

Framework for Cost-Benefit-Sharing in Logistics Networks

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Abstract

In this paper we present a comprehensive approach for an incentive-system in business-networks based on system-wide evaluation and distribution of costs and benefits.

Among the most current trends in the Automotive Industry-networks are slow changes in the OEM's bargaining-power: formerly the OEM was the focal company but now suppliers are becoming increasingly powerful. We are convinced that OEM needs innovative coordination-mechanisms to cope with this development. Such a coordination-mechanism must be suited to coordinate polycentric and heterarchic organizations, encourage cooperative decision-making and create Win-Win-situations.

We propose Cost-Benefit-Sharing in an integrated framework as such a coordination-mechanism. Cost-Benefit-Sharing is a systematic and system-oriented incentive-system that motivates companies in a network to participate in joint projects that do not benefit them directly. According to the systems idea, these projects must not be feasible for each individual company but feasible for the entire system. Then incentives can be provided for companies that do not benefit directly from these improvements. This reasoning leads to the development of an integrated framework for Cost-Benefit-Sharing.

This paper first describes the requirements for the Cost-Benefit-Sharing-system. From this foundation we develop a two-level model for Cost-Benefit-Sharing. It consists of two main components, a structural and an operational module. Both are required to institutionalize the network and to execute the CBS-process. The structural level provides an institutional frame for the network. The network is no longer an informal, virtual organisation, but becomes a business entity with defined inputs and outputs. The detailed processes and calculations for the CBS-process make up the operational level.

Keywords

supply chain management, systems engineering, incentive systems, collaboration

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Motivation

Our economy has features an extremely diverse spectrum of companies: Small or Medium-sized Enterprises, generally referred to as SME, occupy special niches of business and thrive on detailed knowledge of specialized solutions. Large corporations have a different structure: while they are present on the market with a multitude of products, large corporations are still made-up of numerous small and large departments and divisions that specialize in certain aspects of their trade.

Although both types of companies are very different in structure, leadership and size, one could not exist without the other: the large corporation requires special skills of SME's to cheaply enhance their products, while small SME can rarely invest in special equipment to fulfill certain product requirement on their own. Both diverse requirements can be fulfilled either on the marketplace, where parts and services can be bought. Some special requirements may also form long-term business partnerships. Thus, business contacts can be short-term, in the form of a one-time business opportunity, while some contacts develop into long years of cooperation between companies. Under favorable circumstances, these long-term relationships eventually lead to a cooperative organization of certain processes. In these long-term relationships, the underlying cooperative business processes enable innovative products or services. Short-term business opportunities are primarily based on price-decisions combined with a few soft-factors such as customer-service or delivery lead-time. In long-term relationships, additional criteria need to be taken into account: cooperative culture, the handling of the business-contact and new opportunities enabled by the business partner. Under these circumstances, the price is an aspect with an inferior position.

The longer companies cultivate their business-contacts and the more they are also based on social bonds, the more we can speak of business networks. These networks can be very loose arrangements or formalized agreements such as Joint-Ventures or development-partnerships. As an example, the German industry of intralogistics is a prime example of a network economy. Various companies specialize in certain products or services, but no company offers the full range of products. Hence, they are forced to work together to satisfy the customers' needs. Or, as the German periodical "Wirtschaftswoche" puts it: "The secret of success for German Intralogistics companies is in their business network." (Kapalschinski, 2005, 69)

Latest developments (Anon., 2005, 17) (Sanz, 2005, 23), underline how important networks have become for our economy. It is thus time to explore how these networks can be run efficiently and how value can be created for all companies. Our paper addresses this challenge.

Development of business networks in the automotive industry

There are many ways how business-networks are organized and run. The ways differ according to industry, culture, country and product. In our research, we use the example of networks from the automotive industry. Today, networks in this sector of German industry are run as follows: a powerful Original Equipment Manufacturer, the OEM, designs the network according to his needs, see Figure 1. He is the focal company of the network, and the network is focussed to serve his needs. Among his suppliers are usually many specialized small and medium sized enterprises or even large corporations. The suppliers are organized in tiers, with upstream-tiers supplying direct or related downstream customers.

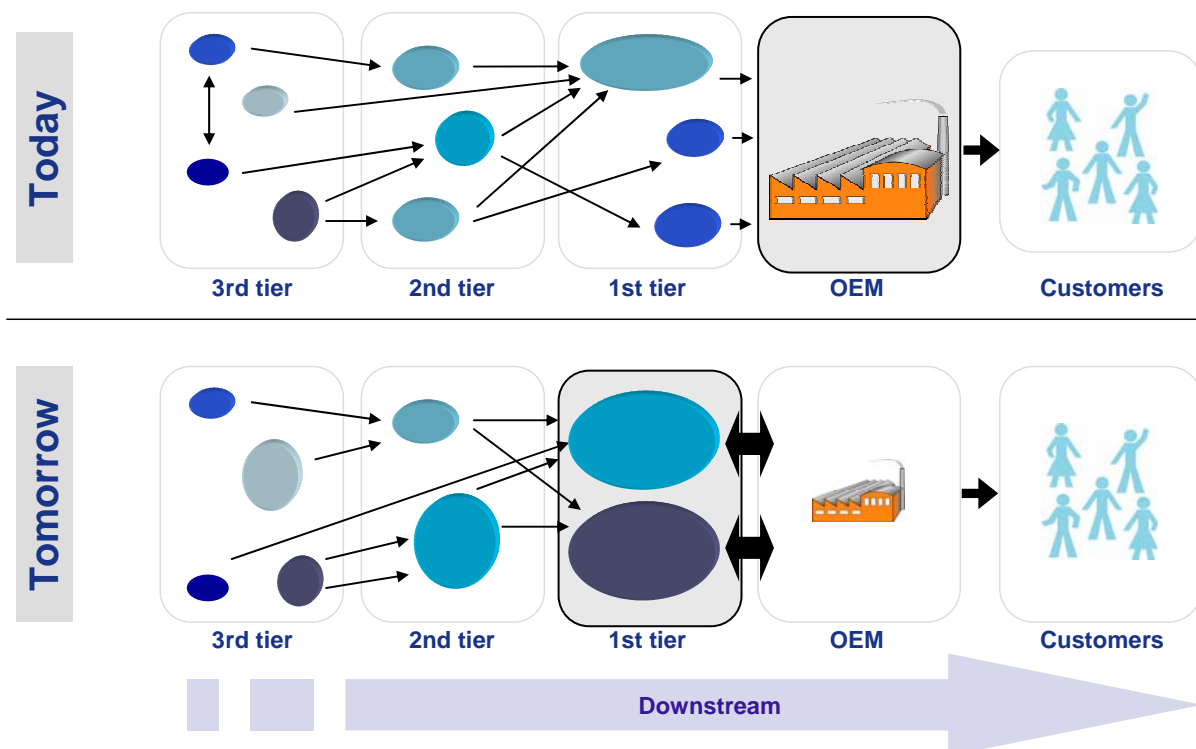


Figure 1. Today's and tomorrow's state of automotive networks

The OEM is involved in every contract. With this focal position he can influence his suppliers according to his needs. This self-centered behavior leads to certain effects on the companies engaged in this supplier-relationship. Suppliers' requirements are usually neglected because the OEM can use his bargaining-power. Suppliers, in turn, are reluctant to furnish the OEM with more information than absolutely necessary as they prefer to retain a bargaining-advantage. They are discouraged from working with the OEM. This eventually leads to suboptimal allocation of resources like investments and information. Instead, the OEM initiates projects only when the effects benefit himself. Although there may be actions which benefit the network in a holistic sense, actions with primary benefit to the OEM are preferred.

Current developments in the networks of the automotive industry suggest that more development-tasks and larger pieces of value-creation are shifted towards the suppliers, most notably the 1st tier suppliers. For a good description of this trend, see (Mercer, 2004).

We are convinced that these developments will limit the OEM's bargaining-power towards his suppliers. Instead, he will have to rely on innovative strategies of coordination in networks. This will significantly increase the use of incentives to coordinate action in the network. For the entire network this development will lead to a less centristic and increasingly heterarchic cooperation.

In our paper we present the basic requirements and concept of such an incentive-system for coordination in networks.

The following questions have been leading us during our research:

- Which processes and structures support cooperative behaviour in networks?
- Which incentives provoke interest in joint development of the network?

Networks and the systems approach

Our every-day world is composed of a variety of systems: the car we drive, our political decision-making process as well as the company we work for, and naturally the supplier-network it belongs to—they are all examples of systems that surround us. Systems have some characteristic properties (Lambert 1787, 91 ff):

- A system is composed of functional parts or components.
- Systems are limited by a boundary that we draw around a number of these components. The position of the boundary depends solely on our purpose of analysis or description. There may be different boundaries to a system depending on which point of view or understanding of the system we have.
- Interaction occurs between the components inside the boundary. The components are interacting: the interaction occurs with a functional purpose. Interaction is the bond that connects the entities and is a mandatory component of any system.
- The level of complexity is high, it is not easy to explain what is going on within the boundary. As the system is based on the interaction of the components complexity can be based on the number and intensity of connections and the feedback- and the cause-and-effect-clarity.

The characteristics of systems laid out here are widely understood, yet most often overshadowed by interests of the company-organization. Understanding networks as systems is thus not a novel approach, but one hardly found in practice.

Among the advantages of using the broader system-based approach for networks are:

- Instead of solving their own problems individually, companies solve problems in a multilateral way, together with customers.
- The companies would push projects that benefit the network/ system as such, instead of engaging in projects that primarily benefit themselves.
- Effects of decisions and projects would be viewed for the entire system, not just for one company. Instead of measuring only the effects on one company, the total effect for the system would become the benchmark.

If companies in a network want to obtain these advantages, they first need to realize that business networks are systems: several companies, different types of interaction on multiple channels throughout the organisations.

Yet, the basic understanding of the networks as systems is just the first step. The more important, second step is to practice thinking in a systemic fashion. Companies have to consider not just their own position but also the partners' position in the network. With this in mind they act as if we were not working individually but for a system of companies: the network. But just why is this so difficult in practice?

Here is one possible reason: companies are led to believe that what is good for them is good for the network. Instead, it is sensible to think: what is good for the network is also good for our company! This is the basis for true systemic thinking.

Companies that work together in a network should realize this flawed approach and give incentives to employees who apply the systems-approach.

One possible approach is Cost-Benefit-Sharing (CBS). This method is described in this paper. Cost-Benefit-Sharing takes the systems-idea seriously and asks: what benefit and costs do we generate within our network and how can we use incentives for the companies to behave in a systems-oriented fashion.

Framework and components for CBS

Current economic analysis describes different players in the economic scene. An overview is given in Figure 2.

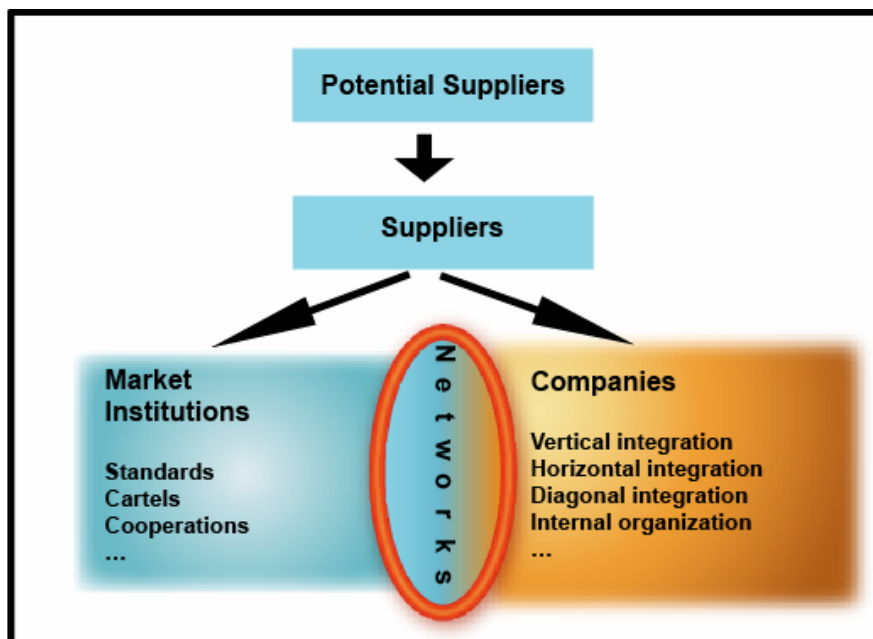


Figure 2. Networks in the market-sphere (see Erlei, 1999, 25, modified)

Figure 2 is an extract of a relationship-diagram of the different entities analyzed by institutional economic analysis. The original chart describes all institutions that interact within

the economic field: from the basic laws of nature, culture and man-made law to the entities in the market-sphere. We concentrate on the market-sphere where we can distinguish between companies and market-institutions. Among the market-institutions are cooperations, cartels and similar constructions on a meta-level. The meta-level contains institutions which are based on the companies themselves and could not exist without them. Networks are an example of these institutions: they could not exist without a number of companies; the companies in turn naturally exist with or without this meta-institution.

Distinguishing between the market and the firm dates back to Coase's 1937-article "The Nature of the Firm" (Coase, 1937). Both institutions differ in how they are organized and coordinated: the market is coordinated through the pricing-mechanism while the company is coordinated by "the entrepreneur-co-ordinator, who directs production" (Coase, 1937, 5). This entrepreneur-co-ordinator, comparable to a manager in these days, replaces the pricing-mechanism in a firm and decides about resource-usage. These mechanisms of coordination—the price and the manager—are two extreme positions.

Let us now consider a network. Literature shows two conflicting positions: Sydow (Sydow, 1992) understands networks as an intermediate form between the firm—which he calls "hierarchy"—and the market. According to this understanding networks, constitute a hybrid form of organization. On the other hand, Semlinger (Semlinger, 1993, 42) suggests networks cannot be described in terms of market and firm. They are neither a hybrid nor as intermediate (for an interesting discussion on these issues see (Krebs, 1993)).

There can be a hierarchical, monocentric relationship between the companies, but typically networks are polycentric and heterarchic (Sydow, 1992). As such, they are not organized centrally but have multiple centers of power and activity.

We can assume that typical means of coordination in a market or a firm will therefore fail if transferred into networks without adaptations. Whether we view networks as hybrid or an independent organizational form, we must develop new means of organizing and coordinating decisions because we neither have the power of hierarchy to decide nor the ability to use the pure pricing-mechanism.

Such a method would have to fulfill the following requirements:

- suited to coordinate polycentric and heterarchic organizations,
- direct resource-allocation towards a common goal,
- encourage cooperative decision-making,
- allow individual preferences for compensation,
- create Win-Win-situations.

The proposed method will have to fit to these requirements which reflect the structural properties of the network and accommodate the processes adherent to doing business in the network.

We shall now call this method a framework because it provides a frame for the method. Doing business in a systemic fashion is facilitated and enabled through the framework.

So far we have talked about the requirements of the method and explained why we call it framework. We have, however, not gone into explaining why we call it a "Framework for Cost-Benefit-Sharing". What is Cost-Benefit-Sharing and why is it essential?

Let us try to describe phenomena leading to the development of the idea of Cost-Benefit-Sharing.

Above, we stated that networks are polycentric and heterarchic. One company has taken the initiative and formed the network. This is usually a company that benefits most from the existence of the network. Most networks are of informal character: they lack written "network-agreements" or formalized cooperation-contracts. They emerge from regular business transactions of any supplier-buyer-relationship. Such loosely coupled networks have no formal hierarchies, they are heterarchic. Usually, the company that takes action can be regarded as the network's focal or leading company. Depending on several soft and hard factors, such as personal standing of persons in charge, reputation, trust, buying-power, benefit from the network and company-size, each company positions itself in the network: some are more active, others more passive in pursuing their interests. Active companies are usually able to shape—or at least strongly influence—the network according to their own interests. Typically this company will benefit the most from actions taken in the network, while others may not gain anything at all.

When companies are engaged in a stable network, they realize that stable networks offer many more chances and business opportunities. The focal company might start thinking about joint projects or other types of joint action in the network. In that case, other companies in the network need to be involved and motivated to participate. Some of those companies need to invest, but will gain much less than the investment. But without their participation, the project fails.

Hence, the key question is: if one company has to invest more into the project than it will gain from it, why would it participate?

Certainly, there must be an incentive for this company to join the project. As a possible incentive-system we propose Cost-Benefit-Sharing.

Let us therefore define Cost-Benefit-Sharing as follows:

"Cost-Benefit-Sharing is a systematic and system-oriented incentive-system that motivates companies in a network to participate in joint projects that do not benefit them directly."

Cost-Benefit-Sharing has long been predicted to be the necessary evolution of networks, for example by (Baumgarten, 2002).

The cost-benefit-sharing framework

Cost-Benefit-Sharing required a supporting structure, the framework. As a network does not possess a structure or hierarchic organization, we find it necessary to give the Cost-Benefit-Sharing an organizational structure: the structural level of the framework provides an organizational structure for the network. It defines how decisions are taken and goals are defined which can be supported by Cost-Benefit-Sharing.

Detailed processes of cost- and benefit-measurement, systematic network-optimization and sharing of costs and benefits are implemented in the structure at the operational level. Our framework for Cost-Benefit-Sharing thus consists of two layers, one giving a support-structure while the other defines the processes that are needed to execute the Cost-Benefit-Sharing.

Figure 3 shows how the operational- and structural levels interact:

Two-Level CBS-Model

Level 1: Structural Level

- Provide an organizational structure for the network

Level 2: Operational Level

- Provide processes for network-optimization and Cost-Benefit-Sharing

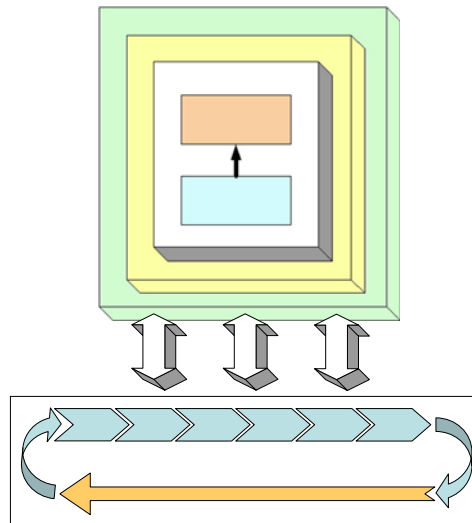


Figure 3. Cost-benefit-framework and interaction

The structural and operational levels are the two main components of the framework, each one consisting of a number of institutions or processes. The basic idea is that the Cost-Benefit-Sharing processes cannot be run in a very loosely coupled business network without other institutions other than the companies themselves. We need to institute our network, give it a basis on which the Cost-Benefit-Processes can operate. The simplest example of such an institution can be regular meetings of the persons interacting in the network. For the requirements of Cost-Benefit-Sharing, this loose interaction does not create sufficient binding energy.

Therefore, our structural level will include more institutions. The institutions at the structural level take decisions that are executed at the second level of the framework: the Operational Level. This level consists of several processes required for the Cost-Benefit-Sharing mechanism and designed as a feedback-loop. This way of organizing the process ensures organizational learning and accommodates the dynamic elements in the network. Both levels are required to initiate and run the Cost-Benefit-Sharing method. They are connected by communicating the decisions from the structural level.

Structural level

The Structural Level provides an institutional frame for the network. The network is no longer an informal, virtual organisation, but becomes a business entity with defined inputs and outputs.

Based on our research and practical interviews we propose that five institutions should be combined in the Structural Level. These five institutions and their relationships are shown in Figure 4.

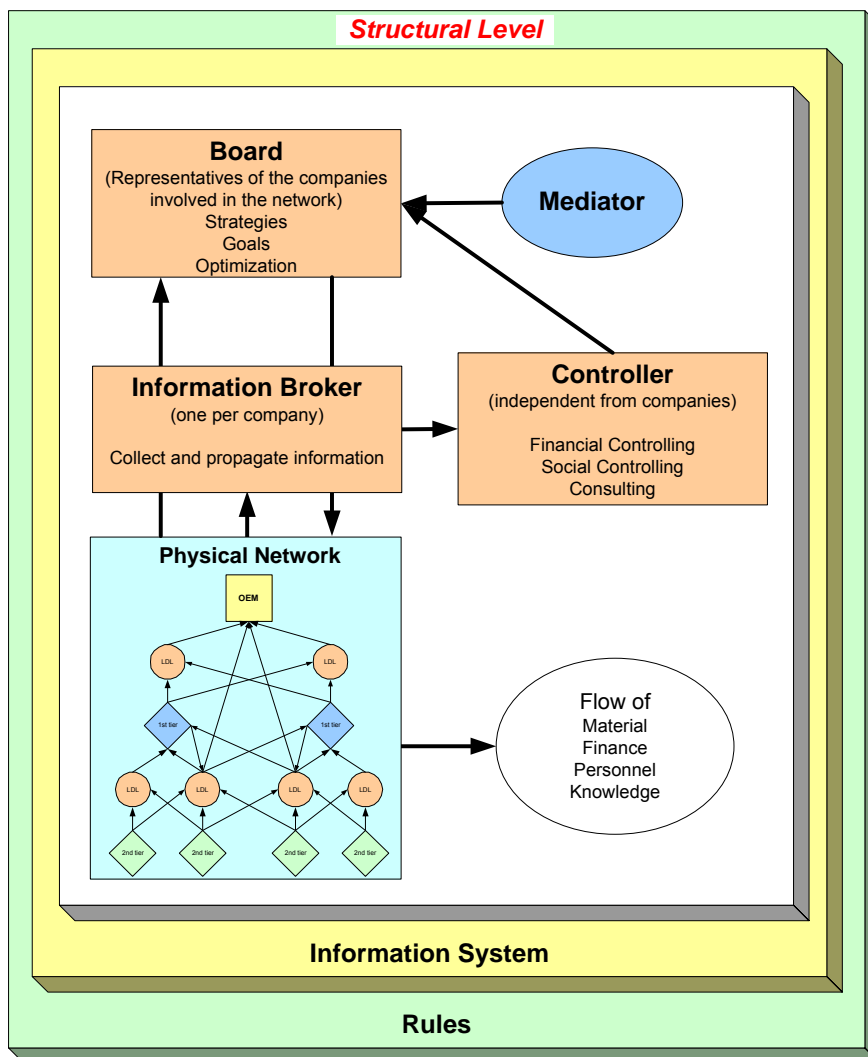


Figure 4. The structural level of the cost-benefit-sharing framework

We begin with the physical network. The physical network is the basis and includes the companies, the products they trade in the network, people and knowledge, and also financial flows between the companies. Entities in the physical network in our example are the OEM, his 1st to n-th tier-suppliers and also Logistics Service Providers (LSP). Regular business transactions occur between these entities and are the foundation for the network. They trade goods, exchange employees and financial resources. They have decided to form the network because it gives advantages to each of them through the use of the partner's resources and lowers their own transaction costs.

Three other institutions are part of our CBS-design. First, we propose that representatives of the companies involved in the network form the Board. This multilateral congregation of individuals can voice the opinions of all companies involved. This congregation and highest decision-maker are responsible for defining network-goals, the joint network-strategy and projects undertaken by the network-partners. The enthusiasm for the network and joint cooperation must be incited from the top-managers of the network's companies.

The boards' decisions must be based on facts and reproducible numbers. All required facts are prepared for the decision-makers by two supporting institutions such as the Information Broker and the Network Controller. Each company should name one employee in charge of disseminating information from the board and vice-versa. He is the "Liaison Officer" of the board and is responsible for timely and accurate information-flows between the board and employees of his company. He can collect the data required by the board and support his own organization.

Additionally, we propose that an independent Controller is in charge of the actual Cost-Benefit-Sharing calculation and summarizes the data provided by the Information Brokers. It is imperative that this Controller does an independent and transparent job. The underlying numbers, calculations and results of the CBS-process must be reproducible and available to all companies involved at any time. The way this calculation of costs and benefits is organized is crucial to the entire CBS-process. It is mandatory to have employees in every company that can understand the logic and limitations of the CBS-calculation. With this knowledge and the numbers available to all parties involved they can check whether the calculations are correct at any time. Furthermore, transparency is supported through freely available basic data and calculations in the Network Information System. This can be an easy-use, web-based information system that provides identical information for all participants of the joint project.

The institution of a Mediator can help to settle disputes about joint projects and the Cost-Benefit-Sharing process. This job-on-demand can be of great help in a voluntary network-setting where conflicts are best avoided or settled by people outside the organization.

As final component of the framework a few rules should be implemented. These rules of the cooperation are multilaterally binding, adopted and spread throughout the network. They could state how decisions are taken on the board, how conflicts are solved, how new companies are integrated into the network. Finally, they could be used to sanction misbehaviour.

With the introduction of the Structural Level the network voluntarily chooses to a loosely hierarchic form to coordinate business within. Hierarchy is combined with acting in good faith.

At this point we can ask: who pays for these institutions? The idea is to keep this overhead-structure as lean as possible. Its installation will save money through better and system-oriented coordination of decisions and resource-allocation in the network. If these institutions are successful with their task, the benefit of a well-designed CBS-process will offset all costs associated with it. Running-costs are mainly expenditures for the Controller and Mediator and opportunity costs for the other employees involved.

Operational level

The detailed processes and calculations for the CBS-process make up the operational level, shown in figure 5. This process is designed as a feedback loop; it is a recirculating process. This way the process will adapt to changes in the network due to dynamic events such as new companies entering, significant events happening and periodic updates.

Figure 5 shows the processes running within the operational level.

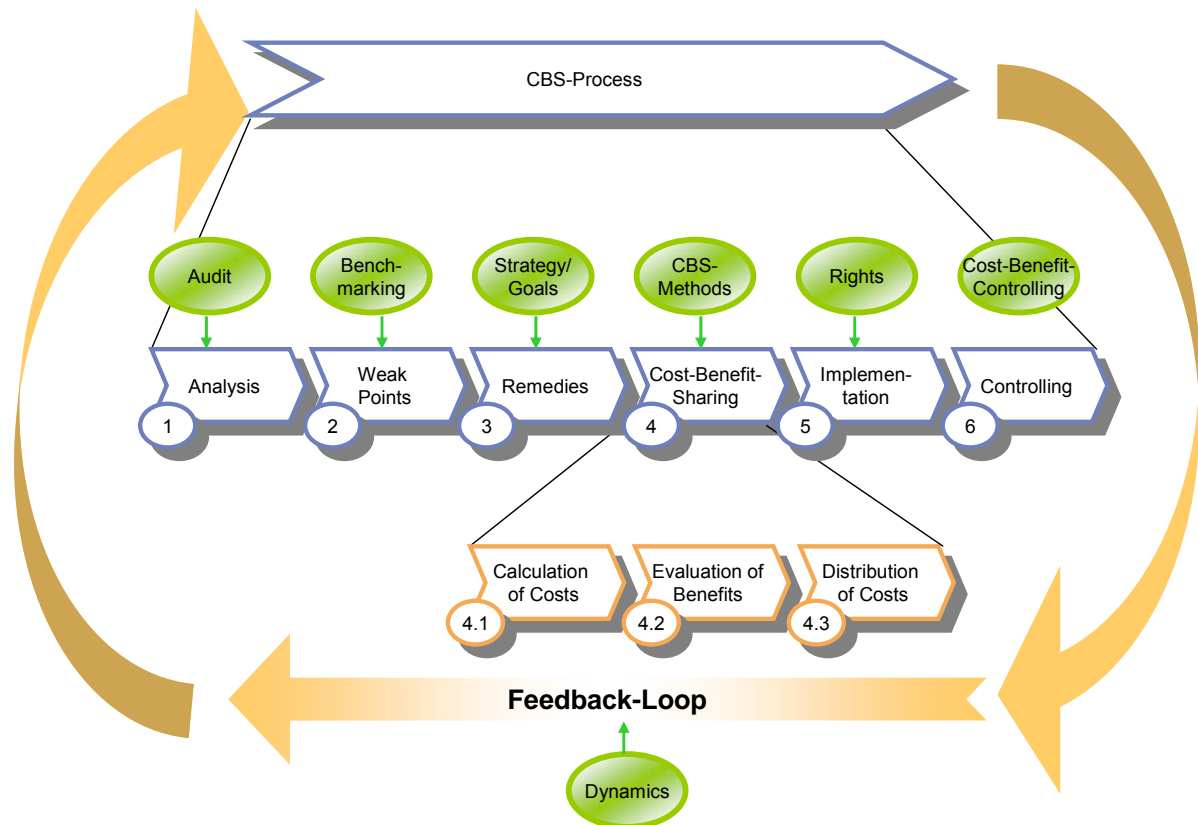


Figure 5. Operational level of the CBS-Process

Before we discuss the details, we explain the idea that lies behind the process. In each network it is possible to improve business processes, machines, structures and responsibility: for example, installing a new machine at a bottleneck-resource, streamlining the process by introducing a common software-solution, or removing non-productive processes. More than one company will benefit from the improvement-project, but not necessarily each one to the same extent.

If a company installs a machine at a critical point in the Supply Chain, only one company might be left with the costs while the others gain benefits without any costs. This example would be a joint project where CBS would be an interesting application. A Joint project is the basis for the CBS-process and can be defined as follows:

"A **Joint Project** is a cooperative effort to improve the processes or resource-allocation in the network. It involves at least two parties in the network."

Each joint project produces positive, desired effects (benefits). At the same time they come at the expense of unwanted negative effects (costs). The implementation of a joint project constitutes an improvement (positive effects) for some parties in the network and associated costs (negative effects) for others. In order to approve a joint project the following basic principle must hold: the total positive effects of the joint project in the network must offset the total negative effects in the network. We would like to point out that the negative effects at a single party must not be offset by direct positive effects at each individual party.

Joint projects are developed after an initial analysis of processes in the network (Step 1). The analysis shows weak points in the system and explains the room for improvement (Step 2). Possible actions to remove or soften the weak points are developed in Step 3. These actions must be aligned to the overall strategy and goals that the board has set. Step 4 constitutes the Cost-Benefit-Sharing Process, displayed in Figure 6.

First, costs, the negative effects of the parties concerned, are evaluated and contrasted with the individual positive effects at each party. According to certain previously discussed mechanisms, excessively unfavorable cost/benefit-ratios can then be remedied by financial compensation taken from very favorable cost/benefit-ratios. We note that we are distributing cash-flow-relevant benefits to make it easier to bear the costs, and thus give an incentive to certain parties to join the project.

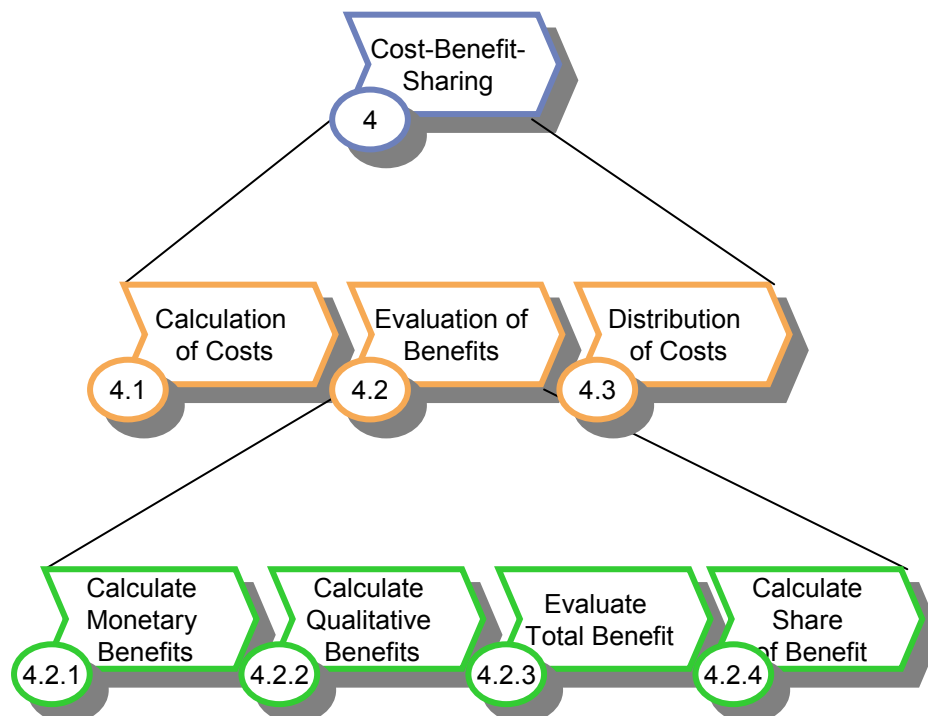


Figure 6. Details of the CBS-Process

We have developed a method to evaluate quantitative as well as qualitative effects of joint projects. Both effects occur and both are very important—with a strong bias towards the qualitative effects, the more informal the network. Most companies are reluctant to include "soft facts" or qualitative criteria into an evaluation because they are subjective and prone to

manipulation. Without further comment we have hence included a weighting-mechanism into evaluating the effects. The board may now decide whether to weigh soft facts with 10% or 40%. Cooperations and networks are strongly influenced by these soft facts; it would not be wise to neglect this despite the reluctance. The Figure 6 shows a detailed overview of the CBS-calculation process. Further details are currently under development and will be part of (Riha, 2006).

Different principles of distribution of the benefits may be applied, such as share of value-added or share of benefit proportional to share of costs.

All benefits and costs are evaluated individually for each party and then distributed according to the principle decided upon on the structural level.

Positive and negative effects are measured as a difference to the status quo. CBS-relevant costs and benefits are therefore only those changes associated with the execution of the joint projects. The basis for comparison is always the "zero alternative", namely the alternative if no project is undertaken.

Step 5 is the implementation phase of the remedies and actions proposed in Step 3. All necessary steps are taken to implement the project in all companies concerned. During the implementation process, progress is monitored and costs are controlled. This is shown as Step 6, Controlling.

The feedback-loop closes the CBS-circle. After the successful implementation of joint projects the participants reflect their experiences and try to improve future processes.

Summary

In this paper we have presented a comprehensive approach for an incentive-system in business-networks based on system-wide evaluation and distribution of costs and benefits.

Studies and empirical data suggest that networks are becoming polycentric and less easy to coordinate by the use of power and pressure towards smaller suppliers. This phenomenon is most visible in the Automotive Industry. Currently, our research suggests that the OEMs have not yet recognized that their powerful position is eroding and they need to prepare for the consequences. Suppliers are already aware of this. But what are the strategic options for the OEM?

One possible answer is to use incentives instead of forcing suppliers to comply. We present the background and a design for such an incentive-system: Cost-Benefit-Sharing (CBS).

As a basic requirement for CBS networks must be understood as systems instead of a collection of individual companies without coordination. Joint projects can be initiated to improve processes and resource-allocation. According to the systems idea, these projects must not be feasible for each individual company but feasible for the entire system. The main feasibility-condition then becomes: the total positive effects of the joint project in the network must offset the total negative effects in the network. We would like to point out that the

negative effects at a single party must not be offset by direct positive effects at each individual party. Then we can provide incentives for companies that do not benefit directly from these improvements. This reasoning leads to the development of an integrated framework for Cost-Benefit-Sharing.

The resulting framework consists of two main components, a structural and an operational component. Both are required to institutionalize the network and to execute the CBS-process. The structural level provides an institutional frame for the network. The network is no longer an informal, virtual organisation, but becomes a business-institution with defined inputs and outputs. The detailed processes and calculations for the CBS-process make up the operational level.

This paper presents a non-game-theoretic approach towards CBS.

Conclusions

Cost-Benefit-Sharing has long been discussed by scholars and practitioners. Unfortunately, there have been very few, only game-theoretic approaches to Cost-Benefit-Sharing. Experience in many industry projects has shown that game-theoretic approaches are difficult to understand by non-academic employees. Yet, it is evident from current developments in business that innovative methods must be sought to coordinate the ever-more-important networks in business.

While many critics say that any sharing of benefits will not work in practice, we open this paper for discussion.

An initial version of the framework presented in this paper has already been discussed with the companies Audi, Steinle and Faurecia, and subsequently been modified. The suppliers readily acknowledge that Cost-Benefit-Sharing is necessary and would like to introduce it; yet a lot of work remains to convince the OEM that it CBS leads to better results than the coordination-mechanism currently in use.

We are convinced that there is still a long way to go towards a practically applicable model of Cost-Benefit-Sharing. Here is one suggestion and we encourage comments and constructive criticism at any time!

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