception conditions result in critical information gaps, including misinformation and, ultimately, leading to mistrust. When partners lose faith in the forecast they receive, they typically respond by building up inventory buffers to guard against demand uncertainty. This is aggravated when there are deficiencies in data security. The disruption that results from dramatic, sudden changes in forecasted demand is amplified as it travels up through the supply chain, and the chain gets a victim of the “bullwhip effect” like if the partners were just dealing on arms’ length instead of collaborating in a supply chain.

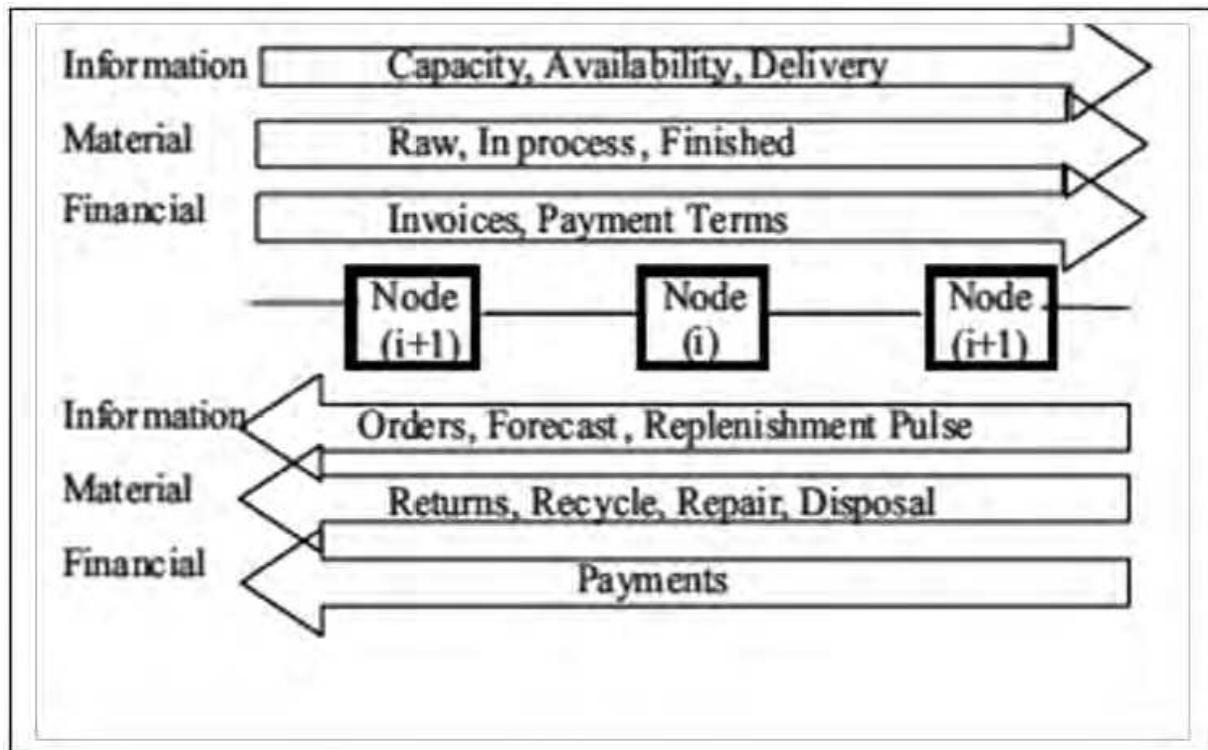


Exhibit 10. Flows of material, information and finance

The above exhibit demonstrates that a strategy is needed to guarantee a secure flow of material, information and finance, not to just eliminate free riders but, first and foremost to enhance performance. The main aspect here is connectivity and trustful collaborative practice. The relevant technicalities will be dealt with in section 3.4. Before getting there, we need to briefly look at what might be deemed the opposite of collaboration: offensiveness.

### 3.3.4 The “offensive” perspective: Competition between supply chains

There is a tendency to assume, from the way in which companies reconsider arms’ length practices and competition, that, in the future, companies will no longer compete against other companies and instead, networks will compete against networks, and supply chains against supply chains. On the other hand, experience shows that supply chains use their competitive advantage in a completely different way: They create internal capabilities through integrating capabilities from upstream and downstream partners. Still, one may consider three scenarios, where actions take place that may be considered as competition between supply chains, and this certainly has an impact on strategic management. Rice and Hoppe (2001) demarcate three scenarios:

- Scenario (A)

*Rivalry among groups of companies across the supply network, competing as one entity, formally or informally. This applies when the following conditions are present:*

- The chain is a vertically integrated company, either competing against another similar vertically integrated company or against supply networks comprised of many companies;
- The supply network is a highly integrated company with no common suppliers;

- The supply network is comprised of companies that have sole-source relationships;
- The industry is fragmented in such a way that there are no common strategic suppliers represented in more than one supply network, and most strategic suppliers are dedicated to one supply network.

- Scenario (B)

*Competing on supply network capabilities.* Competition between individual companies competing on their internal supply network capabilities. Mainly competing on the effectiveness, efficiency and responsiveness of the network and on the network design used (for instance, applying innovative postponement production strategies, introducing new distribution channels, etc.). Network capabilities can be added or integrated (not copied).

- Scenario (C)

*Competition centered on the single, most powerful company of a supply network (referred to as the "channel master").* This scenario is the most relevant and is commonplace in today's marketplace: The channel master uses its market power to exert strict unilateral coordination of processes among its suppliers and customers. Examples are Dell Computer, Procter and Gamble and Wal-Mart, and their exertion of power ranges from being benevolent for the entire network to being entirely company-focused and transaction-oriented (Christiaanse and Kumar 2000).

Above all, the "channel master scenario" is commonplace in today's practice. Daimler's supplier network serves as a good example. The auto-maker considers suppliers to be an integral part of its "extended enterprise" and works aggressively to refrain suppliers from providing their capabilities to other networks. Still, the present relationship of Daimler with its suppliers is far more constructive than it used to be a decade ago (Elmazi and Kordha 2009).

### 3.3.5 Co-opetition

Combining the "inward" and the "outward" (= offensive) perspectives we get to the paradigm of bringing together cooperation and competition into a third position that has been called co-opetition. Cooperation is characterized by autonomous entities in the supply chain which form a dynamic network with integration, coordination, collaboration, information sharing, common interests and mutual competitive advantage. Likewise, competition focuses on the need for development of competitive advantage between the actors; the network environment enables them to optimally allocate scarce resources, providing the impetus for innovation and entrepreneurship, and reducing transaction costs. This paradox proves livable when proper arbitration and sufficient balance is ensured between competition and cooperation in view of the various interdependencies in the network. From a theoretical standpoint, as it is given by transaction cost economics, it is these interdependencies which make the network livable: There are hierarchical interdependencies, as expressed in the tiers of the supply chain or in the powers conferred to the central player of a focal network, and there are market interdependencies, but the members of the network stay legally independent, holding their identity, culture and capabilities and maintaining a structural flexibility.

Transaction cost economics roughly states that the optimal structure of market-relations is determined by finding an optimum for the "costs connected with using the market mechanism" (this definition for "transaction costs" was first discussed by R.H. Coase in 1937). In the context of supply networks, these transaction costs represent the summation of

coordination costs between the actors, including cost to avoid risks relating to operations and risks arising from opportunism. Coordination costs reflect the costs of information exchange (on product qualities, on demand, inventories, production capacity, etc.), costs related to the integration of this information into the process of decision-making, and costs related to delays due to communication problems. La and Cooper (2000) distinguish between coordination risks that relate from operations (risks of misinformation or voluntary withholding of information), and risks that relate from opportunism including those which are connected to lack or loss of bargaining power.

In practice, there are not many cases where transaction costs are actually measured and reported, but it seems logical that the network will at least gradually arrive at a status and a structure where these cost are minimized. Nevertheless, this is not as obvious as one might think. Although integration between members may be the motive of a supply chain, it doesn't happen automatically. An excessive integration could be detrimental to the performance of the supply chain, and it is first necessary to identify activities and key members. In most cases, drivers for integration are situational and different from one process link to another, the degrees of integration differ from link to link and also vary over time. Finally, the integration of the supply chain also depends on certain organizational factors such as trust, commitment, interdependence, organizational compatibility, vision, leadership and top management support (La and Cooper, 2000). Consequently, the road to structuring the network becomes dynamic and non-linear. And, with each member's need to strive for its individual competitive advantage, we will find that they behave in ways so as to create more value by cooperating, but also to capture a large share of the created value by means of competitive actions. This is the outcome of what might be called "bipolar strategies".

There is an intrinsic bi-polarity in supply chains: Cooperation and competition represent an ago-antagonistic couple in the supply chain, since on one hand they are viewed as contradictory, yet on the other hand this paradoxical combination has positive effects. Also, there are two logics to the phenomenon. One is characterized by behavioral aspects (competitive action), and the second is characterized by strategic aspects (cooperative relations): With a view to long-term effectiveness and survival, the members of the network univocally recognize its strategic value. However, each one wishes to achieve short-term improvements individually. For this, the term "co-opetition" was coined in 1996 by Adam M. Brandenburger of the Harvard Business School (Brandenburger and Nalebuff 1998). The approach is towards a "win"- "win"- "win"-situation, where companies can create value by cooperation processes, and at the same time capture value by competitive processes. A case that illustrates co-opetition is Covisint, a venture which had been founded in 1999 by General Motors, Ford and DaimlerChrysler to serve as a common automotive exchange platform (see <https://daimler.portal.covisint.com>). The aim was to build a virtual marketplace in which partners would perform a certain number of activities jointly. The platform performs several functions like networking between all the actors, coordinating and synchronizing processes, standardization of quality standards and of safety standards, and improved allocation of resources between partners. In 2001, Renault and Nissan joined the venture. This cooperative initiative between companies who compete in the market provides economies to each of them: lower product or service purchase prices, collective auctions, reduced transaction costs among members and pooled Research and Development

activities. So as to not lose competitive advantages, the partners integrate private platform mediation which allows them to benefit from cooperation in a competitive environment.

### 3.4 Putting the collaborative perception into practice: control strategies

Inter-organizational control has three aspects: functional, institutional and instrumental. The “**functional**” would refer to the question if there is a dominant role of either accountability issues or purely (procedural) logistic issues. A system which ensures an accountability structure will definitely develop a closer collaboration based on the willingness to widely share information, to initiate problem solving and to adapt to changes; this would be accompanied by restraints from the use of power (Mahama 2006). The “**institutional**” would refer to the question who develops the strategic framework: The two main choices are that this is done either by one powerful supply chain member who has been conferred the leadership role (“focal network”), or by a team consisting of several equally empowered members (“polycentric network”). One determinant factor in this will be the complexity of the network, and, besides the distribution of power, the two alternatives involve the notion of trust. With the “**instrumental**”, we get to the question of how to obtain the data for managing the network and for performance measurement.

#### 3.4.1 Management control patterns

Management control in a network, like in a standalone firm, can be conceptualized and categorized in various ways: formal vs. informal controls, behavior vs. outcome controls, diagnostic vs. interactive controls, mechanistic vs. organic controls, and bureaucratic vs. clan controls (Langfield-Smith 1997). From a long-term perspective, management control in supply chains has to apprehend that

- a. any network will develop along three phases of transactional relations (contact phase, contract phase and execution phase), for which either the market plays a dominant role (and, following this, specific control instruments are not required as they are substituted by market mechanisms), or bureaucratic means are required such as pre-defined norms, standards, and rules, or where trust is the dominant factor (control mechanisms are process-oriented and based on fairness as trust reduces goal conflicts);
- b. the nature of outsourcing relationships will vary over time, and that, again, we may discern between market-orientation or the need for bureaucracy or a situation of elevated mutual trust. From there, the control pattern will either call for strict programmability of (repetitive) tasks, high measurability of output and low asset specificity, and high task repetition, or it will include rules of behavior and rigid performance targets which are captured in detailed contracts, or it will be mainly ruled by competence and goodwill.

Whichever of the above situations is prevalent in a specific case, accounting has to be used to monitor, control and influence the behavior of the network partners. The other determinant for control is market prices, but they must be seen here as an “input” to accounting. The pattern of monitoring may embrace

- self-regulation mechanisms like transfer prices and pre-set fees which would serve to translate knowledge, complementarities and other intangibles into governable resources;
- orchestration mechanisms which deal with the network as a resource and equip it with a common strategy, and enable and empower the partners to hold network relations.

This may best be illustrated through a model developed by Dekker (2004), who sets out from the strategic (“ex-ante”) and connects it to the operational (“ex-post”) mechanisms. Ex-

ante mechanisms mitigate control problems in advance of the implementation of a partnership by aligning partners' interests and through reducing coordination efforts. Ex-post mechanisms deal with concrete control mechanisms by examining the achievement of certain performance goals as demonstrated in the following exhibit which shows the mechanisms that should be implemented both before and after the network has been set up and put into motion:

#### Ex ante mechanisms

<b>Goal setting</b>	<b>Structural specifications</b>	<b>Partner selection</b>
Strategic goals	Ordering and supply procedures	Long lasting joint history and cultural fit
Short-term goals, cost reductions and ordering quantities	Functional specifications Program of innovations	Interactive goal setting
Incentive systems Alliance fund	Quality plans Specification and division of intellectual property rights Organizational structuring	Joint governance design Short-term goals Reputation Trustworthiness for other alliances
	Alliance board Task groups	Trust Long-lasting relationship Reputation Open book agreement Intentional incomplete contracting

#### Ex post mechanisms

<b>Performance monitoring</b>	<b>Behavior monitoring</b>	<b>Shared decision-making and goal-setting</b>
Open-book accounting (=> cost reductions) Rewarding Benefit sharing	Pre-action review of ideas for innovation Board monitoring Auditing use of quality plan	Joint alliance board Joint task groups

Exhibit 11. Management Control Pattern and Management Control Instruments in a Supply Chain (Source: Dekker, 2004, p. 43)

From a strategic view, the emphasis must be on how to organize the best interplay between the functional, the institutional and the instrumental elements. Therefore no attempt is made here to extensively enumerate the instruments for data management that are commonly applied. Instead, section 4 will elaborate on the issue of selecting appropriate metrics with a view to the prerequisites that must be in place. One such prerequisite will be dealt with right now as it constitutes the primary area of connectivity between the members of a supply chain: Collaborative planning, forecasting and replenishment.

### **3.4.2 Collaborative planning, forecasting and replenishment and its prerequisites**

When it comes to combine the intelligence of multiple trading partners in the planning and fulfillment of customer demand, instruments are needed, and they must serve and be based on the process structure in the network. Again, as seen in the previous section, ex-ante considerations will be required. The outset must be way before determining the techniques: Following the idea of combining "the best" of all possible network partners, the overall strategy to become more efficient will have to focus on core competencies of the supply chain members. The capabilities of and the relationships among the supply chain members will have an influence on the type and reliability of the information exchanged. Also, requirements for a supply chain solution may comprise an objective to be followed by the supply chain as a whole, and this includes the notion of fairness.

#### **3.4.2.1 Criteria for discriminating supply chain structures and relationships**

Several criterion specifications should be considered when building a supply network. In order to define the structure of a supply chain, these would be (Stadtler 2009):

- (1.1) the number of supply chain tiers,
- (1.2) the number of supply chain members in each tier, and
- (1.3) the business functions supply chain members fulfil.

The problem here is complexity resulting from the number of links to handle and pertinent decision-making. If we take, for example, a two-level supply chain (one supplier, various buyers) with a scarce resource on the side of the supplier, we may find a decision problem on allocating the scarce material in light of the (unfilled) demand from the buyers. Also, if decisions have to be linked within the same business function, e.g. capacity reservation, the question arises on how to harmonize the planning domains of the supply chain members. This is the reason why one of the structural criteria is the business functions supply chain members fulfill.

There would also be

- (2.1) market- or technological or financial power of each supply chain member,
- (2.2) the extent of self-interest governing a supply chain member's behaviour,
- (2.3) learning effects and
- (2.4) rolling schedules.

Let us pick out rolling schedules which play a role in collaborative planning. This not only involves updating and extending an existing plan by one supply chain member but also renegotiating all changes with all other affected members. One question here is, who will bear the cost resulting from these changes if there is already a previously approved plan? Closely related to rolling schedules is the notion of learning effects. If the negotiation procedure is repeated, then a party may make use of information gained in previous negotiations. This is especially true if there is an overlap of decisions in two successive plans (like in rolling schedules), because once the buyer has decided to choose a specific purchasing contract, all data are revealed to the supplier. Would then there be space for a new negotiation?

Similarly, criteria might be developed for the information status (degree of uncertainty, timeliness, etc.). As will be discussed in section 4.3, the quality of data is an important discriminator for supply chain performance.

When the criteria have been chosen, the structural decisions can be made for the supply chain in question. It should be well documented which members have made which commitment with regard to contributing which capability, which data, which systems, etc.

Also, rules should be set up as to how decisions be made in the case of circumstances beyond control. All this will form the framework for the implementation of the core processes to be moved in the supply chain. For these, the criterion will be how much they contribute to performance improvement.

### 3.4.2.2 Core processes

Nine general practices for supply chain management have been found in numerous studies that might influence performance (Lockamy and McCormack 2004):

- Planning processes
- Collaboration
- Teaming
- Process measures
- Process credibility
- Process integration
- IT support
- Process documentation
- Process ownership

Using factor analysis, Lockamy and McCormack (2004) found that "Planning processes" and "Collaboration" are especially important for supply chain performance within all process categories. In the denomination of the Supply Chain Operations Reference model, these would belong to the top level (selecting the process type) and the configuration level (selecting the core processes a business wants to employ). The Supply Chain Operations Reference (SCOR) model has been developed by the Supply Chain Council to provide a best-practice framework for supply chain management practices and processes with the goal to increase performance. A rough scheme of SCOR is shown in Exhibit 12 on the following page.

As can be seen in the Top Level Quadrant of Exhibit 12, the SCOR model consists of five major process categories: Plan, Source, Make, Deliver and Return. So, SCOR is about "what" (a strategic dimension). In contrast, collaborative planning, forecasting and replenishment (CPFR) is about "how" (operational decisions). But more than just a set of processes that enable planning and monitoring across corporate borders, the acronym, correctly spelled CPFR® with the trademark denomination, is an inter-industry standard of the US-based Voluntary Inter-Industry Commerce Standards organization (VICS). The reason for this is that, early on, supply chain managers have realized the importance of using uniformly adopted systems for data interchange among trading partners. CPFR begins with an agreement between trading partners to develop a collaborative business relationship based on exchanging information to support the synchronization of activities to deliver products in response to market demand. 2011 marks the 25th anniversary of the introduction of CPFR®, and the standard has since then spread into businesses all over the world (<http://www.vics.org/committees/cpfr>) which use it for interactions between processes. This allows them to improve the accuracy of plans and thus ease the flow of products in the channel. By focusing on the flow of supply to consumers, without the clouding effect of inventory, participants can discover and address previously hidden bottlenecks in the flow (by analyzing variances in actual from plan). In turn, by taking care of these inefficiencies, cross-process operational costs can be reduced and performance is enhanced. But this has to be "performance" seen from a supply chain context as per the definitions given in the following section.

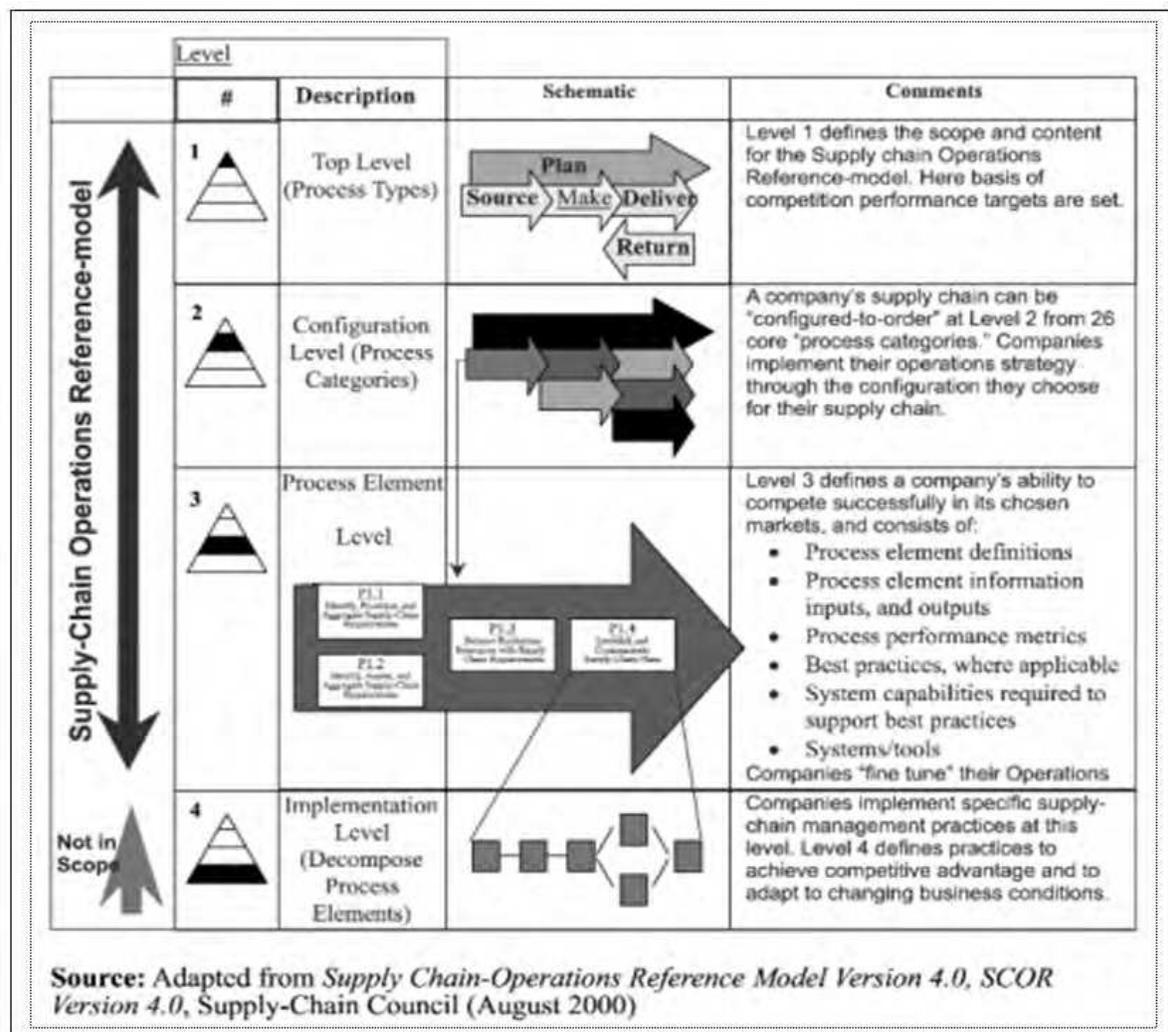


Exhibit 12. The SCOR model

#### 4. Strategies for monitoring supply chain performance

Several approaches exist to transfer existing performance measurement issues into a supply chain context. For this, the objective of performance measurement would most accurately be defined as the *process of quantifying the efficiency and effectiveness of an action performed throughout the various layers and entities of the supply chain*. Based on this, the most common categorization of supply chain performance measures is into

1. *Service measures*, like cycle time, order fill rates, and perfect order;
2. *Cost measures*, like cost per order, logistics cost per unit, and cost per unit;
3. *Return on asset measures*, which measure the extent to which the capital tied up in the supply chain is earning the desired financial return;
4. *flexibility measures* which reflect the ability of the supply chain to respond to changing environments (e.g., range & response flexibility).

Performance measures may also be classified according to their strategic or operational usage (e.g. Soosay and Chapman 2006). For instance, strategic performance measures would comprise key metrics for leadership, strategic planning, human resource management,

customer satisfaction, and process quality. Operational measures might include cost management, asset management, quality, productivity, and delivery issues. The metrics can be related to activities ("actions") to be performed on the various levels within a supply chain relationship. In the level of direct inter-company activities, the metrics relate to the management of internal processes (e.g. internal cycle time, logistics-costs per company, etc.). On the level of relations which expand throughout the whole network, the focus would be on metrics for delivery time, cash to cash cycle time, etc. On the level which looks at the supply chain as an entity in itself, the metrics would relate to the cycle time in the whole chain, time to market, and flexibility within the chain.

#### 4.1 Hierarchies of performance measures

From a strategic viewpoint, a performance measure "hierarchy" should be developed to concentrate on the relevant metrics for various classes of objectives (Hofman 2004). The *top-tier level* would deal with the purpose to "assess" supply chain performance and responsiveness, like demand forecast accuracy, perfect order fulfillment, and "SCM total costs". The *mid tier level* is built to "diagnose" identified strengths and weaknesses. It mainly deals with the measurement of the cash-to-cash cycle time and either supplier or customer payment time. The *ground level* provides measures that should enable the supply chain management control to "correct" identified weaknesses. Another approach would be to arrange the parameters along a classification of "tactical vs. strategic" and "internal vs. external". This approach is pursued by IBM (Kleemann, Erling and Gräfe 2009). The concinnity of this arrangement in a coordinate system is visualized by Exhibit 13: All parameters are be sorted into one of the 4 quadrants, depending on which of the characterization fits best. E.g., if a parameter is very external oriented and strategic, it should be shown in the outer range of the upper right quadrant. If another parameter has a lower external and strategic impact, it should be shown closer to the center. In case any of the quadrants is empty after all parameters are entered, the area should be revised again to be sure it is either on purpose that there is no entrance or until the white spot area is filled. The division into strategic and operational performance measures has been researched in field studies (Soosay & Chapman, 2006). They show that there is a disproportionate focus on costs (42%) over non-cost measures such as quality (28%), time (19%), flexibility (10%), and innovativeness (1%). Only a few measurement systems deal with activity-based cost and customer satisfaction. From there, we encounter three areas of deficiency:

- A lack of approaches which balance financial and non-financial measures.
- A lack of systems thinking, i. e. viewing at a supply chain as an entity in itself.
- A loss of the supply chain context which encourages sub-optimal outcomes by local optimization of each supply chain partner.

#### 4.2 Inter-organizational metrics

Measures that relate to the entire supply chain must cross company boundaries. A set of metrics that fulfill this requirement would have to comprise service metrics, assets (inventory) metrics, and speed metrics as all these refer to the result of actions as specified above. At least one performance measure of these three dimensions should serve as "key indicator" (in addition to quality which may be often regarded as an issue that is separate from performance, see Hausmann 2003). Some metrics for the three dimensions

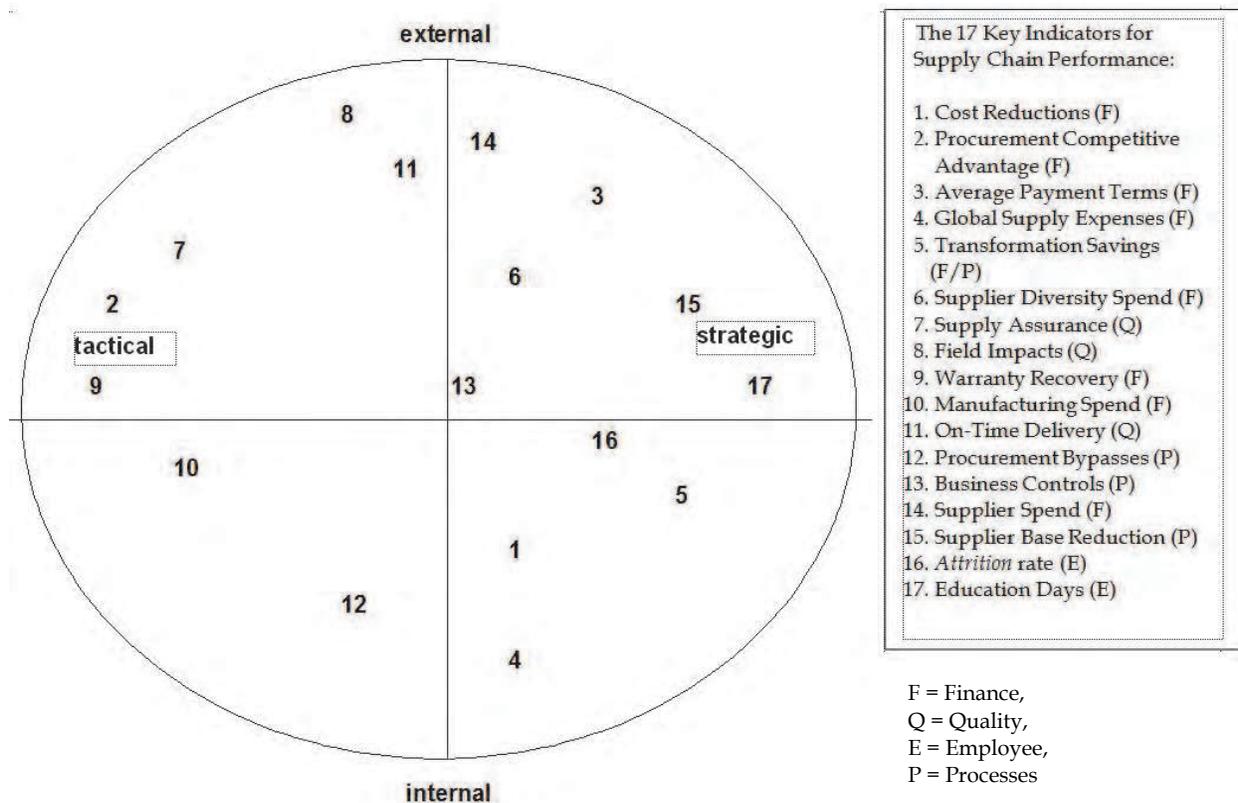


Exhibit 13. Positioning of SCM Performance Indicators. Source: Kleemann, Erling and Gräfe 2009.

service, assets (inventory) and speed will be listed below (from Paulitsch 2003). Otherwise, the measurement issue will not be covered here because it is operational and not strategic. But strategy formulation and strategy implementation is intrinsically conjoined with defining measurable targets:

**Service Metrics:** service metrics measure how well a supply chain serves its members. Since it is generally difficult to quantify costs of stock-outs or late deliveries, targets are usually set on member levels.

For service metrics, two different environments have to be accounted for: One is “*build-to-stock*”, and the other is “*build-to-order*”. Build-to-stock items are items that should be immediately available for purchase, (e.g. mechanical standard components), while for build-to-order the customer is willing to wait a certain time.

Some common service metrics for build-to-stock environments are:

- *Line-item-fill-rate* is the percentage of "lines" of all customer orders that are filled immediately.
- *Complete-order-fill-rate* is the percentage of which all lines of an order have been filled (the distinction between line item or complete order fill rate is important in case of a large number of lines per order).
- *Delivery process on time* is the percentage of the delivery processes that are on time. This metric is included - although it does not have a direct effect for the customer - because it is important for the (safety and cycle) inventory and subsequently for the cost of a product.

- *Costs of back-ordered/lost sales* are the costs of back-ordered and lost sales in a period.
- *Number of back orders* are the number of back orders in a period.
- *Aging of back orders* is the time it takes to fill a back order.

Some common service metrics for build-to-order environments are:

- *Quoted customer response time* (also *standard lead time*) is the time a customer is told to wait for order fulfillment.
- *Percentage on-time completion* is the percentage of orders completed on time.
- *Delivery process on time* is the percentage of the delivery processes on time.
- *Costs of late orders* are the costs that arise from late orders.
- *Number of late orders* are the number of late orders in a period.
- *Aging of late orders* is the time it takes to complete an order that is late.

**Assets (= Inventory) Metrics<sup>2</sup>:** these metrics measure the inventory involvement throughout the supply chain.

- *Monetary value* of the supply chain inventory (measured as an asset on the firm's balance sheet or as cost of goods sold per inventory value).
- *Turnover rates and "Time Supply"*. The latter accounts for the time the supply chain can surf and relates to the inventory flow.

From a supply chain perspective, it is important to see these metrics in combination with the achieved service level the supply chain provides.

**Speed Metrics:** these are related to timeliness, speed, responsiveness, and flexibility.

- *Cycle (flow) time at a node* is the total time it takes to fulfill an order.
- *Supply chain cycle time* is the total time it would take to fulfill a new order if all upstream and in-house inventory levels were zero.
- *Cash conversion cycle* is the duration between paying for raw material or components and getting paid by the customers. An estimate of the cash flow conversion cycle is the sum of inventory and accounts receivable minus the accounts payable (measured in days of supply).
- *"Upside" flexibility* measures if demand is higher than forecasted, which is particularly interesting in high-tech industry. The metric refers to the requirement for a supplier to be prepared to deliver an additional percentage within specified time windows.

Paulitsch (2003), from whom we took this enumeration of metrics because it fits the practice very closely, does not mention the dimension of quality. For this, we will refer to a study by Mentzer, Flint, and Hult (2001). The study suggests that customers' perceptions of suppliers' service quality begin to form as soon as they try to place orders, and the perceptions develop until they receive complete and accurate shipments, in good condition, with all discrepancies addressed. When viewed as a process, suppliers can identify the drivers of various supplier service quality perceptions. The process view enables marketers to see the interrelationships among service quality components. Mentzer, Flint and Kent (2001) conceptualized and tested Logistics Service Quality (LSQ) as a second order construct, with nine dimensions:

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<sup>2</sup> Metrics that relate to fixed assets, like commonly used warehouses or software systems etc. are often neglected. They are an issue of partnership accounting which involves target setting investment, rules for cost- and profit sharing etc. (see Bardy 2006).

<ul style="list-style-type: none"> <li>· Personnel Contact Quality (PQ),</li> <li>· Order Release Quantities (OR),</li> <li>· Information Quality (IQ),</li> <li>· Ordering Procedures (OP),</li> <li>· Order Accuracy (OA),</li> <li>· Order Condition (OC),</li> <li>· Order Quality (OQ),</li> <li>· Order Discrepancy Handling (OD),</li> <li>· Timeliness (TI).</li> </ul>	<b>Order placement</b>
	<b>Receipt of shipment</b>

As for the strategic perspective, Mentzer, Flint, and Hult (2001) found five parameters which influence the nine dimensions: „Commitment“ (info sharing and congruence of objectives), “Supplier development”, “Conflict resolution mechanisms”, “Logistics partner fit” and “Communication / joint projects”. Even though numerical measures for these cannot be determined, and may sound theoretical, any practitioner will know how to rate the influence of these parameters.

### 4.3 Ascribing metrics and directing the data input

#### 4.3.1 Another aspect of performance: The knowledge issue in sharing information

For any metric to be effective, two ingredients must be properly rendered: accurate definition and accurate capturing of data. This is where knowledge management comes into place: Mainstream research propositions suggest that it is three main attributes which enhance the capturing, organizing, and disseminating of knowledge throughout the aggregate of interactions between suppliers and clients (Desouza et al., 2003). Connectivity is the first attribute to allow the flow of knowledge. The second attribute is the communication of this knowledge in a fashion that allows all the users in the supply chain to make business decisions that maximize value while reducing costs and cycle times. The third attribute of supply chain knowledge management systems is the ability to collaborate in a real-time fashion, encouraging knowledge sharing and allowing the supply chain to adjust to market changes. In practice, this third attribute highly depends on how far higher management has got in establishing trust, power of decision-making and application skills on all levels from middle management down to the shop floor (Bardy 2010).

The performance metrics that have been pointed out in the previous section heavily depend on an appropriate data input. But data input itself is an issue of criteria fulfillment (we do not want to have “garbage out” from “garbage in”). So it becomes apparent that a two-way-definition of supply chain performance is needed: One way would refer to meeting the customer requirements, including product availability and on-time delivery (“downstream”), and the opposite way (“upstream”) would refer to meeting the supplier expectations on data input and data handling. It is understood that the two-way performance is best if the mechanics of data exchange and the quality of information fully yield what both vendors and customers require for their day-to-day business. From there, the question arises if a better performance can be achieved by implementing more sophisticated tools for planning and co-ordination, or if there are other ingredients which affect the mechanics of data exchange and the quality of information. This shall be examined further on.

From the outset – definition and target setting – to the evaluation of results, the metrics to be chosen in a specific supply chain are the product of information sharing between the members. Even if a metric is applicable only on the level of one specific member, it will

nevertheless have nevertheless to be communicated throughout the whole chain together with comments on its objectives and content. This would include inventory, sales, demand forecast, order status, product planning, logistics, production schedule, etc., and can be summarized as three types: product information, customer demand and transaction information, and inventory information. These are outlined in the next section.

#### **4.3.2 Product information, demand and transaction information, inventory information**

**Product information:** Going back to when exchange of product information among the supply chain partners was done by paperwork, such as paper catalogue, fax, etc., we had delays in information sharing and miscommunications among the trading partners. With today's IT-technology, entering the product information into an information system, a supply chain member still has to check on the data, which may or may not come along with the product, for consistency and accurateness. Keeping the data updated is an additional task. For example, if some information has been changed since its last release, all the supply chain members retailers in the industry have to check the data individually. According to UCCnet<sup>3</sup> (Trost 2009), 30 % of data exchanged between suppliers and retailers doesn't match up due to the inefficiencies of manual data entry and convoluted processes. This is an enormous problem for the industry, because incorrect data translates into an erroneous understanding of what retailers actually have on their shelves and what suppliers actually have in their warehouses. This means that often data have to go through a long-winded manual, error-prone procedure before being re-entered into the IT systems.

**Customer Demand and Transaction Information:** Customer demand and transaction information is as a critical source of information about future business. It is here that the advantages of working with a CFPR standard enables supply chain members to forecast demand and schedule production jointly and on a rolling forecast scheme. Capacity planning, labor availability planning and related activities are all dependent on exact and reliable data inputs for customer demand throughout the levels of a supply chain.

**Inventory information:** Deploying inventory status and inventory decision models in a network directly affects the amount of orders placed to the upper stream supply chain partners. Often, trading partners are less willing to share inventory information than customer demand and transaction information. So, manufacturers may not only be unwilling to divulge their true inventory situation but even portray false inventory levels to discourage competitors from building additional capacities. They may fear that customers may use inventory and sales data to get a better bargaining leverage. But when trading partners convene to share a vendor-managed inventory facilitation, they must be absolutely sure of trustworthy data, because in a vendor-managed inventory system it is the manufacturer who generates the purchase order, not the customer.

Subscribing to a supply network, thus, obligates the member to feed a broad array of reliable information and resources into that network. But there is more: Forming a partnership with its suppliers and/or customers may mean for the entrant to change jobs and job descriptions. One the other hand, a division of work to be established with regard to evaluating and handling inventories, systems, processes, new technologies, training, work methodologies, equipment utilization, etc. may also provide access to procedural resources

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<sup>3</sup>UCCnet, a non-profit subsidiary of the Uniform Code Council, is a standards organization that provides an Internet-based supply chain management data registry service.

like, e.g., instruments for preparing strategic decisions that will be exhibited in the next section.

#### 4.4 Strategic instruments: balanced scorecard, activity based management, target costing, total cost of ownership

##### 4.4.1 Supply chain balanced scorecard

The balanced scorecard (BSC) connects strategic objectives with operational metrics, both financial and non financial, for the traditional financial and three further perspectives. This was shown in section 1.4. Adaptations of this concept have been made to the supply chain context to capture its inter-organizational complexity. This can be done by either replacing the perspectives by new ones or by adding more perspectives. In any one of these perspectives, objectives (“goals”) must be set. As per the following exhibit, each of the goals is to be expressed in a strategy:



Exhibit 14. Six perspectives of a BSC: Drivers and Stakeholders. From: [http://www.fin.gov.on.ca/en/bpssupplychain/documents/perf\\_meas\\_framework.html](http://www.fin.gov.on.ca/en/bpssupplychain/documents/perf_meas_framework.html)

Subsequently, numerical targets must be set for each of the goals. The organization will thus not only be able to monitor how a strategy performs, the BSC technique will also enable it to promote organizational effectiveness (Chia, Goh and Sin-Hoon Hum 2009).

An example for an additional supply chain perspective in a BSC would be *partnership management* and *management of information flows* expressed in a cooperation perspective. This is shown in the following Exhibit. The table shown in the upper right with “Objectives”, “Metrics”, “Benchmarks” (= Targets) and “Initiatives” applies to all perspectives. For the cooperations perspective, one of the objectives might be “Improve Order Accuracy!”, the metric would be “Number of order queries”, the target would be “Reduce by 50 %!” with the corresponding initiative being “Elaborate new order entry system together with suppliers”. This example might look simple, and practice has shown that the most prominent obstacle for the implementation of a BSC throughout a supply chain may be the

simple fact that the supply chain partners' individual goals and objectives cannot be integrated into one BSC. Still, Supply-Chain BSCs have been reported to be in use e.g. in the automotive sector for the tire business and in the chemicals sector (Zimmermann 2005).

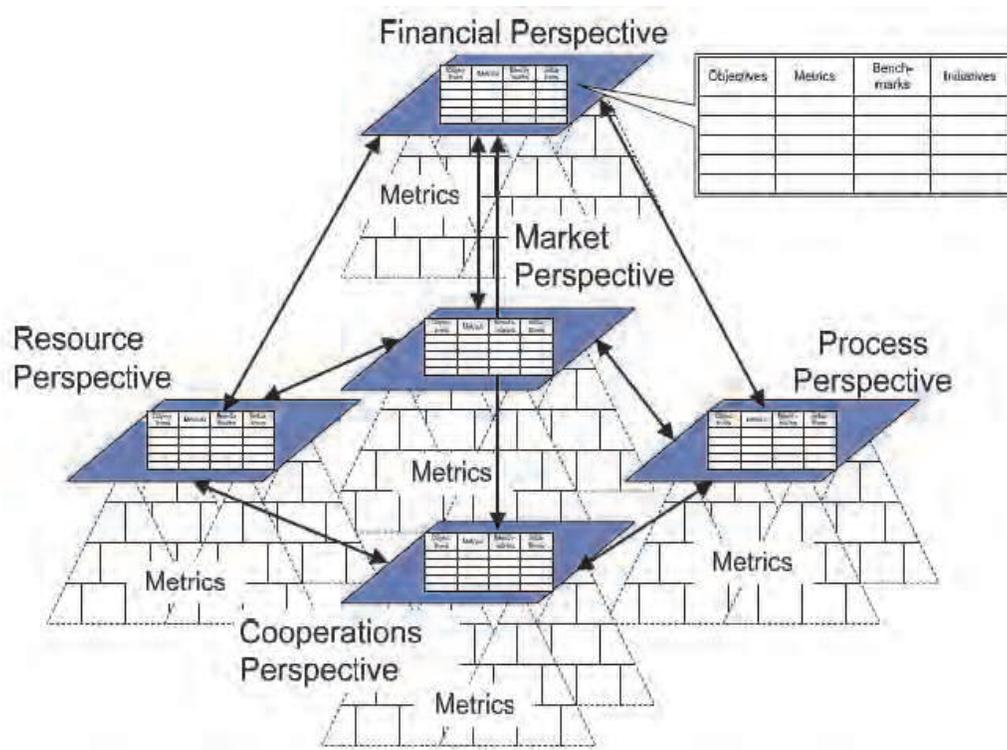


Exhibit 14. Adding a co-operations perspective to the BSC. Source: Von Haaren and Malyshko 2007.

#### 4.2.2 Activity-based management and target costing in supply chains

As with the BSC, activity-based costing (ABC) seems to lend itself easily to a supply chain environment as it focuses on activities and processes (for a general overview and recent developments see Gosselin 2007). Transferring the ABC method into the processes and collaborative activities of a supply chain would mainly lead to optimization through analyzing process structures, identifying and eliminating redundant activities and pointing at alternative channels and sourcing structures. However, the ABC method is not strongly supported by practitioners because it involves a considerable amount of time-consuming groundwork, and there are many pitfalls and caveats (Bardy and Hartgraves 2002). Still, a well-focused effort that is restricted to previously identified problem areas will definitely achieve a result. And, when used as a strategic tool for preparing decisions e.g. on how to deal with redundant activities, ABC comes closer to activity based management as it avoids the setbacks caused by implementing routine activity cost reporting. Furthermore, ABC in its strategic adoption, can easily be combined with target costing. First implemented in Japanese firms, the target costing approach uses collaborative principles to establish a cost target that is connected with the desired functional outcome of the cost object, breaks down the cost target into its components and finally optimizes both outcome and cost. Transferring this into the supply chain environment would firstly connect to customer

requirements and consider product- or service-functionalities. Suppliers are often involved in target costing projects, however, sometimes only as recipients of rationalization targets set by a focal company. From there, depending on the relationship with the supply chain partners, a wider approach of target costing seems feasible. In line with this, special inter-organizational cost management initiatives should also be implemented (see below).

The core concept of target costing is very straightforward. It is based on the logic that a company should manufacture the products that yield the desired profit. If the product is not yielding the desired amount of profit, the design of the product should be changed to obtain the desired profit. The design issue incorporates early supplier involvement, beginning, mostly, in the research and development phase. This is where the concept of "strategic purchase" comes in: The procurement function is to be included at this stage of buyer-supplier relations already. By including R&D in the scope of supply chain management, cost, quality and time objectives can be affected positively and with a lead-time that enables well founded decision-making. Up on that, the involvement of supply chain partners allows companies to connect heterogeneous sources of expertise. However, this type of collaboration involves risks of unintended leakage of knowledge and competencies, since the range of inter-organizational activities is broadened. This can certainly be avoided by all sorts of secrecy agreements, but, from a strategic point of view, the first choice would be to determine where to position the type of inter-company relations to be chosen.

The *following* graph (Source: Schmidt 2010) illustrates that there are nine basic options of combining "make", "cooperate" and "buy" in R&D and in, e.g., manufacturing (with all feasible analogies in service providing etc.).

The unintended leakage as specified above will occur if the decision is made to opt out of the position that has been in use so far. Thus, if a corporation within an existing supply chain switches either to "make" (quadrants 1-3) by terminating a long term contract with a supplier in favor of an in-house production or to "buy" (quadrants 7-9) by introducing an independent supplier on the basis of a short term contract, the cooperative relationships in the supply chain will run the risk of being decomposed and knowledge will start to leak.

The leakage-risk is mitigated if the pertinent decisions encompass two classes of safeguards: One relates to the "secrecy agreement" issue mentioned above (legal protection rights and contractual agreements), the other one relates to mechanisms which factually prevent an unintended knowledge transfer. The major device here would be to prevent that an imitator does not get an opportunity for product modification. Teece (1986) gives the example of microelectronics, where selecting designs is dictated by the need to meet certain compatibility standards so that new hardware can interface with existing applications software, and designs become locked in when the circuitry is chosen. Product modification is then limited to debugging or software modification. In industries with large developmental and prototyping costs and hence significant irreversibilities, one would expect that the probability that the imitator would commit a substantial amount of capital to build the same structure anew is low. Another factual device to prevent imitators from using wrongfully appropriated knowledge would be to heavily control the specialized assets of the overall business such as distribution channels, specialized manufacturing capacity. No efforts should be made to protect generalized equipment and skills, since they are, almost by definition, available in an industry at all times (Teece 1986).

<b>R&amp;D</b>	<b>Make (internal R&amp;D)</b>	<b>Cooperate (vertically, horizontally)</b>	<b>Buy (external R&amp;D)</b>
<b>Manufacturing</b>			
<b>Make</b>	Internal R&D and in-house production <sup>1</sup>	R&D cooperation and in-house production <sup>2</sup>	External R&D and in-house production <sup>3</sup>
<b>Cooperate (vertically)</b>	Internal R&D and cooperative supply chain relationships <sup>4</sup>	R&D cooperation (with supply partners or others); cooperative supply chain relations <sup>5</sup>	External R&D (by supply partners or others); cooperative supply chain relations <sup>6</sup>
<b>Buy</b>	Internal R&D and pure supply relations <sup>7</sup>	R&D cooperation and external procurement <sup>8</sup>	Both R&D and procurement are external <sup>9</sup>

Exhibit 15. R&D and manufacturing cooperation choices. Source: Schmidt 2010.

#### 4.2.3 Inter-organizational cost management and total cost of ownership (TCO)

The concept of supply chain costing or inter-organizational cost management (IOCM) can be seen as an extension of traditional cost management, adding the notion of information asymmetries as it eliminates differences in access to data and to data analyses. It is thus based on the transaction cost economics (TCE) approach (see section 3.3.5). But while TCE looks for the lower of cost of either network- or standalone conditions, the main objective of IOCM is to find ways to reduce costs which are beyond the own companies' boundaries; for this, cooperative actions of the supply chain members are needed. In conclusion, the IOCM approach extends the scope beyond the boundaries of a firm towards synchronized processes and similar definitions of process steps and key performance indicators (KPIs) across the supply chain. The prerequisite for this is coordination and cooperation and the willingness of sharing the relevant data. Inter-organizational cost management systems, in this way, contribute to several supply chain management issues: (1) they provide support for the implementation of inter-organizational teams, (2) they allow the negotiation of modifications within product and process specifications along the supply chain to reach cost objectives, and (3) they support in identifying ways to make the relations between the supply chain partners more efficient and to help members to improve their cost structures.

Conducting IOCM-practices requires profound knowledge about internal processes in a member firm and partner-specific processes. The pertinent analysis can be handled with the help of value chain analysis approaches which deliver maps that reflect the process-structure of the supply chain. Based on that, an inter-firm planning system must be configured. This must be supported by what has been called "open-book accounting", i.e. complete cost transparency for all the members of the network (see. e.g., Mouritsen, Hansen and Hansen 2001). This creates new space for cost management within a supply chain, as more information from each of the supply chain members can be taken into account during the planning procedures.

Some of the techniques associated with IOCM would be easily recognized as an inter-organizational application of traditional internal cost management practices (e.g. budgeting and performance, investment appraisal, target costing, and open book accounting), while other techniques may not be related to conventional management accounting, like target costing, kaizen costing and total cost of ownership studies. However, all of the IOCM

techniques are similar in that they are cooperative activities that have a common goal to create value for all partner firms through modification of interorganizational cost structures. For organizations to engage in IOCM activities, a set of institutional and dynamic capabilities are required (Fayard, Lee, Eitsch and Kettinger 2006):

- a. the organization's information technology integration (electronic integration among supply chain members),
- b. the organization's existing internal cost management capabilities and practices, and
- c. the management's inter-organizational absorptive capacity (i.e. the ability to acquire, assimilate, transform, and exploit knowledge in order to create and utilize organizational capability).

In other words, the organization should be nearing the state of the art in accounting and EDP, and managers should be willing to learn and to cooperate.

The remainder of this paragraph will focus on kaizen costing and total cost of ownership (TCO) since the other instruments have already been dealt with. Kaizen costing is similar to target costing in that both techniques aim at cost reduction, but while target costing focuses on the design and development phases of a product, kaizen costing is used to reduce costs in the manufacturing and delivery phases. Originating from quality improvement practices in Japanese firms, kaizen costing is a system of incremental and continuous cost reductions of the product manufacturing process. So, other than target costing, kaizen costing may be deemed to be short term and more operational than strategic. But the mere decision to involve supply chain partners into target or kaizen costing initiatives is of strategic importance as it determines the structure of interrelations in a supply network.

The principle of TCO has impacted commercial negotiations by expanding the narrow confines of price to a larger field of opportunities for attaining win-win results in a buyer-supplier relation. Simply put by a consultant: "Anyone can get a lower price". The object of business is to attain the lowest TCO" (Menard, 2010). It is definitely true that good negotiation will contribute to attain a low TCO, as all purchase officers will know. They have been trained to conceive cost as being constituted by Quality, Service, Delivery and Price, so TCO would be the sum of those cost elements, or  $TCO = Quality + Service + Delivery + Price$ . And negotiation practices should follow along this line. Another approach would be to set out from an internal perspective like inventory costs, where each of the elements (holding cost, damage cost, cost of obsolescence, handling cost etc.) is susceptible to be influenced by a prudent buyer-supplier relation, or to set out from life-cycle analyses where TCO is the sum of acquisition cost and lifecycle cost like maintenance, spare parts and discharging cost. There are some strategic constituents in all these considerations: One is about long-term supplier selection, another one is about choosing the format of contracts, impact ("Does it make sense to analyze the cost of a cow farm if I only want a glass of milk?"). What is meant here can be illustrated by the following graph (Exhibit 16). The (strategic) decisions to be made relate to the extent of analyses and of supplier negotiations, regarding the phase and the level in which cost improvements can be sought (acquisition, reception, etc. phase and supplier, product etc. level.). This will provide a framework for how TCO should be deployed.

Similar frameworks like the one for how TCO should be deployed are also useful for the other strategic instruments: Target and kaizen costing, for example, will as well require a set of pre-conditions; otherwise the "cost of cost saving" may get too high.

		Acquisition	Reception	Possession	Utilization	Elimination	Total Cost
<b>Supplier Level</b>	Cash						Σ Level 1
	Non cash	Quotation Contract Follow-up Change					
<b>Product Level</b>	Cash				Replacement		Σ Level 2
	Non cash				Personnel training Adaptions		
<b>Order Level</b>	Cash		Transportation				Σ Level 3
	Non cash	Order	Reception Invoicing Litigation				
<b>Product Order Level</b>	Cash						Σ Level 4
	Non cash		Quantity test Quality test				
<b>Unit Level</b>	Cash	Price and discounts Price evolution Payment delay			Intrinsic efficiency	Waste valorization	Σ Level 5
	Non cash	Service cost Product testing		Inventory holding	Production failure Product failure Maintenance Installation Quality control		
							<b>TCO</b>

Exhibit 16. A TCO Decision-Matrix. Source: Degraeve, Labro and Roodhooft, 2005.

## 5. Risk management and business continuity planning

The interdependence of all members which is a constitutive characteristic of a supply chain provides an array of chances, as was exposed in this chapter, but it also bears risks – from small operational accidents that may occur at any level of the various tiers to a catastrophic breakdown throughout the whole supply chain. Exhibit 17 on the following page depicts the areas of risk (analysis), the types of risk and the instruments of risk and business continuity management. The “Unit of Analysis” axis in the graph demonstrates where risks may occur. The risk avoidance strategies are shown in the vertical axis, and from there one may guess how far the measures could go. Displaying all the possibilities would definitely exceed the limits of this chapter. So much can be said: What is required is a well-orchestrated and harmonized common risk management strategy (which will very often be difficult to reach because of varying interest and powers within the partnerships). We will constrain ourselves to an observation that is not covered by the graph:

One risk avoiding strategy would certainly be to reduce the number of the supply chain members. This would also reduce the cost of coordination (which stem from complexity; see section 3.3.3 above). But this approach is ambiguous. Limiting the partnership to a few efficiently connected "value partners" can end up in unintended dependencies and risks. Up to the logistical risk of replenishment, there is the risk of losing the control on purchasing prices as they are dictated from the (powerful) tier two-supplier who himself skims the market and gains competitive advantage. The leverage effect of purchase prices on the

overall company performance is a menacing indication of the limitation that might result from this strategy. So alternative strategies have to be evaluated. This would mostly lead to an asymmetric strategy, where the buying company takes the lead by using a supplier relationship management platform. So instead of symmetric equal-level-cooperation, the buyer asymmetrically selects, defines and implements its concepts of collaboration per partner.



Exhibit 17. The three dimensions of supply chain risk management. From Norrman and Lindroth, 2004.

This type of risk avoidance has led to quite a few supplier-relationship management platforms, e.g. in the automotive industry, and there is wide support for this from application service providers like SAP, Cascade Works or Actuate. They provide IT-support for supplier selection, performance management, relationship management and collaborative management, among others, but the decisions are made by the lead-firm which thus dominates the mode of collaboration with a large number of network partners (Ortner and Schweiger 2010).

## 6. Summary and conclusion

Procurement strategies in a supply network must above all aim at stable and long-term partnerships, standardisation, consolidation of the procurement volume, assurance of supplies based on re-positioning after disruptions and well-balanced procurement procedures. Determinants will be procurement market complexity and the strategies'

influence on product success. Total cost orientation, functional integration and a harmonized and reliable flow of information are the prime ingredients.

To conclude, here are five best-practice recommendations given by John Evans, Managing Partner with Denali Group, who has consulted in the supply chain and strategic procurement space since 1989, beginning with A.T. Kearney:

1. Use of a single, consistent and formal savings tracking methodology, based on total cost of ownership (TCO).
2. Formation of a cross-functional financial steering group comprised of financial representatives from impacted organizations that review, approve and make budgetary reductions for all supply chain improvement initiatives.
3. Expansion of the roles of strategic sourcing and supply chain improvement project teams beyond an analysis- and recommendation-role into implementation responsibilities.
4. Utilization of broad unit-based cost metrics, balanced by service and quality metrics, to track savings at the spend category and initiative level.
5. Linkage of savings realization targets to supply chain departmental goals and personal development plans.

Improving corporate financial performance is certainly not the only strategic role for supply chain organizations, but it is inarguably a very important one. Most corporate supply chain organizations have the ability to impact 50 to 70 percent of their corporation's total cost structure, so creating a model that can optimize this lever is critical to any supply chain organization's success. The biggest obstacles to achieving optimized supply chain management solutions are traditional mindsets concerning buyer-supplier relationships. When these are overcome, and the partners have cost-effectively established the required information systems networks between different organizations, performance will increase. Those companies and organizations that succeed in achieving this level of supply chain integration will be richly rewarded. Those that do not will get the crumbs (Metz 1998).

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Over the past few decades the rapid spread of information and knowledge, the increasing expectations of customers and stakeholders, intensified competition, and searching for superior performance and low costs at the same time have made supply chain a critical management area. Since supply chain is the network of organizations that are involved in moving materials, documents and information through on their journey from initial suppliers to final customers, it encompasses a number of key flows: physical flow of materials, flows of information, and tangible and intangible resources which enable supply chain members to operate effectively. This book gives an up-to-date view of supply chain, emphasizing current trends and developments in the area of supply chain management.

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