

PERFORMANCE/ BENCHMARKING CHAINS AND NET-WORKS

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Abstract

In this paper a study is presented that had as goal to develop a management instrument (benchmarking)for co-innovation projects on basis of a set of performance indicators for chains and net-works of firms. To base the indicators on a sound basis relevant theories were studied, like industrial economics, resource-based theory, marketing theory, net-work theory and also specialised theories related to flexibility, innovation and quality care. Thereafter a framework was developed. The framework consist of a quick scan of performance measurement and comparative benchmarking to get a global idea of the possible improvements. For the aspects that need to be improved a more fine tuned approach is the measurement of performance related tot the different processes and a benchmark thereof. In the fine tuned part of the framework we distinguish capacities, realisation and perspectives. The quick scan part is used to get a global idea of the performance of different apple chains in The Netherlands, France and New-Zealand. It appeared to be a useful approach to get an idea about the performance of different chains with help of desk research and published information. Finally, some conclusions are drawn.

Keywords: performance, benchmarking, chains, net-work

1. Introduction

The purpose of the research discussed in this paper was to develop a management instrument for co-innovation projects (to be used in practical situations) on basis of a modular approach to measure performance and to make benchmarking possible of chains and net-works. The instrument has to give a set of relevant performance indicators and the factors that are of influence on the performance. This means that besides measuring also understanding, explaining and managing performance was of interest.

A number of trends in the business environment have stimulated the application of external net-works and chains as an organisational form. Vertical co-operation in chains is used to develop new products, to reduce costs and risks, to obtain knowledge and to respond more quickly to customers requirements. Horizontal co-operation in net-works is used to meet the challenges of changing demand, increased competition, swift technological change and internationalisation.

On theoretical grounds like transaction cost economics (T.C.E) and the theory about social capital these types of external organisations are expected to have a positive influence on the results of chain and net-works. However the measuring of the results of chains and net-works, the performance has been neglected thus far. There are methods available to measure the performance of a firm (f.i balanced score card), an industry like poultry (the Porter approach) and on a macro level. Without a method to measure and determine the performance of chains and net-works it is also difficult to manage the alliance.

The standard approach for measuring the performance of firms and industries can not be used for chains and net-works. Because the co-operation in chains and net-works is only used for a part of all the activities of a firm. This implies, that new data related to the chain or the net-work has to be assembled and that available information for firms and industries has to be decomposed. Besides this aspect also the goal of the chain and net-work is of influence on the measuring of performance. The purpose of the co-operation may be diverse. It can be oriented

to flexibility in order to respond to changes in consumer demand, or to the development of new products, to guarantee the quality or safety of the products etc.

In this paper in paragraph 2 the theories that may be used to develop a method to measure performance in chains and net-works are discussed. In this part theories on the micro, meso and macro level will be discussed. There after the outline of a new approach to the measuring of chain and net-work performance will be given in paragraph 3 and its possible use in benchmarking illustrated. In paragraph 4 the results of a first case-study will be described. The case was based on 4 apple-chains in 3 different countries. In paragraph 5 a number of conclusions and interesting remaining research questions will be given.

2. Theoretical concepts

The changes in the market that have resulted in the application of external net-works and chains makes it necessary to measure the performance on a number of aspects and not only on profitability. In our research project we decided to measure the performance on the following points: profit, innovation, flexibility/ responsiveness, quality maintenance systems and logistics. We performed a broad survey of the theoretical literature on performance and benchmarking to provide a sound theoretical background for our framework. In the survey we concentrated on the aspects around profit, innovation, flexibility/responsiveness and quality care systems. In this paragraph we present a short review of the treatment of performance and benchmarking in several disciplines. These theories mostly deal with performance on meso and micro level, because that are the levels where chains and net-works are found.

Neo-classical approach

In neo-classical economic theories the performance of firms, industries and countries are mainly measured and compared through efficiency¹ and effectivity² indicators (Bunte, 1998).

Industrial economics

In the general concept of industrial economic theory (Scherer and Ross, 1990) the performance of an industry is the result of the basic conditions with respect to demand and supply and the market-structure (number of firms, location, concentration, entry barriers etc.). These factors determine the possible conduct with respect to competition that on his turn determines the performance (efficiency, profit, etc.). The external situation and governmental policies are considered as given in this approach.

Porter (1980, 1985) has further developed this theory to a theory of competitive advantage. He distinguishes two basic types of competitive advantage; low costs or differentiation. These advantages are based on five competitive forces: the entry of new competitors, the threat of substitutes, the bargaining power of buyers, the bargaining power of suppliers and the rivalry of existing competitors. The sources of competitive advantage is according tot Porter based in the value chain, which desegregates a firm is his strategically relevant activities. He distinguishes the following primary activities (inbound logistics, operations, outbound logistics, service, marketing and sales) and four support activities (firm infrastructure, human resource management, technology development, and procurement).

The value chain of the firm is embedded in a larger stream of activities that Porter calls the value system. These vertical linkages are frequently overlooked. However, gaining and sustaining performance depends not only on a firms value chain, but how the firm fits in the

¹ The indicator is based on the relation between output and input.

² The effectivity indicator measures the relation between output and target

overall value system. The performance of a firm, chain or net-work can be improved by co-ordination and co-operation between chain and net-work members. Both product (logistics) and information flows are crucial.

The resource-based theory

This theory (Rumelt, 1984) defines a firm's performance by a bundle of unique resources and relationships. These resources and relations has to be adjust and renewed as time, competition and change erode their value. This is the main task of general management. These resources must be combined in such a way, that the firms position is different in the eyes of the buyers (like better quality, lower price). To lead to sustainable above normal profits the resources must be valuable, rare, not perfectly imitated and not be substitute easily.

Hamel and Prahalad (1994) have state that it is not enough to build on your existing core competence or make a new combination of existing core competencies, but you have to create the core competencies that you expect are necessary to compete in future.

Marketing.

In recent marketing literature performance is dependent on the market orientation of firms or industries. A market orientation includes (1) the systematic gathering of information on customers and competitors, both present and potential, (2) the systematic analysis of information for the purpose of developing market knowledge and (3) the systematic use of this knowledge to guide strategy. A better performance is achieved through product differentiation, product innovations, quality, service or suitable product range. Hunt and Morgan (1995) argue that there may be great ambiguity as to precisely what attributes are making the product perceived to be superior. Furthermore ambiguity may exist as to the resources which are used. Another argument is the presence of a tacit dimension in implementing a market orientation effectively.

Net-work theory

In the net-work approach (Håkansson, 1989) an organisation is seen as functioning in a net-work of relations with buyers, sellers, partners, governments etc. The nature of these relations can differ. Håkansson distinguishes three basic variables in a net-work, namely, actors (persons that fulfil activities or manage inputs), activities (transformation and transaction activities) and inputs (physical, financial or human). Between the actors a mutual relation is present. This relation is characterised by his content (what is exchanged), nature (strengths and quality of relations) and structural (internal and external) aspects. The social structure of the net-work is an important factor for the behaviour of firms. The components of the social structure are trust, information exchange and common problem solving methods.

Flexibility

Volberda (1992) sees flexibility of firms as a organisation and management problem. The flexibility potential is determined by the aspects technology (routine/non-routine), structure (mechanistic/ organic) and culture (conservative/innovative). The desired flexibility is determined by the turbulence in society and markets like dynamism, complexity and unpredictability. The actual flexibility is a result of the potential flexibility and the procedures activated by management to reached the desired level of flexibility. This may be a mix of operational (routines), structural (organisational adaptations) and strategic (related to the goals of the firm) aspects.

Innovation

Innovation is seen as an investment (Scherer and Ross, 1990). In Cobbenhagen (1999) the results of a pair wise comparison of firms are published. The research confirmed the existing ideas about innovation. Cobbenhagen based its research on the theory of the resource based school. In this theory resources and capabilities are important. Capabilities which are heterogeneous, not materialised, not or badly transferable, firm specific, resource-based and related to central qualities of the firm form the basis for his performance. The theory further assumes that society and markets can be influenced by the firm. A successful innovative firm has in internal “locus of control”. This locus takes its own position as a starting point and presumes success can be forced, It also enables persons to learn more and faster from external knowledge and to indicated what knowledge is needed. Finally it makes better choices. In this theory the firm is considered a bundle of separate units. For chains the findings of Cobbenhagen’s research result in the organisation of innovation teams which are multidisciplinary and in which persons from different firms in the chain are taking part. Innovation in chains is there for depending on processes, outputs and surrounding of the chain and of the inputs, processes, outputs, capacities and surrounding of the firms that are part of this chain.

Quality care

Total chain quality care is the part of a total management task that is decisive for the formulating and realisation of the quality policy of the chain. It gets a usable form in a chain quality system, which are the organisational rules, responsibilities processes and resource available for realisation quality care at chain level. However, the model is not validated, the performance is measured via the intensity of co-operation. To evaluate the chain quality system a reference model is developed Dutch quality Price (Nederlandse kwaliteitsprijs) (Hardjono et al, 1996). In this model are distinguished organisational aspects (capacities) and results (realisation). The organisational aspects are leadership, personal management, strategy, resource management and process. The aspects of the realisation are: valuation by personal, customers, society and the results of the enterprise.

Conclusion

The survey of the literature gives the following key-elements of performance. The neo-classical theory focussed for a long time on costs as the main determinant of performance. In industrial economics the structure, conduct performance model was long time leading. Porter gives a broad overview in which activities directed at low-costs or a differentiation strategy are important. Furthermore, vertical linkages (value

Theory	Key elements	Relevant aspects for performance measurement
Neo-classical theory	Relative costs differences caused by differences in labour productivity	Costs, Productivity, economies of scale, efficiency and effectiveness
Industrial economics	<ul style="list-style-type: none"> - Scherer and Ross (1990) Structure, conduct performance model - Porter 80/85 Strategy (low costs or differentiation), the competitive forces, the value chain (nine strategic activities create value by using purchased inputs, human resources and technology), the value system (co-ordination and co-operation, product flows, information flows) 	<ul style="list-style-type: none"> Basic conditions, market structure and conduct. Strategy: low costs or differentiation The value chain: nine strategic activities create value by using purchased inputs, human resources and technology The value system: co-ordination and co-operation, product flows, information flows

Strategic management	<ul style="list-style-type: none"> - Resource based theory: Resource or core competencies: strategy must be flexible and directed at adjusting and renewing these resources. - Hamel and Prahalad: Creation of core competencies that you expect to be necessary to compete in the future; ability to adapt to external events; long term strategy 	<ul style="list-style-type: none"> Core competence Resources Strategy Flexibility Vision Creation of new core competencies
Marketing	<ul style="list-style-type: none"> - Market orientation: Product differentiation, product innovations, quality, service and a suitable product range (assortment) 	<ul style="list-style-type: none"> Market orientation: Product differentiation, product innovations, quality, service and a suitable product range (assortment)
Net-work theory	<ul style="list-style-type: none"> Basic variables: actors, activities and inputs. Mutual relations: content, nature and structure Social structure of relations: trust, information exchange and common problem solving methods. 	<ul style="list-style-type: none"> Basic variables: actors, activities and inputs. Mutual relations: content, nature and structure Social structure of relations: trust, information exchange and common problem solving methods.
Flexibility	<ul style="list-style-type: none"> Management and organisation problem Potential: technology, structure and culture, Desired: dynamism, complexity and unpredictability in society and market Actual: potential flexibility and management procedures at operational, structural and strategic level 	<ul style="list-style-type: none"> Potential: technology, structure and culture, Desired: dynamism, complexity and unpredictability in society and market Actual: potential flexibility and management procedures at operational, structural and strategic level
Innovation	<ul style="list-style-type: none"> Resource –based: capabilities, resources, firms can influence society and markets. Internal locus of control 	<ul style="list-style-type: none"> Inputs, processes, outputs, capacities, surroundings of firms and the processes, outputs and surrounding of the chain
Quality care systems	<ul style="list-style-type: none"> The model separates organisational aspects (leadership, personal management, strategy, resource management, process) and results (valuation by personal, customers, society and the results of the firm) 	<ul style="list-style-type: none"> organisational aspects: leadership, personal management, strategy, resource management, process results: valuation by personal, customers, society and the results of the firm

system) with other firms are important. The strategic management literature stresses the possession of difficult to copy resources or core competencies. Strategies should be directed at the creation of resources that are needed in the future. The marketing literature stresses that a market-oriented approach is a key determinant of performance. The net-work theory indicates the social structure (trust, information exchange and common problem solving methods) of the net-work as an important factor for the behaviour of firms. Volberda sees flexibility as the result of organisation and management that depends on a mix of operational, structural and strategic aspects. Innovations are seen as investments. The results of these investments are positively influenced by an internal locus of control. In chains this boiled down to the forming of multidisciplinary teams of innovators from different partner firms. Performance with respect to quality care is measured with help of a model (Nederlandse kwaliteitsprijs) in two area's: organisational aspects and realisation.

3. *The framework*

To measure the performance it is necessary to define and select indicators that can be used to manage the firm. These indicators must give insight in the functioning of a firm and to define levels that indicate a satisfying situation. Examples of these performance measure systems are the balanced scorecard (Kaplan, 1992 and 1996). The balanced scorecard measure the performance via a financial dimension, customer satisfaction, internal processes and innovation. Another system is the EFQM-model. In this model the performance is measured in the following area's: people results, customers results and society results.

The theories discussed in paragraph 2 make clear, there are a lot of aspects that may be of importance in measuring performance in chains and net-works. Not only the present situation is of importance but also the possibilities for the future. An illustration of this point is, the relation between present profit and investments in R&D. A decision to increase the investment in R&D, that is to improve the performance in future can result in a lower profitability in the current year. That's was another reason why was decided to measure performance via a number of indicators. Further the trade-offs between the different indicators must be made clear. This means a change from balanced to unbalanced measurement systems in which the indicators are weighted in relation tot the strategy of the firm.

Benchmarking is a continuous systematic process for evaluating the products, services and work processes of organisations that are recognised as representing best practices for the purpose of organisational improvement (Spendolini, 1992). In this definition the following points are of interest. Benchmarking is a continuous process, it relates the performance not to theoretical levels, but to levels realised in practice and finally the purpose is an organizational improvement, that is tot learn from others.

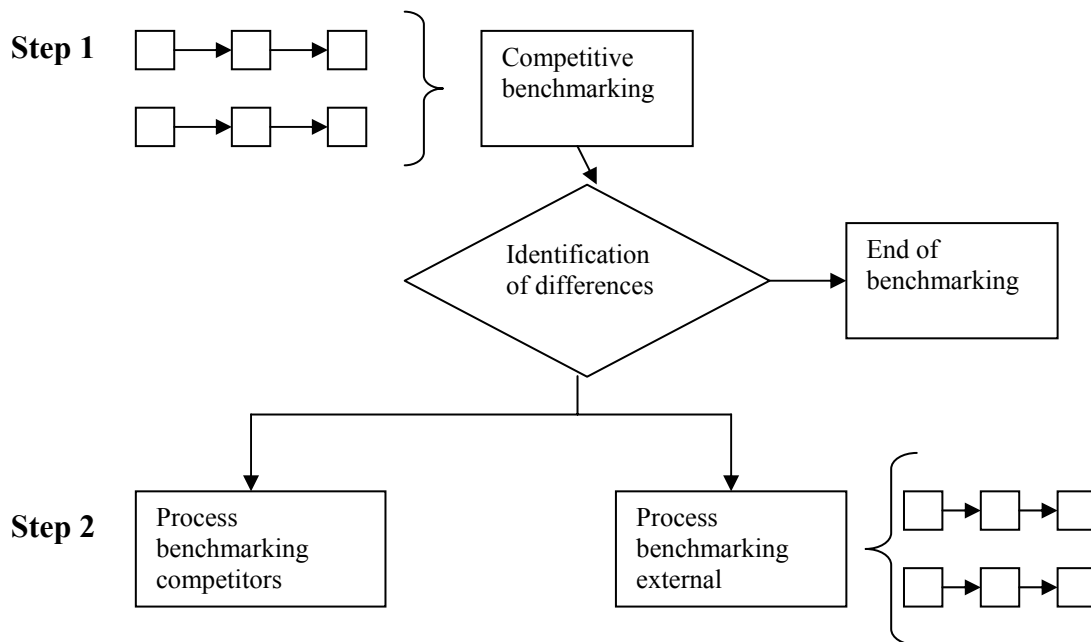
The most important approaches of benchmarking are competitive benchmarking and process benchmarking. The first approach compares the performance on a set of indicators of competing firms or chains. The second one compares performance and functionality of comparable processes. This can be done between different types of firms and chains.

In the project the following approach is chosen. With a global quick scan approach the overall performance of chains and net-works is measured and compared with other chains and net-works. This quick scan gives on overview of the possible gains via improvements on an aggregate level. This quick scan is best done as a comparative benchmark with competitors in the same market with the same type of products and processes. To get more specific information over how to improve the performance a process benchmark is necessary. This gives the opportunity to compare the same processes in different industries which makes it easier to compare with 'best practices' and get more opportunities for improvement. Such an in depth study of a process makes a strong focus to a single process necessary, otherwise the comparison becomes to complicated.

To get a consistent instrument both steps have to be tuned a such a way, that the performance scored in the first step is explained by the scores in the second step. In this manner the indicators are nested and related to the processes in the chain. An example of this approach is given for profitability. The indicator for the chain is total added value. At firm level the indicator is added value per firm or worker.

In Figure 1 both steps are represented in relation to each other. If step 1 shows a bad performance for the chain or net-work on one or more indicators, than step 2 follows.

Figure 1. Scheme chain and net-work benchmarking



Benchmarking is based on performance indicators. Based on the literature studied we selected the following five aspects of chain and net-work performance:

- de financial situation
- customer satisfaction
- adaptation dynamics to changed circumstances
- R and D activities including resulting innovations
- Information systems to guarantee quality and safety of the produce

In our approach we used indicators for different aspects namely with respect to what is available (capacities), how are the capacities used(results) and what is the effect for the future (future perspective). We added the surrounding as an additional aspect. Because the surrounding like laws and governmental rules can not be influenced by chain or net-work, but has much impact on the performance.

The capacities are all physical production means but also knowledge and information (systems). Capacities are the innovation capacity, the financial situation, the market intelligence, the flexibility and the available care systems.

The *innovation capacity* is oriented towards technological changes and organisational or logistical changes. An innovation may be a new technology or a new product and can be related to a process or a product. The base for the innovation capacity are R&D expenses, the schooling level of the workers, the exchange of information and the organisation of the innovation process.

The *financial situation* is the most important economic capacity of chain and net-works. Of importance are the financial structure and the possibilities to get additional money.

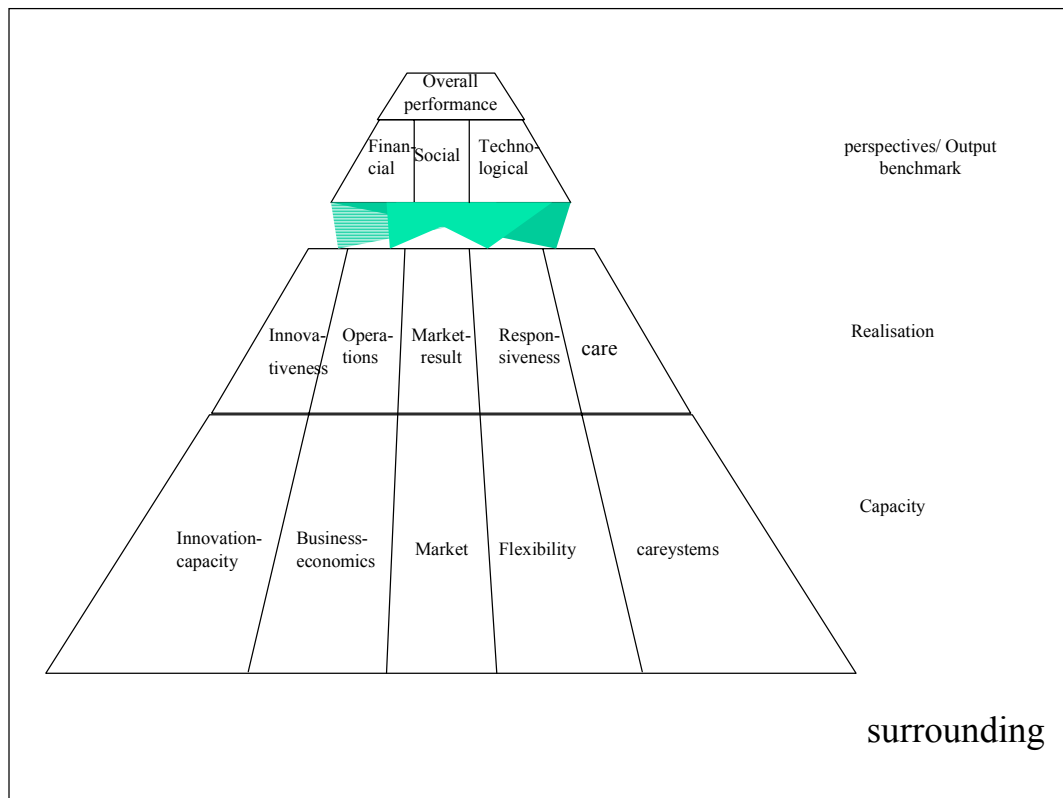
The *market* is related to the market intelligence present and the method of market promotion.

The *flexibility* is influenced by the co-operation in chain and net-works. Contracts, specific assets and loyalty diminish the possibilities to changes partners or to end the partnership.

Further the available technology, organisations structure and culture are of influence.

The presence of *Care-systems* These systems can be related to environment, product quality, animal welfare or biological guaranties.

Figure.1: The area's of performance (indicators) and their relations



The results give an indication of the achievements of chains and net-works. Thus how they have used their capacities. Partly these results are future capacities. As results we have distinguished: innovativeness, operations, market results, responsiveness and care. The *innovativeness* is the extent chains and net-works were able to introduce product process and organisational innovations. *Operations* enclose all financial results of chains and net-works, including value added, degree of capacity utilisation. *Market result* is in the first place market sales, but also image, price/quality relation and customer satisfaction. *Responsiveness* this is the extent a chain or net-work signals a change in her surrounding and timely and in the right manner responds to this change. Responsiveness is difficult to measure. Indicators must be related to difference in time and manner of response. Indicators of the result *care* are the use of Genetic Modified Organisms (GMO), the emissions to ground, air and water.

In the report the aspects of interest with respect to performance like the different items of capacity and results are elaborated into performance indicators. With respect to the result factor innovativeness for example the following indicator are mentioned:

- number of new products
- number of improved products
- success ratio of new and improved products
- number of new production processes
- number of changed production processes
- number of patens

The strategy of a chain or net-work depends on the surrounding. In a chain with differentiated or branded products the performance with respect to market-indicators is of more importance than in a market with homogeneous unbranded products. In the last chain costs and efficiency

indicators are of more importance. Based on the strategy of the chain the relatively importance of the different result area's will be weighted.

4 The quick scan

The quick scan has to fulfil the following demands:

- give a good picture of the whole chain or net-work. This implies the availability of indicators for every link that are simple to aggregate.
- Must be done with help of only published and public data. This is a restricting demand, but necessary to have a quick scan.
- The indicators must cover the relevant aspects mentioned in the former paragraph.
- A number of 5 indicators is given the literature about performance management optimal.

On basis of the experience with the balanced score card is decided to use indicators with respect to the following area's:

1. innovativeness - responsiveness:
 - a. number of new products in recent years
 - b. the extent of chain or net-work wise organisation or financing of R&D efforts
 - c. R&D as percentage of sales.
2. Operations
 - a. financial indicators like ROI, growth of invested capital
 - b. non-financial indicators: added value per worker, logistic performance, chain relations
3. market results
 - a. recognizability of the products for the customers
 - b. customer appraisal / development of market share
4. care
 - a. Availability of a care-system and the contents of this system

The quick scan method is used in a case to test its usefulness. The case is done for 4 apple chains. Two chains in the Netherlands, one in France and one in New Zealand. The chains are differentiated with respect to novelty. In the Netherlands the chains for Elstar and Elise are chosen. In New -Zealand the Braeburn chain and in France the Gala chain. Both Elstar and Braeburn are elderly varieties, while Elise and Gala are recent developed varieties.

The following indicators are used:

- market result: the development of the market share of the variety
- operations: the financial results of production and the logistic costs of the distribution in the home land of the variety
- innovation - responsiveness: number of acknowledged grower rights, the organisation of the development of new varieties and the influence of consumer demands on this development
- Care: a qualitative judgement of the used system

The necessary data are collected via desk research. To collect data in France and New-Zealand the help from experts from that countries is asked and got.

Market result

The market share of the relatively new varieties Elise and Gala is growing and the prices are relatively high. The market share of Elstar and Braeburn diminishes and the prices low.

Operations

The situation for the different varieties is almost the same. The costs of Braeburn are relatively high, but they sale high quality to and this variety is sold to countries on the Northern hemisphere when they don't have apples of their own. The production costs of Elise and Elstar are relatively high, but this is compensated by a very efficient logistical system. The cost price of Gala is relatively low because the production scale is large, while the distribution system is less efficient as that of Elstar and Elise.

Innovation and responsiveness

In France relatively less new varieties are developed then in New Zealand and the Netherlands. In new Zealand new varieties are the strategy to get a competitive advantage and to compensate for high distribution costs. In the Netherlands there is a permanent search for varieties that are adapted to the less good growing conditions in this country.

Care.

Everywhere we see the growing importance of production that is in accordance with the demands of buyers for instance the Eurep/gap norm of the European supermarket organisations. Every producers will have to meet these norms in future. In the Netherlands and New Zealand we see in addition an orientation towards environmental friendly methods of production while in France the use of quality marks is more common

Figure 3. The scores of the different apple chains on performance indicators

	<i>NL-Elstar</i>	<i>NL-Elise</i>	<i>Frankrijk-Gala</i>	<i>NZ- Braeburn</i>
Market results	***	****	****	*** (relatively high distribution costs)
Operations	***	***	***	***
Innovation and responsiveness	***	***	**	***
Care	*** (stress on MBT 1)	*** (stress on MBT)	*** (stress on quality marks)	*** (stress on tracing en tracking)

1.) Environmentally friendly production methods

Legend: The more points the higher the score (Source: LEI on basis of different information)

This case study underlines that all chains and net-works do have strong and weak aspects. This makes summarisation of performance in one score not a useful approach. Besides that not all clients have the same demands. They may differ in appreciation of the same performance score. The quick scan method gave signals of the weaker aspects of the different chains and net-works. This means it is a just instrument to determine on which aspects the process benchmark has to concentrate. A problem is that in public sources only a few figures about chains and net-works are found. This means that collecting data from chains directly or from experts with help of inquiries is necessary. This demands a lot of time. The alternative is to use data for the whole industry.

5. Conclusions

1. The competitive position and power of firms, chains and net-works are only in relation to that of others of interest. In this paper a method is discussed to determine the competitive position. However, of more importance are the reasons for a certain position and the possibilities to improve. The developed quick scan methods give the essence of this approach. The deeper analysis with help of process benchmarking is only given in the form of list with relevant aspects.
2. The case study made clear that in public sources hardly any information about chains and net-works is found. A further complication is that firms can participate in different chains or net-works. This situation results in the necessity to process the data available to information about the study object. However, this may not result in a very expensive instrument.
3. The study of relevant literature made clear we had to distinguish between capacities and realisation. It also gave a number of relevant items and indicators and underlined our idea to choose for a multidimensional measurement of performance. Beside that it also stressed the need for adaptation to quick changing situations and thus for learning capacities of organisations. Finally, it made clear that the importance of the different aspects has to be weighted in relation with the strategy of the chain.
4. The method developed will be used for chains and net-works. Therefor the aspects that can not be influenced by chain or net-works and are the same for all chains and net-works studied are not taken into account. The approach is therefor not suited to determine the impact of the government on the competitive power of chains and net-works.

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