Nordic Innovation Centre

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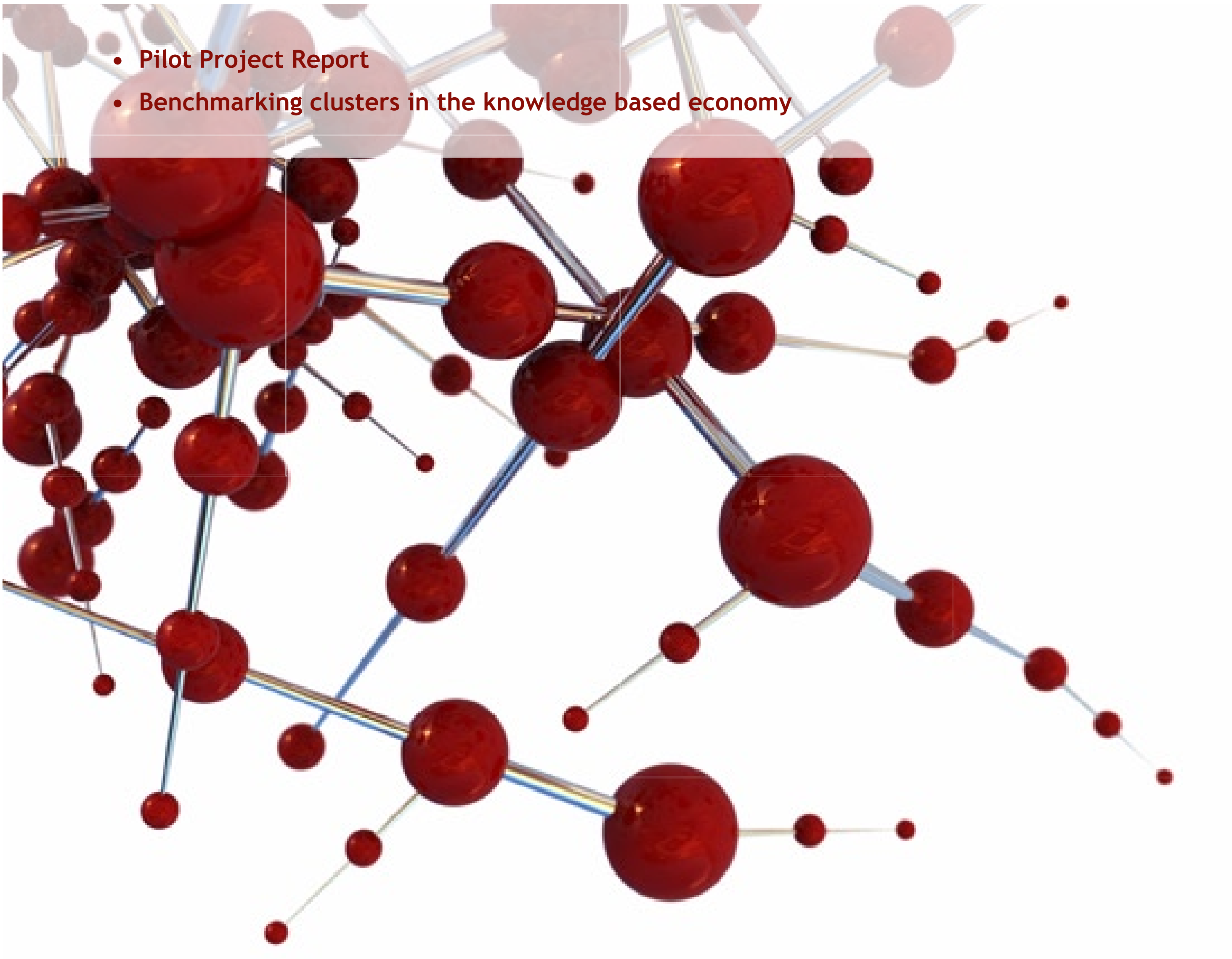
The Cluster Benchmarking Project

- **Pilot Project Report**
- **Benchmarking clusters in the knowledge based economy**



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Title:
The Cluster Benchmarking Project: Pilot Project Report - Benchmarking clusters in the knowledge based economy

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Abstract:

The pilot project report outlines how clusters can be benchmarked in the knowledge based economy.

The main conclusion is that it is possible and feasible to build a model for benchmarking clusters. 4 methodologies for mapping are examined in detail as well as current projects of analysing and benchmarking clusters.

The cluster benchmarking model is outlined and finally data considerations are presented for outcome data, performance data and framework condition data and first steps are taking in developing a research design to gather these data.

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Executive Summary

The aim of the Cluster Benchmarking Project is to develop an internationally standardised tool for analyzing cluster performance and cluster-specific policies across countries and regions.

The tool serves three overall goals:
A. To identify international, national, and regional clusters.
B. To benchmark cluster performance across countries and regions.
C. To identify successful cluster policies and to enable systematic peer reviews of cluster specific framework conditions.

The purpose of this pilot project was to:
1) Examine the feasibility of the cluster benchmarking model
2) Examine existing knowledge which is relevant to the project
3) Develop and outline the model

In two reference group meetings experts from the Nordic countries discussed these three issues and exchanged experience. On this basis, the project had three main deliveries

1) It was concluded that the cluster benchmarking model is an ambitious, but realistic vision, which should be pursued in the following years.
2) Existing knowledge was examined to understand how this can be done. This included methodologies for mapping and defining global industries, existing international data sources and existing analysis of clusters within and outside the Nordic region.
3) The model was developed and the first steps sketched. Conclusions were reached regarding model setup, methodology, data definitions, and indicators.

During the process the project changed geographical scope to include the Baltic countries, Poland and Germany. This involvement of new and relevant experts from the BSR region opened the eyes to new perspectives. It was therefore not a straight path going from the project description to the final pilot project report - the pilot project balanced these new perspectives with the original idea.

At the beginning of the pilot project, the BSR INNO-net was approved with an analytical work package which can conduct some of the work outlined in this report.

During the process of implementing the pilot project, the scope of the analytical work was limited however, so only some parts of the recommended model can be implemented within this framework. Most the recommended work still needs to be undertaken. This drives the need to seek other sources of funds, to complete the model as envisioned.

In the following period, the first steps towards a cluster benchmarking model will be taken in relation to the BSR INNO-net project. Other parts will be sponsored by the Danish National Agency for Enterprise and Construction. However, this is only a first step on the way. It is

necessary to conduct further work to provide solid knowledge which can give policy makers an understanding of the dynamics of clusters and the specific policies which can be used to increase their performance.

Conclusions:
The main conclusion of the pilot project is that it is possible and feasible to build a model for benchmarking clusters. 4 methodologies for mapping have been examined in detail as well as current projects of analysing and benchmarking clusters. The cluster benchmarking model is outlined and data considerations are presented for outcome data, performance data and framework condition data. Furthermore first steps are taken in developing a research design to gather these data. Steps which will be followed up within and outside the BSR INNO-net project.

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Preface

The Cluster Benchmarking Pilot Project was launched to look into the feasibility of establishing a joint cluster analytical tool in order to improve the knowledge base of policy-makers interested in clusters. The project has been implemented throughout the summer of 2006. This report marks the end of the pilot project.

The pilot project has been jointly financed by the Nordic Innovation Centre together with the Finnish Ministry of Trade and Industry, the Swedish Agency for Innovation Systems (VINNOVA), and the Danish National Agency for Enterprise and Construction.

The report has been written by a team in FORA consisting of Torsten Andersen, Markus Bjerre, Emily Wise Hansson and Marie Degn Bertelsen. We would like to extend our gratitude to Anders Jørgensen who has made valuable contributions in conducting extensive research and in collecting data for the project. Jørgen Rosted has curved the idea and steered the process with a gentle hand from beginning to end.

Throughout the process a number of researchers, analysts and policy-makers from the Baltic Sea region have been involved. The authors would like to thank Petri Letho and Matti Pietarinen, Ministry of Trade and Industry, Finland; Rolf Nilsson, VINNOVA, Sweden; Örjan Sölvell, Göran Lindqvist and Christian Ketels, Stockholm School of Economics, Sweden; Knut Senneseth and Olav Bardalen, Innovation Norway, Norway; Zygmunt Wons, Ministry of Economy, Poland; Esko Virtanen, Tekes, Finland; Hannu Hernesniemi and Pekka Ylä-Anttila, ETLA, Finland; Hjördís Sigursteinsdóttir, University of Akureyri Research Institute, Iceland; Martin Thelle and Anne Raaby Olsen, Copenhagen Economics, Denmark; Simon Schou and Kim Møller, Oxford Research, Denmark.

Furthermore insightful comments have been received from Erin Cassidy,

NRC Canada and Jon Potter, OECD-secretariat.

A first reference group meeting was held in Copenhagen on 22 May 2006 and a second meeting was held in Helsinki on 11 September 2006, where the draft report was presented.

The pilot project has been finalized in September 2006.

Chapter 1 Introduction

Why do we need a cluster benchmarking model?

Today, it is generally accepted that geographical co-location of companies has a positive effect on the economic performance of the companies in a cluster (Porter, 1990, 2003; Cortright, 2006; OECD, 2001, 2006).

Therefore the controversy is no longer about whether firms within a cluster have higher economic performance than firms outside a cluster. Much evidence points in this direction.

Instead, the discussion is about whether it is possible to design a national and/or regional cluster policy which can positively affect the performance and outcome of companies within a cluster.

To be able to answer this question, it is important to examine the relationship between cluster performance and cluster-specific framework conditions and thereby get a better understanding of the key drivers of the best-performing clusters.

Specific political instruments cannot be transferred from one political, cultural and administrative context to the other without careful consideration. But in-depth peer reviews of the best-performing clusters will enable policy learning and provide policy-makers with inspiration from best practice.

It is therefore proposed to launch the “Cluster Benchmarking Model”, which will establish a fact-based tool in which knowledge-based cluster policy can be established.

Our vision:
The vision of the Cluster Benchmarking Model can be explained in five steps:

1. Policy relevant cluster mapping
We want to map the clusters which are relevant to policy-makers. To ensure that the analytical tool is relevant for different aspects of policy-making, it is necessary to make the tool as flexible as possible, so policy-makers can flexibly choose the composition of the clusters that they would like to benchmark.

2. Description of the economic outcome and the performance of clusters
We want to be able to describe the economic outcome and performance of clusters. Since cluster performance is not a single-dimensional concept, it is necessary to look at a range of outcome and performance indicators if we want to benchmark cluster performance properly.

3. Examination of cluster-specific framework conditions
We want to examine and quantify cluster-specific framework conditions and control for differences in the horizontal framework conditions at national and regional level.

4. Correlation of cluster performance and cluster-specific framework conditions
To understand the relationship between cluster performance and cluster-specific framework conditions, we want to regress the two to see if a strong positive correlation exists which can justify political intervention. This will furthermore make it possible to understand which policies foster growth in clusters and which policies do not.

5. Learning from best practice through peer reviews
We want to further examine the cluster-specific framework conditions of best-performing clusters. This will enable policy-learning through in-depth peer reviews.

Definition

There have been many attempts to define of the concept of clusters.

Cortright (2006)[1] concludes that one fixed definition of clusters cannot be made. Instead, it is necessary to modify one's definition depending on the purpose of one's study.

For the purpose of this study, which is international benchmarking, it seems like the most fruitful to follow the approach of Porter, who defines clusters as:

"geographic concentrations of inter-connected companies and institutions in a particular field" (Porter, 1998)

In line with this we will examine what Sölvell and Ketels call "cluster categories" as opposed to "cluster initiatives" (Sölvell and Ketels, 2006)

However, this report does not insist that this definition is the only or best definition of clusters. Different definitions can be used for different purposes when studying clusters.

Outline

In chapter 2, we will examine some central methodologies for mapping clusters. In chapter 3, the concepts of cluster-specific performance and framework conditions will be introduced. Chapter 4 presents considerations regarding the availability of data. Chapter 5 provides some examples of cluster analyses that are similar to what we are proposing. Finally, in chapter 6, the Cluster Benchmarking Model is presented.

1) In our work we have found many references to an article by Joseph Cortright from The Brookings Institution (Cortright, 2006). It seems that this article represents a state-of-the-art within the academic community on the topic of clusters.

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Chapter 2 Identification and Mapping of Clusters

In this chapter, we describe some of the central methodologies for identifying clusters, based on a review of existing cluster literature. This will serve as basis for selecting a methodology for future use.

2.1 Introduction

The literature reveals many different ways of grouping industries into clusters. In order to get the most realistic picture of cluster formations, different kinds of statistics and databases have been used, and different approaches for gathering information in other ways have been applied. Generally, the choice of method for cluster mapping depends on which kind of clusters you want to identify.

Usually the different methodologies only consider global industries as relevant to include in clusters.

The global industries – or traded industries – are broadly defined as industries that export to markets outside their region or country. That is, traded industries sell goods and services outside their region and often to a global market. They are in that way 'globally oriented' as opposed to locally oriented industries, which sell their products to a local market, and opposed to natural resource depending industries, where the industrial location is defined by the location of the resource.

Traded industries of a given country, in general count for only around 30-40 percent of the economic activity in all industries. But this is the most important share of industries for a given region or country, since these industries are drivers of the economic growth of other industries.

After identifying global industries, the actual grouping of industries into clusters can begin.

In the following sections we will take a closer look at four different mapping methodologies from the literature that we have found relevant to discuss. We start out by discussing the criteria from which we have based our choices.

2.2 The four methodologies

The literature reveals many different ways of identifying global industries and grouping and mapping the industries into clusters.

We will start by looking at the widely known localization quotient method, followed by a comment on a new method named the Ripley's K-method for geographic localization. Two other widely known methods, which will be described, are the input-output methods and the method of asking experts. As a special case of asking experts, we will look at the snowball method which has the potential for understanding the contours of clusters of the future.

For each example, the methodology for mapping and some important pros and cons of using the method will be described.

2.2.1 The localization quotient method

Clusters can be identified and mapped by looking at localization quotients based on employment data. This method is widely known and described in the cluster mapping literature.[2]

A localization quotient for a given industry measures the extent to which a region is more specialized in an industry compared to the geographic area in question.

The localization quotient is calculated as the industry's share of total employment in a given region relative to the industry's share of total employment in the whole geographic area in question. A localization quotient equal to one means that the given region is not specialized in the given industry. A localization quotient equal to 1.5 means that the given industry is represented by a 50 pct. bigger share of employment in the given region than the industry's share of employment on the level of all regions. This indicates that the region is specialized in the industry.

If several regions are specialized in an industry, the methodology assumes that the industry is globally-oriented. When a pattern appears where a group of global industries are localized in the same regions, these industries are grouped into a cluster.

2) The method was developed by Michael Porter, Harvard Business School (1990, 1998, 2003).

The method is structured as follows. First, the geographic area in question is divided into regions. Then the next step is to identify global industries by calculating localization quotients for every industry in every region. In this step, the industries of every region are divided into three groups: local, resource-dependent and global industries.

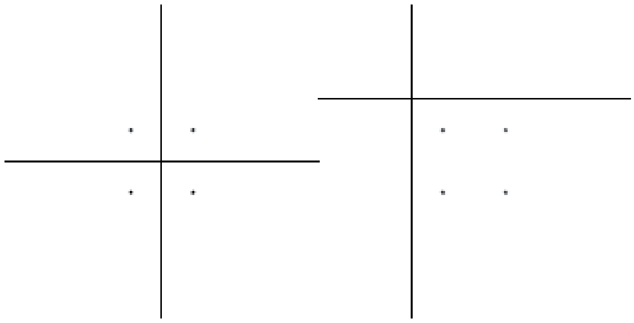
In the following step, the localization quotients of the global industries are analyzed to find patterns of clustering. A statistical approach (a cluster algorithm) is used to run through different groupings of industries to find the best solution for grouping the industries based on the localization quotients. It is taken as an indication of a cluster when the same group of industries is over-represented in several different regions.

The choice of regions, the identification, and the grouping of industries are all part of an iterative process. Going through the method, refinements can be made in the different parts of the process until the formations of clusters seem to fit reality. For this, the resulting clusters are checked by different qualitative evaluations.

The method is widely known and has been applied in many countries, mostly because it is relatively easy to use and it is only based on employment data on a regional level. This data is normally easily available.

An issue with the method is its great dependency on the choice of borders between regions and the regional aggregation, that is, the size of the regions. The choice of regions must be made a priori before the clusters can be identified. Although the sizes of the regions can be altered in order to find a best fit, only one choice of regional aggregation can be made before the actual mapping. Some clusters might only be identified at a small geographic scale, while others require a larger geographic scale to be identified. Therefore, the mapping method has the risk of separating clustering industries into two regions with the result of no clusters are identified in either of the two regions.

Figure 2.1 illustrates the problem. Here four co-located industries in a cluster are indicated by dots. In the first illustration, the regional choice (represented by the straight lines) results in that no clusters are identified. But an alternative regional choice in the second illustration leads to the identification of a cluster including the four industries.



Figur 2.1
Different choices of regional boundaries

2.2.2 The new geographical method

To solve the problem of choice of regional sizes (used in the localization quotient method) and get a more flexible way of mapping clusters, research is being done on a new geographical method called the Ripley's K-method.[3]

The idea is that the method considers the mapping of clusters as an optimizing problem of distances between companies. No regional choice needs to be made in advance as the method finds the optimal size of each cluster with no predetermined geographical borders.

The methodology has a quite technical character. The first step is to plot the geographical locations of all companies in every industry, and then calculate the distances between all companies in each industry. The geographical concentrations of each industry can then be compared to a benchmark distribution, e.g. the distribution of total employment. The comparison reveals whether the given industry has locally overrepresentations and can be considered as globally-oriented.

The geographical concentrations are found by optimizing the distances between the companies, that is the sizes of the specialized areas. This solves the problem of pre-defining choices of regional sizes as in the localization quotient method.

In the second step, the co-locational patterns of the global industries are evaluated by the use of a statistical approach. A cluster algorithm seeks to match the locations of every industry in order to identify systematic patterns of clustering among industries.

Like in the localization quotient method, the mapping is an iterative process going back and forth between the two methodological steps making refine-

3) The Ripley-K method has been described by Danny Quah and Helen Simpson, LSE (2003) and parts of the method has very recently been applied by Duranton, G. & H. G. Overman (2006) – not yet published.

ments to the different parts of the process in order to find the best fit of cluster formations corresponding to reality.

The potential of this method is very interesting and future research will show its applicability for cluster mapping. One issue though is its great dependency on detailed location data for each company, which can be difficult to attain.

Another very important issue is the computational demands of using this method which seems to be quite immense and will require enormous computational power.

Nonetheless, the methodology contains some promising elements which might be used to develop an alternative to, or an improvement of, the localization quotient method.

2.2.3 Export data and the input-output method

An alternative to using localization quotients based employment statistics can be to use export data and input-output tables based on production statistics.

Using the production statistics makes it possible to measure to what degree the industries interact with each other.

In the following we will describe how export data can be used to identify global industries and how to use input-output tables for cluster mapping.

Export data

The definition of global industries as industries which are exporting out of their regions or countries, suggests identifying these industries by the use of export data.[4]

The most interesting global industries can then be identified by setting up different criteria for the exported commodities. A criterion could be that the national share of world export of the commodity exceeds the average national share of world export. Other criteria for the commodity could be a high world market share or a high export growth.

Export data is rarely available for industries on a regional level, but can be obtained on a national level.

The input-output method

The method uses input-output tables which register transactions between in-

4) This approach has been applied by ETLA (1996) and by EBST (2002). Both studies are based on the OECD foreign trade database ITCS.

5) Examples of using the input-output method are found in a study by Johan Hauknes et al. for STEP Centre for Innovation Research (1998), in a study by Esko Virtanen and Hannu Hernesniemi, TEKES (2005), and in a Dutch Ph.D.-thesis by Hessel Verbeek at Erasmus University Rotterdam (1999).

dustries.[5]
As a first step, the mapping method selects out the industries to be grouped into clusters. This can be done by identifying the most interesting global industries based on export criteria or simply by focusing the analysis on all the relatively largest transactions between industries in the input-output table.

As a second step, graph analysis is used to look for patterns of clustering among the remaining trading industries. Graph analysis can be used as illustrated in the trade flow diagram in figure 2.2. Here, the thickness of line in the drawing corresponds to a ranking of the sizes of the transactions. The direction of the arrows indicates the flow of each transaction. The diagram gives an overview of both the key industries acting as central activity points and where the weakest links between industries occur. This overview can be used to identify the groups of industries, which seem to be cooperating in a cluster.

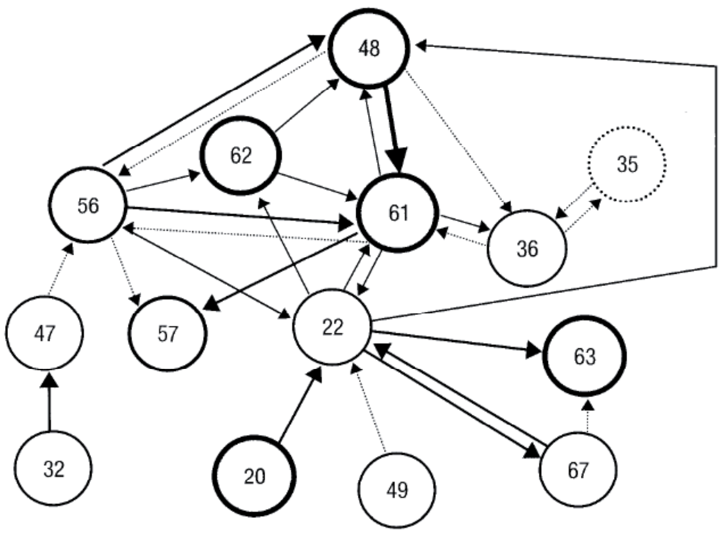


Figure 2.2
Example of trade flow diagrams

Source: "Klusterin evouutio", TEKES (2005)

As with the previous methods described, the approach is an iterative process going back and forth between selecting out industries and looking for the most sound cluster formations - clusters which seem to give the best fit of reality. Furthermore, the method can be supplemented with a qualitative review based on knowledge and experience from working with clusters.

The input-output method is well known for cluster mapping around the world due to the fact that agglomeration of industries following this methodis measured by the actual outcome transferred between the industries. The actual interacting industries and the size of transactions are thereby identified.

However, since the method does not focus on co-localization it will not necessarily provide the best picture of clusters in line with our focus in this study looking at clusters as co-located companies. Therefore, the methodology is not the best suited methodology for the purposes of this report.

2.2.4 Asking experts and the snowball method

Another widely used way of identifying and mapping clusters is the qualitative approach of asking experts within the field. This can be systemized in different ways through setting up a panel of experts or by sending out questionnaires or interviewing experts and central business persons on which clusters or cluster initiatives they see as important in their region or country.[6]

When the clusters are identified, data for the cluster can be collected for further evaluation and analyses.

The methodology of asking experts has some obvious issues. With few experts there is a risk of getting a subjective view on the clusters in the area in question. This form of identification is also difficult to standardize and compare across regions and national borders – which is an impediment to benchmarking. Nonetheless, the approach is a good supplement to other identification methods.

A special case of asking experts to identify clusters is the snowball method.

The snowball method

Today, we are in a transformation period. There is an important shift from the production society to the knowledge-based society, which in many ways has great policy implications. This situation calls for a new way of mapping to supplement the past-dependent mapping methodologies. One way of getting more information on the cluster transformation process is to use the snowball method.[7]

The snowball methodology starts out by asking a panel of experts on which emerging clusters they know of within a given geographical entity. These clusters can be defined around the key driver of innovation of a company such as for example environmental technology, design, or security. This step gives a draft idea about the most important emerging clusters according to the experts.

A 'snowball' is then launched among the experts specialized in a given cluster.

6) Examples of using this approach can be found in studies by Sölvell et al. (2003) and EBST (2001), Van der Linde (2003) and in The Cluster Initiative Database of TCI at http://www.competitiveness.org/cid (2004).

7) The snowball methodology was applied by FORA (2006).

Here, the experts are asked for important references to key companies and knowledge institutions in the cluster. They are also asked for a reference to an expert who knows more about the cluster.

The snowball continues by asking the newly attained expert references about their important references to key companies and knowledge institutions in the cluster and about their relevant expert reference.

The snowball stops when no new expert references are revealed.

A new snowball is launched among all the companies and knowledge institutions identified in the snowball among the experts. The companies are asked if they recognize themselves in the given cluster, which subcluster of the main cluster, they think they belong to, and lastly, about their references to other companies and knowledge institutions within the given cluster.

As before, the snowball among the companies and knowledge institutions continues by asking the newly attained references about their relevant references. And the snowball stops when no new references are revealed and it is concluded that the cluster has been mapped. In a following step, data on key economic indicators can be collected from the statistical bureau.

The method has the advantage of revealing the contours of emerging clusters. Another positive aspect of the method is that the mapping is on a company level and can also include various networks and knowledge institutions.

An issue with the method is that the specific cluster must be defined up-front before sending out the electronic questionnaire. Another issue is that the method is based on surveys, which makes the results difficult to standardize and compare internationally – again an impediment to benchmarking.

Since few experiences have been made applying the snowball methodology to map clusters there are many considerations and refinements to the method which still needs to be made before its usefulness for cluster mapping can be evaluated.

2.3 Conclusion

Summarizing the different methodologies for mapping clusters that we have described in this section, the following lessons can be learned.

A widely known method is the localization quotient method which groups global industries into clusters by the use of regional employment data. The method is relatively easy to use and relies only on employment data which is the most available data.

Research is being done on a new geographical method called the Ripley-K. This method has a significant potential as it has the advantage of being flexible in its choice of boundaries and size of cluster regions. On the other hand, however, it has computational limitations and there is only limited experience with applying this method for the purpose of mapping clusters.

A widely used practice when mapping clusters is to make use of the product statistics. Here export data can be used to identify the most interesting global industries and input-output tables and graph analysis can be used to find patterns of clustering among interacting industries.

As opposed to using statistical databases for mapping clusters, experts and other central business persons can be asked about their knowledge on existing clusters. This qualitative method is difficult to standardize and use for international comparison and benchmarking, but it can serve as a good supplement to other mapping methods.

Lastly, we looked at a special case of asking experts by applying the snowball method. This method can be applied to reveal the contours of emerging clusters. Not many experiences has been made using this method for mapping cluster, but it has good potential for being a good supplement for other evaluations of cluster formations. Another advantage is that the mapping is on the level of both companies and knowledge institutions.

Going through the different methodologies for mapping clusters, our conclusion is that different methodologies exist for different purposes and different definitions of clusters - no method is perfect. An important aspect is the data availability which must always be taken into consideration when choosing a mapping method (See chapter 4).

A simple and automatic mapping methodology with available data is the localization quotient methodology.

Chapter 3

Cluster Performance and Cluster-Specific Framework Conditions

As explained in the introduction, clusters are increasingly recognized as an important driver of economic growth and innovation. Therefore, regional and national level policy-makers are increasingly interested in clusters as they are attempting to answer questions like:

What clusters do I have in my region/country? And which of these clusters drive significant wealth creation and innovation?

How do these clusters perform relative to other clusters in the country – and leading clusters in other countries?

What drives the different performance of clusters?

Are there specific actions that my region/country can take in order to positively affect the performance of the clusters?

In order to answer these questions, one must identify what part of wealth creation can be attributed to specific clusters. But how can this be done?

Based on previous experience with international benchmarking of innovation capacity and performance[8], the structure of logic can be explained as follows:

1. Identification and measurement of key economic outcome of clusters
2. Identification of the drivers of the outcome (cluster performance)
3. Analysis of the framework conditions which have an impact on the performance of clusters
4. Examination of the instruments entailed in these framework conditions through in-depth peer reviews

Figure 3.1 provides a graphical picture of this:

8) FORA, in coordination with the OECD, have been part of the development of the Innovation Capacity Model – analyzing how economic output (as measured by MFP) is driven by four key drivers (human resources, knowledge building/knowledge sharing, ICT and entrepreneurship), and how performance in these areas are driven by different national framework conditions (see FORA, 2005).

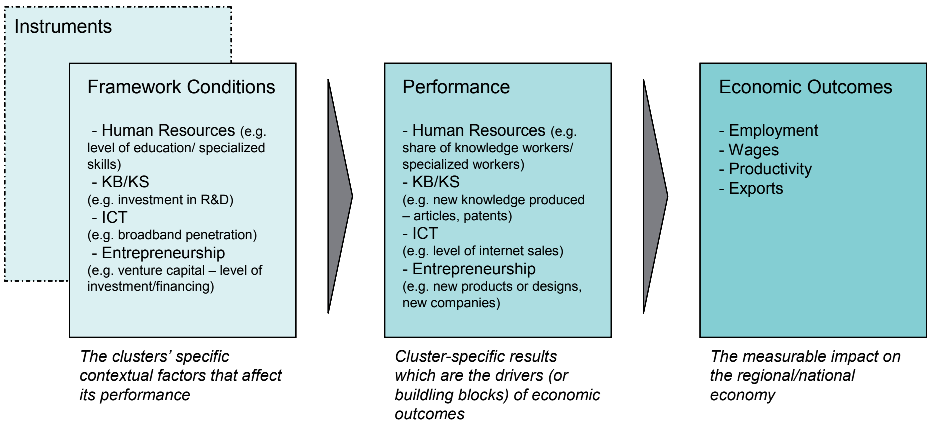


Figure 3.1
Logic of the Cluster Benchmarking Model

In the following these four steps will be presented from right to left in the figure above.

(1) Identify and measure key economic outcome

First, it is necessary to assess the outcome of the cluster that is the impact the cluster has on the regional or national economy as a whole. In figure 3.1 above a list is presented with examples of indicators. This includes employment, productivity, wages, turnover, etc.

(2) Identify drivers of outcome (performance indicators)

Next, the drivers of this outcome must be determined. What specific activities or investments lead to higher employment, productivity, or turn over? What drives innovation and economic growth in clusters?

Drivers of innovation and economic growth can be grouped into many categories. We take as a starting point three of the four growth drivers developed by OECD (OECD, 2001): human resources, knowledge building and knowledge sharing and entrepreneurship.

Cluster performance is a broad concept. It is important that different aspects are taken into consideration when evaluating how well a cluster is performing. Some indicators of cluster performance can be derived from 'hard facts' (statistics) – e.g. number of knowledge workers or number of start-ups within a cluster. However, other indicators of cluster performance can only be examined with more qualitative data collection methods such as surveys. Moreover, not all indicators are relevant at all stages of development of the cluster.[9] It is important to be able to look at a range of indicators in order to have a good picture of cluster performance.

9) One typology divides cluster "stages" into: Agglomeration, Emerging, Developing, Mature, Transformation/Decline (from The Cluster Policies Whitebook, Andersson et.al. 2005).

(3) Identify the framework conditions which have an impact on cluster performance and cluster outcome

We are interested in understanding the framework conditions that influence cluster performance – to understand the factors that drive clusters' success. Understanding the conditions that drive cluster performance will help policymakers in formulating more effective measures supporting clusters to innovate.

Framework conditions can be understood in two dimensions: type of policy and target of policy.

The first dimension concerns the type of economic policy, and one can differentiate between different kinds of policies. In this respect we can differentiate between[10]:

Stabilization policies which create the foundation for economic prosperity by securing fiscal and monetary discipline

Structural policies which secure the presence of well-functioning markets and institutions, and an orientation to build an open and competitive economic environment, ensuring that resources are allocated in an optimal way

Micro-policies which establish the framework conditions conducive to innovation

Over the last 10-15 years, research suggests that –when overall economic governance and macro-economic conditions are secured – it is the differences in micro-economic framework conditions which explain the differences in growth.

The policy focus is therefore on improving conditions for companies to innovate (OECD 2001). We will focus on the micro-economic level for the purpose of this model.

The second dimension concerns the level which the policy is attempting to target i.e. national, regional, or cluster levels. We want to look at the cluster-specific framework conditions.

10) Excerpted from InnovationMonitor 2004 (FORA, 2004).

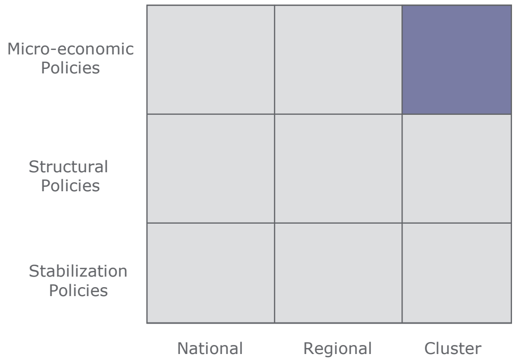


Figure 3.2

The two dimensions of framework conditions

Some of the differences in cluster performance will be explained by differences in horizontal regional and national framework conditions. Since we have narrowed our focus into only the cluster-specific framework conditions, we want to ensure that the differences in performance cannot be ascribed to national or regional differences in framework conditions. Therefore, it is necessary to control for these differences.

In conclusion, we are interested in cluster specific micro-economic framework conditions.

4) Examine 'top performing cases' in detail

The final level in the structure of logic is the level of instruments. A sufficient level of knowledge on political instruments can only be determined through in-depth peer reviews of particular policy areas of the best-performing clusters to understand how and why particular policy instruments work.

In figure 3.3 the structure of logic has been modified to include examples of indicators. In the following section, we will discuss the availability of data in the different steps of the model.

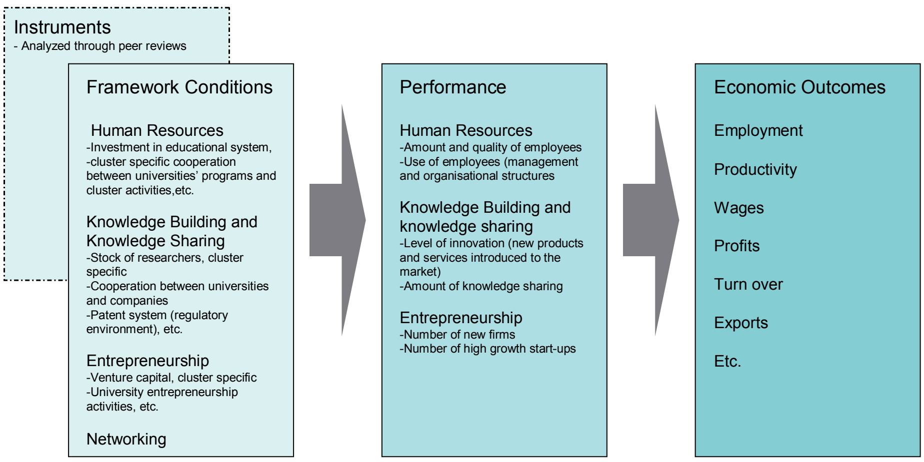


Figure 3.3

Model - including examples of indicators

Chapter 4

Data Availability and Data Collection Methods

4.1 Introduction

In this chapter we will examine the availability of data to be used for cluster benchmarking purposes.

From the previous chapter it follows that we will need three types of data:

- Outcome data – data on key economic indicators which describes the outcome of the cluster
- Performance data – data describing the drivers of performance of the cluster
- Framework conditions data – data on the cluster-specific framework conditions.

4.2 Cluster outcome data - data on key economic indicators

In table 4.1, the most important indicators are presented when looking at cluster outcome.

Table 4.1

Important indicators when looking at cluster outcome

	Indicator	Proxy
1	Productivity	Labour hourly productivity = Value added per working hour or per employee
2	Employment	Employment
3	Real Wages	Average Wages
4	Profits, earnings	Return of net capital
5	Turnover	Turnover
6	Gross Investment	Gross Investment
7	World market share	Export relative to world market export
8	Value Added	Value Added

In the national statistical offices much data exists, but only a limited quantity of data is made internationally comparable and located in international databases. In this section, we will present some considerations regarding the availability of the potential indicators.

Industry division

In the Cluster Benchmarking Model, we want to divide the data by a 4-digit NACE rev. 1.1 code. NACE is the statistical classification of economic activities in the European Community, and ensures statistical comparability between national and community classifications. More disaggregated internationally comparable business statistics are not available. Industry data of more than a 4-digit level are furthermore often associated with discretion problems.

The cluster key developed by Michael Porter using the localization quotient method on American data consists of traded industries. This key has been translated from the American 4-digit SIC-code into the 4-digit NACE code.[11] In the translation approximately 190 traded industry codes are included out of the 514 NACE 4-digit industries in total (37 pct.).

Regional division

In the Cluster Benchmarking Model we would like to include data on NUTS I or II level. NUTS is a nomenclature of territorial units for statistics. There are 254 NUTS II regions defined within the EU. For other countries which are not part of the NUTS nomenclature, the existing regional division has to follow similar regulations.

The hierarchical division of a NUTS region varies from country to country for political reasons. This is expressed by Eurostat as:

"Boundaries of the normative regions are fixed in terms of the remit of local authorities and the size of the region's population regarded as corresponding to the economically optimal use of the necessary resources to accomplish their tasks" (Eurostat, 2004).

However, recommendations regarding the size of the different NUTS levels exist. The recommended ranges of the NUTS levels are defined by the intervals of population in the following table.

Table 4.2

Intervals of population

Level	Minimum	Maximum
NUTS I	3 million	7 million
NUTS II	800.000	3 million
NUTS III	150.000	800.000

Source: Eurostat 2004, Regional Statistics

11) See Örjan Sölvell, Christian Ketels, Göran Lindqvist 2003 and 2006.

The indicators 1 - 6 in table 4.2 are generally available from national statistical bureaus (but not from Eurostat) on NACE 4-digit and NUTS II levels due to international conventions.[12] The indicators 7 and 8 are harder to get on NACE 4-digit, NUTS II levels.

At this point, one word of caution should is in place. It is a very big task to make data internationally comparable for the above mentioned indicators. However, leading experts believe that it is possible and experience from former projects has shown that the task is by no means impossible.

The data for the indicators above are in most cases (except for employment data) limited to firm level (=headquarter) and not distributed on production units (i.e. where the production is located). This is only a problem when a country consists of more than one region[13] since the production units otherwise are situated in the same geographic region as the headquarter.

4.3 Cluster performance data

In the knowledge society, innovation is the key to economic performance. In the following years, it will be necessary to develop an overview of the drivers of a cluster's innovative performance.

This overview could be inspired by the work from the innovation capacity model, where four drivers of growth were identified: Entrepreneurship, use of ICT, Human resources and knowledge creation, and Knowledge dissemination.

Other sources of inspiration could be Cortright (2006) or OECD (2006), who each has some considerations on the cluster-specific drivers of growth.

They are inspired by Porter's diamond and/or by Marshall's three reasons for industrial agglomeration. These models were developed (and worked well) for explaining growth in the industrial society. However, in this project we would like to focus more specifically on explaining innovation and growth in the knowledge society.

Today, not much data is available at a comparable level. It will therefore be necessary to collect data through both national statistical offices and through tailor made surveys addressing the more intangible aspects of cluster performance like entrepreneurship, innovation, or networks.

For example for entrepreneurship, indicators could include aspects of cluster

__12)__ For the relevance of the BSR-INNO-net project, all member countries except Russia are following the Structural Business Statistics Regulation which makes data comparable. The regulation ensures that the business statistics which companies report to statistical bureaus are consistent. __13)__ Five out of the ten countries in the reference group are only defined as one NUTS II region. Employment is the only variable which is often available at the production level. By extrapolation with employment data, the economic activity/performance data can be constructed into the regional division of NUTS-II. Robustness tests can be done to see the consequences of the extrapolation.

performance like number of start-ups and growth in new companies.

4.4 Framework condition data

In the above section, the two dimensions of framework conditions were presented. We will focus on the microeconomic policy level and the cluster level.

The cluster level

Some attempts have been made to gather framework condition data at the cluster level (see next chapter for a presentation of different attempts). For the purpose of this model, focus should again be on the microeconomic framework conditions, which drives cluster performance in the knowledge society. This means focusing on aspects like:

- Access to and use of human resources
- Access to and use of knowledge
- Rivalry and dynamism from new companies

It will be necessary to collect cluster-specific framework condition data through hard data from national statistical bureaus and through surveys of the clusters.

To be able to perform a correlation between cluster-specific framework conditions and cluster performance, it is necessary to control for information on horizontal framework conditions at the national and regional level. In the following section, some data considerations will be presented regarding national and regional framework data.

The national level

Data exists for national framework conditions. Examples of different projects to benchmark the national microeconomic framework conditions include:

- The Knowledge Economy index (World Bank)
- STI Scoreboard (OECD)
- European Innovation Scoreboard (EU)
- Innovation Capacity Model (FORA)

Indicators for the various framework conditions used in the models above are quite similar, as are the sources for the data including Eurostat and OECD patent databases, and international surveys like Global Competitiveness Report from World Economic Forum, and the Community Innovation Survey

(CIS) undertaken by the EU.

In conclusion, sufficient data exists to enable a control for national framework conditions.

The regional level

Analyses of framework conditions on a regional level are not as widespread. One example of benchmarking of regional performance and framework conditions is the IBC BAK International Benchmark Club. Established in 1998, the club's database currently covers 400 regions and up to 64 business sectors and it is regularly extended and updated.[14]

The IBC database includes an overview on the position of the regions regarding several location factors. These are organized into so-called modules. The BAK's Innovation Module[15] tries to describe and analyze the innovative capabilities of individual regions. This module provides data on a wide range of innovation indicators, including indicators for innovation resources, like human capital, R&D expenditure, venture capital and communication infrastructure. Furthermore there are indicators for the innovation processes like patents, bibliometric indicators and company founding. Unfortunately, most indicators are only available for a sub-sample of regions, and these are often small and differ from each other. Therefore, only two variables out of the innovation module can be used in empirical analysis: human capital (share of labor force with secondary education, share of labor force with tertiary education) and R&D expenditures (as a ratio of nominal GDP) (ibid., p.72-73).

However, data on horizontal regional framework conditions are currently being developed by different organizations and research groups – amongst others there are plans that the European Innovation Scoreboard will be expanded at the regional level.

In conclusion, framework condition data is generally not available at the cluster level. It will therefore be necessary to launch a process for collection of data. This data collection will focus on framework conditions for innovation. For the purpose of correlating framework conditions and performance of clusters, it is necessary to control for differences in national and regional framework conditions. Adequate data exists both on the national level and (to a lesser extent) on the regional level to do this.

14) See BAK Basel Economics, 2006.

15) Inspired by the work of the Massachusetts Technology Collaborative.

4.5 Conclusion

In conclusion, we have seen that the availability of data is depending on which types of data one's are looking for. Much data exists to describe the cluster outcome. But the picture is more mixed regarding cluster performance and cluster-specific framework conditions.

Chapter 5 Experience with Cluster Analysis

In this chapter, we look at different examples of organizations who have measured and analyzed cluster performance and framework conditions. We conclude with a number of observations and lessons learned.

Before presenting the various examples, it is important to clarify the difference between cluster initiatives and clusters. Cluster initiatives are generally self-identified clusters which in many cases participate in national schemes, whereas clusters are industrial agglomerations identified by standardized statistical information. Access to data and qualitative information for cluster initiatives is generally much higher than that of clusters.

5.1 Examples of cluster analysis

The examples presented below have been identified through internet searches, international network contacts, or information provided by the pilot project's reference group. Five examples are reviewed: the Monitor Group (USA), the Massachusetts Technology Collaborative (USA), the National Research Council (Canada), Innovation Norway, and the Cluster Competitiveness Foundation (Spain).

In each example, we present an overview of four elements:

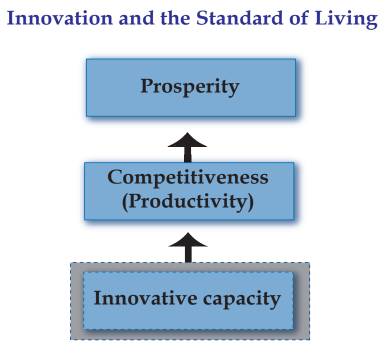
1. The method used to identify the clusters (e.g. statistical mapping of clusters vs. self-identified cluster initiatives);
2. The sources of data employed (e.g. standardized data and/or surveys);
3. The use of benchmarking analysis (e.g. are clusters benchmarked against each other or not?); and
4. The structure of the model (e.g. does the model present a structure of cause and effect? is there any correlation analysis?).

5.1.1 The Monitor Group, United States

The Monitor Group (through its affiliate ontheFRONTIER) has worked with the U.S. Council of Competitiveness to conduct an analysis of Clusters of Innovation in the US (from 1998-2001). The Clusters of Innovation initiative developed a framework to evaluate cluster development and innovative performance at the regional level. It also shared analytic tools, benchmarking results and lessons learned with key decision makers in every part of the country. The initiative resulted in a national summary report, as well as five regional reports (Atlanta-Columbus, Pittsburgh, Research Triangle, San Diego, and Witchita).[16]

The clusters evaluated were identified by the localization quotient method (used in the U.S. Cluster Mapping Project led by Michael Porter). The regions and the specific clusters were analyzed based on data from a number of sources. The principal sources were the Cluster Mapping Project of the Institute for Strategy and Competitiveness (ISC, Harvard Business School), the Cluster of Innovation Initiative Regional Surveys, and in-depth interviews of business leaders in each region. This information was compiled in a database at the ISC, from which the relative strength of regional economies' and their clusters' economic and innovation performance could be tracked over time.

Although data was collected for five different regions, no benchmarking analysis was done. Regions and clusters were evaluated independently of each other. The model presents a link between innovative capacity and resulting economic performance (see illustration below).



Figur 5.1
Innovation and the Standard of Living

Performance was evaluated in three areas:

Economic Performance measured by (overall economy) indicators such as regional average wages, unemployment and cost of living, and (innovation output) indicators such as regional patents, venture capital investments and firm establishment (see illustration below);

16) See http://www.compete.org/nri/clusters_innovation.asp

Figur 5.2

Economic Performance Indicators

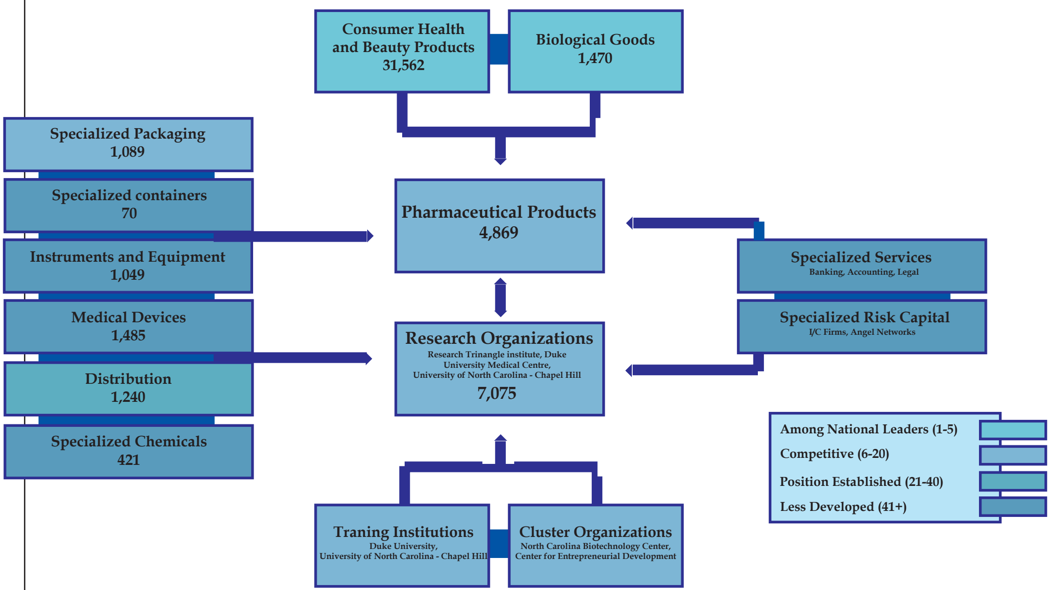
Overall Economy	Innovation Output
Employment Growth - Rate of employment growth	**Patents** - Number of patents and patents per worker
Unemployment - Percentage of people unemployed	**Establishment Formation** - Growth rate of number of establishments
Average Wages - Payroll per person	**Venture Capital Investments** - Value of venture capital invested per worker
Wage Growth - Growth rate for payroll per person	**Initial Public Offerings** - Number of initial public offerings per worker
Cost of Living - Cost of living index	**Fast Growth Firms** - Number of firms on the inc. 500 list vs. overall size of the regional economy
Exports - Value of manufactured and commodity exports per worker	

(Cluster) Composition of the regional economy describing the areas of specialization, strengths and weaknesses for each region and cluster; and

Innovative Capacity assessing the region's and the cluster-specific innovative assets (e.g. workforce, research and companies) and challenges (e.g. competitive context and cluster linkages) – using the structure of the Porter Diamond.[17]

Figur 5.3

Competitive Position - the Pharmaceuticals/Biotechnology cluster



5.1.2 Massachusetts Technology Collaborative, United States

The Massachusetts Technology Collaborative (MTC) is the development agency for renewable energy and the innovation economy. Within the agency, the John Adams Institute is responsible for conducting analyses of critical issues facing Massachusetts, identifying needed actions and resources, promoting collaboration among key stakeholders, and supporting sound policymaking. Since 1997, the Institute has conducted an annual 'Index of the MA Innovation Economy'.[18] The Index is based on the Institute's Innovation

17) The Porter Diamond is comprised of four areas: **factor (input) conditions** *(looking at, e.g., human and capital resources),* **related and supporting industries** *(looking at, e.g., the presence of clusters instead of isolated industries),* **demand conditions** *(looking at, e.g., level of customer sophistication), and* **context for firms strategy and rivalry** *(looking at, e.g., the local competitive context).*

18) http://www.mtpc.org/institute/the_index.htm

Framework (see illustration below).

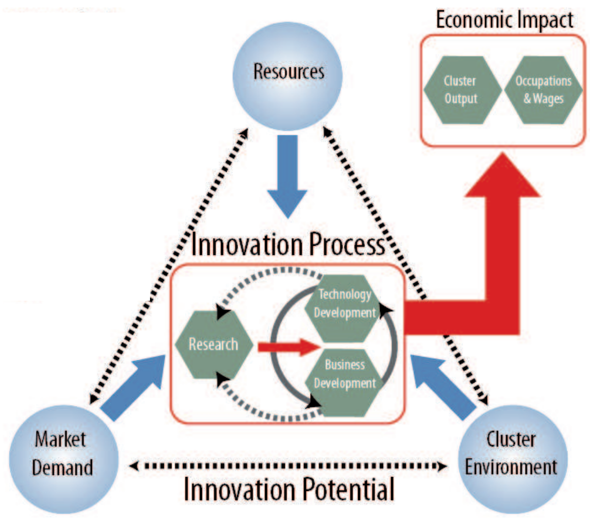


Figure 5.4

MIT Innovation Framework

As presented in the illustration, the framework is comprised of innovation potential – the outside factors that have an influence on the overall success of the innovation process; the innovation process – representing the dynamic interaction between research, technology development and business development; and the economic impact – assessing the societal impact and outcomes that the innovation economy provides. The economic impact is split into two components: the local innovation economy (or cluster level) and the overall state economy (state level).

Innovation potential is comprised of resources (capital, skilled labor and infrastructure enablers available in a cluster), market demand (signifying the strength of the demand for gods and services produced by the industries comprising the cluster), and cluster environment (referring to the interaction between industries that are part of a specific cluster).

Although the model presents cause and effect linkages between framework conditions and performance, the MTC does not currently examine statistical correlation between the two.

The evaluated clusters are identified by the localization quotient method. Cluster performance is measured as part of the economic impact, and encompasses indicators such as: cluster employment, average annual sales, average annual salaries, and exports.

The indicators selected for each of the framework's three areas are based on objective and reliable data sources, which are statistically measurable on an ongoing basis. In order to understand how Massachusetts is doing in a relative sense, several indicators in the Index are compared with the national average or with a composite measure of eight competitive Leading Technology States (LTS). There is a growing demand to include international comparisons as well.

5.1.3 National Research Council, Canada

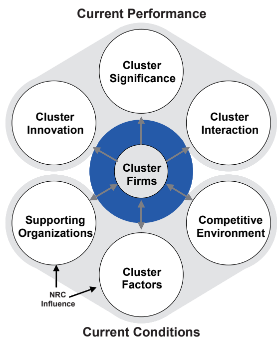
As part of its commitment to Canada's Innovation Strategy, the National Research Council has invested over $500 million since 2001 in a series of cluster initiatives aimed at developing regional capacity in science and technology-based innovation, with the broader goal of supporting national economic growth. As a result, NRC requires indicators to monitor the progress of its cluster initiatives, to support reporting requirements to the federal government, to assist in program planning and management of current and future initiatives, and to aid in communications with stakeholders within the clusters, the provinces and the government.

Over the course of a number of studies, a framework, indicators, and a process to analyze the effects of NRC's involvement in technology clusters has been developed and implemented for six of its cluster initiatives (Davis et.al., 2006).

The NRC approach and methodology for cluster development is built on the concept of the cluster lifecycle, recognizing that the role of public institutions as well as the resulting policy outcome can change as clusters evolve through various phases of development. The NRC Cluster Framework (initially presented in 2001 and continuously updated since then) segments between the immediate and longer-term outcomes from cluster development activities. Furthermore, the NRC model differentiates between current conditions (inputs) and current performance (outputs), and specifies those areas in which NRC interventions have an influence. The cluster framework and table of constructs are presented below.[19]

Figure 5.5

NRC Cluster Framework



19) Discussions with international experts within the ISRN (Innovation Systems Research Network) and a recent literature review (Hickling Arthurs Low, 2006) have confirmed the academic basis for this approach.

As illustrated in their cluster framework, NRC views cluster performance as a result of firm activities, which are affected (or even driven) by various framework conditions.

Concepts	Constructs	Sub-constructs	Indicators
Current Conditions	Factors	Human Resources	Access to qualified personnel
			Local sourcing of personnel
		Transportation	Quality of local transportation
			Quality of distant transportation
		Business Climate	Quality of local lifestyle
			Relative costs
			Relative regulations and barriers
	Supporting organisations	Innovation and Firm Support	Contribution of NRC
			Contribution of other research organisasa-tions
		Community Support	Government policies and programmes
			Community support organisations
			Community champions
		Suppliers	Local availability of materials and equipment
			Local availability of business services
			Local availability of capital
	Competitive Environment	Local Activity	Distance of competitors
			Distance of customers
		Firm capabilities	Business development capabilities
			Product development capabilities
Current Performance	Significance	Critical Mass	Number of cluster firms
			Number of spin-off firms
			Size of cluster firms
		Responsibility	Firms structure
			Firm responsibilities
		Reach	Export orientation
	Interaction	Identity	Internal awareness
			External recognition
		Linkages	Local involvement
			Internal linkages
	Dynamism	Innovation	R&D spending
			Relative innovativeness
			New product revenue
		Growth	Number of new firms
			Firm growth

* Shaded boxes indicate areas in which NRC has an influence

Table 5.1

NRC Cluster Model Constructs

Not all indicators are equally important to the conditions or performance of a cluster. Based on the literature and the experience of the Innovation Systems Research Network (ISRN), and the implementation of this process in six NRC clusters, the relative importance of each indicator has been ranked. The indicators, by themselves, only provide a partial view of a cluster. As a result, the cluster analysis process includes in-depth interviews and stakeholder meetings (in addition to collection of quantitative indicators) in order gather qualitative information and engage cluster stakeholders (ibid., p.7).

At present, measurements of cluster conditions and current performance have been completed for six clusters - setting the baseline which will enable NRC to track the impact of their activities on these clusters' performance over time. The performance of cluster initiatives is not benchmarked internationally.

For the moment there is no analysis of the relationship/correlation between cluster conditions and performance. The next step in the development of NRC's cluster framework is to draw on cluster measurement data to assess socio-economic impacts of NRC cluster initiatives on firms and the cluster region as a whole (the macro framework).

5.1.4 Innovation Norway

Innovation Norway has contracted a private consultancy, Oxford Research, to develop a system for monitoring and evaluating the projects (cluster initiatives) within the Norwegian Centres of Expertise programme. The development includes a baseline assessment of six Norwegian Centres of Expertise (NCE) appointed in May 2006. Oxford Research is conducting a collection of data, combined with registers, surveys and detailed interviews of the six clusters (participating in the NCE-program), with questions on cluster-specific performance and process (see below) which also covers framework conditions.

The information will be gathered from cluster 'registration forms' (put into an Innovation Norway database), national (firm-level) databases, cluster facilitator logs, surveys and interviews (designed both for the firm participants and knowledge institutions/other stakeholders). Data for all indicators will be collected and analyzed at the start (baseline). Following this, some data will be collected every year (monitoring/activity data), some after three years, and some after seven years.

Examples of performance and process indicators are listed below:

Performance	Process
Critical Mass • Productivity • % revenue from regional, national, international markets	***Complementarity/critical mass*** • Evaluation of climate for cooperation (survey) • # of studies (from local universities) developed for use by the cluster
Innovation Activity • # of companies who have introduced new products or services in last three years • # of companies who have introduced and organizational change in last three years	***Competitive situation*** •# of strategically important knowledge suppliers (survey) • evaluation of competitive situation (survey)
Human Resources • % of workforce with documented specialized competencies • % of workforce with higher education	***Devpt & dissemination of knowledge*** • Sources of ideas/innovation (survey) • % of workforce recruited locally
Knowledge Resources • R&D investment (as a % of revenues) • Costs of R&D services purchased externally	***Collective learning*** • # of students gaining employment within cluster last year (survey)
Financial Resources • Yearly investments from seed and risk capital funds • Evaluation of availability of risk capital (survey)	***International contacts*** • Evaluation of international market position (survey)

Table 5.2

Innovation Norway - Data collection

The performance of cluster initiatives is not benchmarked internationally, but it is the intention to look at the development of each cluster over time.

5.1.5 Clusters and Competitiveness Foundation, Barcelona, Spain

The Cluster Competitiveness Report is a survey answered by cluster participants and the cluster rapporteur, covering local (regional) conditions, cluster-specific information, and company specific information. The clusters being evaluated are identified by self-selection.

The questions on local conditions are structured according to the Porter diamond. Cluster and company-specific questions deal mainly with informational details and performance information (see below).

LOCATION SPECIFIC questions:	CLUSTER-SPECIFIC questions:
Current competitive situation	Definition of the cluster
Factor Conditions	Profile of the cluster
Context for Strategy and Rivalry	Size and performance
Demand Conditions	Institution-specific
Related Industries	Threats and Opportunities
Government and Institutions	

Table 5.3

Location specific and cluster specific questions

The survey was developed by research at the Institute for Strategy and Competitiveness at Harvard, and is administered by the Clusters and Competitiveness Foundation (TCI Foundation) in order to help government officials and business leaders to better understand their clusters competitive position, act as a guide for strategy evaluation, and provide a rich source of information for researchers of cluster theory. Respondents pay a fee to participate in the survey. Surveys are completed on the web, compiled, and analyzed; results are published in a report. No register based data is included - the analysis is based on survey results. So far, no analytical report has been published, although it is foreseen that international benchmarking should be possible using this tool. The CCR framework does not look at the relationship between framework conditions and cluster performance.

In addition to the examples mentioned above, Scottish Enterprise is in the process of developing a comparable model. There is also ongoing work/expertise in this field in Australia, Japan, and France.

Furthermore, inspiration can be drawn from various models examining sector performance and framework conditions. Several sector performance models have been presented at the project's first reference group meeting: the Sector Online Tool from the Ministry of Trade and Industry (Finland), the Growth Barometer from VINNOVA (Sweden), and the Construction Sector Performance Model from FORA (Denmark).

5.2 Conclusion

Based on the examples of cluster analytical models, a number of lessons learned can be drawn:

1. There is not extensive experience with, or literary references to, measuring and benchmarking cluster-specific performance and framework conditions internationally.

2. Organizations working in the field employ similar approaches:
    - Similar data/information points
    - Gathering data/information from a combination of statistics and surveys
    - Limited benchmarking with 'top performing' clusters

3. However, there is no 'recognized' standard:

- No standard structure for delineating which factors/framework conditions have an impact on which performance results
- No standard set of data/information points for measuring cluster performance
- No standard/or broadly-used survey or process for administering it

4. The 'Porter diamond' is often the structure used for examining cluster-specific framework conditions. This structure, developed in the 80's, is well-suited for analysis of an industrial-focused economy. However, other structures (e.g. the 'Innovation Framework' from the Massachusetts Technology Collaborative) are better adapted to the knowledge economy…highlighting the relationship between innovation framework conditions and resulting performance outputs.

5. No systematic attempts have been made to look at the relationship/correlation between (cluster-specific) microeconomic framework conditions and cluster performance. In some of the examples presented above, the relationship between cluster-specific framework conditions and performance is expressed clearly (e.g. that framework conditions are the 'input factors' which affect the performance 'output'). In other models, framework conditions are 'mixed in' with performance conditions (e.g. there is no clear distinction on what the relationship is between framework conditions and performance). Furthermore, some models look at regional, or even national, framework conditions, rather than cluster-specific framework conditions (as this is generally very difficult to get data for).

In the course of writing this chapter one more lesson was discovered: There is a profound interest in working together in some form of international collaboration to develop a model for evaluating cluster performance and framework conditions (and examining the relationship between the two).

Drawing upon this knowledge there seems to be a need for developing standards to enable international benchmarking of clusters.

This includes finding standard indicators of performance which can be compared between clusters, regions, and countries and finding comparable indicators of cluster specific framework conditions including the results of clustering processes.

In addition, it is a challenge to structure the indicators in an appropriate way – i.e. establish a relationship between the cause and effect.

In the final chapter, an attempt to establish an internationally comparable standard – the cluster benchmarking model – will be outlined.

Chapter 6

Outlining the Cluster Benchmarking Model

As a starting point it should be noted that examining cluster performance and framework conditions is possible. It has been done in the US in a comprehensive way by for instance Harvard's Institute of Strategy and Competitiveness.

An initiative has now been launched to map the clusters of Europe. This is a good starting point, but we need to be more ambitious. There is a need for establishing databases of indicators for cluster outcome, cluster performance and cluster-specific framework conditions.

In this chapter we will outline the cluster benchmarking model. Four areas of work will be presented:

Work related to:

- Identification of clusters
- Cluster outcome data
- Cluster performance data
- Cluster-specific framework condition data

6.1 Identification of Clusters

We need an initial way of identifying the clusters which will be included in the Cluster Benchmarking Model. It should be emphasized however, that this only serves as a starting point from which flexible clusters can be defined

As a start, we propose to use the cluster definitions which originally stems from Harvard's Institute for Strategy and Competitiveness using the localization coefficient methodology. In Europe we will use the translation performed by Sölvell et al. (2006) from American SIC codes to European NACE codes.[20] The mapping of the clusters will be conducted by international consortia (funded by the European Commission, DG Enterprise) and will be made available to our project.

20) See Örjan Sölvell, Christian Ketels, Göran Lindqvist 2003 and 2006.

The argument for using the American key in Europe is that the US economy is the largest border-free market economy. American clusters have formed in an open, highly-competitive environment over time and therefore represent how clusters would co-locate in a world without borders.

To ensure that the clusters identified are a valid starting point for our database, we propose to review the identified cluster maps with policy-makers and analysts from the participating countries in order to find out if the clusters stemming from the cluster mappings make sense and are the clusters which are relevant to policy-makers.[21]

One potential problem with using the American cluster key springs to mind. Europe has not undergone the same economic development as the US. It is possible that industries co-locate in different patterns in the EU compared to the US.

Therefore, it could be interesting to re-estimate the cluster key based on European data. To date still no attempts have been made to re-estimate the cluster key. It could be interesting to do this to establish whether this would lead to significantly different results.

In conclusion, we propose to take the clusters revealed by using the American cluster key made by Harvard's Institute for Strategy and Competitiveness as a starting point and check it by a qualitative assessment by national correspondents and if necessary by a re-estimation of the American cluster code.

6.2 Cluster outcome data

To examine the cluster outcome (the effect on society) we propose to include some of the indicators which were presented in chapter 4 in our cluster benchmarking model. We will collect data for key economic indicators like productivity, employment, wages, value added, and profits.

Data will be gathered directly from national statistical offices, since the international databases in the field do not have a satisfactory quality.

21) This activity is planned for the countries in the BSR-region as part of the work of the BSR-INNO net project, financed by the European Commission.

6.3 Cluster performance data

We want to examine what drives this outcome. In the knowledge society, the main driver of growth is innovation. We want to collect data which describes the innovative drivers of the outcome of clusters (the cluster performance).

We propose to elaborate a model of cluster-specific growth drivers in the knowledge economy. As we have seen, most cluster analytical models today consider Porter's diamond and/or Marshall's three conditions as central pieces of cluster-specific performance.

As a starting point, we propose to take the drivers of growth in the knowledge based economy developed by the OECD. This model in particular looks at access to and use of human resources, knowledge building and knowledge sharing, and entrepreneurship.

Indicators could for example include number of start-ups and growth of new companies regarding entrepreneurship and number of knowledge workers regarding human ressources.

The work on establishing the cluster-specific drivers of growth is not an easy task – but a solid starting point in the national drivers of growth and a network of correspondents willing to discuss these matters will ease the process.[22]

6.4 Cluster-specific framework conditions

In the cluster benchmarking model, we would like to examine and quantify cluster-specific framework conditions[23] and examine the relationship between framework conditions and performance for various clusters.[24]

In the cluster benchmarking model, the focus will be on the microeconomic framework conditions for innovation. As explained in section 4, this means focusing on aspects like access to and use of human resources, access to and use of knowledge and rivalry, and dynamism from new firms.

We propose to gather data on the cluster-specific framework conditions through statistical databases, national correspondents, and surveys.

As stated in section 4, some data is available for the purpose of controlling for national and regional framework conditions. However further work is necessary to ensure that this can be done in a methodologically correct way.

22) In the BSR INNO-net project some initial work will be done in this field. **23)** *To start with, one or two clusters (that are deemed most relevant within the Baltic Sea region) will be selected to 'pilot' this part of the model.* **24)** *This can be done by, for example, multi-factor regression analysis (a method currently used in FORA's Innovation Capacity model). A consultancy has been hired to work on this (building a statistical correlation/econometric model to determine the relationship between cluster-specific framework conditions and cluster performance). This consultancy will also be controlling for national and regional framework conditions (in order to 'isolate' the impact of cluster-specific framework conditions).*

6.5 Platform and flexibility

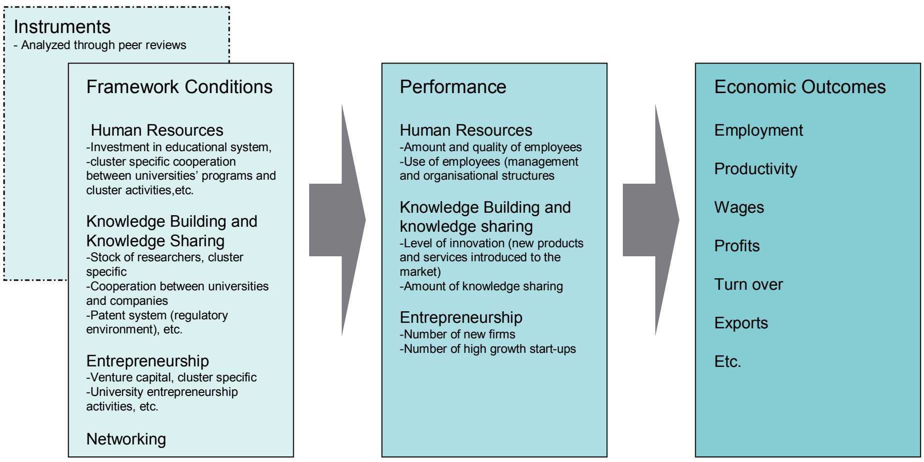
It is important to ensure the flexibility of the data. Only by making the tool as flexible as possible, can we ensure the relevance for analysts and policy-makers.

As stated in section 6.1, we will start out by using the American cluster key translated by the Europe INNOVA cluster mapping project and check the mapping with policy-makers to ensure its relevance. However, we cannot be certain that these clusters are relevant to policy-makers.

Adding and removing industries from the cluster definition will therefore be possible to some extent. Outcome and performance data will (pending discretionary problems) be available on a 4 digit NACE level. Approximately 200 industries on NUTS II-level will be included in the benchmark database.

6.6 Conclusion

To sum up it is useful to have a look again at figure 3.3:



There are three main bulks of cluster data which needs to be gathered in the project:

- Data on cluster outcome. Six key indicators of the cluster outcome will be available to describe the impact of the cluster for the national/regional economy as a whole.
- Data on cluster performance. A model will be elaborated looking at cluster-specific drivers of growth.
- Data on cluster framework conditions. Data will be collected through both statistics and surveys.

When this work has been done, implementation of the five steps of cluster benchmarking from the introduction will be possible.

1. Policy relevant cluster mapping
It will be possible to map the clusters which are relevant to policy-makers.

2. Description of the outcome and performance of clusters
It will be possible to describe the outcome and the performance of the clusters. This will lead to a better understanding of the drivers of economic growth in clusters.

3. Examination of cluster-specific framework conditions
It will be possible to examine and quantify the cluster-specific framework conditions.

4. Correlation of cluster performance and cluster-specific framework conditions
It will be possible to regress cluster performance and cluster-specific framework conditions to see if a strong positive correlation exists which can justify political intervention. This can be done while controlling for differences in the horizontal framework conditions at the national and regional level. When this is done it is possible to understand which policies foster growth in clusters and which policies do not.

5. Learning from best practice through peer reviews
It will be possible to further examine the cluster-specific framework conditions of the best performing clusters. This will enable policy-learning through in-depth peer reviews of the specific instruments which are part of the well functioning framework conditions.

When these steps have been implemented, a tool will be created which will enable countries to develop fact-based cluster policies, and help policy-makers, analysts and cluster practitioners to understand better the dynamics of clusters.

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The Nordic Innovation Centre initiates and finances activities that enhance innovation collaboration and develop and maintain a smoothly functioning market in the Nordic region.

The Centre works primarily with small and medium-sized companies (SMEs) in the Nordic countries. Other important partners are those most closely involved with innovation and market surveillance, such as industrial organisations and interest groups, research institutions and public authorities.

The Nordic Innovation Centre is an institution under the Nordic Council of Ministers. Its secretariat is in Oslo.

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