REPORT

Cluster programs in Norway – evaluation of the NCE and Arena programs

MENON-PUBLICATION NR. 1/2012
January 2012

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MENON
Business Economics

Contents

Abstract

The Arena and NCE programs have recently been subjected to thorough evaluations by Menon and NIFU (2011) and Econ and Damvad (2011) respectively. This article sums up the most important findings from these evaluations. Our main point of focus will be the programs' capability to develop and strengthen cluster characteristics in business environments. In this article, we develop a conceptual model for cluster-based innovation and growth which illustrates how cluster programs influence interaction in business environments. The conceptual model and the framework of understanding the model provides are utilized both in the presentation of the results from the two evaluations, and in a more open, general discussion of Norway's cluster programs.

1. Norwegian cluster programs – from theory to program

Norwegian business and industry policy has a long tradition of contributing to improved value creation in trade and industry by supporting development projects in individual enterprises. Enterprises can apply for support for specific projects on the basis that they are innovative or contribute to additional activity in some way. Additional activity in regions with special needs has been especially important in this context.

Support is awarded within the framework of a number of different programs governed by varying guidelines. What they have in common is that they are all designed to address a form of market failure. Eligibility for public support is based on the rationale that projects which are supported would not have been realized in the same form without cost-reducing contributions in the form of public financing. Most of the programs are administrated and developed by Innovation Norway, but the Research Council of Norway and SIVA are also responsible for a number of programs directed at enterprises.

From the mid-1990s, there has been increasing focus on the fact that a number of innovation projects were developed in collaboration between different enterprises – and between business environments and research-oriented and academic environments. In parallel with this realization, an international discussion developed around the phenomenon that enterprises that were part of larger clusters achieved higher value creation than enterprises without such linkages, see Porter (1990), Krugman (1991), NOU 1996:17, Reve and Jacobsen (2001). Based on this insight, a number of countries developed policies and policy instruments explicitly directed at stimulating existing and new clusters, see f.ex. OECD (2007) and Asheim and Isaksen (2010).

1.1. From direct to indirect innovation support

Public policy instruments took, however, only rarely the form of direct support to enterprises. Normally, public contributions entail that authorities offer to finance facilitation of common arenas, typically via a publicly financed facilitator. The thought behind this was that these arenas would simplify collaboration, the development of ideas and strengthen mutual attractiveness between participating actors – both enterprises, research environments and others.

In 2002, Norway established the program *"Arena – Innovation in networks"*. The establishment of the program's basic structure was based on experiences from a series of regional pilot projects in the period before 2002. Later, the program's name was simplified to Arena. The program's objectives were revised a number of times, but its overall strategy has been clear all the time: *Professional and financial support to multi-year development processes in regional business environments and clusters, based on collaboration between business and industry, R&D and the public sector.* The Arena program is national and free of any regional or sectorial constraints. Selection of participants is made through yearly competitions where Norwegian business environments apply for admission to the program. Selection is based on technical criteria, where the industrial *milieu's* resource foundation, established relations and development potential are assessed, in combination with the proposed *project's* capability to realize this development potential through specific activities. In total, 47 business environments have been accepted into the program. The program's main objective is "to strengthen the capability of regional business environments for innovation and value creation through a stronger and more dynamic interaction between business actors, knowledge providers (R&D and education) and the public sector".

In 2006, the program Norwegian Centres of Expertise (NCE) was established. The program was designed on the basis of prior analyses and inspiration from other countries. The analyses were explicitly based on cluster

theory and how public intervention can strengthen cluster mechanisms. Public support is aimed at "strengthening innovation activity in the clusters with the largest potential for growth and a clear international orientation in Norway". [1] The program is supposed to focus, improve and accelerate on-going development processes in those clusters. Those business environments that receive support for cluster facilitation have succeeded in publicly announced competitions to document their potential for improved value creation as a consequence of better collaboration. The criteria consist of: the resource foundation of the cluster, relations between the actors, together with maturity in the development process, level of innovation, international orientation, the project's objectives and strategies, the project's organization and plan for execution, and development potential in relation to these criteria. Based on three publicly announced open competitions, the program has selected a total of 12 cluster projects that receive technical and financial support for up to ten years, divided into three contract periods with assessments after 3 and 6.5 years regarding the continuation of financing.

Compared to the rest of the instruments available within trade and industry policy, the Norwegian cluster programs are distinguished by the fact that they:

- Provide indirect support through financing *facilitators*, not direct support to enterprises
- enable long-term support
- are developed on the basis of well-grounded theoretical reasoning

1.2. Norwegian clusters have weak linkages to research communities

In most countries, public cluster programs have been based on clusters with links to academic institutions or established research communities. In addition to strengthening collaboration between enterprises, the authorities in different countries have focused on stimulating collaboration between enterprises and research environments. Typically, the objective of these efforts has been to increase the extent of research-based innovation in business and industry. The picture is not completely unambiguous, but both the reasoning behind and the number of programs with this type of profile have contributed to pushing development in the direction of supporting clusters with linkages to strong academic communities.

In some countries, cluster programs are also motivated by a need to strengthen business environments which, for different reasons, seem to be on the decline, often from an originally strong position. OECD (2007) mentions cluster programs in France, Great Britain and Italy as examples of this kind of motivation.

In Norway, the starting point has been different. From the beginning, the creators of the program were aware of the fact that Norwegian industrial clusters – both clusters at the very start of their life and established clusters with a strong international position– have relatively few links to Norwegian academic communities. This difference is underlined by an interesting comparison of cluster programs (Centres of Expertise programs) in Norway, Sweden and Finland conducted by Asheim and Isaksen (2010). The comparison shows that Sweden and Finland have, to a much larger degree than Norway, emphasized the connection of cluster policy with universities or research institutions.

The reason for this lies to some extent in the geographical localization of Norwegian enterprises. Norwegian business and industry clusters are typically located far away from Norwegian universities, even though there are important exceptions. The clusters have in most instances developed on the basis of geographical proximity between related enterprises, geographical concentration of experience-based competence and customer-

[1] NCE – Program description, 24.11.08

driven *application* of knowledge. Norwegian cluster programs have therefore primarily concentrated on strengthening collaboration between participating enterprises more than between enterprises and academia.

1.3. Do the weak linkages between clusters and research environments constitute a problem?

As pointed out above, Norwegian cluster programs differ from programs in other countries in that there is less emphasis on the link between research and business and industry. In a number of the projects within the Arena program, universities, university colleges and knowledge actors play a peripheral role, and some NCE projects also have a relatively small knowledge component. This means that Torger Reve's concept of a knowledge hub, developed in connection with the research project *Et kunnskapsbasert Norge* [A knowledge-based Norway] (Reve and Sasson, 2012), where knowledge is central to cluster-based business and industry development, is not well suited as a model for the development of business and industry milieus in the Norwegian cluster programs. The question is whether the weak linkages to research environments in Norwegian cluster programs should be seen as a weakness or as a sensible adaptation to the actual development dynamics of Norwegian clusters.

In order to shed light on this question, the division between user- and research-based innovation might be relevant. R&D and formal competence are not the only sources of innovation and productivity growth. Competence based on experience and user-initiated development also play an important role. The existing literature on innovation systems (Lundvall, 1992; Jensen, Johnson, Lorenz, & Lundvall 2007) often makes a distinction between so-called DUI- (Doing, Using, Interacting) and STI- (Science and Technology to Innovation) based learning. The first of these is experience-based and builds on close linkages between customers and suppliers, while the other is driven by systematic research and formal competence. These two models should not be understood as competing systems, but as complementary and mutually reinforcing. According to Lundvall, the combination of DUI- and STI-based innovation is not only possible, but is actually seen as a strength. The two innovation models reinforce each other. Lundvall's research shows that enterprises that combine DUI- and STI-based learning are more innovative than those that rely on just one of these.

An important part of the collaboration between enterprises has been to strengthening regional research and education. The motive has been to improve the enterprises' capability of meeting new customer needs on a continual basis. Thus, Norwegian cluster programs can also been seen in context with an ever-increasing emphasis on the importance of user-driven innovation. In a number of the business and industry analyses in *A knowledge-based Norway*, it is documented that innovation is primarily customer-driven and that the importance of R&D-actors is seen as limited and even partially peripheral. This applies for example to the maritime sector, where 70 percent of all enterprises view customers as their most important source of innovation, while only 2 percent regard actors within R&D as the most important source (Jakobsen and Espelien 2011). In other words, innovation is mostly driven by *pull*- rather than *push*-mechanisms. In addition, it is a well-documented fact that innovation in the maritime sector is cluster-based, with shipping and oil companies acting as demanding customers that initiate and finance innovation projects on behalf of their suppliers. Our opinion is that the Norwegian cluster programs constitute a sensible adaptation to the way innovation take place in Norwegian business and industry. In business environments where innovation is mostly STI-based, for example in the Oslo Cancer Cluster, the focus is on research-oriented collaboration. In other business environments with DUI-based innovation, such as NCE Fjord Tourism, there is more emphasis on market-based product development. At the same time, contact between enterprises and knowledge providers is encouraged in all projects, both in order to make enterprises more knowledge-based, and simultaneously

increase the attention of actors within R&D and education towards business and industry. Research-based innovation also has to be customer-driven and ought to utilize firms' practical experience.

Short description of methodology and data sources in the evaluations

The evaluations discuss the program's target achievement with regards to the criteria of relevance, attainment of objectives and effectiveness:

Is the program relevant with regards to their general objectives? The evaluations discuss to what extent the program's design supports the program's objectives. To which degree does the program build on existing knowledge about cluster processes, innovation and internationalization as a basis for improved value creation? Furthermore, does the program respond to actual needs within enterprises and clusters? Does the program hit its target group?

Is the program on course to achieving its objectives? The evaluations provide an assessment of how far the program has progressed towards reaching its targets, and of the chances of the program achieving its targets in the course of the program period. Which results does the program have to show at the present point? To which degree is it possible to establish that these results would not have been realistically possible to achieve without the program's help?

Is the program organized efficiently? The evaluation also examines whether the programs are organized in an appropriate way. Have tasks been allocated and are they administrated optimally to trigger, reinforce and accelerate development processes in the clusters? Are the programs sufficiently adaptable and robust? Are the resources that have been allocated to the programs utilized in the best possible way, in other words, are the programs set up in a way that make economic sense?

With regards to methodology, the evaluation of the NCE-program has emphasized extensive in-depth interviews and structured interviews of 56 enterprises, all project managers, and a number of involved stakeholders. Our choice of methodology was based on the fact that there are large variations in the intensity of enterprises' ties to the various clusters, so interviews were necessary to understand issues as for example which collaboration activities enterprises experienced as especially important. In the Arena evaluation, a questionnaire survey was combined with in-depth interviews with the cluster fascilitators.

In addition to the in-depth interviews, the analysis in the evaluation is based on statistical financial data from participating enterprises and data regarding financial support awarded to the cluster enterprises in question by various Norwegian public programs for research support. An extensive document review was also part of the evaluation.

2. What kind of effects can we expect from cluster programs?

2.1. Business environments with different degrees of cluster characteristics

How can the intervention of cluster programs in business environments contribute to improved value creation? In this chapter, we develop a conceptual model for cluster-based development, showing in a generalized way how cluster programs can help to trigger and reinforce collaboration processes leading to innovation and growth. The purpose of this chapter is to position the programs in the context of cluster theory, and to establish a framework for a joint discussion of both evaluations. A frequent question is *whether* a regional business environment or a nation-wide industry constitutes a cluster or not. In our opinion, this type of discussion is not particularly meaningful. It makes more sense to concentrate on the typical characteristics of clusters and the *degree* to which these are present in a regional business environment or a nation-wide industry. Furthermore, we believe that it is useful to demystify cluster effects by describing cluster characteristics and the interrelations between them as precisely as possible.

Business environments can be categorized according to the presence of an increasing degree of cluster characteristics:

1) **Agglomeration without collaboration:** A group of enterprises and other actors located in the same geographical neighbourhood (agglomeration), but without collaborating – the enterprises profit from a common labour market, infrastructure and other factors that lead to economies of agglomeration.
2) **Business environment with non-coordinated collaboration:** A group of enterprises that collaborate, without any formal joint coordination, when it benefits the individual actors
3) **Formalized cluster cooperation with facilitator:** A group of enterprises that establish a common unit for the coordination and strengthening of collaboration processes (cluster facilitator) – but without any support from public policy measures
4) **Business environment formalized in public cluster program:** A group of enterprises that establish a joint unit for the coordination and strengthening of collaboration processes, and where the facilitator role and collaboration processes receive support from public programs.

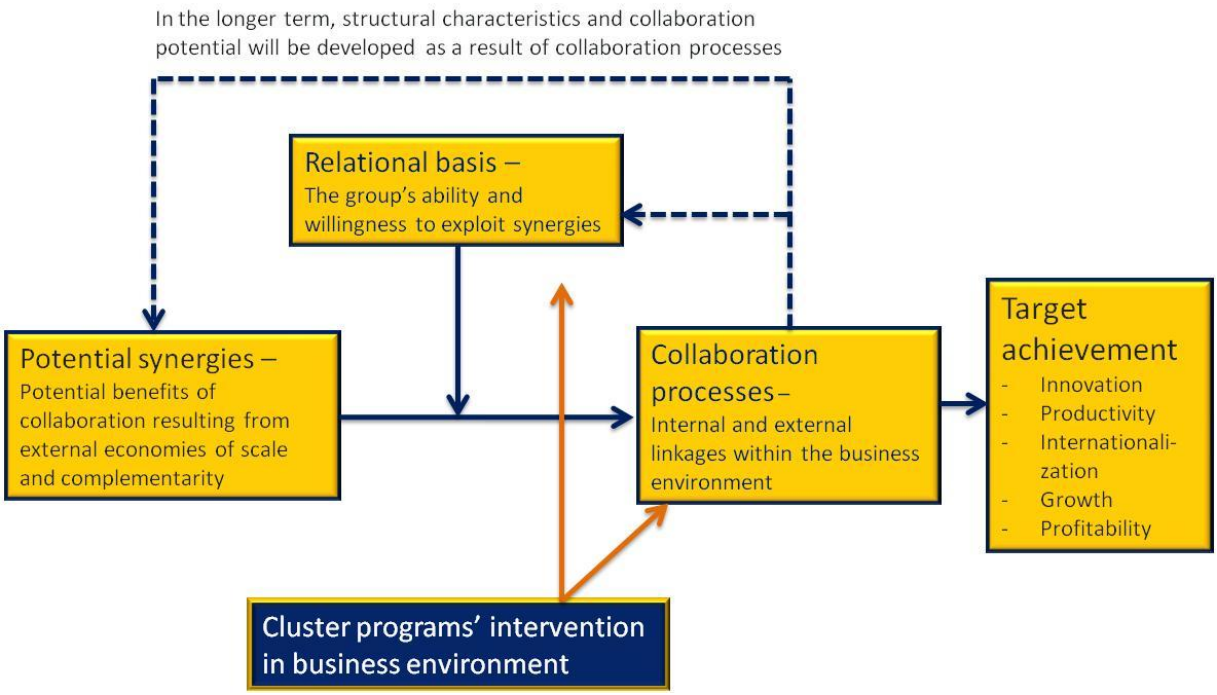
The evaluations of the NCE and Arena programs are neither concerned with examining the question of whether collaboration in business environments has positive effects, nor if formalized cluster collaboration has such effects, but try to establish whether public cluster programs result in significantly larger benefits than collaboration which would have taken place without the help of such programs. An important factor that distinguishes coordinated / facilitated collaboration from non-coordinated collaboration is that the former makes it possible to expressly formulate joint objectives for the cluster and the work of the facilitator. Typical objectives for clusters are improved value creation, innovation and profitability.

2.2. Development of a conceptual model for cluster development

The model below shows what cluster characteristics are and how they lead to improved target achievement, i.e. to improved performance. The unbroken lines show direct effects, while the dashed lines illustrate long-term effects generated by system dynamics. The reasoning in the unbroken lines goes as follows: Capability and willingness to initiate and carry out collaboration processes in order to realize potential synergies depend on the groups' relational basis for collaboration. If potential synergies are significant and the relational basis is

in place, actual collaboration processes will result in benefits such as innovation, improved productivity and/or internationalization, and consequently growth and profitability.

Figure 1: Conceptual model – cluster-based development



In the following, we will concretize the concepts in the model and the interrelations between them.

Potential synergies between the actors in the group – or potential external economies of scale, as they are also called – exist if there are

- **economies of scale** in activities that are *collective for the actors and non-excludable*, such as infrastructure
- **complementarity** in markets and/or competences, activities and resources

These potential synergies can be found in the group's vertical and/or horizontal structure, i.e. along the value chain the enterprises are part of (vertically) or in related businesses (horizontally). The *extent* of the synergies depends on the group's size (number of enterprises and their size).

Potential synergies between actors in a business environment can be realized through **collaboration processes**, i.e. through internal and external linkages within the business environment:

- **Cooperation and sharing of resources within the environment**: Formal and informal cooperation where the actors *develop* (innovation), *share* (economies of scale) and *transfer* (complementarity) resources between each other
- **External linkages to business environments**: The actors' connections to related industrial milieus in Norway and other countries, including their own subsidiaries/offices within these milieus
- **Linkages to knowledge actors**: The *number* and *competence level* of relevant actors within education & research and specialized suppliers of knowledge in the region, plus the *extent and strength of the linkages* between enterprises and knowledge actors

- **Links to professional capital providers**: The extent of owners/investor groups that are geographically close and/or are specialised towards a certain business environment's market, technology and competence

Even though potential synergies between the actors in a business environment clearly exist, they might still not be realized. Actors might for example lack sufficient information about other actors' activities to know when collaboration might result in mutual benefits. The incentives to invest into collaborative relationships might also be unevenly distributed. Trust is in many cases the decisive factor to make collaboration work in practice, and if there is a lack of trust, collaborating might easily seem like too much of a risk to take. In other words, the actors' ability to realize potential synergies through collaboration processes depends on their relational basis for collaboration, such as whether there is enough mutual trust for them to be willing to share knowledge and invest into the community.

The relational basis includes factors such as:

- **Geographical proximity:** How simply and effectively the actors are able to communicate with each other as a function of *travel time*
- **Cultural proximity:** How simply and effectively the actors are able to communicate with each other as a function of *language, education and attitudes/values*
- **Cluster identity:** To what extent the actors in the group perceive themselves as part of a cluster, and to which degree they identify with this cluster
- **Mutual trust:** To which degree the actors in the group trust each other and are thus willing to share information and invest time and resources into collaboration
- **Facilitator:** To which degree there is a common actor that executes tasks on behalf of the group; tasks that require coordinated handling, and tasks which benefit the members of the group collectively, but which the individual members of the group lack incentives to execute alone (i.e., collective benefits for the group)

Assuming that real synergies do exist between the actors in a business environment, and the relational basis for collaboration is in place, **collaboration processes** will be implemented to realize those synergies.

Which particular activities are carried out depends on the nature of these synergies. For example, a natural way to realize market complementarity between actors would be through joint marketing and joint sales promotion activities. A shared need for competence might lead to the development of a specialized course of education offered by a knowledge actor belonging to the cluster.

Assuming that the collaboration processes are relevant (to realizing synergies) and are carried out in an efficient and goal-oriented way, they will lead to tangible results for the actors in the form of

- More innovation
- Strengthened productivity
- A larger capability to create customer value and consequently higher prices, larger market share and/or introduction to new markets in Norway or internationally

Innovation, productivity growth and improved customer value will in their turn lead to increased value creation and profitability for the actors.

The NCE and Arena programs' role for cluster development

It is crucial to distinguish between cluster effects – i.e., effects resulting from collaboration in business environments – and effects of cluster programs. The cluster programs' role is to stimulate cluster development, or more specifically to *trigger collaboration-based development* which otherwise would not have happened, *and to reinforce and accelerate existing collaboration*. This is both about stimulating collaborative potential (relational basis) and about financing and enabling specific collaboration processes. In the conceptual model above, the cluster programs' role is illustrated by the blue box: The cluster programs' activities aim to

- Strengthen business environments' relational basis for collaboration
- Finance, organize and carry out specific collaboration projects

Effects resulting from system dynamics – upgrading mechanisms

In the conceptual model, effects resulting from system dynamics are illustrated by the dashed lines. Collaboration processes strengthen the group's relational basis, and contribute to the development and identification of new potential synergies between the actors. Earlier studies, such as Reve and Jacobsen (2001), outline four kinds of upgrading mechanisms generated within a well-functioning cluster:

- **Innovation pressure** – resulting from the combination of geographical proximity to demanding customers and intense competition for the customers' favour. This pressure propagates to all product and factor markets where competition is sufficiently intense, as enterprises that are subject to innovation pressure in turn become demanding customers within their own supplier markets.
- **Critical mass** – scale and specialization within immobile resources (infrastructure, competence and deliveries). Growth and the establishment of new businesses lead to a point where investments and business ideas reach critical mass and are realized. This will increase the environment's attractiveness, which will result in further growth and prepare the ground for new projects reaching critical mass.
- **Knowledge externalities** – knowledge that is developed and spread through the circulation of people (mobility of employees, managers and consultants) and through formal and social arenas of communication.
- (Reduced) **transaction costs** – as a consequence of easy access to information, continuity in relations, trust and low transport costs.

This type of system dynamics is, however, complex, indirect and often takes the form of side effects of the actual program activities. Therefore, these effects are very difficult to measure and evaluate. They are no less important for this reason, and in chapter 4 we discuss what type of methodology can be used to identify upgrading mechanisms.

2.3. Expected effects resulting from the programs' design

Cluster theory and the conceptual model described above provide information about how cluster programs are likely to affect innovation and economic results.

The programs' design can affect innovation and other economic results in a number of ways, through:

a) How public support will be provided

b) Design and application of selection criteria
c) Choice of target group, i.e. the composition of participating actors in projects – and thus the type of potential synergies between them
d) What type of activities are encouraged and offered financial support
e) Weighting of relational factors in specific development activities

Even though a cluster program might appear well defined with regards to the objectives it is intended to achieve, its design might still be inconsistent and in itself contribute to weak results.

The Arena and NCE programs are both designed in the form of the provision of limited support to a cluster facilitator who in turn is meant to develop the collaborative activities supposed to lead to improved value creation for the cluster's enterprises.

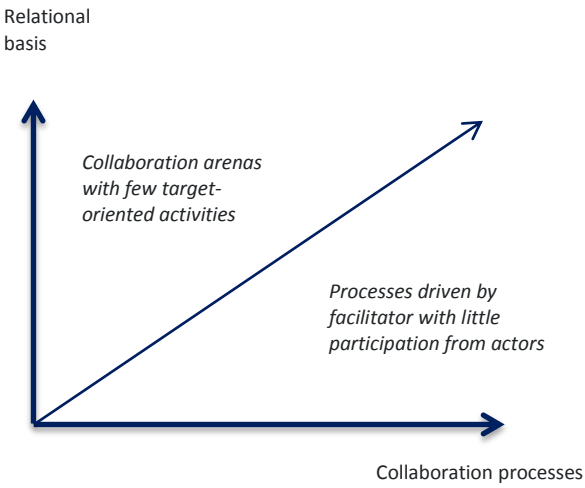
Furthermore, both programs are designed on the basis of a conscious decision that they should target clusters of enterprises where a form of mutual collaboration has already been established. The idea is to increase the intensity and extent of this established collaboration and, if necessary, also to make some organizational improvements. The programs give the individual cluster organizations a large degree of freedom to choose for themselves in which areas the cluster facilitator should contribute support that will intensify collaboration or trigger collective benefits.

Both programs have a design that is:

- **Market- and business-oriented.** The clusters *themselves* decide what types of challenges and activities make most sense for them, within a very liberal framework drafted by the program owner. Other design options would have been possible, for example programs with the explicit aim of strengthening the links between business & industry and research.
- **Competition based**. The clusters that have been accepted into the programs have been judged the best projects according to specified selection criteria. Alternatively, it would have been possible to make a selection based on industry/competences, geographical location, or certain characteristics (for example the best-developed relation between business & industry and research).
- **Balanced between development of relations and actual tasks.** The conceptual model above distinguishes between relational basis and actual collaboration processes. In connection with the follow-up routines for the various clusters in the programs, the program owner has made a special point of ensuring that the clusters engage in activities that affect both factors. Clusters where the balance is skewed in favour of one element are actively encouraged to adjust the weighting of the cluster facilitator's activities.

To find the right balance between strengthening the relational basis and actual collaboration processes has proven to be important. The figure below illustrates the significance of this balance. Projects that solely emphasize the development of relationships within the cluster will not achieve results, because the arenas for collaboration are not filled with substantial content. On the other hand, in cluster projects where the relational basis for collaboration is not sufficiently developed, development projects and other activities will not be anchored well enough among the actors, and their participation will be limited. This will limit the possibilities for realizing the full potential benefits from collaboration. This problem can be avoided if the cluster program emphasizes the development of arenas for collaboration, mutual trust and cluster identity before specific development projects are started. If, on the other hand, a cluster is well established, with short geographic distances, cultural closeness and a large degree of trust between the actors, specific collaboration activities within the project can be initiated right away.

Figure 2: Balance between development of relations and specific development projects



During the course of the evaluation, it has become clear that Innovation Norway's joint program secretariat for the NCE and Arena programs has become very aware of the need to keep a balance between the development of relations and specific development projects. The secretariat aims to contribute to such a balance in every single project. In other words, the programs' design also entails an element of central monitoring of the cluster facilitators' practice. The program secretariat has few formal mechanisms for intervention at its disposal, but the evaluations show that its position as program authority ensures that its recommendations are listened to.

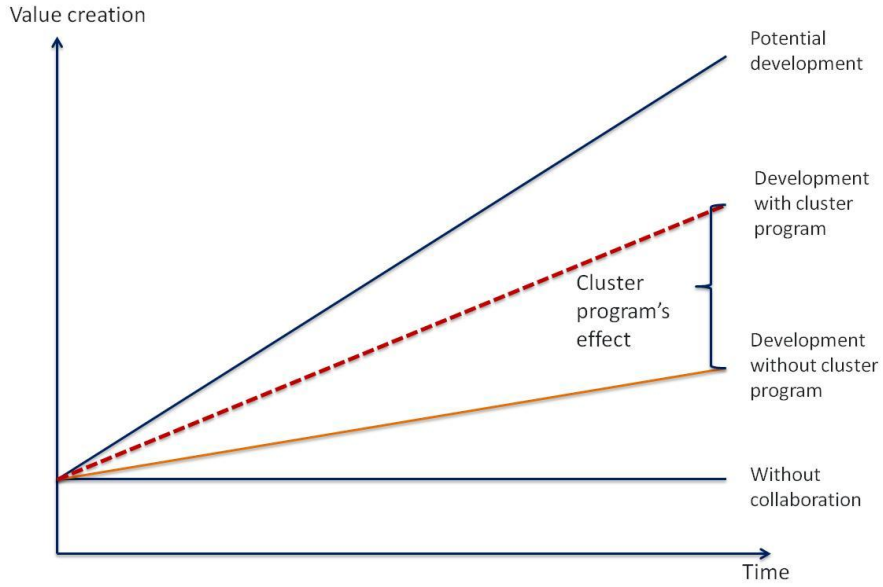
2.4. Selection and effects of cluster programs

In order for the NCE and Arena programs to provide a significant contribution to improved value creation in the business environments that have been accepted into the programs, the programs' activities need to have a significant effect on the environments' capability to create results through collaboration. This point is illustrated in the figure below.

To make it simple, let us imagine that a group of enterprises that do not collaborate, over time (X-axis) shows a flat development trajectory in value creation (Y-axis). With optimal collaboration, however, the enterprises can realize external economies of scale within a large number of areas, such as joint infrastructure, knowledge development, knowledge dissemination and recruitment. In this manner, the enterprises can manage to achieve a value creation trajectory looking like the one marked by the steep blue curve (potential development). With other words, the blue curve shows the business environment's *potentiality curve*.

Due to the existence of different forms of market and coordination failure, however, enterprises are not able to realize the full potential that lies in collaboration. Instead, they only achieve a value creation development equal to what is illustrated by the orange curve (development without Arena or NCE). Through the individual cluster projects, the cluster programs can contribute to improved value creation by helping to realize a larger amount of collaboration potential. The potential for value creation increases more than the enterprises would have managed without help (dashed red line).

Figure 3: Potential value creation of a cluster project

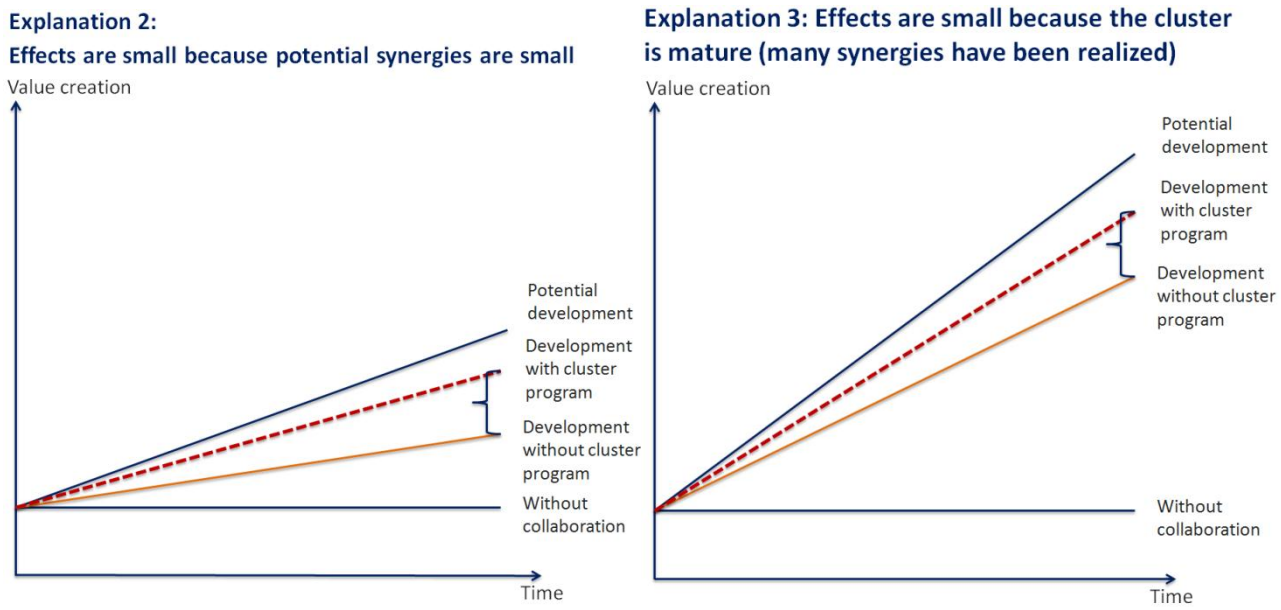


If we cannot observe an effect from an individual program, there are three different potential explanations:

1) The projects are executed badly, which in its turn might be due to:
    a. Weak project management
    b. Not sufficiently relevant measures (framework and services offered by the program)
    c. Lack of commitment and involvement by the participants
2) Limited potential synergies (i.e. the difference between value creation development without collaboration and potential development is small)
3) Cluster characteristics are already well developed (i.e. the difference between development without the program and potential development is small) – for example because the enterprises have already developed a large degree of collaboration without support or because other public policy instruments are much more important to the enterprises' collaboration.

Explanation 2) and 3) are illustrated in the figure below.

Figure 4: Different models for explaining the differing effects of cluster programs



This means that a lack of target achievement in the programs might just as likely be due to selection effects (explanation 2 and 3) as to weak project execution.

Variations in potential benefits deriving from cluster programs raise an important general question: **Should cluster programs support mature clusters where a lot of the potential has already been realized, or less developed business environments where there is more insecurity with regards to the size of potential synergies?**

We can formulate this question more precisely with the help of our categorization of different business environments from the introduction to this chapter: Should cluster programs be targeted at business environments

1) where no collaboration is established?
2) where collaboration exists solely on an informal, non-coordinated basis?
3) where collaboration already is formalized and coordinated (i.e. clusters that normally are labelled mature)?

The Norwegian cluster programs are designed in such a way that they primarily support clusters with formalized collaboration. At the same time, the selection process (the competition to be accepted into the program) demands that the business environments must demonstrate how this collaboration is supposed to be strengthened during the project period.

In practice, there are significant variations in the degree of collaboration between the business environments accepted into the programs. The evaluations show that one of the programs (Arena) shows a much larger degree of tolerance than the NCE program for milieus with limited formalized collaboration, in many cases even little non-coordinated collaboration. NCE is comprised to a much larger degree of clusters where the enterprises have progressed quite far with the development of both non-coordinated and formalized collaboration. The evaluation also shows that the creators of the program have not taken a clear stance on the

question whether the programs should employ different selection principles. When a country has a number of different cluster programs, such as Norway, this opens up the possibility of practising different selection principles in order to consciously tailor program design so that it will accept business environments with different degrees of collaboration.

The cluster organizations' freedom to define by themselves which activities result in the largest collaboration effect is another important design element. The evaluation shows that the cluster organizations have shown significant ability to organize activities that are much in demand, which in its turn has led to a relatively good response to these activities by the participating enterprises.

Nevertheless, there is still reason to ask whether competition should be sharpened further. There is a tendency for cluster organizations in programs that offer short-term public support (Arena) to spend a lot of resources on trying to qualify for programs offering the possibility of long-term financing (NCE). The distinction between programs could be made clearer in such a way that the short-term program (Arena) offers the possibility of experimenting with the composition of business environments where cluster facilitation is likely to result in effects on both the potential for collaboration and collaboration processes. The long-term program (NCE) could to a larger degree be a program for working towards the maximization of collaboration processes and collective benefits that might lead to a permanent strengthening of the cluster's growth trajectory. A formal linkage between the programs' selection of clusters will help to establish such a division of labour.

This question is interrelated with the question above, i.e. whether it makes sense for a country to have several types of cluster programs that employ different selection principles. We will comment on this possibility in more detail in our conclusion to this report.

3. The programs' effects on cluster characteristics

3.1. The cluster programs have strong relational effects

The evaluations showed that the Norwegian cluster programs have been very successful in creating a common identity for the participating actors. One of the most important mechanisms of identity creation is actually the application process in itself, and the immediate sense of victory in connection with being accepted into the program.

Both the NCE and Arena programs are, as mentioned earlier, application-based, and acceptance into the programs is the result of an extensive assessment process. Acceptance is not just an automatic function of satisfying set criteria. Applications must be better than other applications, and up to now, the number of qualified applications to the programs has continuously exceeded the number of actors that have been awarded status as NCE or Arena projects.

When a cluster achieves the status of an NCE or Arena project, it is rendered visible as a business environment which the public authorities believe to have a particularly strong potential for growth. The environment is marked out as a successful business environment and can, as a function of this, further develop its common identity as a cluster. The programs, especially NCE, have received much attention and participants are profiled as the leading business environments in the country. This positive attention has reflected back positively on the environments as their official status has contributed to an internal sense of pride which in turn creates interest in contributing to the further development of the cluster projects.

In addition, most NCE projects have also chosen to use project funds for different kinds of marketing of the project and the business environments it is based on. The combination of positive attention as a consequence of the status achieved and the conscious profiling of the cluster in the aftermath of this has made a number of clusters a lot more visible than they were before they were accepted into the programs.

The effect of the new status and attention has naturally been strongest for those clusters which were little known to start with and where the enterprises in the cluster during the initial years of the project have shown a continued positive development. Two examples for clusters where this has resulted in pronounced effects are the Subsea cluster in Hordaland and the NODE cluster on the South Coast of Norway. Both were relatively unknown as clusters before they achieved NCE-status. Both have developed into clearly defined environments with successful enterprises that have gained ground in markets where unique knowledge is a centrally important parameter for competition.

The positive attention following from acceptance into the programs also helps to reinforce the work of the cluster facilitators in developing common collaboration arenas and infrastructure. The evaluations show that the cluster members have a very positive attitude towards participating in and utilizing both organized meeting places, cluster-relevant education and training and incubators that are being developed.

Attention and status can have many positive effects on a business environment, such as increased attractiveness for potential investors/venture capital, new businesses and potential employees. As a relational factor, status is important in order to create a sense of pride and a common identity.[2] Despite the fact that NCE

[2] Overall, the evaluation shows that the Norwegian cluster programs have made a significant contribution to strengthening the clusters' relational basis for collaboration. It is, however, important to note that the most important stimulus derives from the actual status as a program project, the consequent attention and the immediate follow-up activities by the cluster facilitators. Later in the project period, this initial effect will necessarily diminish. Continued maintenance of the increased

projects have received considerably more attention than Arena projects, participation in the Arena program also has significant effects on status and pride. In the evaluation of the Arena program, 162 project participants assessed which relational effects they experienced as a consequence of participating in an Arena project. As the table below shows, more than half of them completely agreed that the Arena project conferred increased status on the business environment, while less than 10 percent completely or partially disagreed with this.

Table 1: Relational effects of participation in Arena projects

	Completely disagree	2	3	4	Completely agree	Average score (1-5)
Experienced higher status as a consequence of the Arena project	3 %	6 %	15 %	26 %	51 %	**4.15**
Increased mutual trust between actors in the cluster	1 %	6 %	14 %	34 %	43 %	**4.12**
Sense of community and cluster identity	1 %	9 %	21 %	34 %	35 %	**3.94**
Discovered synergies between actors in the cluster	1 %	10 %	23 %	34 %	32 %	**3.85**

The table above shows that most of the participating enterprises feel that the Arena project led to increased mutual trust and a greater sense of community. In addition, two thirds of the actors agreed or partially agreed that the project helped to discover synergies between the actors. In general, the participants are of the opinion that the relational effects resulting from the program are bigger than other types of effects. We will return to this in the last chapter.

3.2. The programs' effects on collaboration processes

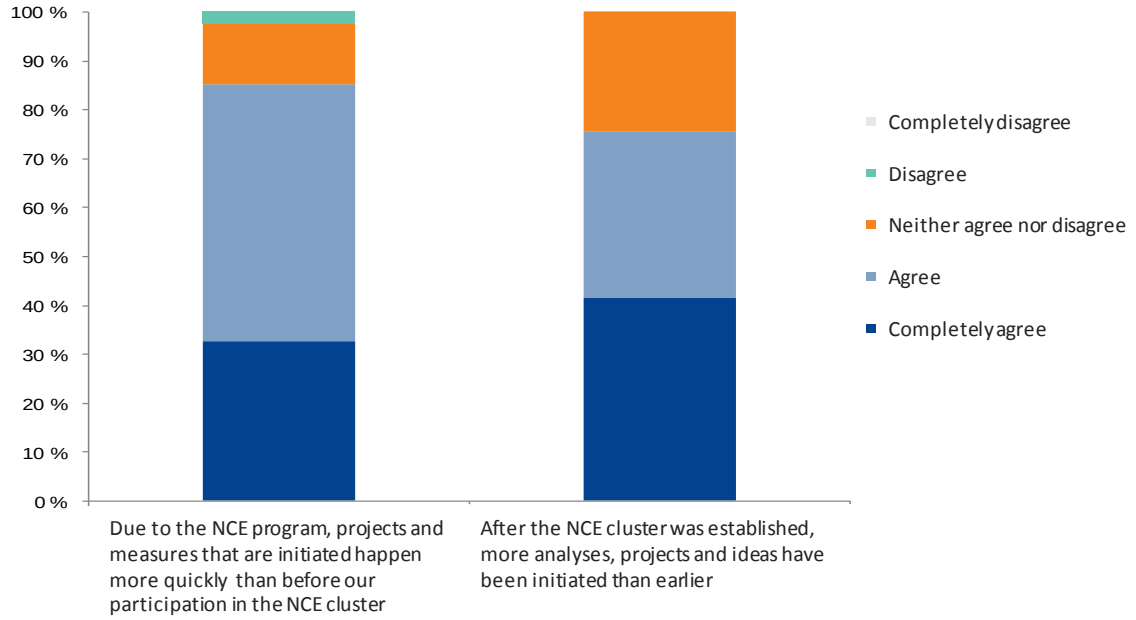
The programs' target achievement depends to a large extent on the individual projects' degree of success. The programs' contribution to this consists in initial selection of projects, funding and the right balance between flexibility and guidance during project execution.

The NCE projects have generally made much progress in achieving improved collaboration and well-functioning infrastructure. This manifests itself in meeting places, cluster-relevant educations and incubators, and shared research laboratories. The NCE program has without doubt created interest in and commitment to the development of clusters. The projects in the program have triggered and reinforced collaboration-based innovation and internationalization processes which, according to practice and experience from other countries, can be assumed to trigger effects in the form of improved capability to innovate and compete. The only possible interpretation of the interview results from participating enterprises is that they are to a very large extent satisfied with the program.

The interview objects in all projects that were initiated believe that the projects have contributed to the start-up of more and faster collaboration processes than before the NCE project was established, ref. Figure 5.

level of collaboration depends on the condition that the activities and the processes that are initiated are perceived as relevant also in a long-term perspective.

Figure 5: Interview objects' agreement with specific statements



Source: Econ Pöyry and DAMVAD (2011). Interview with 56 business managers

3.3. Cluster projects require active participation to achieve good results

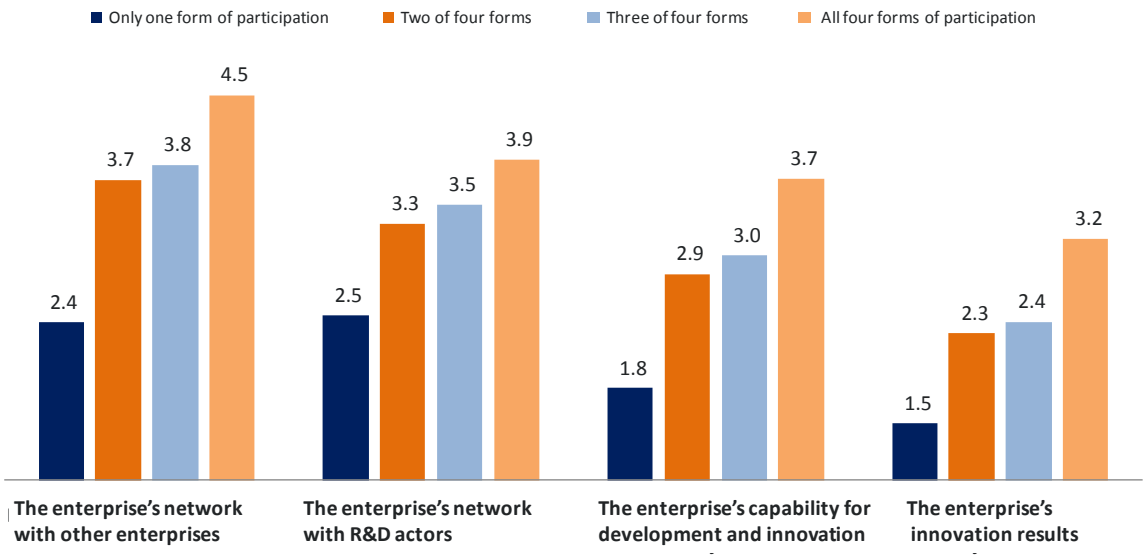
The evaluation shows that it is primarily in those cases where participants in individual projects decide to invest some of their own time and resources into participation that they also manage to achieve effects from participating. This effect is analyzed most clearly in the evaluation of the Arena program. The participants in the Arena projects were asked about their participation in the projects. Specifically, they were asked to indicate if they had

- Participated in development projects
- Participated in training/skill development activities
- Participated in joint meetings
- Participated in steering/reference groups

The answers to these questions were used to create a graduated scale of the actors' active participation – from 0 to 4. Actors who had not participated in any of the four alternatives were not included in the analysis. The figure below shows the relation between active participation and the perceived results[3] from the projects. The four factors in the figure are put together from 11 specific questions. The correlation is clear: The more actively actors participate in the projects, the bigger the effects they achieve.

[3] The respondents were asked the following question: To which degree do these effects correspond with your experiences and the experiences of your enterprises? Scale from 1 to 5 where 1=not at all, 5=to a large degree. The total number of respondents was 162.

Figure 6: Differences in perceived results of Arena projects with varying degrees of participation in the projects



The question is how this should be interpreted: The most obvious interpretation is that the positive effects resulting from the activities in the project are strongest for those actors that have participated the most. It seems reasonable to assume that access to information, learning effects and the opportunity to influence activities are better for enterprises that are actively involved than for actors that only have a peripheral role in the project. In this case, we should expect that those who have participated in for example competence projects will have achieved bigger competence effects than those who did not participate, and those who have participated in development projects have achieved bigger innovation effects. We can see these correlations in our data, but there is no clear pattern with regards to the *type* of effects that are achieved. The general picture is that the more active an enterprise is, the larger the effects from participation.

It is important to point out that what we have discovered here is a correlation, not a causal relationship. The strong correlation between active participation and experienced effects could potentially also be due to the fact that enterprises have chosen to take a peripheral role and might even completely withdraw from a project if they feel that the potential benefits are small. If this is the case, this entails a reverse causality, where the degree of target achievement decides how active a role the enterprises choose to take in the project. Interviews and in-depth studies do however support the interpretation that active participation gives better results.

3.4. Cluster management is important and requires a high level of competence

One clear result found by the evaluations is that the personal characteristics of the cluster facilitator are seen as very important for the success of cluster projects. There is also general agreement that the management and organization of clusters – i.e., the execution of the role of cluster facilitator – requires more and other kinds of competence than a traditional development project. First of all, Arena projects constitute a connecting link in a triple helix, which means that the cluster facilitator must be able to communicate effectively with actors in three different arenas: a business arena with owners and managers of enterprises operating under conditions of market competition, a research arena with researchers and other actors operating in a world of universities

and university colleges, and a political arena with bureaucrats and politicians. Mastering all these arenas requires a certain 'multilingualism'.

Another element that makes cluster projects demanding is that they are organized bottom-up, in the sense that enterprises and knowledge actors that are part of the project participate on a voluntary basis and can withdraw if they lose interest and belief in the project. A cluster organization therefore depends on continued legitimacy and commitment from its members. Above, we have documented that there is a close relation between active participation and results in the Arena projects: The more involved enterprises are in activities, the more they benefit from the project. This underlines how important it is that the project manager has the ability to create excitement and enthusiasm, while also ensuring credibility and a long-term perspective.

The survey in the Arena evaluation contains three questions to the enterprises about the qualifications the cluster facilitator (project manager) needs to succeed in creating good results for the project:

- To which degree do you feel that the project manager (facilitator) has/had sufficient **competence** to achieve good results in your Arena project?
- To which degree does/did the project manager have the **ability to act as unifying force and create enthusiasm**?
- To which degree does/did the project manager have sufficient **credibility and legitimacy** amongst enterprises as well as knowledge actors and actors responsible for public policy measures?

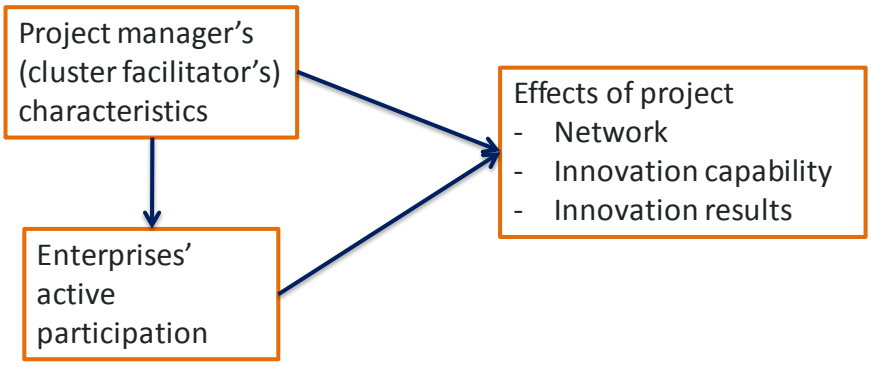
Overall, the project managers received good evaluations, and the three indicators showed a very high degree of correlation. Even though this seems to indicate that project managers that do well along one dimension also do well along the others, there is reason to believe that the high degree of correlation might also be due to the fact that the respondents have not really been able to distinguish the different characteristics of the project manager from each other.

Even though the project managers on average receive good evaluation results, there are significant differences between them.[4] The analyses show a close correlation between how the project manager was evaluated and how satisfied the respondents are with the project as a whole.[5] Based on the rationale above, there is reason to believe that parts of the correlation between the characteristics of the project manager and the effects of the project go *via the active participation of enterprises*. With other words, we believe that one of the most important things the project manager can do in order to create results is to encourage the enterprises to allocate enough time and resources to active project participation. This is illustrated in the figure below, where the project manager's characteristics have both a direct effect on the project's target achievement, and an indirect effect – via the enterprises' active participation.

[4] The differences between the groups are statistically significant at the 0.99-level, and the standard deviation within each project is small.

[5] Parts of this correlation (the correlation between the overall assessment of the project leader and the overall assessment of the project = 0.55) can be spurious; this means that the respondents' overall satisfaction with the project probably influences how the individual target variables are assessed. It is impossible to say how strong this effect is, so we choose not to give substantial importance to the strength of this correlation.

Figure 7: Direct and indirect effects of the cluster facilitator's characteristics on Arena projects' target achievement



We have not carried out a full analysis of the interrelations illustrated in the model, but we have executed regression analyses for all the central target variables (network, innovation capability and innovation results, and overall evaluation). The analyses show, in line with the model above, that the effect of enterprises' active participation on target achievement is weakened when we control for the project manager's characteristics. The differences are not large, but they apply to all target variables.

The evaluations show that the characteristics of the cluster facilitator are important in order to succeed in making the cluster project's activities relevant to the participating enterprises. In addition, the evaluation shows that the more sophisticated and established the business environments are, the more demanding the cluster facilitator's role becomes. Established environments engage in collaboration on a number of levels; from well-developed customer-supplier contacts to formal and informal meeting places outside the auspices of the cluster project. In established environments, it is a very demanding task for a publicly financed cluster facilitator to develop arenas that are both relevant and offer collaboration which does not already exist by virtue of itself. The evaluation of the NCE program shows that the most established environments have chosen different approaches to help increase collaboration potential. Two main paths have been chosen: 1) a strong emphasis on developing better common infrastructure related to relevant education and other knowledge-related collective benefits, and 2) contributions to the development of ambitious and innovative projects with potential for new activities/businesses.

Ingstrup (2011) discusses different types of cluster organization and claims that different characteristics are needed in connection with clusters in the start-up phase and more mature clusters. He lists three cluster facilitation roles:

1. Facilitators that mainly focus on the development of *favourable framework conditions* for collaboration in the cluster. Often, these clusters will be new. When this is the facilitator's primary task, it is of decisive importance that the cluster facilitator is able to act in line with the cluster's own values. In addition, the facilitator must have personal integrity and trust to handle different types of relations in a professional way.
2. Facilitators that mainly focus on supporting the development of *specific collaboration projects* in the cluster. This type of task will often be important in more mature clusters. Here, characteristics like a certain humbleness (an attitude that takes care not to force one's own opinions into a facilitation process), flexibility (openness to changes in thinking and processes) and an awareness of one's own influence will be important. The facilitator needs to understand the power and control that his role entails and act in such a way that desired activities actually take place.
3. Facilitators that take on both of the roles described above.

Each NCE and Arena project independently chooses its own project management. Innovation Norway, which has the main responsibility for all the programs, has few possibilities to influence the choice of facilitator other than through the selection of applicants to the program. It has been a conscious design choice that the choice of cluster facilitator is made at the start of the individual project, and the choice of cluster facilitator constitutes a selection criterion in itself.

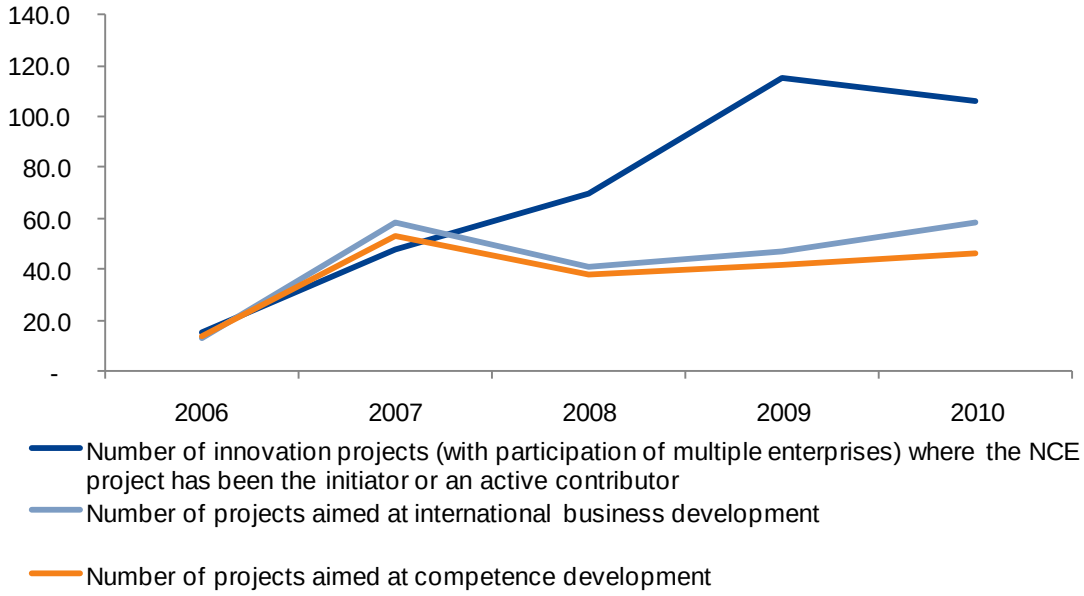
The evaluations show that the program owners have gradually managed to increase attention to the importance of choosing good facilitators for the individual projects. This increased attention must be seen partly in the light of the fact that experiences with the different programs have made clear that it varies which facilitator characteristics are important for success. In addition, the relatively long duration of the projects within the NCE program has also provided an opportunity to study facilitator characteristics that cannot easily be identified at the beginning of the program. Both evaluations recommend that the programs should place more emphasis on the facilitators' competence and personal characteristics in the selection of future projects.

4. The programs' effects on innovation and economic results

4.1. The programs' effects on innovation capability and innovation results

The evaluation of the NCE program supports the impression that the clusters' capacity to innovate has increased in the period after the different NCE projects were established. The projects' self-reported activities show a clear overall increase for the first projects that were started, ref. Figure 8. The interviews we carried out point in the same direction for the NCE projects that were established after the first round of awards in 2006.

Figure 8: Development in the number of innovation projects amongst the projects awarded NCE status in 2006



Source: Econ Pöyry and DAMVAD (2011)

Initially, it might be reasonable to expect that the many innovation projects run by the clusters will result in an increase in the enterprises' own R&D activity. This increase in the number of self-reported innovation projects is, however, not reflected in public statistics from enterprise-oriented research programs run by the Norwegian Research Council, SkatteFunn or the OFU/IFU program by Innovation Norway.

One reason for the lack of correlation between the increase in cluster-initiated innovation programs and publicly registered R&D projects by cluster enterprises could be that the enterprises' capability to get together in value-creating collaboration projects is not necessarily dependent on funding awarded by the administrators of public policy measures.

There is, however, reason to ask if the R&D and innovation projects that have been initiated are of a different character than those that normally manage to secure financing from public programs. One answer could be that the reported collaboration projects have not progressed far enough yet to qualify for R&D-targeted support. In this case, it is uncertain whether the projects actually manage to realize their full potential. Another possible answer is that the reported projects are largely established on the side of the participating enterprises' normal R&D and innovation activities. Involvement in joint projects might thus be more an expression of experimentation with establishing new collaboration processes than related to the enterprises' own innovation processes. The evaluation indicates that there is a need for more knowledge about the connection between

enterprises' participation in cluster programs and the actual extent of innovation in the participating enterprises.

4.2. The programs' economic effects

Both programs aim to contribute to improved national value creation. Whether the programs actually result in improved value creation for the nation is very difficult to measure for two reasons: Firstly, the additional income created by a cluster will not necessarily show in the form of extra earnings for the involved enterprises. Normally, this income is more likely to take the shape of higher general returns from factor input in the country or the region where it is located, ref. Knarvik and Orvedal (1997). Secondly, even though activities leading to improved value creation are triggered in the cluster, it is very difficult to determine whether these activities would also have taken place independently of the cluster programs – in other words, which *additionality* the programs actually have for the projects.

Empirical studies such as Rosenthal and Strange (2004) and Reve and Jakobsen (2001) show that value creation in enterprises that belong to industry clusters is significantly higher than in enterprises that do not belong to such clusters. These results are mainly due to differences in productivity, measured as value creation per employee. If the program works according to its intentions, it is reasonable to expect that this sooner or later should result in higher productivity and value creation for the enterprises participating in the NCE projects. In addition, there will also be value creation from enterprises which are established as a consequence of a dynamic development of competence and relationships within the clusters.

The evaluation of the NCE program has attempted to chart the probability for the NCE program contributing to increased value creation by 1) charting the economic costs of the program and 2) relating the costs to the benefits in the form of data for the development of accounts in the participating enterprises and self-reported effects at the participating enterprises.[6] Even though the basis for assuming a certain development in the enterprises' total value creation is due to their participation in the NCE program, a comparison can still give an indication of whether the participating enterprises have benefitted from the program.

The economic costs of the NCE program are relatively easy to calculate and are estimated to NOK 72 million per year, including the economic costs resulting from the fact that they are funded through the tax system. In order for the NCE program to be economically profitable, it therefore needs to trigger activities that give a value add in the form of improved value creation equal to at least this amount.

Statistical analyses of the participating enterprises' development with regard to value creation and productivity show that the enterprises in the NCE program have experienced strong growth in value creation and productivity compared to both Norwegian and Danish enterprises, both before and after participation in the NCE program. The development shows that the NCE program attracts enterprises with ambitions and potential for growth. It is, however, not possible to prove that this growth can be attributed to effects resulting from the program.

In connection with the structured interviews of individual enterprises, we asked for estimates of by how much value creation had increased as a consequence of activities triggered by the Arena program. These estimates

[6] There were no attempts to measure the economic effects of the Arena program, partly because it was difficult to identify all actors that had participated in the projects and because of significant variation in the degree of involvement. These problems were also encountered in the evaluation of the NCE program, but to a smaller extent.

are not based on analyses of the enterprises' accounts. The numbers that are quoted are subjective and have to be interpreted with caution. The estimates can, however, still be used as a pointer with regards to the effects the enterprises themselves think the program has.

Approximately half of the respondents think they have experienced or will experience growth in turnover due to activities completely or partly under the auspices of NCE. Those who answered that they had experienced growth in turnover have estimated that the growth due to NCE has been in the range of 1-4%. Potential improved value creation in the enterprises is not necessarily equal to the increase in turnover, as the enterprises' additional costs apart from salaries must be subtracted. With an unchanged ratio between the purchase of intermediate goods and own value creation, the growth rate in turnover and value creation will nevertheless be relatively alike.

The feedback from the enterprises shows that the programs do not need to trigger many successful projects for improved value creation to exceed the economic costs of the program. In the evaluation of the NCE program, the program will create an economic profit if 50 of the participating NCE enterprises increase their yearly value creation by 2 percent as a consequence of participation in the program.

4.3. What kind of long-term economic effects can the programs be expected to deliver?

The evaluation shows that both programs have delivered significant results in the form of increased collaboration potential and collaboration processes. Despite this, the evaluation has not managed to establish a clear empirical connection between the programs' activities and the development within the cluster's innovation, productivity or value creation. One reason for this might be that the clusters contain enterprises of large variation in size. Since some firms are quite big and the number of enterprises is large, the contribution of the cluster programs is both relatively small, and its influence on the enterprise only indirect. The correlation between program activities and the enterprises' results can thus be too weak to be identified.

This lack of an empirically proven correlation is nevertheless problematic. The programs are largely developed on the basis of a well-grounded theoretical rationale and have been in operation for so long that there is reason to expect increased demands to see measurable effects.

Martin, Mayer and Mayneris (2011) and DAMVAD (2011) have carried out studies of economic effects on enterprises for French and Danish cluster organizations. Martin, Mayer and Mayneris (2011) studied the French Local Productive System (LPS) and used a comprehensive set of enterprise data. The study compared enterprises with the same characteristics and the same probability of participation in the program, where one part of the pair had participated and the other had not. The method used was «difference-in-difference». First of all, the result showed that the program selected clusters in relative decline. In addition, the study showed that the program did not contribute to reversing an ongoing deterioration in the enterprises' productivity. The program did not have any effect on the enterprises' number of employees, either.

The results of Martin, Mayer and Mayneris (2011) pose a strong contrast to the results from DAMVAD (2011), which on the same methodological basis analyzed the effects on the participants in 22 Danish clusters/networks with strong linkages to R&D institutions. DAMVAD (2011) concluded that participating enterprises were 4.5 times as likely to innovate one year after participation in the network, compared to similar enterprises outside such networks. The enterprises also have a four times higher likelihood of participating in R&D one year after their participation in the network, compared to similar enterprises outside such networks.

There is a need for similar analyses of the Norwegian cluster programs. The Norwegian cluster programs differ from the French programs in that they primarily attract relatively newly established enterprises with ambitions and potential for growth. They are also different from the Danish programs in that the linkages to R&D institutions are weaker. An empirical survey of the Norwegian clusters could for example be based on the Norwegian studies of innovation in order to analyze if there are systematic differences between enterprises' innovation activity depending on whether they participate in cluster programs or not.

5. Programs and policy for the future

The Norwegian cluster programs show many of the characteristics of successful programs. They

- Have been developed on the basis of a solid theoretical rationale
- Achieve effects in the form of a stronger relational basis among the participants
- Contribute directly and indirectly to new collective benefits and the initiation of new collaboration processes
- Cost little in form of transfers financed through the tax system

The above indicates that the programs should be continued or even scaled up. Since no analyses of their economic effects have been carried out, it can, however, not be ruled out that the real economic effects are so small that the programs are more an expression of a trend within industrial policy rather than a really powerful tool for economic growth. In this case, increased use of resources will yield small returns and other policy measures targeted at encouraging innovation might be preferable.

Our opinion is that the evaluations make it seem probable that the programs achieve relatively clear long-term effects with little use of resources. There is, however, a lack of adequate documentation of economic effects in the participating enterprises. It is crucial for the programs' future legitimacy that such documentation is established in the form of empirical methods that can deliver valid results.

Independently of the identification of effects on enterprises, the Norwegian evaluations show that both the selection criteria and the choice of facilitator are important for the results. The chosen selection criteria have favoured business environments which have established collaboration arenas and processes already before they were accepted into the program. At the same time, the evaluations show that facilitation of really new and value-increasing collaboration processes becomes more demanding when the cluster is quite well-established to start with. The results can be good, but the precondition for this is that the cluster facilitator understands what creates added value and how the potential can be realized.

We think that the experience from the Norwegian programs raises the question whether cluster programs should differentiate more clearly if it is a) clusters with established collaboration or b) business environments without much collaboration, but potential for synergies that should be supported.

a) Are easiest to identify, but most difficult to strengthen further through public programs
b) Affords large opportunities to support business environments with significant synergies, but at the same time also possibilities to fail in the sense that expectations are not fulfilled

Norway, which has developed two closely linked programs, can manage to follow both strategies. The precondition for this is however that the program designers need to become more aware of this opportunity. In this case, program design needs to vary more between the programs: one experimental, cluster-creating program and a much more selective, cluster-developing program. In the last instance, public support is contingent on the fact that the program systematically shows results and that projects that do not achieve documentable effects are discontinued.

A choice of different designs for different cluster programs also gives reason to look more closely at the characteristics that the cluster facilitator ought to have. In case a) facilitators that are able to identify potentials and create favourable framework conditions are important (cf. type 1 in Ingstrup, 2011). In case b) facilitators

that are also capable of developing specific collaboration projects are needed (cf. type 2 and 3 in Ingstrup, 2011).

A clearer division of labour with regards to the type of business environments the cluster programs are targeted at will also make it easier to measure the hopefully positive economic effects on enterprises caused by publicly financed stimulation of clusters.

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