EXPLORING CLUSTER DYNAMICS USING SYSTEMS THINKING METHODOLOGY – AN INTERNATIONAL STUDY

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Executive Summary

Economic development agencies worldwide have worked hard to develop ways to stimulate cluster growth as a way to boost local economies. Scottish Enterprise (SE) was an early adopter of clusters as a policy tool and has adapted and modified this strategy over the intervening years to reflect changing market conditions and industrial strengths both at home and worldwide. One of the issues encountered by many public sector bodies when developing a clusters strategy is that much analysis of the industry sectors only gives a "snap shot" of how the cluster operates. Often it is the system dynamics that have a bigger influence on success or otherwise of the sector. SE worked with system thinking experts to bring this approach into an understanding of clusters' development. The outcome of this work was a five stage model that helped explain how a cluster develops and the changes in behaviour and company interaction that might be seen at each stage.

One challenge to the model is that it may just portray a specifically Scottish process of cluster development. In order to further test the model, and to explore its more general applicability, this methodology was shared with other agencies working to support clusters in their countries and regions, to research the use of the model across these different contexts. The study drew interest from a wide range of geographies (Denmark, Finland, California, Switzerland and Sweden) as there is felt to be a lack of analysis tools which investigate the interrelations and dynamics within a cluster, although this is perceived to be extremely important for successful cluster development. These partners carried out parallel studies across ten clusters in their regions to test the hypothesis that the model was applicable outside Scotland.

The results of the study and of the focus group workshop are analysed showing how the model was applied, drawing out any general pattern of responses, and identifying potential improvements to the process. Overall the study concludes that the model is applicable outside Scotland and proves to be a useful tool is assessing the stage of development of a cluster. This was felt to be helpful in describing how a cluster has developed, and most importantly in identifying the interventions that should be made in order to encourage and support that development.

Contents

1. Introduction

Since Michael Porter, in his study *The Competitive Advantage of Nations* (1990), first identified the economic power in certain interconnected groups of firms and organisations, and labelled such groupings “clusters”, economic agencies have worked hard to develop ways to stimulate cluster growth as a way to boost local economies. Scottish Enterprise (SE) was an early adopter of clusters as a policy tool and has adapted and modified this strategy over the intervening years to reflect changing market conditions and industrial strengths both at home and worldwide. Cluster interventions have a growing interest across Europe and the rest of the world. In the European Union (EU), Directorate General (DG) Enterprise has shown a keen interest in clusters, noting that the strategic importance of clusters for European innovation and global competitiveness is only now becoming fully recognized. The recently developed EU Clusters Memorandum (EU 2008) proposed that clusters are part of the answer to Europe’s innovation challenge and can leverage potential and become key factors in attracting capital, people and knowledge. The memorandum proposes EU level policy agendas in support of cluster development. There are similar calls for a coordinated approach to cluster development in the US, Canada and elsewhere.

One of the issues encountered by agencies such as Scottish Enterprise (SE) when developing a clusters strategy is gathering the right evidence to feed into the strategy through analysis and measurement. The EU Cluster memorandum (EU 2008) identifies that more work needs to be done to improve the tools and techniques available for evaluation of cluster initiatives. As such studies such as this one, involving improvements to analysis and evaluation methodologies for clusters are potentially of great interest to this audience. It is worth noting that this study involved resource and time commitment from five different countries who all viewed the study as worthy of investment. Their reasons for participation are explored further in a later chapter (on Results from the Studies, chapter 3), but it does indicate a gap in research in this area, and an appetite for investigation.

One challenge is that much of the analysis of the industry sectors only gives a “snap shot” of a cluster, rather than explain how the cluster operates. Often it is the system dynamics that have a bigger influence on success or otherwise of the sector. In order for a clusters approach to industry development to be successfully implemented, a good understanding of the dynamics, interrelations and influences of different interested participants needs to be understood. Government policy interventions can then be targeted to help these dynamics work for the positive growth of the sector.

SE had identified this aspect of interrelations and dynamics in cluster development as an area of potential research and in the autumn of 2006 worked with system thinking experts to build a systems theory approach into an understanding of clusters development. The outcome of this work was a five stage theoretical model that helped explain how a successful cluster would develop and the changes in behaviour and company interaction that might be seen at each stage. The use of this model including the accompanying descriptions and question set has been successfully pilot tested with a number of Scottish clusters.

One challenge to the model is that it may just portray a specifically Scottish process of cluster development. In order to further test the model, and to explore its more general applicability, it was proposed to expand the research, to share this methodology with other like-minded economic development agencies working to

support clusters in their countries and regions and analyse the results across these different contexts. Interest in participating was received from a number of regions and the final research project covered five separate geographies (Denmark, Finland, Switzerland, Sweden and California) and a total of ten clusters, in addition to the studies carried out in Scotland.

There is widespread interest within cluster practitioners and policy makers in developing this kind of analysis for clusters. This is exemplified by the input volunteered by the international participants. For this study it is worth noting that all of the regions put time, effort and resources into the study, and to support the participation of their delegates to the focus group workshop. As such there was a good deal of commitment and input to the research. In order to gather evidence of the need for research in this area each of the regions were asked for their reasons for being willing to participate. Their full responses are detailed in Appendix 5, but key points raised include:

- A distinct lack of tools to assess cluster interrelations and dynamics
- The ability to identify the correct interventions for cluster development
- The ability to use this type of assessment to promote strategic conversations with cluster members
- An ability to learn from others internationally as part of the study

In general the feedback on reasons for participation was very positive from participants, including what they saw as the value of the model, that they view it as lead practice and they can see the benefit of using it with their clusters, as well as the benefit in general from participating in these type of collaborative studies.

In summary the objectives of the research can be described as follows:

- Test Cluster Dynamics model on a number of clusters in different countries to answer this specific question
    - Is the model a useful methodology for mapping cluster development that is applicable outside Scotland?
- Describe the outcomes from each country cluster study (product)
- Learn from experience of each country in using the model (process)
- Conclusions and recommendations on how to apply the model, including improvements to the process.

This paper reports on the study and its findings.
Chapter 2 introduces the cluster dynamics model and the process used for analysis in the pilot studies in Scotland. Although not part of the key research question, this gives valuable background to help understanding of the main study.
Chapter 3 reports on the results from the studies carried out in the five countries.
Chapter 4 gives an analysis of the results, both from the studies and from the focus group workshop.
Chapter 5 concludes the study, drawing conclusions regarding the key research question, identifying areas for action, highlighting the limitations of this study and suggesting further areas of research.

2. The Cluster Dynamics model

2.1. Introduction

In order to better understand the international study, it would be useful to explain the Cluster Dynamics model as developed by Scottish Enterprise and to describe the process used when analysing clusters. It should be remembered that although it is hoped that an additional benefit of the international study will be recommendations of how the model and the process can be enhanced, the fundamental research question in this project is focusing on whether this model is applicable outside of Scotland. However this chapter will present a description of the model so that the outputs of the study can be better understood.

As described in Chapter 1, Scottish Enterprise worked with system thinking experts to bring this methodology into an understanding of clusters development. The outcome of this work was a five stage theoretical model that helped explain how a successful cluster might develop and the changes in behaviour and company interaction that might be seen at each stage. This is now being used as practical methodology (including descriptions and a structured question set) for Priority Industry teams in Scotland to assess the cluster development in their sector and from this to feed into strategy and intervention development. This is helping explain cluster growth and can be used to identify interventions for the public sector to assist in this growth for long term development. It is this model that this research project wished to test with like-minded agencies involved in cluster development in different locations around the world.

2.2. The Cluster dynamics model

The following is a brief description of the final Cluster dynamics model that has been developed and used during this study. (See Fig 2.1)

Core of the cluster

Central to any cluster is a core of businesses in the same sector within a geographic concentration. Core to the development of cluster policy is that clusters cannot be imposed and started from scratch. They must build on an existing strength with a sense of reality as to their potential specialisation. The first step in many cluster policy interventions is to identify the sectors where a region has evidence of a number of business and other organisations which collectively could be significant. These businesses are exposed to global competition and external market pressure and can react in a number of different ways. Their reaction is partly driven by an awareness of that global competition, but also by the behaviours and cultural norms exhibited by the group.

Level 1- Inter-firm rivalry

One way firms can react to this to pressure is that it becomes an internal driver for innovation to outperform their rivals. The pressure to improve drives new product and process innovation as the companies compete to win orders and market share. The main driver here is competition and although there may be some companies who are unable to compete effectively and fall victim to the market, in general this is positive for the overall group of companies.

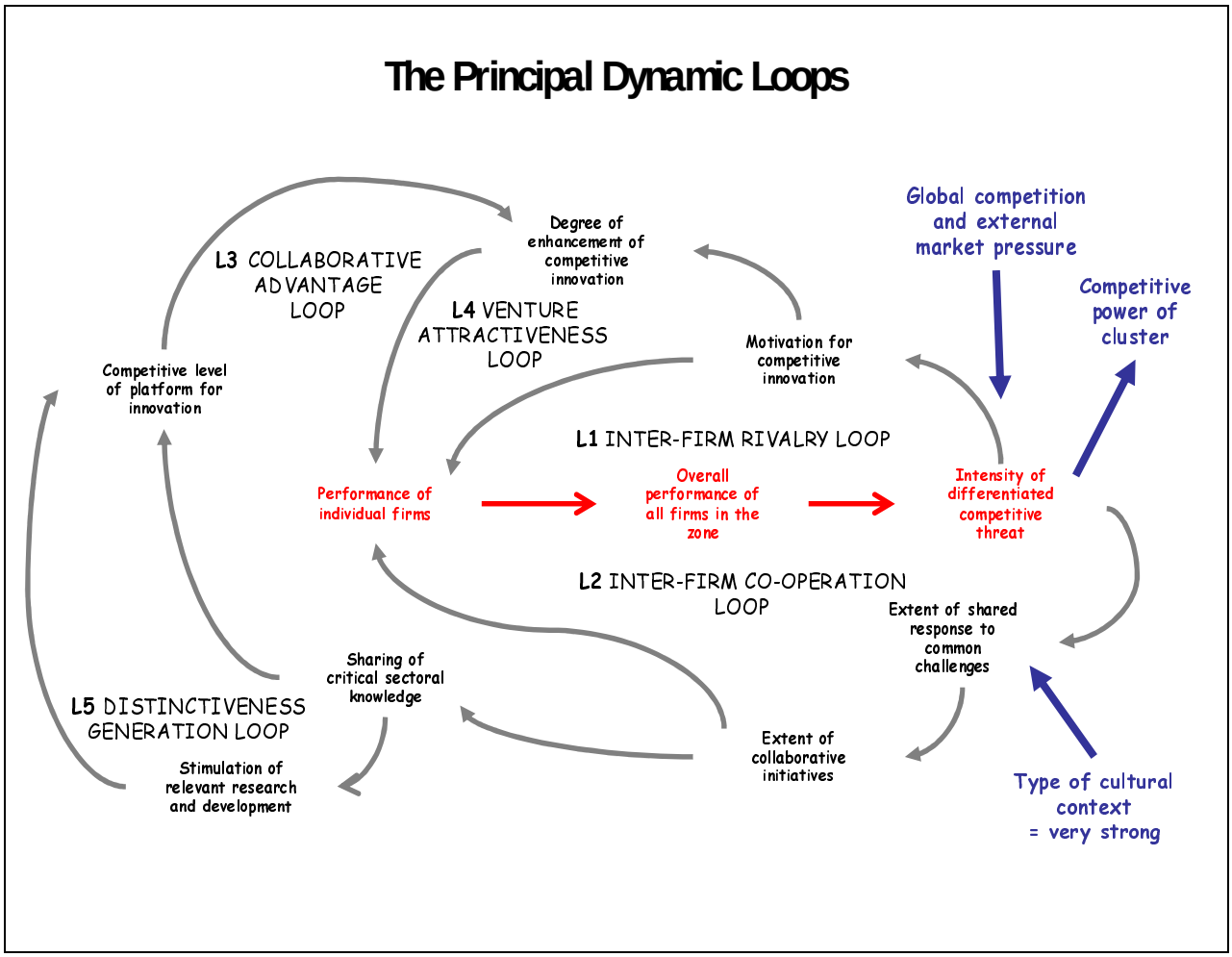


Fig 2.1.Cluster Dynamics model, Scottish Enterprise 2007

Level 2 – Inter-firm co-operation

Another response to global competition is for firms in the sector to start to work together. There is a degree of shared response to common challenges, rarely at this stage core to the business, but which nonetheless can help the performance of the group of firms. This may be evidenced by such things as shared transport issues, joint approaches to common suppliers to leverage buying power, or presenting a common identity for the group or region.

N.B. It is possible to have too much cooperation, where the group becomes too internally focused and unchallenging. For a successful cluster an element of both level 1 and level 2 is essential. Much cluster analysis describes this balance between Inter-firm rivalry and Co-operation (often described as Co-opetition).

Level 3 – Collaborative Advantage

As the culture and trust evolves, built on the success of cooperative initiatives, this may lead to the sharing of critical knowledge and assets. This collaboration is focused on areas that are more core to the business and therefore higher risk, but the potential for collaborative advantage leading to a new level of competitive performance can make the rewards worthwhile. Examples may include joint development of new product areas, or sharing and trading of critical assets.

Level 4 – Venture Attractiveness
The new level of innovative performance starts to make this sector "the place to be". For the sector, in global terms, the cluster is significant. This leads to attracting new players (e.g. firms relocating), new money, and new talent. Once again this can be challenging for some of the existing firms, but overall it is good for the cluster.
Level 5 – Distinctiveness Generation
The collaboration moves from focusing on current issues to looking for future breakthroughs. This may involve collaboration on acquisition or generation of relevant research agendas to inform the next stage of development, to enable the cluster to be truly distinctive.

From the above model and the more detailed descriptions of each phase that were produced, a methodology involving a structured questionnaire was developed to help teams analyse where their particular sector was performing. It should be remarked that this analysis was carried out in addition to more traditional indicators of sectoral growth and performance, e.g. employment, number and size of companies, exporting levels and Gross Value Add (GVA) from the sector.

2.3. Analysis Process

In order to use a structured and repeatable process for analysis a structured questionnaire was developed to help a cluster assess its stage of development. The questionnaire was based on the dynamic loop model (Fig.1 shown above) which seeks to give a rationale for understanding the behaviour of actual and potential clusters over time. The questionnaire is divided into six sections. The first five sections address key observational questions around behaviour associates with each of the five loops in the model. The sixth section addresses questions to the development and integration of the loops as a whole system, and acts as a double check on the analysis.

The answers are rated on a five point scale, the meaning of which varies slightly depending on the question. In general the rating scores these elements from Absent (1) to Very Strong (5). The general pattern is that a higher score indicates a greater systemic strength and hence performance potential. Lower scores indicate weaknesses which might be addressed by a variety of initiatives. The final set of questions refers to the progression through the loops.

The questions are essentially self assessment, and are based on basic behaviours that would be observed within the cluster. Evidence and examples are looked for to substantiate the mark given and these can be recorded in the notes section as further evidence. There are some more detailed descriptions of behaviours seen at each stage of cluster development which informed the development of the question set and act as background information for the facilitator.

2.4. Implementation methodology

The following is the methodology that has proved to be successful when implementing the model during the pilot stages in Scotland. In order to test the model in an international study the same methodology was to be followed as far as is practicable (See Research Methods Chapter 4 for a more detailed description and explanation).

2.4.1. Identifying the Group

There is a lot of discussion for both researchers and practitioners involved in clusters as to how important size and geographic proximity are for cluster development. What

is apparent is that clusters come in many shapes and sizes, and the range of policy support in different areas from very localised to national cluster programmes reflects this variety. The team behind the Cluster Dynamics model believe it is sufficiently generic to be applicable to many of these different levels. However if the group is too localised there is unlikely to be sufficient richness in the interactions (density and critical mass are also an important element). Conversely too wide a definition and the businesses involved will not view themselves as defined by that larger group and the linkages will not be seen. In addition clusters in different regions are organised in different ways according to the policy context of the area. Some have cluster teams within or funded by development agencies. Others are organisations set up by groups of businesses. The key focus of the study output is as a tool for cluster teams and managers and as such that often helps to define the system under review i.e. identify who will use the study outputs and how, and that helps to identify the most useful group. To an extent it is a decision for the cluster or cluster management to define at what level the most use can be gained from this assessment tool, and this helps to define the group to undertake the assessment. In addition there is an issue on group size. Too large a group and the process is unwieldy. Too small and the breadth of knowledge is potentially not sufficient to give an overall cluster view. In the final analysis, as long as the group is knowledgeable about the cluster characteristics (including at a subsector level) and can help inform potential future strategy it is envisaged that the tool should be of use, and the group would be suitable for the analysis.

2.4.2. Analysis Methodology

The methodology used follows three stages.

Stage 1
Introductory Presentation
Having defined the cluster to be analysed, the initial step was a presentation to the cluster team or management group. The presentation introduced the Cluster Dynamics work, explaining the model and inviting discussion and initial reaction from the group. From that group a smaller team (5-8 people) who could bring expert knowledge were volunteered to be involved in the question set analysis. (If the management or cluster team is only a small group it may be appropriate to involve the whole team).

Stage 2
Question set workshop
This was a (potentially smaller) workshop with members of the team who could bring expertise on specific subsectors. Ideally this should take place within two weeks of the initial presentation to ensure the model is reasonable fresh in the participant's memory.
During this second workshop the formal methodology of the question set was used. This helped the participants analyse the sector using the question set and give evidence and examples from the cluster. The question set had helped to challenge perceptions where the temptation had been to assess the sector as performing well in a certain level, but on reflection there was a lack of evidence. The role of the facilitator in this challenge process is key. This is also why a workshop format rather than filling out the questionnaire in isolation proved more useful. At the end of the session the completed questionnaire was able to identify the level of performance of the cluster and have captured evidence of the scoring in the notes section. The team involved have reached consensus on this assessment through discussion and challenge.

Stage 3
Feedback workshop and wider discussion
The results of the questionnaire analysis were then presented back to the wider group. These allowed a discussion with the wider group as to how this could then feed into strategy development and identify the right interventions to help the cluster develop. As the analysis often has looked at multiple subsectors, this may lead to different interventions being needed for different subsectors.
These initial facilitated discussions with the team using the model helps them identify at what stage of development each of the subsectors is performing, and therefore whether they need to modify their interventions to help with cluster growth.

It is this same methodology that was used in the International Study across the different regions to ensure a consistency of approach across the analysis.

3. Results from the Study

3.1. Introduction

Each of the five regions carried out studies using the clusters dynamics model. In total ten studies were carried out across the five regions. This chapter outlines the results from those individual studies, as well as looking at their motivations for participation. For each study a description of the results is given as well as a graphical representation of the outputs, which shows how for each level in the model (level 1 – Inter-firm rivalry to level 5 – Distinctiveness Generation) the clusters assessed their performance (from 0 = Absent to 4 = Very Strong)

3.2. Reporting Back

In order to collect sufficient information, and to allow cross comparison and analysis, the participants were asked to report back in a standard format.
The following reporting elements were required as part of the study.

1. Description of the cluster to give context
   As mentioned in previous chapters clusters are formed and managed in a variety of different ways. As such to understand the context of the study in each region, a description of the cluster, who is involved, who manages and funds the cluster, and what is its geographic location was requested.

2. Description of the methodology used
   Although it was anticipated that the same methodology would be used during this study, a description of the how the study was carried out was requested, including the workshop participants, the facilitator's role, the number of meetings etc.. This was put in place to ensure that any differences in implementation were surfaced and could identify where a slightly different approach was the reason for a slightly different outputs. In addition there may be the opportunity to highlight where a certain approach had proved more or less successful.

3. The outputs from the questionnaire showing evidence of where the cluster is performing.
   The completed questionnaire(s) showing the assessment and evidence collected in the notes page was felt to be vital for completeness of data gathering and to allow comparison during this study.

4. Feedback on the process.
   In addition some feedback on how useful the model has proved to be, and comments and potential improvements to the process was elicited through a structured feedback questionnaire. Many of the questions were on a Likert scale (1 very weak/poor to 5 very strong/good) with other questions asking for more free text responses. As full copy of the questionnaire is attached in Appendix 1. The results from this part of the feedback reports will be analysed further in Chapter 6.

3.3. Results from the studies

3.3.1. Sweden

The Swedish partners carried out two studies using the model. One of the clusters, Triple Steelix is financed within the VINNVÄXT programme. This is a national programme that funds 12 cluster or regional innovation systems in Sweden. A particular focus of the programme is to help develop the links between research, industry and the public sector. The study was also done on another very successful cluster in Sweden; The Paper Province. The main partners and facilitators from Sweden were from the national innovation and research agency, VINNOVA

The Paper Province

The Paper Province is an economic association that coordinates and develops co-operation between participants in the pulp and paper technology business in Värmland, northern Dalsland and Närke in central Sweden. The main focus is on packaging technology. Close proximity to raw materials, modern infrastructure and the central position in northern Europe make this region a global leader in this sector of industry. Nowhere else in the world is home to such a large cluster of competence in pulp, paper and packaging. Around 250 companies with approximately 12,500 employees are active in the sector. The network started in 1999. The formation of The Paper Province network was a way to gather together local businesses active in the pulp and paper industry, along with customers, machinery suppliers, consultants and other service providers. The aim was to help market the region and support development through the reliable provision of competence.

The main study involved face to face meeting between two representatives of the cluster, including the Cluster Manager, and two representatives from VINNOVA. There were then some follow up conversations by telephone and a further meeting within VINNOVA to discuss the final analysis.

The results showed a very strong assessment for loop 1 (rivalry), falling slightly through the following levels (cooperation to collaboration) to medium at Venture attractiveness (loop 4). However the cluster was assessed to be very strong for the final loop 5 (Distinctiveness generation) which captures research strengths.

For a graphical representation see fig 5.1.

Triple Steelix

The steel industry in Bergslagen (in the middle of Sweden) had a long history and leads the world in its niche. With the steel industry as a base, a cluster of companies has developed in the region in the fields of steelmaking, manufacturing, processing and knowledge-based services. Together with the universities and colleges, the focus is on developing expertise regarding materials, steel processing, nanotechnology, industrial IT, the environment and energy efficiency. In total more than 700 companies work in this sector in the region.

The study involved an interview with the process manager and the interactive researcher in Triple Steelix. There were then some follow up conversations by telephone and a further meeting within VINNOVA to discuss the final analysis.

The results showed a strong performance in loop 1 (rivalry), very strong in loop 2 (cooperation) and strong across the other levels.

For a graphical representation how the cluster assessed each level (against a scale of 0 = absent to 4 = Very Strong) see fig 3.1.

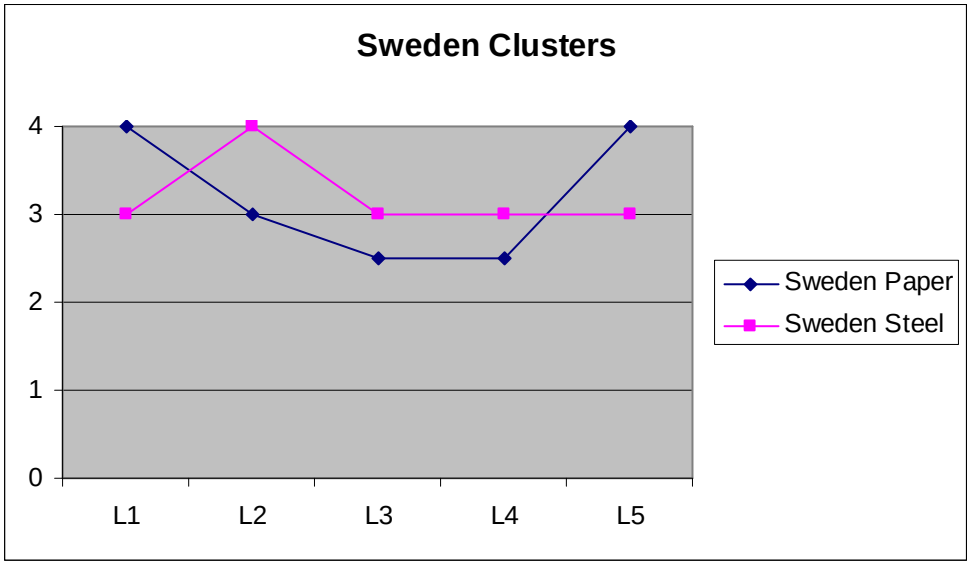


Fig 3.1. Graphical representation of Swedish studies.

3.3.2. Denmark

The Danish partners carried out two studies using the model. The main partners and facilitators from Denmark were from the national innovation and research agency, FORA.

The ICT Cluster in North Jutland

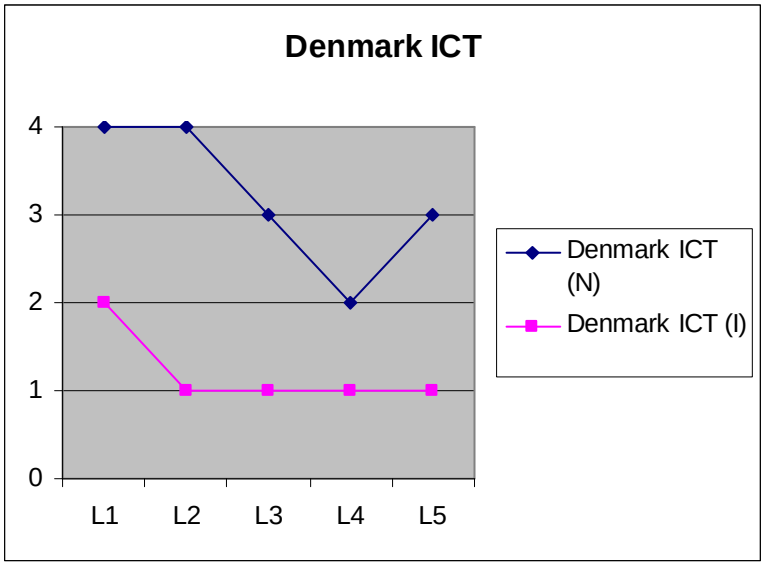
The ICT cluster in Northern Denmark can be characterized by two sub-clusters:

- The Mobile cluster (Norcom)
- ICT Cluster (IKT Forum)

Norcom hold world-class knowledge in wireless communication, simulations, satellite equipment and acoustics. IKT forum hold world class knowledge in monitoring and controlling solutions (i.e. to production facilities), intelligent logistics solutions to airports, harbours and post handling and in decision support systems. This is a much less mature part of the cluster. Overall the cluster totals approximately 200 companies, of which the majority are small and medium sized companies, and employs a total of approximately 15,000 people. Also key to the cluster is Aalborgt University, known for their research capacity in wireless communications and related disciplines. A recent initiative (ICT Partnership) between the IKT Forum, Aalborg University, Aalborg municipality, the region of Northern Jutland and NorCom is aimed at bringing the two sub-clusters closer together, including funding a joint cluster manager.

The study involved three people from the cluster together with a facilitator from FORA, during a face to face meeting. A fourth contributor was unable to make the face to face meeting, but completed the question set remotely. The four participants represented the different aspects of the cluster and had significant insight into the history development and operations of the cluster in the region. The responses captured the feedback from both parts of the cluster (Norcom responses are marked N, IKT responses are marked I).

The responses can be seen in Fig 5.2, which shoes the differences between the two parts of the cluster, in particular how the more mature part of the cluster (Norcom) shows a stronger performance throughout.



0 = Absent
1 = Weak
2 = Medium
3 = Strong
4 = V Strong

Fig 3.2 Graphical representation of Danish ICT Cluster.

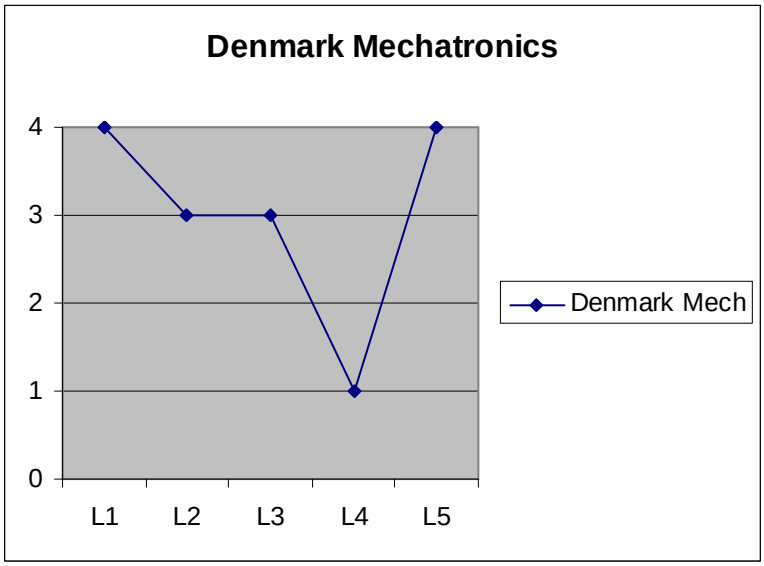
The Mechatronics Cluster

The Mechatronics cluster in southern Denmark consists of:

- Cooling devices
- Medical devices
- Clean Technology

The cluster consists of than 60 companies and knowledge-institutions. The cluster employs 11.000 people and represents one of the largest concentrations of engineers per resident living in Denmark. The Danish company Danfoss (a major international player in this sector), is one of the drivers behind the clustering process. The study involved three people from the cluster together with a facilitator from FORA, during a face to face meeting. The four participants represented the different aspects of the cluster and had significant insight into the history development and operations of the cluster in the region.

The responses can be seen in figure 3.3, showing a very strong assessment in the early loops, falling to a weak performance for loop 4, but rising again to a very strong performance for loop 5, particularly driven by research strength.



0 = Absent
1 = Weak
2 = Medium
3 = Strong
4 = V Strong

Fig 3.3 Graphical representation of Danish ICT Cluster

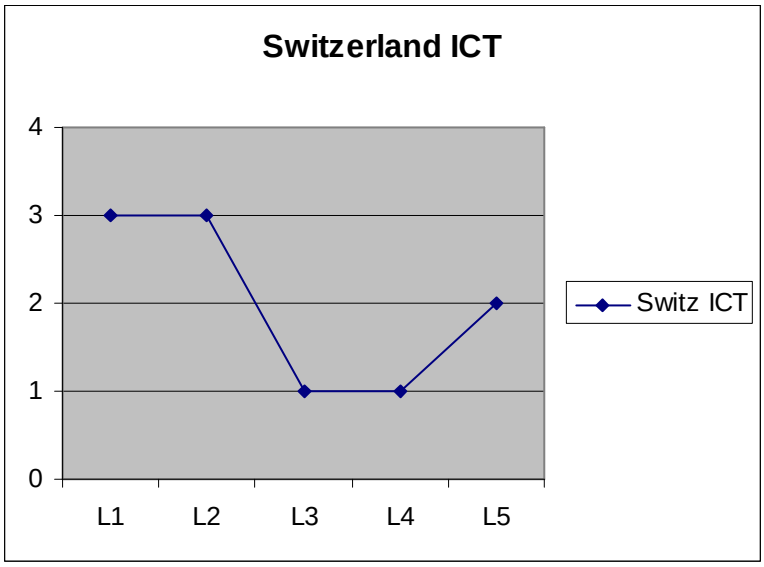
3.3.3. Switzerland

The Swiss partners (innoBE, a private organisation who specialise in cluster management and innovation support) carried out one study with the ICT cluster.

ICT cluster, Berne

The ICT cluster based around Berne is a membership organisation with about 200 members, which has been established for over ten years. Much of the work done is on a voluntary basis by the members, especially all the work on the board and in the working groups.

The study was carried out in a workshop with five members including the President and Vice president of the board.



0 = Absent
1 = Weak
2 = Medium
3 = Strong
4 = V Strong

Fig 3.4 Graphical representation of Swiss ICT Cluster

The responses can be seen in figure 3.4, showing a strong assessment in loops 1 and 2 (Rivalry and cooperation) dropping to a weak performance in loops 3 and 4 (collaboration and Venture Attractiveness), but rising to a medium assessment for the final loop, once again driven by perceived stronger performance in research.

3.3.4. California

Even though this was a relatively small international study, it was felt that it would be important to have a partner from outside of Europe. This would give an analysis from a region where the climate for policy interventions in cluster development was different. The approach in the US tends to be very industry driven with no national cluster strategy. Once again this would test the model in a different context. Applied Development Economics acted as facilitator, and identified the Water and Flow Technology cluster in California as a suitable study participant.

The Water and Flow Technology Cluster, San Joaquin Valley

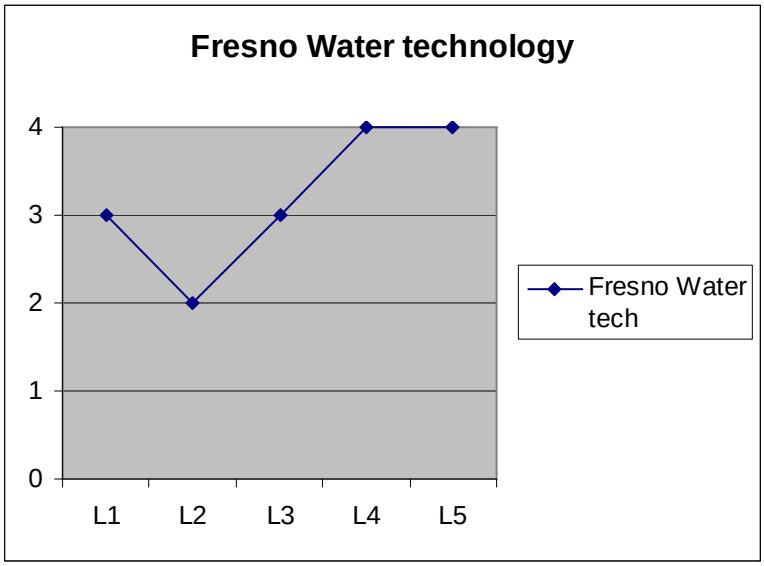
The Water and Flow Technology Cluster is managed by the staff of the Center for Irrigation Technology (CIT) and the International Center for Water Technology (ICWT), an organization formed by the cluster to implement its first business plan developed in June, 2001.

The cluster is comprised of many industries, including:

- Pumps and related equipment such as piping, valves and tanks;
- Filters, water meters, and hydrants;
- Electronic controls and flow measurement equipment, water quality measurement and sensor technology components, and
- Irrigation and related components such as valves, sprinklers and emitters.

The ICWT is located at the California State University in Fresno (Fresno State), which takes primary responsibility for fundraising, hiring and managing personnel, building and managing the facilities and creating and implementing programs and services. The ICWT is governed by a Board of Directors from the private sector and an executive committee responsible for oversight. The cluster involves approximately 90 companies, many of whom have global trade links in this sector. These companies together employ about 2,800 workers.

Due to the large geographic area covered by cluster members, it was decided that the most effective means of obtaining cluster members' responses to the questionnaire was to conduct two conference calls about one week apart, involving key cluster members including the original three co-chairs who started the cluster in 2001, and the project manager. Questions for loops 1 to 3 were covered in the first call. Questions for loops 3 to 5 were covered in the second call. In total 7 members participated. Unfortunately it proved impossible to members to participate in both. As such different members contributed to each conference. Within one week, the Facilitator wrote up all answers to each of the study questions and then forwarded the write-up to each participant for any corrections.
The results can be seen on Fig 3.5, and show a slightly different pattern to other studies, with a stronger performance in later loops and a weaker performance in loops 1 and 2 (Rivalry and Cooperation). In addition loop 5 shows a strong assessment, reflecting the strength of research in the cluster. There may be a contribution to this slightly different perspective due to the fact that there were two groups of participants who answered the questions so there is a slight lack of consistency in this approach. This will be discussed further in the next Chapter on Analysis of results.



0 = Absent
1 = Weak
2 = Medium
3 = Strong
4 = V Strong

Fig 3.5 Graphical representation of Fresno Water Technology Cluster

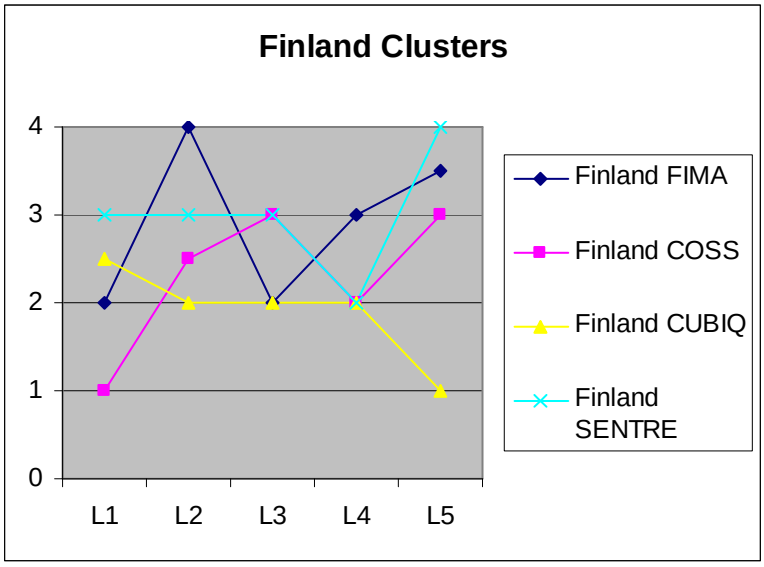
3.3.5. Finland

The study partner in Finland was the Technology Centre Hermia who operate and manage a group of membership-based business networks, or “mini-clusters”, each of which works with the aim of advancing the competitiveness and performance of business in certain key domains. The networks are designed to incorporate and bring together actors from the business sector with those from academia and research institutions and from the public sector. The study was carried out on four of these “mini-clusters”.

- CUBIQ: - the Centre for Ubiquitous Computing
- COSS: - the Finnish Centre of Open Source Solutions
- FIMA: - the Forum for Intelligent Machines
- SENTRE: - the Centre for Sustainable Energy, Tampere

The study involved a workshop format with 6 participants from across the 4 mini-clusters and a facilitator.

The results can be seen on Fig 5.6, and show a variety of patterns across the studies. Some, for example CUBIQ show a stronger assessment in the early loops, dropping to a weaker performance in loop 5. Others, for example COSS, show the opposite pattern, with weaker assessment in the rivalry loop 1, and stronger performance in later loops. On considering their function as Business Networks, it is perhaps not surprising that a cluster focused on Open source assesses itself to be stronger in collaboration which is after all a key part of Open Source methodology. In addition having only one representative from some of the areas may have led to less challenge in the assessment. This will be discussed further in the following chapter.



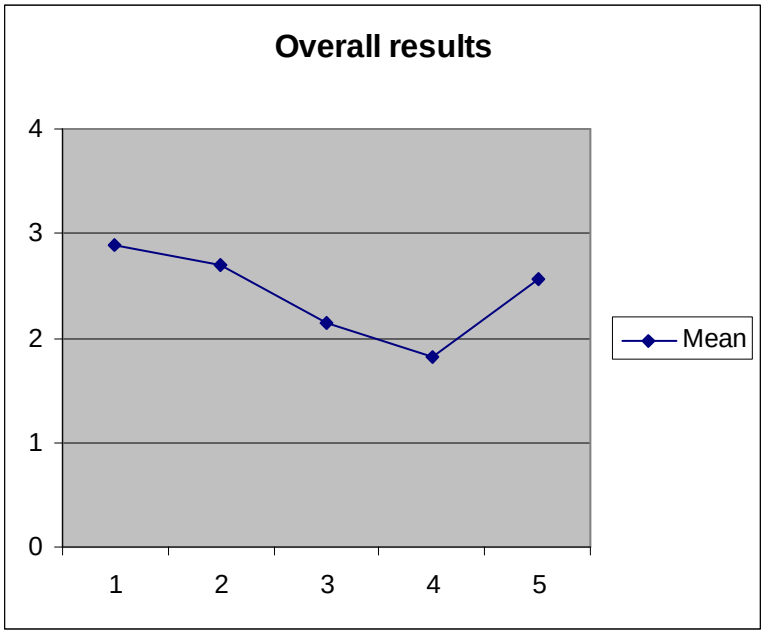
0 = Absent
1 = Weak
2 = Medium
3 = Strong
4 = V Strong

Fig 3.6 Graphical representation of Finnish Clusters

3.3.6. Overall Results

Despite some differences between regions it is interesting to look at the pattern of responses. Across all the studies if an average (arithmetic mean) response is plotted for each level (where a score of 0 = absent through to 4 = Very Strong) the overall

pattern is one where the assessment is stronger in the early loops, falls to a weaker position in loop 3 and 4, but rises again for loop 5.
The overall picture can be seen in Fig 3.7



0 = Absent
1 = Weak
2 = Medium
3 = Strong
4 = V Strong

Fig 3.7 Graphical representation of the overall study pattern

4. Analysis of Results

4.1. Introduction

This chapter will further analyse the responses on the feedback reports from the study participants and try to draw some general conclusions. The second part of the chapter will discuss the focus group workshop.

4.2. Feedback Results

All the study participants responded with some feedback on their experience of the study using the feedback questionnaire. Many of the questions were on a Likert scale (1 very weak/poor to 5 very strong/good) with other questions asking for more free text responses.

Below is a compilation of the Likert question responses, showing the mean response, the range and the mode. Overall the response was to the study was extremely positive, with all the questions recording a mean score of over 3, and only one respondent in one question across all the studies recording a score less than 3. A graphical representation of these results can be seen in Fig 4.1.

1. On completion of the study was this felt to be an accurate description of the stage of development of the cluster/sector?
   Mean 3.35 Range 3 - 4 Mode 3

2. Does the group feel this would be equally applicable to other clusters/sectors in their area?
   Mean 3.95 Range 3 - 5 Mode 4

3. Does the group feel this has been a useful process in identifying the stage of development of their cluster/sector?
   Mean 3.80 Range 3 - 4 Mode 4

4. Does the group feel that the model suitably describes the stages of cluster development?
   Mean 3.10 Range 2 - 4 Mode 3

5. Does the group feel that the methodology/process was appropriate in testing the model?
   Mean 4.05 Range 3 - 5 Mode 4

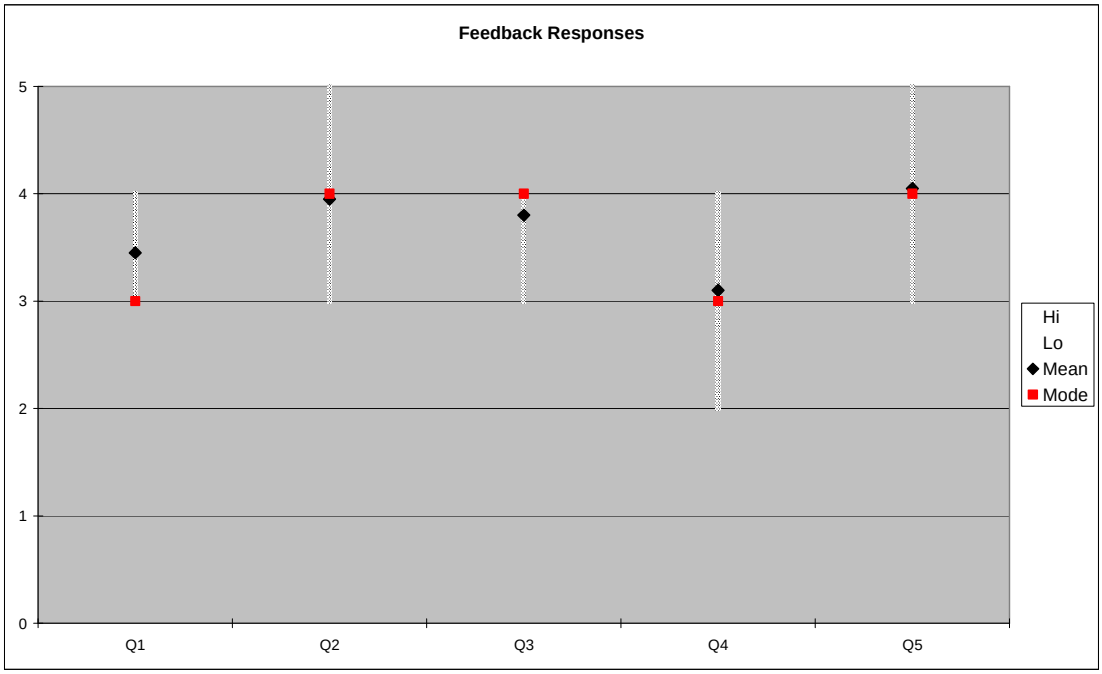


Fig 4.1 Results from Likert Scale questions

The remainder of the questions were free text questions. From the feedback from these questions, and also from the free text element of questions 1 to 5 (which allowed the respondent to clarify their responses) some general comments and conclusions can be summarised.

4.3. General feedback responses

The feedback from the Cluster Dynamics studies carried out in partner regions can be summarised under three broad headings:

1. The Process
2. The Model
3. Further Research

It should be noted that this analysis concentrates on what can be improved. It is worth noting that the feedback in general was very positive, with several of the study participants feeding back that they had come across no other study tool that helped them analyse their cluster in this way.

"This is in great demand. The Loop provides an excellent starting point for describing the development stages of clusters." Denmark ICT

"Today we don't have any tools for describing the development stages of a cluster. This methodology is an important tool in this direction." Denmark Mechatronics

The very fact that all ten studies across the five regions managed to complete the study using the model and found some useful analysis suggests that they had found the process and the model beneficial.

4.3.1. The Process

In this section the comments and feedback are regarding the process used for the study, how that worked (or not) and how context played a part.

– The importance of a workshop environment was raised by several studies. This enabled different views and agendas to be brought together and helped generate lively but fruitful discussions when agreement was not immediately forthcoming on question responses. This helped challenge perceptions and deepen

understanding of the cluster. For some studies this was not possible, either because of time or geography. This made discussion harder as face to face discussion were not always feasible. Although the facilitator may challenge, they cannot over-rule, so only having one perspective can be too limiting. There is a balance to be struck between getting a broad enough cross section of views, and not making the group so large that the process is unwieldy. A smaller group is easier to manage but "cannot know enough".
"*There were questions in study where the participants did not agree on the answer, and this resulted in a good, fruitful and interesting discussion." Denmark Mechatronics cluster*

- Issues with explaining the model were frequently raised. Feedback suggests it is not readily understood by those not used to discussing cluster analysis. The model itself looks complicated (although building the loops through animation helps). This is a barrier to its use for broader groups. In addition language is an issue, both from a translation point of view, but even for those for whom English is their first language the descriptions and questions are not expressed as simply as they could be. This can lead to misinterpretations and wrong assumptions.
- The overall process is potentially too long and labour intensive. As such one study elected to split the questions into two interview groups with different panels. This perhaps raising questions of continuity and makes issues of understanding (raised above) even more apparent, especially as the difference between loops 2 and 3 (cooperation versus collaboration) is crucial yet quite subtle. Redesigning the process to enable on-line input may help speed up the process and overcome geography constraints, but still raises the issue of how to enable the workshop discussions. However with its current length it is inevitable that the time taken in the discussion over Loop 1 almost inevitably outweighs time taken over discussion on loop 5. This is partly due to increased understanding of the process as the session progresses, but also could be the case of the participants being keen to finish the session.
- The context of the study also needs to be understood. This process was designed to be a supplement to other cluster analysis (for example company performance, research strengths, analysis of the business environment e.g. access to funding, skills, infrastructure etc.). The Cluster Dynamics model was designed to fill the gap of analysing cluster interaction and social capital that is so essential for a well functioning cluster but extremely difficult to measure. Several of the study participants fed back that there needed to be more performance measurement for the cluster. The process needs to make clear that this study is in addition to, not instead of, other cluster analysis.

4.3.2. The Model

In this section the comments and feedback are regarding the model itself and how applicable it was for the different regions. Different geographies have different cluster frameworks. Some are very geared to facilitating networks and research collaborations, some are built from research strengths, whereas others are driven by strong industry and may have one or two dominant players. All of these issues were raised as feedback on the study. Whether, despite these issues, the model is sufficiently robust to be applicable generally (i.e. beyond Scotland) was explored more fully in the workshop, and will be discussed at greater length later in the chapter.

- For several regions the focus of policy is linking research, industry and government in the so called "triple Helix" model. The feedback on the model is

that potentially the role of research is underplayed, particularly where the cluster is built on a research strength. In addition the questions for loop 5 probably do not adequately analyse how connected into the cluster is the research. As such a cluster can have strong research and score highly in this level, even though the research is not well connected into the company base and is not benefiting the local cluster growth. These questions need to be better phrased to capture whether the research strength is an integral part of the cluster, whose outputs are being absorbed by the company base, or whether they just happen to share geography.

- The role of large companies was also raised. Very often the model describes the stage of development of a cluster that is distorted by the role of one or two lead players. Some studies raised the benefits of having a large company involved (more global perspective, common customer for smaller companies). Equally it was also raised that smaller companies were more willing to leverage common identity
- Subsectors in clusters also played a role in the study. Very often it was difficult to generalise across a cluster as some parts of it were more developed than others. This also allowed useful comparisons and lessons to be drawn from the study. *"Very difficult to get one unique answer for all companies" Sweden Paper Province*
- The main role of the cluster organisation also had an impact. Where the focus was on funding and generating collaborative projects and research and companies had joined specifically for this, there was, not surprisingly, a greater emphasis on cooperative and collaborative behaviours as opposed to rivalry and competition. For example one of the lowest scores in loop 1 was recorded by a network set up to encourage open source collaboration. There may also be a factor involving cultural norms towards collaboration, but this is outside the scope of this project.
- One benefit of the model raised several times was how it showed progress over time. Other studies of clusters tend to be static, whereas this model allows the "story" of cluster development to be explored.

4.3.3. Further Research

The participants were asked specifically about potential areas of further research and several areas of further research were suggested by the study partners.

- As a cluster grows, and particularly those involved in global value chains, the boundaries of the cluster expand beyond the regional and national boundaries of policy makers. International clusters are becoming increasingly important. For this kind of study, it was suggested how to define the boundary of the system, and whether that is relevant in modern globalised world would be an area of fruitful research, as well as investigating how policy makers can support clusters that spread beyond their borders.
- Further analysis of the relationships in a cluster, including the role of power, dominance, interdependence etc. was seen to be an important area.
- As raised in an earlier section, the influence of large companies on a cluster should be researched.
- Drivers of cluster participation, and the perceived benefits for companies
- Potential interventions that help development at each stage, including case studies for how clusters made the breakthrough to the next level of development.

This initial analysis of the feedback responses from the questionnaires was prepared in advance of the focus group workshop, so that it could provide an initial insight into the partners' experiences and help prompt fruitful dialogue and discussion.

4.4. Focus Group Workshop

The second stage of gathering the experience of participants in the study was through the use of a focus group. A study workshop (focus group) was held in Glasgow after all the international studies had been completed. This allowed participants to share learning and experience and discuss possible improvements to the process. Each participant region was expected to present a brief description of their cluster and the outputs from their analysis. There was then further opportunity to discuss these findings and review common issues.

A key part of this process was to enable an assessment of whether the cluster dynamics model is transferable to other contexts outside Scotland, i.e. directly addressing the key research question. A further output from the focus group was to gather any suggestions from the participants as to how the process could be improved, in addition to the feedback they had already given as part of the reporting back process following their own studies in each of their regions. The focus group format would allow interactive discussion on these elements.

Following this workshop the final report of the study will be prepared, and shared with the participating regions. This allows them to input into the findings to ensure they are comfortable with the conclusions drawn. This is part of the methodology to ensure agreement and informed consent from the participants. Dissemination opportunities will also be explored, including publication and sharing findings at relevant conferences e.g. Clusters 2008, which is the largest annual gathering internationally of cluster practitioners and policy makers.

4.4.1. Focus Group Structure and Process

In advance

Each region had been asked participants to prepare a 20 minute overview presentation, to include a short context piece describing the cluster & its structure, and the process used for the study and the results. In addition each participant region had also been asked to answer the key research question ('*Does the model work for clusters outside Scotland?*'), and to feedback on their experiences of using the model, highlighting up to 3 positive aspects (*what did the model enable you to do?*) and up to 3 areas for improvement (*how could the model work better?*).

On the Day

The focus group was scheduled to last from 10am until 4pm. (A full agenda is shown in Appendix 2) and included 10 participants from across the regions (including Scotland) together with a number of facilitators. (A full attendance list is shown in Appendix 3).

The morning session focused on understanding each overview presentation, agreeing the applicability of the model beyond Scotland and agreeing the positives and areas for improvement. Each region presented their study outcomes and experience. Questions were limited to clarification. Broader areas of discussion were asked to be held for the afternoon discussion session. The afternoon session focused on further exploration of these areas of discussion, exploring how to develop the model and the process of applying it for practical use, based on the positives/development areas identified during the morning.

In order to be able to gather and collate the information as the presentations took place the facilitators had pre-prepared four posters for the walls as follows:

Poster 1: Titled '*Does the Model Work Outside of Scotland?*'

- This was sectioned with '*yes'*, '*no'*, '*not yet sure*' and listed the participants' organisations/countries/clusters down the left-hand side.
- The facilitators listened to the participants' views on this question & recorded their answers, capturing any relevant associated detail, in the relevant section with a tick. Facilitators also attempted to elicit detail on what specifically participants found useful about the tool.

Poster 2: Titled *'Positives'*

- Facilitators listened to participants' presentations & the discussions around these and captured summaries of any positives highlighted (these could be related to the model itself or the process that participants used to apply it.)

Poster 3: Titled '*What Could Work Better?*'

- Again, facilitators listened to participants' presentations and the discussions around these and captured summaries of any development areas highlighted/suggested. Again, these could be related to the model itself or the process that participants used to apply it.

While participants were at lunch, the facilitators reviewed all of the contributions and grouped them into emerging themes.

After lunch the initial finding of the feedback reports was presented to the focus group (as described in the earlier part of this chapter. In addition the facilitators also gave an overview of the outcomes of groupings captured on the posters. This allowed a check with participants that they're ideas had been captured accurately and also helped to set an agreed base for the afternoon discussion on agreeing key areas for development.

Poster 4: Titled '*Actions/Development Areas/Recommendations for Improvement*

Facilitators helped capture the group discussion to agree key next steps/actions for development. This was prompted by the following questions:

- What participants would recommend that should be done next to further develop the process and;
- How they, as practitioners, intend/would want to use the model in the future, how it could best fit with other models/tools and what they will do to support further development/refinement of the process for practical use.
- What further research would they recommend/think needs to be done?

Facilitators captured any agreed actions on the poster as the discussion developed and help group them into themes. This was fed back to the whole group at the end of the session to check that these grouping adequately reflected the discussions and the sentiments of the participants.

In addition the whole focus group was recorded. This ensured that nothing was lost from the discussion, as the recordings and transcriptions could be further analysed after the event.

4.4.2. Focus Group Outputs

The focus group workshop provided a rich source of inputs tothis study, and the opportunity to explore some of the areas in depth through interactive discussion. The key outputs from the focus group are summarised into the following sections.

a) Key Research Question
b) Positives
c) Areas to improve
d) Further research areas
e) Actions from the focus group
f) Focus group process feedback

These will each be explored below.

a) Key Research Question

The whole study was designed to be able to answer the key research question, namely *'Does the model work for clusters outside Scotland?'*

Each region answered this question very positively. They had all found that the model worked for analysing clusters in their region, and that it helped describe the development of the different stages of cluster formation. These responses were therefore captured on Poster 1, shown in Fig 6.2.

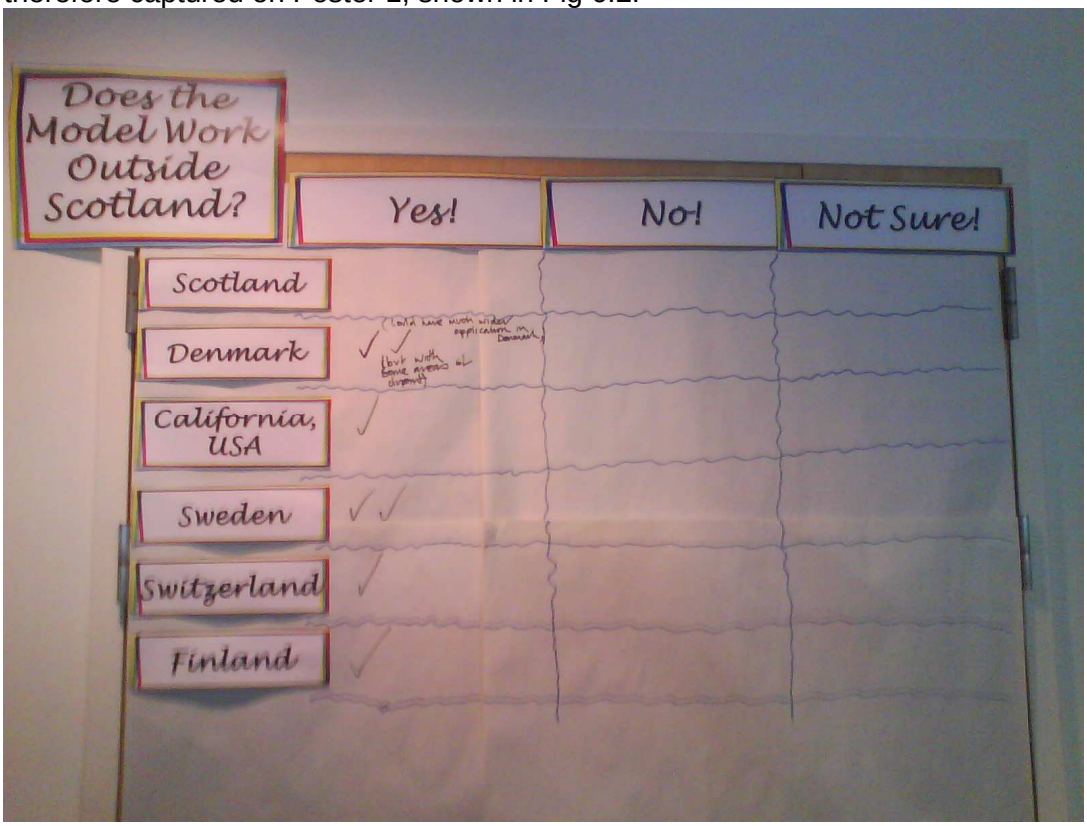


Fig 4.2 Poster 1 showing response to Key Research Question

b) Positives

To further explore why the model was felt to be successful and how it helped the participants in their analysis, each region was asked to expand on the answer to this question and explore what is enabled them to do. The key points captured from the discussion in this area were as follows (direct quotes from the workshop are shown in italics):

- The model was felt to be a unique tool for analysis of relationship dynamics/social capital in cluster development
  - *This is the **only** approach – internationally – that helps us to identify, understand and describe the necessary interpersonal interactions and relationship and group dynamics in cluster development."*
  - *There is no other internationally applicable tool that does this job so well.*
- It augments and enhances the cluster development analysis toolkit
  - The model complements and augments other cluster development analysis/study techniques. It adds depth to current analysis.
  - It provides a good description of the stages of development in clusters and helps to understand the process of cluster development.
- Allows us to tell the cluster story and track performance
  - It not only provides a historical view of cluster development, but provides a focus for development actors to develop the cluster.
  - It helps to benchmark and to track performance over time.
- It helps ask new questions, stimulates innovative thinking and clarifies strategic development priorities
  - Stimulated new, innovative thinking in cluster leaders and the businesses involved in the process and gave a platform for honest analysis and discussion
  - Asks a whole new set of questions & provides depth of inquiry.
  - *The model is provocative – it gets people thinking on how to progress the evolution of the cluster.*
- Helps to engage and integrate cluster participants
  - Good as a communication and engagement tool with cluster participants
- Easy to use
  - The process was short & less time consuming than the possible alternative approaches to doing this. The questions are clear and well formulated and structured.
- General comments
  - The process of sharing knowledge, learning and experiences of using the model with international colleagues has been very useful.
  - *I would like to congratulate Madeline on her work – it is very much in demand and is the only international tool that can be used in this area*.

c) Areas to Improve

The participants were also asked to explore how the model and /or the process could be improved. The key points captured from the discussion in this area were as follows:

- Simplify the language used in the model and the overall process
  - At first sight it was suggested the model can be complex, confusing and potentially off-putting
  - The language and terminology used in the model and the question set can be difficult which limits understanding and makes translation challenging
  - Some of the questions are not clear and the overall process is too long
- Getting the right participation and engagement in the process
  - To optimise results from the process it is essential to plan for consistent involvement/participation throughout the process (i.e. the same people contributing to all stages)

    - In addition the it is important to get a good variety of experience and background
    - Experience suggested that face-to-face, interactive workshops worked better than simply issuing questionnaires to participants
- Taking account of diversity within structures of clusters
    - The model needs to take more explicit account of the different structures/make-up within clusters, e.g. large company dominating, SME dominated, university dominated etc.
    - There is a need to capture the role of regional universities as key drivers of cluster development and competitiveness, particularly as these are so often integral to the innovation system in a region. In addition currently loop 5 is not currently well captured and may be giving a skewed picture. Therefore the questions need to be revisited and reframed to ensure they cover the extent to which strengths in research & development (including public R&D) feed effectively into the cluster and drive its development.
    - Is it a linear model? Which stages are necessary before others can take place? Does it matter as long as the analysis is useful?

d) Further Research areas

A number of areas for further research were suggested by the focus group

- The role and importance of leadership in cluster development (what is good leadership & the extent to which good leadership is an essential for progressive development of clusters).
- How to identify/understand the difference between cluster leaders and '*followers'*.
- How to integrate the results from the model into daily work, i.e. developing intervention options and implementing actions.

e) Actions from the Focus group

Many of the items already captured under "Areas for Improvement" have highlighted aspects that the focus group felt need further work or exploration. In addition there were some concrete actions suggested by the group as realistic steps which could help progress the use of the model.

- Clarify who should make most use of the model and how
    - The key use of the model was viewed to be as a self evaluation tool for cluster managers/agencies, but it was also felt to be a useful tool for cluster policy makers
    - Develop a better explanation of the model, explaining its use **in addition** to other cluster analysis tools (e.g. hard data on company numbers and employment).
- More accurately reflect the role of Universities and research organisations as key drivers of innovation
    - Change the description of university R&D to ensure the model allows for the pivotal role of this through all levels of the model. It is important to adequately capture the links between universities/research, education & business/industry & to recognise that these can contribute at all stages.
    - Review the questions in loop 5 to better reflect how research can help drive the growth of a cluster.
- Develop a "library" of intervention options designed to support progress through the model
    - Use the experience and knowledge in this learning network to develop a pool of intervention options relating to each level ('*what can we do about this*').

  - Each participant will write-up a case study describing their experiences of applying the model, and how it "tells the story" of their cluster development. This will help provide with examples of what happens at each loop.
  - Through these case studies evidence can start to be gathered about how better performance and suitable interventions can correlate with better performing clusters i.e. making the link between good assessment in the loop model and good economic performance. This is another area of further research.
- Create a new "learning network" for Cluster Managers, Cluster development agencies and practitioners
  - Develop the model as part of a '*best practice toolbox'* for cluster development practitioners/facilitators.
  - It was proposed that SE should lead to develop this group into a formal learning network for cluster managers, facilitators & others (agencies) involved in cluster development. This could be used to review experiences of using the model, on an ongoing basis, but **also** for a much wider exchange of knowledge, experience & learning on other leading-edge cluster development tools, techniques and approaches.
  - Other regions should be invited to join this group – this would extend the group's learning & the wider use of the model.

f) Focus Group Process feedback

At the end of the Focus Group Workshop participants were explicitly asked for their feedback on the process that had been used during the day. This was to make sure that they were content with their opportunity to contribute during the day, that they were confident that their input had been correctly captured and finally to allow learning for future focus group workshops.

The feedback was very positive, and the event was viewed by the participants as a success. The comments from that element are shown in Appendix 4.

5. Conclusions and Recommendations

5.1. Introduction

This final chapter will conclude the study, drawing conclusions regarding the key research question, identifying areas for action, highlighting the limitations of this study and suggesting further areas of research.

5.2. Key Research Question

The main focus of the study was to answer the Key Research Question, namely *'Does the model work for clusters outside Scotland?'*
The outputs from each of the studies, the response from the feedback reports and particularly the answer to this question at the focus group workshop from each of the ten studies over the five participating regions was an emphatic "Yes" (See Fig 4.2 for response at the focus group workshop and Fig 4.1 for the results from the Likert questions feedback as evidence of that response). The fact that they had all successfully implemented the model and the process for analysis suggested that this tool could work in many different clusters beyond the boundaries of Scotland.

5.3. Areas for Improvement

Although the model was viewed as successful and very useful for the participants, there were suggestions as to how the process could be improved.

- A clearer methodology description would be beneficial. This needs to out the cluster dynamics analysis in context, in that it is useful **in addition** to other studies and should not be seen as a replacement. For example data and analysis on cluster company performance, including such things as company numbers, employment, exporting levels, investment in research and development can give "hard data" about the cluster. The analysis using the model can help understand how the social capital and interactions within the cluster can be improved to help the cluster grow. The link between good assessment using the model and good performance data has not been proven, and this is a potential future area of research.
- The methodology should also emphasis the importance of having a workshop environment to go through the question set analysis. This enables discussion and challenge to give a more informed and honest response to the questions and as such gives a better output from the analysis. A better description of the methodology will also help repeatability of the study across new regions.
- The language used in the model and some of the questions is not necessarily clear or easily understood. Modifying this language would help make the process easier to use, especially for those partners where English is not the first language.
- The strength in research for some clusters is not well captured in the model. Questions in this area need to be reviewed in order to properly assess whether the research strength is acting in isolation to the company base or whether it is fuelling and driving cluster growth.

5.4. Limitations of the Research

There are several limitations to this study which will mean that generic conclusions that can be drawn from this research are constrained.

- The study was only carried out with a small sample, with five regions contributing ten studies. In addition the regions were not selected randomly, but were self selected by putting themselves forward for participation. As such there may well be bias in the sample as those regions already anticipated that they would find the cluster dynamics analysis useful. The limitation was ameliorated through

using the selection of different types of cluster, by having more than one study from some of the regions and from ensuring that there was clusters were from regions inside and outside of the EU and from outside Europe. However this will limit the extent of external validity and transferability of the study findings and it is only through expanding the study to further examples that the conclusions from this research can be properly tested.

- Some of the differences in results could have been because of a number of factors. These include the set up of the clusters, how they were organised, which type of organisation was driving the cluster, and even cultural differences between the regions. These differences were beyond the scope of this research project and as such were not explored.
- Despite the methodology being shared with all the participants at the start of the project, there were still some differences in approaches across the studies. Although they were not major, this could still have led to some differences in results. Exploring the effect of these differences was also beyond the scope of this research. Indeed having slight differences between the study approaches helped test the main hypothesis in different contexts. However the effect of differences was not explored.
- Finally the link between good cluster performance from an economic output point of view and good performance from assessment from the model has not been explored. This is potentially a key area for further research.

5.5. Further Research

During the study a number of areas of further research have been suggested.

- Expanding the study to more partners would overcome some of the limitations of the study. This would not be exploring a different research question, but would be testing the hypothesis in a wider context of clusters. One of the suggestions from the study participant was to develop a “learning network” of those practitioners and policy makers using the model. This could therefore act as a source of study participant for a wider analysis.
- Potentially the most important area for further research would be to explore the relationship between good assessment using the model and good economic performance of the cluster involved. Whereas there have been studies linking strong social capital in a region to good economic growth (Helliwell and Putnam 2000) the evidence between this model and growth has not been gathered.
- One area of discussion with the participants was around whether the model was linear. Although there was some agreement that the earlier stage of the model (levels 1 and 2) needed to be developed before further development (into level 3, 4 and 5) could take place it was less clear if these later stages happened sequentially and in that order. The conclusion from this study was that regardless of the order this model was still felt to be a useful assessment tool. However further exploration of the stages of development may be a fruitful area of research.
- Other areas for research highlighted by the study included roles within a cluster, including power, dominance and relationships and the importance of leadership. (The recent EIU survey (EIU 2007) on collaboration highlighted deficient leadership as one of the main barriers to effective collaboration, so this is a key topic of interest in this area). These are common areas of research in collaboration that could be applied to a cluster environment. Linked to this was the question of the reasons for an organisation to participate in a cluster. This was felt to be a useful area for further exploration as it could inform cluster

practitioners and policy makers in their attempts to gain organisational involvement in their cluster interventions.

5.6. Next Steps

Resulting from this study there are a number of actions that can help take the outputs and further apply them for the benefit of Scottish Enterprise and the other participants.

- Act on the areas for improvement highlighted by the study, including developing a clearer methodology, simplifying the language and exploring how the research strengths of a cluster could be better captured.
- Collect case studies from the participating clusters, to better explore how the clusters have developed, to capture where successful interventions have proved beneficial to cluster development, and potentially to begin to explore the link between good cluster dynamics performance and strong economic performance.
- Expand the study to others and initiate a "learning network" for those involved so that we can share experience and gain knowledge from each other.

5.7. Conclusions

Overall, although this was a small study with a number of limitations, it did manage to test the main hypothesis that the cluster dynamics model was transferable outside Scotland and concluded it to be true. The response from the participating regions to the model was extremely positive. In addition some proposals for improvements to the process were captured and can now be initiated and some further areas of research have also been suggested.

The cluster dynamic model tries to describe the development of a cluster, and use of this model should help practitioners to intervene effectively to support that development. At the heart of cluster development is deeper forms of collaboration giving benefit to all parties. Although challenging and involving risk, the potential gains to be achieved from this way of working can be hugely rewarding. "The *world of collaboration*. It is a world where it is possible to feel inspired. Almost anything is, in principle, possible through collaboration because you are not limited by your own resources and expertise. You can, in principle, achieve whatever visions you may have by tapping into resource and expertise of others…, when it works well you can feel the collaborative energy." (Huxham and Vangen, 2005, p3)

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Appendix 1 - Feedback questionnaire

Exploring Cluster Dynamics International Study

Feedback Questions
Please answer the following questions using a Likert scale – 1 very weak/poor to 5 very strong/good. There is also free text space for further explanation.

1. On completion of the study was this felt to be an accurate description of the stage of development of the cluster/sector?
   1 2 3 4 5

Further comments:

2. Does the group feel this would be equally applicable to other clusters/sectors in their area?
   1 2 3 4 5

Further comments:

3. Does the group feel this has been a useful process in identifying the stage of development of their cluster/sector?
   1 2 3 4 5

Further comments:

4. Does the group feel that the model suitably describes the stages of cluster development?
   1 2 3 4 5

Further comments:

5. Does the group feel that the methodology/process was appropriate in testing the model?
   1 2 3 4 5

Further comments:

6. Could the process be improved?
   Please add comments:

7. Could the model be improved?
   Please add comments:

8. What areas of further research/analysis are needed?
   Please add comments

9. What other methods do you use to describe cluster development?
   Please add comments

Appendix 2 – Workshop Participants

Cluster Dynamics International Workshop
24th June 2008

Participants

- Denmark - Mechatronics and ICT:
  Lotte Landkilde (representing FORA)
  Lars Horsholt Jensen from the ICT cluster in Northern Denmark

- California - Water Flow Technology Cluster :
  Kathie Studwell, representing the California Water Flow Technology Cluster,
  Laura Ramos of the International Center for Water Technology

- Sweden - Steel, Paper and pulp;
  Cecilia Johansson, Rolf Nilsson, from Vinnova

- Switzerland - ICT Cluster Bern ;
  Christoph Beer from TCE

- Finland - ICT sector :Ubiquitous Computing, Open Source, Sustainable Energy, and Intelligent Machines ;
  Karen Thorburn (Ubiquitous Computing Cluster Programme)

- Scotland – Lifesciences, Energy and Food & Drink
  Madeline Smith, James Alexander, Andy McDonald, David Robson, Margaret Maynard, and Ross Brown from Scottish Enterprise (SE)

Appendix 3 – Workshop Agenda

Cluster Dynamics International Workshop
Agenda
24th June 2008

Participants:
Denmark
Sweden
Finland
Switzerland
California
Scotland

10.00 Welcome and introduction — Madeline Smith

10.30 Feedback on study from each group — All
6 presentations on studies is each regions and results
Max 20 mins each
- Scotland
- Denmark
- California
- Sweden
- Switzerland
- Finland

13.00 Lunch

13.30 Initial analysis from reported results — Madeline Smith
Feedback from morning presentations — Margaret Maynard

14.00 Discussion — All
- Is this a useful model?
- Is it applicable generically?
- How could the process be improved?
- How could the model be improved?
- What stimulates progressions through the model
- What good practices in interventions can be shared?
- How are partners planning to use the model?

16.00 Next Steps — Madeline Smith

16.30 Close

Appendix 4 – Workshop Feedback

CLUSTER DYNAMICS STUDY LEARNING WORKSHOP

MEETING FEEDBACK

What Went Well?

- Very good format. Good facilitation techniques which moved the discussion forward without cutting it short. Good time management.
- Very open mindset. Well prepared. Good size & mix of the team.
- Good, open conversation & discussion with nice people – a good source for further discussions.
- Organisation & structure of the workshop.
- Size of the group.
- Very well planned, professionally carried out with the recording and the facilitators' work.
- Comfortable environment, conducive to productive discussion.
- Good size of group for discussion.
- It was a very well organised and effective meeting.
- Interesting to get to learn what other 'nations' have learned from their exercise.
- Meeting environment was comfortable and supportive. Communications technology was great. Looking forward to reading the write-up.
- Well structured &, throughout, great preparation. Great break between mini case studies & discussion.
- Great meeting management – time, flow and agenda were great.
- Great ideas and open minds from participants.
- Good learning opportunity, both for cluster managers and national agencies.
- Wonderful opportunity for learning and sharing. Want to stay involved to help write article and learning network.
- Time is going too fast!

What Could We Improve for Next Time?

- Different national pre-requisites – this could be discussed more.

- Improve background info on cluster – a little more, not just on clusters related to the model

- Same structure for country presentations – a little confusing as we were not focussing on the same issues!

- Time is going too fast!

Appendix 5 - Reasons for Participating in the Cluster Dynamics Study

It is interesting to review the reasons that the different partners gave for participating in the study. All of the regions had volunteered to put time, effort and resources into the study, and to support the participation of their delegates to the focus group workshop. As such there was a good deal of commitment and input to the study. At a relatively early stage in the process, i.e. whilst many of the studies were still just in the planning stage, they were asked what were their reasons for being willing to participate. Their responses are detailed below. (N.B. The Swiss partner had not at this stage confirmed their participation and so were not included in this analysis.)

According to the participants from **Finland** the Finnish cluster agreed to participate because:

- "There is a distinct lack of these kinds of tools available to cluster managers. There are of course companies that specialise in cluster mapping services etc., however it is more interesting for us to test out a tool and methodology which has been developed by another regional/national development agency.
- The Finnish cluster really recognises the potential value of the cluster dynamics study, since it is easy to get caught up in daily operations, rarely stopping to take a truly critical look at the clusters' development.
- The Finnish cluster is forward-thinking and is willing to take a certain amount of risk in anticipation of more return (acquisition of a tool which can be used again in the future and which should really help the cluster identify its stumbling blocks).
- The fact that the project involves partners from around the world is also a big bonus for us. It will permit the transfer and sharing of knowledge, experiences and good practices and help towards increased standardisation"

According to the **Danish** participants, they are part of the study because:

- by studying the Scottish model, testing the model on Danish clusters and discussing the results with the Danish clusters and international partners, Denmark expects to obtain different input and views on how to develop our own methodology for designing, studying and collecting cluster specific data
- Denmark is in the process of establishing a Danish Cluster Academy. One of the tasks in the academy is to have a tool-box for taking the "temperature" on clusters. The loop[1] is a first step in obtaining inspiration on how to develop such a tool
- FORA is leading Work package 4 in the BSR Innoprojects, which is a cluster project under the DG enterprise of the European Commission. One of the tasks in this taskforce is to identify fact-based cluster specific framework condition. Working with - and understanding - the loop is a step in this direction

[1] The "Loop" is shorthand for the name of the Scottish Enterprise cluster development model.

And from the participants from **Sweden**:

- Our clusters wanted to test themselves and they wanted to have an opportunity to discuss the "small", main questions.
- A main reason is that they saw it as a help for their clusters' development. One of the Cluster leaders described the meeting on the model as "one of the best meetings we had had for the long time."
- It will be interesting to participate in an international evaluation-pilot and to have the opportunity to compare themselves with other clusters.
- It is important to keep in mind that in Sweden (Europe) the clusters have big trust for the national side - we are glad to "help" each other and we have no anxiety talking about trust."

California, outlining reasons for participating in "this unique study" the main reasons for participating in the Scottish Enterprise research study are:

- To identify whether interventions are needed to move the cluster to another level so as to fully realize the full economic potential of the cluster organization;
- To learn from other countries' experience with cluster organizations;
- To promote the success of the Fresno Water Flow Technology Cluster and give it exposure to the international community.

In general the feedback on reasons for participation was very positive from participants, including what they saw as the value of the model, that they view it as lead practice and they can see the benefit of using it with their clusters, as well as the benefit in general from participating in these type of collaborative studies.