

# **The Structural Design of Regional Clusters**

**An exploration of the evolution of structural  
designs and the influence on cooperation**

**Egbert Eshuis**

## **Explanation of cover**

The background of the cover is a leaf in which several veins are present that differ in direction and size. The veins form the structure of the leaf. A leaf is very like a regional cluster.

The veins may be different of function, size and direction. But together the different veins form a leaf. The veins represent different organizations that differ from each other or are heterogeneous, but are located in each other's vicinity. Despite the differences they form together a leaf or a cluster. Each vein is needed for the strength of the leaf, without a large central vein the smaller veins are nothing and without the smaller veins a large central vein is nothing. A central vein takes care of feeding the leaf and direct the smaller veins, like a central actor can feed and direct the other organizations involved in a cluster. But the smaller veins are also connected to each other in order to become a large, fully developed and strong green leaf.

In its environment a green leaf takes care of providing oxygen for its environment in which all kinds of animals and humans can live. Clusters also provide oxygen, by generating innovations, profitability and employment. But as almost any leaf, in the autumn of its life the leaf loses its green colour and its function. Clusters can be very prosperous, but do not have the eternal life and are mortal like any other creature.

## **Verklaring van cover**

De achtergrond van de cover is een blad waarin verschillende nerven zichtbaar zijn die verschillen qua grootte en richting. De nerven vormen de structuur van het blad. Een blad lijkt op een regionaal cluster.

De nerven mogen dan wel verschillend zijn qua functie, grootte of richting. Maar samen vormen de nerven het blad. De nerven staan voor de verschillende organisaties die verschillen ten opzichte van elkaar, maar in elkaars omgeving aanwezig zijn. Ondanks de verschillen vormen ze samen een blad of cluster. Elke nerf is nodig voor de sterkte van het blad, zonder een grote centrale nerf zijn de kleine nerven niets en zonder de kleine nerven is de grote centrale nerf niets. Een centrale nerf zorgt voor voedsel en de richting van de kleinere nerven, zoals een centrale actor de overige organisaties in een cluster kan voeden en besturen. Maar de kleine nerven zijn ook verbonden met elkaar om een groot, volledig ontwikkeld en sterk groen blad te worden.

In zijn omgeving zorgt een groen blad voor zuurstof voor haar omgeving waarin allerlei dieren en mensen kunnen leven. Clusters zorgen ook voor zuurstof, door het creëren van innovaties, winstgevendheid en werkgelegenheid. Maar zoals elk blad verliest het blad haar kleur en functie in de herfst. Clusters kunnen voorspoed brengen maar hebben niet het eeuwige leven en zijn sterfelijk zoals elk ander schepsel.

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**“of making many books there is no end; and much study is a weariness of the flesh.”**

**Ecclesiastes 12:12 – The Bible**

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## Preface

With this thesis I will complete the Master of Business Administration at the University of Twente. As a specialization I have chosen the track Innovation Management. In this track attention has especially been paid to the benefits and opportunities of cooperation for the innovation performance of companies. Cooperation can have several forms; a regional cluster is an example of a form of cooperation.

The VMO (Verenigde Maakindustrie Oost) and the ADGEN Cluster (Aerospace and Defence Group East Netherlands) in particular have provided me the opportunity to examine the structure of (regional) clusters. I would therefore like to thank Bert Wessels and Martin Leushuis for establishing the first contacts and giving me the opportunity to execute this research, respectively. I have learned a lot in the half year at the VMO, and will never forget the 'pure humor' (I would therefore also like to thank Petra Deterink).

The purpose of the research has been to investigate the structural design of regional clusters, its evolution and the influence of the structural design on cooperation. Cooperation (and competing), especially between horizontal partners, is quite a challenge as I have noticed. Despite the fact that designing a solution to the problems of the ADGEN Cluster turned out not to be possible, I sincerely hope that they incorporate the suggested recommendations. Because there is one thing that I have noticed during my graduation assignment: cooperation can be beneficial for all partners involved.

By means of semi-structured interviews, and other valuable data that has been made available, I have been able to execute this research and answer my research questions. The interviews could not have been executed without the input from the people from the organizations involved in the various clusters. I would sincerely thank them for offering me some of their valuable time for my research. Their interest in this research strengthens my opinion that there is a need for knowledge on the management of clusters in practice.

I would also like to thank my supervisors. First, I would like to thank Dries Faems for his valuable input in this research. He has been of great help to guide the research. I would also like to thank Jeroen Kraaijenbrink, my second supervisor, although our meetings have been infrequently, the input during those sessions always has been valuable. Last, I would like to thank Robert Pelgrim from the ADGEN Cluster, he might have had a minor role, but the synchronization with practice is always useful.

Finally, I would like to thank my parents, family and friends for providing me a basis on which I could fall back on if things were not clear or not going as planned. Last, but certainly not least, I would like to thank Rianne for her patience, support and bringing me down to earth if necessary. I will never forget this period!

*Egbert Eshuis*

*Wierden, 26 August 2008*

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## Management Summary

Regional clusters have been identified as one potential mechanism in which organizations can engage in cooperative efforts with other organizations. The performance effects of such clusters are well described in literature, but how to manage a cluster effectively is not described. There are some indications that managing a cluster might not be a straightforward task because organizations cooperate and still strive for their own goals at the same time. A cluster that has problems with the management of a cluster is the ADGEN Cluster, Aerospace and Defence Group East Netherlands, a cluster that is established at the end of 2006 under the charge of the VMO (Verenigde Maakindustrie Oost).

A qualitative research has been executed in order to give an advice. In this research the structural design (measured by three dimensions: level of formalization, centralization and heterogeneity) in the initial phase of regional clusters and the evolution of the structural design has been explored. In literature there is a contradiction between scholars about the influence of each dimension on cooperation. Each dimension can influence cooperation positively and negatively. Therefore also the influence of the structural design of a regional cluster on cooperation has been examined.

Nine cases have been studied in this research, three from literature and six from practice, in order to examine the structural design of regional clusters and the influence on cooperation. In these cases organizations are, or have been, cooperating together in a regional cluster form. The structural design in the initial phase, the evolution of the structural design and the influence on cooperation has been examined per case and similar cases or influences have been grouped and compared to other groups in order to discover within-group similarities and cross-group differences.

There are three main conclusions that could be derived after this study. First, the structural design can vary among the clusters in the initial phase. Different levels of formalization are related to different levels of cooperation; the higher the level of cooperation, the higher the level of formalization is likely to be. A high level of centralization is not likely to be present in the initial phase of regional clusters because organizations want to maintain their autonomy. Vertically oriented clusters have a moderate form of centralization; horizontally oriented clusters have a low level of centralization. The level of heterogeneity depends on the goals and environment of a cluster and on the type of partners needed.

Second, it is likely that the level of formalization will increase or be sustained. But it has not decreased in the studied cases. The reasons for an increase are that additional rules concerning the cooperation are needed or more formalization (less degree of freedom) is needed. The level of centralization sustains in horizontally oriented clusters and increases in vertically oriented clusters because more management is required or central actors emerge, unintended

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and intended. In general the change of the level of heterogeneity depends on the environment and goals of a cluster and the type of partners needed.

And last, both negatively and positively influences of the (evolution of the) structural design on cooperation have been identified. A high level of formalization positively influences cooperation because it provides a framework. Because of the negative influence (distrust and high risk), a moderate form of formalization is chosen in order to develop trust and mitigate uncertainty. An increase in the level of formalization stimulates cooperation because more additional rules are established in order to establish a more accurate framework for the cooperation. A moderate form of centralization is perceived as necessary in vertically oriented clusters because organizations want to maintain their autonomy but coordination is also required. The increase of centralization (in vertically oriented clusters) results in more coordination of a cluster and so stimulates cooperation. A high level of heterogeneity can stimulate cooperation because the members can learn from each other and need each other in order to benefit from the cluster. However, when the cognitive distance is too large, it has a negative effect because organizations do not speak the same language or understand each other. A medium level of heterogeneity has less positive influence on cooperation because organizations in the same field share, but also want to protect, their resources. An increase in the level of heterogeneity positively influences cooperation because more partners enrich a cluster or cooperation is stimulated because more commitment is created.

Based on the current situation and this study several recommendations have been made to start up a cluster and manage it. These recommendations can be grouped in three managerial implications. First, an independent chairman or an independent organization should be installed in order to secure a prosperous development of the cluster by serving as a process mentor and coordinating the cluster. Second, it is not recommended to use a high level of formalization for the cluster in the initial phase. However, several arrangements should be made in order to create unity. For example, a joint goal can be established by identifying what the (potential) added value of this cluster is for its environment, an annual contribution can be established in order to increase the level of commitment and arrangements on cooperation can be made, for example a preferred supplier procedure or project specific contracts, in order to provide some sort of framework for cooperation and make the cooperation transparent. Organizations need to become acquainted in order to facilitate the development of trust; not only top and senior management should become acquainted. Also lower levels should become acquainted, on the long term, because they are in practice the ones who cooperate directly with each other. Third and last, the level of heterogeneity of the current composition seems relative low at first sight. The cluster should be compared to market demands and the composition should be adjusted to those demands in order to meet those demands if necessary. Also those organizations that are an OEM'er, first tier or second tier need to be identified in order to organize the cluster around those organizations, because they can coordinate the cluster.

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## Management Summary (in Dutch)

Regionale clusters zijn geïdentificeerd als een potentieel mechanisme waarmee organisaties kunnen samenwerken met andere organisaties. De prestatie effecten van zulke clusters zijn goed beschreven in de literatuur, maar hoe een cluster effectief is te managen is niet beschreven. Er zijn enkele aanwijzingen dat het managen van een cluster geen eenvoudige taak is omdat organisaties samenwerken, maar tegelijkertijd hun eigen doelen zullen willen bereiken. Eén van de clusters die problemen heeft met het managen van een cluster is het ADGEN Cluster, Aerospace and Defence Group East Netherlands, een cluster dat is begonnen eind 2006 onder de hoede van de VMO (Verenigde Maakindustrie Oost).

Er is een kwalitatief onderzoek uitgevoerd om een advies te kunnen geven. In dit onderzoek is het structurele ontwerp (gemeten aan de hand van drie dimensies: niveau van formalisatie, centralisatie en heterogeniteit) van regionale clusters in de initiële fase en de evolutie van het structurele ontwerp onderzocht. Er is in literatuur een contradictie over de invloed van elke dimensie op samenwerking. Elke dimensie kan een positief en negatief effect hebben op samenwerking. Daarom is ook de invloed van het structurele ontwerp op samenwerking onderzocht.

Negen cases zijn bestudeerd in dit onderzoek, drie uit de literatuur en zes uit de praktijk, om het structurele ontwerp van regionale clusters en de invloed op samenwerking te onderzoeken. In deze cases werken organisaties samen of hebben ze samengewerkt in een regionale cluster vorm. Het structurele ontwerp in de initiële fase, de evolutie van het structurele ontwerp en de invloed op samenwerking is onderzocht per case en gelijke cases of invloeden zijn gegroepeerd en vergeleken met andere groepen zodat overeenkomsten binnen groepen en verschillen tussen groepen ontdekt kunnen worden.

Er zijn drie hoofdconclusies af te leiden uit het onderzoek. Ten eerste, het structurele ontwerp kan variëren tussen de clusters. Verschillende niveaus van formalisatie zijn gerelateerd aan verschillende niveaus van samenwerking, hoe hoger het niveau van samenwerken, des te hoger zal het niveau van formalisatie zijn. Een hoog niveau van centralisatie is niet waarschijnlijk in de initiële fase van regionale clusters omdat organisaties hun autonomie willen behouden. Verticaal georiënteerde clusters hebben een middenvorm van centralisatie, horizontaal georiënteerde clusters hebben een laag centralisatieniveau. Het niveau van heterogeniteit hangt af van het doel en omgeving van clusters en welke type organisaties nodig zijn.

Ten tweede, het is erg waarschijnlijk dat het formalisatieniveau zal stijgen of gelijk blijven. In geen van de cases is het niveau gedaald. De redenen voor een stijging zijn dat meer regels nodig zijn voor de samenwerking of meer formalisatie (minder vrijheid om activiteiten uit te voeren naar eigen inzicht) is nodig. Het niveau van centralisatie blijft gelijk in horizontaal georiënteerde clusters en stijgt in verticaal georiënteerde clusters omdat meer management



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nodig is of centrale actoren ontstaan, bewust of onbewust. In het algemeen hangt de verandering van het niveau van heterogeniteit af van de doelen en omgeving van een cluster en het type partner dat nodig is.

Ten laatste, zowel positieve en negatieve invloeden van (de evolutie van) het structurele ontwerp op samenwerking zijn geïdentificeerd. Een hoog niveau van formalisatie beïnvloedt de samenwerking positief omdat het een raamwerk biedt. Vanwege het negatieve effect (wantrouwen en hoge risico's), is een middenvorm gekozen om vertrouwen te laten ontwikkelen en onzekerheid te beperken. Een stijging in het niveau van formalisatie beïnvloedt de samenwerking positief omdat meer regels worden vastgelegd die een beter raamwerk bieden. Een middenvorm van centralisatie wordt nodig geacht in verticaal georiënteerde clusters omdat organisaties hun autonomie willen behouden maar ook coördinatie vereist is. De stijging van het niveau van centralisatie (in verticale clusters) resulteert in meer coördinatie en stimuleert zo samenwerking. Een hoog niveau van heterogeniteit kan samenwerken stimuleren omdat leden van elkaar kunnen leren en elkaar nodig zijn om te kunnen profiteren van het cluster. Maar wanneer de cognitieve afstand te groot is, heeft dit een negatief effect op samenwerking omdat de organisaties niet dezelfde taal spreken of elkaar niet begrijpen. Een middenvorm van heterogeniteit heeft minder positief effect op samenwerken omdat organisaties in een gelijk veld hun resources willen delen maar tegelijkertijd beschermen. Een stijging in het niveau beïnvloedt samenwerking positief omdat meer partners een cluster verrijken of omdat samenwerking wordt gestimuleerd omdat meer betrokkenheid is gecreëerd.

Op basis van de huidige situatie en dit onderzoek zijn verschillende aanbevelingen opgesteld. Deze aanbevelingen kunnen gegroepeerd worden in drie management acties. Ten eerste, een onafhankelijke voorzitter of een onafhankelijke organisatie zou geïnstalleerd moeten worden om te zorgen voor een vruchtbare ontwikkeling van het cluster door het cluster te coördineren en te fungeren als een proces mentor. Ten tweede, het is niet aanbevolen om een hoog formalisatieniveau te gebruiken in de eerste fase. Maar verschillende afspraken zouden gemaakt moeten worden om eenheid te creëren. Bijvoorbeeld, een gezamenlijk doel kan worden opgesteld door het identificeren van de toegevoegde waarde van het cluster voor haar omgeving. Door een jaarlijkse bijdrage kan de betrokkenheid worden vergroot. Ook kunnen afspraken over samenwerking worden gemaakt, bijvoorbeeld een preferred supplier procedure of project specifieke contracten, om een soort van raamwerk te bieden en de samenwerking transparant te maken. Organisaties zullen om vertrouwen te ontwikkelen elkaar moeten leren kennen, niet alleen top en senior management. Ook lagere niveaus moeten elkaar leren kennen, op de langere termijn, omdat zij in de praktijk direct samenwerken met elkaar. Ten derde en tot slot, de heterogeniteit van de huidige samenstelling van het cluster lijkt relatief laag op het eerste gezicht. Het zou vergeleken moeten worden met de eisen van de markt en de samenstelling zal indien nodig aangepast moeten worden om te voldoen aan die eisen. Ook zullen die organisaties die een OEM'er zijn, first tier of second tier zijn geïdentificeerd moeten worden om het cluster te organiseren rondom die organisaties omdat zij in staat kunnen zijn om het cluster te coördineren.

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## Table of content

Preface.....	II
Management Summary .....	III
Management Summary (in Dutch).....	V
1. Introduction .....	1
1.1 Research Setting .....	1
1.2 Research Goal .....	2
1.3 Research Objective.....	3
1.4 Central Question.....	4
1.5 Structure of thesis.....	4
2. Theoretical Framework .....	5
2.1 What are regional clusters? .....	5
2.2 Structural design of regional clusters .....	8
2.3 Evolution of structural design over time .....	10
2.4 Influence of structural design on cooperation .....	13
2.5 Overview .....	16
2.6 Research Questions .....	17
3. Research Methodology.....	19
3.1 Qualitative Research .....	19
3.2 Multiple Case Studies.....	19
3.3 Selection of cases .....	21
3.3.1 Sampling of cases.....	22
3.4 Description of cases .....	24
3.4.1 Case I: TIMP Cluster.....	24
3.4.2 Case II: InBroNet .....	25
3.4.3 Case III: Italian Consortium of Opera Houses .....	26
3.4.4 Case IV: ProzessKompetenz.eu .....	26
3.4.5 Case V: Focus Group Internationalization of the VMO .....	27
3.4.6 Case VI: Dutch Sigma.....	28
3.4.7 Case VII: Mechatronica Valley Twente.....	29
3.4.8 Case VIII: “PCT” .....	30
3.4.9 Case IX: NOM TxU Network Program Compensation Projects .....	30
3.5 Data Collection.....	31
3.5.1 Interviews .....	32
3.6 Data Analysis .....	34

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4.	Results .....	37
4.1	Level of formalization.....	37
4.1.1	Initial phase .....	37
4.1.2	Evolution .....	40
4.1.3	Influence on cooperation.....	42
4.2	Level of centralization.....	47
4.2.1	Initial phase .....	47
4.2.2	Evolution .....	49
4.2.3	Influence on cooperation.....	52
4.3	Level of heterogeneity.....	57
4.3.1	Initial phase .....	57
4.3.2	Evolution .....	61
4.3.3	Influence on cooperation.....	65
4.4	Overview .....	70
5.	Discussion and Conclusion .....	71
5.1	Discussion .....	71
5.1.1	The structural design in the initial phase.....	71
5.1.2	The evolution of the structural design.....	73
5.1.3	The influence of the structural design on managing cooperation .....	75
5.2	Conclusion.....	79
5.3	Limitations .....	80
5.4	Suggestions for further research.....	81
6.	Recommendations .....	83
6.1	Problem setting.....	83
6.2	Recommended structural design .....	85
6.3	Influence on cooperation.....	88
6.4	Managerial implications.....	89
	References .....	91
	List of abbreviations.....	94
	List of figures .....	95
	List of tables .....	95
	Appendices.....	96
	Appendix I:           Interview protocol	
	Appendix II:         Quick scan form	

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# 1. Introduction

In this chapter the subject and goal of this research will be introduced. The research is focusing on the structural designs of regional clusters. The evolution of the structural design and its influence on cooperation is being examined. This research is executed for the ADGEN Cluster. ADGEN stands for “Aerospace and Defence Group East Netherlands” and consists of several companies that are member of the VMO (Verenigde Maakindustrie Oost), which is the initiator of the research. The cluster is targeting a specific segment: the Aerospace and Defence market. First, the setting of the research will be described by discussing the problems of the ADGEN Cluster briefly. Next to this the research goal will be described from a theoretical point of view resulting in a research objective. Then the central question will be formulated. Finally, the structure of the remainder of this thesis will be described.

## 1.1 Research Setting

The “Verenigde Maakindustrie Oost” (VMO), is the branch organization for all industrial production companies and knowledge carriers in the production industry in East Netherland. The organization comprises more than 170 companies and knowledge carriers. The goal of the VMO is to enhance the sustainability of the production industry in East Netherland. The VMO takes care of the interests of its members, not only by a large number of initiatives but also by supporting the members directly in mutual company initiatives in order to create optimal chances and opportunities.

The research is executed for the Aerospace and Defence Cluster of the VMO. In this cluster a group of sixteen companies wants to cooperate with each other. These companies are both complementary and substitutable to each other. Also the size varies between small and medium enterprises and divisions of large national corporations. The group wants to cooperate for a specific market segment: Aerospace and Defence. From the end of the year 2006 the cluster has tried to develop itself but they have not succeeded until this date.

During interviews with five members of the cluster that have experience with other, previous clusters it turned out that in this cluster some companies have distrust, or a negative experience with other clusters in this region. On the other hand there are also companies that have a good experience with cooperation in a cluster. But there are also companies that are not experienced with cooperation in a cluster at all. So because the companies have both negative and positive experience with clusters, or have no experience at all, they do not now how to cooperate in a cluster. During the interviews also questions have been asked about their expectations and the problems they expected to occur. They expected that some problems would occur if things are not managed in a proper way: no trust because the companies do not know each other that well, or because companies are only focusing on themselves and not on the cooperation. Also the division of work and how to manage that was

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perceived as a potential problem. Also the current size is perceived by some as problematic, because the size of sixteen companies is too large according to some interviewees: *“the quality of members is more important than the quantity”*. In the next section clusters and cooperation will be introduced from a theoretical point of view.

## 1.2 Research Goal

Since the '80's of the previous century (or even before that) the paradigm towards innovation has changed from a closed to an open paradigm. The concept of open innovation is mentioned by Chesbrough (2003). There are some principles underlying this concept that explain the thinking behind this concept. These principles are: not all the smart people work for us; we need to work with smart people inside and outside our company; external R&D can create significant value: internal R&D is needed to claim some portion of that value; we don't have to originate the research to profit from it; building a better business model is better than getting to market first; if we make the best use of internal and external ideas; we will win, we should profit from others' use of our IP and we should buy others' IP whenever it advances our own business model (Chesbrough, 2003: 38).

This concept is thus suggesting that an organization is not able to do everything itself, but that an organization is dependent on other organizations to get things done. Open innovation refers to the open boundaries of the organization in order to achieve innovation. This implies that organizations must cooperate with other organization to achieve their goals in an effective and efficient way.

Regional clusters have been identified as one of the potential mechanisms through which organizations can engage in cooperative efforts. Clusters are in general defined as a geographically confined concentration of organizations that can be similar, related or complementary and clusters can involve linkages to the knowledge field (Porter, 1990; Rosenfeld, 1997; Roelandt and Den Hartog, 1999). Clusters can be categorized as horizontal or vertical or even as a combination of both. Vertically clusters are the traditional buyer-seller relationships in the value chain networks of organizations. Horizontal clusters are competing organizations that cooperate with each other. A combination of the two implies that there are both horizontal and vertical linkages between complementary and substitutable partners in a cluster. Studies, especially from agencies linked to the government like the OECD, also have provided evidence that (regional) clusters might have a significant positive effect on the economical and innovation performance of a region and the partners in a cluster. Clusters are also considered to be an important mechanism to foster innovation in Europe according to the latest communiqué from the EC Lisbon Programme.

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Clusters can thus be considered to be an important mechanism to foster innovation at a regional level (Porter, 1990; Rosenfeld 1997; EC Communiqué Lisbon Program, 2006). Firms can use clusters to interact with each other and with other organizations such as learning or technology centres like universities. The most famous example of a cluster is Silicon Valley in the United States of America.

However, much less is known about how to manage regional clusters in an effective and efficient way (seen from a “helicopter” point of view) since the studies have mainly been focused on the performance aspects and effect of clusters. There are some indications that managing clusters might not be a straightforward task. On the one hand partners in a cluster are cooperating with each other to achieve a mutual goal. This mutual goal can encompass a variety of goals dependable on the nature of the cluster. So partners can cooperate with each other, but on the other hand partners are also striving to achieve their own goals. They cooperate and compete at the same time (e.g. Porter, 2000).

The cooperation in regional clusters is examined in this research by looking at how the structural design influences cooperation. The structural design is understood in this research as ‘a composition of the structural position that partners in a clusters have towards each other’ (Burt, 1992 (in Williams, 2005)). It will be measured by three dimensions, the level of heterogeneity, the level of centralization and the level of formalization. The latter two are based on concepts from Organizational Design, the first is based on the different definitions of a regional clusters. These dimensions will be elaborated in Chapter 2. Cooperation is understood in this research as the process of organizations that come together, interact and form psychological relationships (Smith et al., 1995). The term ‘cooperation’ covers (in this research) the whole continuum that is recognized in literature, with cooperation at the low end and collaboration at the high end (Thomson and Perry, 2006). In literature there is a contradiction, each dimension of the structural design both positively and negatively influences cooperation according to different scholars. See Chapter 2 for some more elaboration on the concept of regional clusters, structural design, cooperation and the influence of the structural design on cooperation.

### **1.3 Research Objective**

In this research it is explored how partners in a cluster are cooperating together. This is done by looking at how the structural design influences cooperation. The evolution over time is also important because this can be caused by cooperation or influences cooperation. So in order to establish a deeper insight into the dynamics of the structural design and the influence on cooperation also the evolution over time is important, because the composition of a cluster is likely to change over the time (e.g. Klein Woolthuis, 1999; Lechner and Dowling, 1999), and the reasons why might be related to cooperation.

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## 1.4 Central Question

The core problem, or central questions, of this research, based on the research objective, is formulated as:

*“How are structural designs of regional clusters evolving over time and how does the (evolution of the) structural design influence cooperation?”*

### Definitions:

- *Structural design*: is a composition of the relationships between partners, the structural position that partners in a cluster have towards each other (Burt, 1992 (Source: Williams, 2005)). It will be “measured” by three dimensions: formalization, centralization and heterogeneity.
- *Regional cluster*: “Arrangements between groupings of a distinct number of similar, related or complementary organizations in different fields that compete but also cooperate in a geographically bounded region. Sometimes it involves linkages to the knowledge field. The goal of a cluster is to gain or sustain competitive advantage.” (Own definition, based on Porter, 1990 and 2000; Rosenfeld, 1997, Roelandt and Den Hartog, 1999; Lechner and Dowling, 1999)
- *Cooperation*: the process of organizations that come together, interact and form psychological relationships (Smith et al., 1995); it covers the whole continuum between cooperation at the one side and collaboration at the other side (Thomson and Perry, 2006).

These definitions are further discussed in the theoretical framework.

## 1.5 Structure of thesis

In Chapter 1 “Introduction” the topic is presented resulting in a *Research Objective* and *Central Question*. In Chapter 2 “Theoretical Framework” a theoretical base is developed based on a study in literature on this subject, and the *Research Questions* derived from the theoretical framework will be presented and discussed. In Chapter 3 “Research Methodology” the used methodology in this research is discussed. It will be explained and elaborated how the research questions are answered by means of multiple case studies in a qualitative research and why this specific methodology is used. Here, also the cases will be described and the means of data collection and analysis will be discussed. In Chapter 4 “Results” the results are presented that are derived from the case studies. In Chapter 5 “Discussion and Conclusion” the results of this research are discussed and linked to the *Theoretical Framework* (Chapter 2) and a *Conclusion* will be made up. Next to this *Limitations* and *Suggestions for further research* will be given. In Chapter 6 “Recommendations” an advice to the ADGEN Cluster is given how to structure their cluster and cooperation. First, the problems are described, then the structural design recommended and influence on cooperation will be described resulting in *Managerial Implications*.

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## 2. Theoretical Framework

In this chapter the literature on management of regional clusters and cooperation will be further explored which will result in a theoretical framework that guides the research questions and the concepts that are explored. First, the concept of regional clusters will be further explored, and then the structural design will be defined and discussed including the dimensions. After this, the evolution of structural designs over time will be discussed. Next to this the influence of those dimensions on cooperation will be discussed. Finally, an overview will be given and the research questions will be formulated.

### 2.1 What are regional clusters?

The concept of a Regional Cluster is introduced by Porter in 1990 in his book *'The Competitive Advantage of Nations'*. Porter uses the following definition of clusters: *"Clusters are geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (e.g., universities, standards agencies, trade associations) in a particular field that compete but also cooperate"* (2000, 15).

However, this is a very basic definition of a cluster and Porter has used this at several different levels. He first used this to discuss the competitive advantage of nations (1990); later on he used this to discuss local competition of specific regions in countries (2000). The focus of clusters and level of analysis can thus vary. His work is also more focused on the analysis of clusters in terms of type and number of partners, the economic effects (e.g. creating competitive advantage, learning through a cluster and the economic development of a region) of clusters and potential policies (of governments) towards clusters. The question how to organize clusters and manage them is not answered. For answering this question the definition of clusters as formulated above is too vague.

Regional clusters are also defined by other scholars. Rosenfeld (1997) has defined clusters as: *"a geographically bounded concentration of similar, related or complementary businesses, with active channels for business transactions, communications and dialogue, that share specialized infrastructure, labour markets and services, and that are faced with common opportunities and threats."*

Another definition is given by Roelandt and Den Hartog (1999): *"Clusters can be characterised as economic networks of strongly interdependent firms linked in a value-adding production chain. In some cases, clusters encompass strategic alliances with agents in the knowledge infrastructure, such as research institutes, universities, engineering companies and firms of consultants."*



A scan in literature also reveals that there are several types of clusters defined. These types are all very similar and often used as synonyms. In following table several names and definitions of regional clusters are summarized:

<b>Different names and definitions of regional clusters (from Lechner and Dowling (1999))</b>		
<b>Name</b>	<b>Scholar</b>	<b>Definition</b>
Regional cluster	Porter (1990, 1998) Enright (1998)	<i>A regional cluster is the concentration of firms of more than one industry in a region regardless of firm size</i>
Industrial district	Brusco (1992)	<i>An industrial district is a geographically confined, over-proportional agglomeration of firms competing in the same industry or in related industries, and of supporting institutions (e.g. universities, industry and trade associations etc.).</i>
Business network	Staber (1996) Sydow (1996)	<i>A business network consists of several firms that have ongoing communication and interaction, and might have a certain level of interdependence, but that need not operate in related industries or be geographically concentrated in space.</i>
Regional Networks	Lechner and Dowling (1999)	<i>Regional networks are “long-term, purposeful” and deliberate (Fontanari, 1996) “arrangements among distinct but related for-profit organizations” (Jarillo, 1988) in regions (Buse, 1997) “that allow those firms in them to gain or sustain competitive advantage vis-à-vis their competitors in the network” (Jarillo, 1988). Structurally, they are regional concentrations of interconnected firms and institutions in a particular field (Porter, 1998). Regional networks are not guided by a focal firm (Sydow, 1992).</i>
Strategic networks	Sydow, (1992) Lorenzoni, (1995)	<i>Strategic networks are regional or non-regional networks that are guided by a strategic centre.</i>
<b>Overview of cluster definitions of the European Union</b>		
Innovation clusters	<i>Groupings of independent undertakings — innovative start-ups, small, medium and large undertakings as well as research organisations —operating in a particular sector and region and designed to stimulate innovative activity by promoting intensive interactions, sharing of facilities and exchange of knowledge and expertise and by contributing effectively to technology transfer, networking and information dissemination among the undertakings in the cluster.</i>	
Regional cluster	<i>A concentration of ‘interdependent’ firms within the same or adjacent industrial sectors in a small geographical area</i>	

<b>Overview of cluster definitions of the European Union</b>	
Regional innovation network	<i>More organised co-operation (agreement) between firms, stimulated by trust, norms and conventions, which encourages firms' innovation activity</i>
Regional innovation system	<i>Co-operation between firms and different organisations for knowledge development and diffusion</i>

**Table 1: Different names and definitions of regional clusters**

It is obvious that a regional cluster and industrial district often are used as synonyms. Both definitions are focusing on the concentration or agglomeration of organizations. A regional network is more focusing on the arrangements between independent, but related profit firms in a certain region. They also focus on structure, in which the definition of a regional cluster is used. Finally, a distinction is made between a regional network and a strategic network. A regional network is said to be guided without a central focal firm, where a strategic network is guided by a strategic centre.

The definition of a regional cluster according to the European Union (EU) is very alike the definition of Porter. However, the EU focuses more on boosting innovation by the means of clusters. But according to Porter clusters can also increase the productivity of the companies in the cluster and stimulate new business in the field. According to the EU the regional cluster can evolve in a regional innovation network and then in a regional innovation system; they recognize a hierarchy between the different types.

There are also different types of clusters recognized by Porter (1998); he distinguishes techno clusters and historic knowhow-based cluster. The first are high tech and have research centres involved. The latter are based on traditional know-how which is developed over the years. The difference between these types is kind of knowledge. There can also be made a distinction between horizontal, vertical, geographical and sectoral clusters. A regional cluster is a geographical cluster as discussed above. A sectoral cluster is an agglomeration of companies or related institutions that operate in the same sector. Horizontal and vertical clusters are already discussed in the introduction.

So in general it can be said that a cluster is an agglomeration of firms / organizations that are related to each other. There are some variations and or typologies that sometimes define a cluster, a cluster is regional or not and has a central actor or not. Also arrangements can be made between for-profit organizations.

In this case (the ADGEN Cluster), a regional cluster is very alike the definition of Lechner and Dowling (1999) of a regional network because the member of the ADGEN Cluster want to cooperate deliberately with each other and therefore want to establish long-term arrangements in order to enhance their competitive position in the (global) market. This implies that these organizations have interorganizational connections between them. But also

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issues from the definitions of Porter (2000), Rosenfeld (1997) and Roelandt and Den Hartog (1999) give necessary information about a cluster. In this research an own definition of a regional cluster is used. In this research clusters are understood as:

*“Arrangements between groupings of a distinct number of similar, related or complementary organizations in different fields that compete but also cooperate in a geographically bounded region. Sometimes it involves linkages to the knowledge field. The goal of a cluster is to gain or sustain competitive advantage.”*

Several types of regional clusters can be distinguished, but in this research the following types are distinguished:

- Horizontal/vertical clusters: similar or complementary organizations are cooperating with each other;
- Regional network: long-term, purposeful and deliberate arrangements ... see table 1;
- Innovation cluster: organizations sharing knowledge and ideas;
- Regional innovation network: more organized cooperation to enhance the innovation activity of organizations;
- Regional innovation system: more organized cooperation for knowledge development and diffusion

## **2.2 Structural design of regional clusters**

In this paragraph the structural design will be discussed, consisting of the (level of) formalization, centralization and heterogeneity of a cluster.

The structural design of regional clusters can be approached from many perspectives. However, in this theoretical framework the structure is used from a network perspective. Here structure refers to *‘the relationships that exists between the organizations comprising an Interorganizational Network that are properties of that Interorganizational Network itself’* (Burt, 1992 (Source: Williams, 2005)). The structural design is defined in this research as ‘a composition of the structural position that partners in a cluster have towards each other’ (Ibid, 1992). Structure can have several dimensions, in this research the structural dimensions are discussed from an Organizational Design perspective or are based on the several definitions of a regional cluster. The following dimensions will be used: “Formalization”, “Centralization” and “Heterogeneity”, because these dimensions are part of the structure of networks and clusters and influence cooperation. So the dimensions chosen are relevant for both the structural design of a cluster and the influence on cooperation and thus for the subject of this research.

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*Formalization* reflects the emphasis on following rules and procedures in conducting interorganizational activities. Formalization is typically measured by the presence of rule manuals, or more generally, by the degree of freedom available to organizations when they pursue their activities versus the extent of rules that define those activities (Damanpour, 1991). Formalization is high when there are formal contracts used. This implies that there is a high level of formal control. Formalization is low when there are no rules or procedures present for cooperation (Williams, 2005; Grandori and Soda, 1995).

*Centralization* reflects the locus of authority and decision making and is the extent to which decision-making autonomy is dispersed or concentrated in a cluster. The inverse of decentralization, it is usually measured by the degree of organizational members' participation in decision making or by the degree of authority and freedom organizational members have to make their own decisions (Damanpour, 1991). Grandori and Soda (1995) distinguishes parity based networks and centralized networks: the presence of a central agent. Grandori and Soda suggests that a central agent often coordinates vertical interdependencies between firms and that a parity based network often is concerned with horizontal interdependencies. A central actor, central agent, a central firm or focal firm are used as synonyms in this research. Centralization is high when the locus of authority and decision making is concentrated in a cluster, it is low when the cluster is parity based or the when members have freedom to make their own decisions.

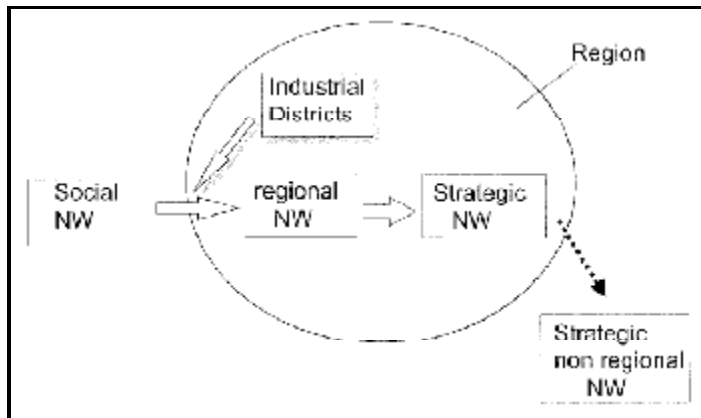
*Heterogeneity* reflects the variety of members in a cluster. When looking at the definitions of a regional cluster from Porter (2000) and Rosenfeld (1997) several indications of variety are revealed. Clusters can comprise similar, complementary or related organizations (Rosenfeld) and specialized suppliers, service providers and associated institutions (universities, trade associations) (Porter). Also the concept of resource similarity (Chen, 1996) can be introduced to categorize the type of partners. Partners are said to be equal or symmetric when they have similar resources and / or are active in the same market. Heterogeneity is, in this research, understood as high when the organizations involved are asimilar and a large variety of partners is present, such as universities, specialized suppliers or service providers. Heterogeneity is low when the partners are similar and the variety of different type of partners is low.

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## 2.3 Evolution of structural design over time

In this paragraph first the development process of networks will be discussed. Then the expected implications of the development process on the structural design, consisting of the three dimensions, over time will be discussed. The concrete changes and rationale for those changes also will be discussed. The evolution is important because the change of the structural design can be based on managing cooperation or can influence cooperation.

Lechner and Dowling (1999) examined the evolution of a regional cluster or regional network in practice. Their (theoretical) expectations were met and confirmed during a case study of a biotechnology regional network. Their expectations towards the evolutions of clusters can best be discussed based on their own work. See following figure:



**Figure 1: The ideal development process of networks (source: Lechner and Dowling, 1999)**

From this figure it can be derived that the basis for each regional network is a social network. A social network is defined by Grandori and Soda (1995) as ‘social relations between organizations without any formal agreements between them’. Inside the “boundary” or a region the transition of a social network into a regional network (defined in chapter 2.1), the establishment of formal arrangements between for-profit organizations without a central firm, is influenced by an industrial district (an over-proportional agglomeration of firms). Eventually the regional network can evolve into a strategic network; this implies that then the network is guided by a strategic centre. The strategic network could also evolve beyond the regional “boundary” into a strategic, non regional network.

For the three dimensions of structural design, formalization, centralization and heterogeneity, some issues can be recognized. The establishment of a regional network implies that deliberate arrangements are made, however the extent to which these arrangements are made formal cannot be derived from this process. The evolution of a regional network in a strategic network implies that the level of centralization will increase because a strategic centre is established which has the authority and power of decision making. The changes of the level of heterogeneity are difficult to determine because this is not described in the process. Although

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it can be said that the presence and influence of an industrial district could imply that the level of heterogeneity is high at the start of a regional network because an industrial district has an over-proportional agglomeration of organizations.

The change over time can also be discussed from a network trajectory perspective (Kilduff and Tsai, 2003). A network trajectory is perceived to be a sequence of changes of internal identity and external relationships (Ibid: 88). They recognize two different processes that might change a network over time: goal-directed process and serendipitous process. Goal-directed process occur in networks that have developed clear goals that their members share, which is the case in a regional network, like the example of Lechner and Dowling, because a regional network consist of purposeful arrangements: goals. The influence of this goal-directed process on a network is discussed along some issues: underlying assumptions, typical network growth, structural dynamics, conflict and implications for individual actors. The change over time is dependent on success and failure. If a network is successful it may be ceased to exist, or when the network is a failure it may also be cancelled or ended. Developing a new goal, then, can extend the “life-span” of a network. The structure is likely to be centralized around one or a few leaders that develop and arrange the network. The growth of the number of members should be based on suitability to the goals of the network. An eventual sub-network formation is perceived as problematic, which a network is not able to survive. Conflicts over goals are likely to result in break-up of networks. The goal-directed process is also likely to lead towards more homogeneous actors, actors that are equal to each other. Trust is perceived as important between the individual actors to achieve the shared goals. It is also stated that in goal-directed networking serendipity exploits and that a goal-directed network might change to a serendipitous network (actors do nothing more than interacting with each other) when goals are achieved.

Several expectations can be developed when the goal-directed process is linked towards the three dimensions. First, the level of formalization will be high or increase because goals are developed and communicated throughout the network. To achieve those goals incentives and or punishments can be used. If a network transforms into a serendipitous network the level of formalization might become lower because interaction has become more important than achieving a shared goal. The level of centralization is also perceived as high because it is expected that *“the network that pursues a goal-directed trajectory is from the beginning highly structured around a leader of set of leaders who articulate the goals of the putative organizations and recruit members. Attempts to avoid network hierarchy in the name of egalitarianism are likely to founder over the course of the network trajectory as the network consolidates around goal-directed leadership. It is therefore likely that networks exhibit a centre-periphery structure”* (Kilduff and Tsai, 2003: 95). Concerning the level of heterogeneity of a cluster it can be remarked that developing a shared goal is said to be leading towards a lower level of heterogeneity. This implies that developing a variety of goals or new goals also alters the composition of the network and thus influences the level of heterogeneity. The change of the level of heterogeneity is then thus dependent on the

multiplicity of changed or new developed goals. The assumption that the actors will be homogeneous is also in contradiction with Lechner and Dowling, because the influence of an industrial district is said to result in a high level of heterogeneity because of the over-agglomeration. So it is difficult to develop prediction about the evolution of heterogeneity, the main point is that it depends on the goals and type of network and thus the needed members.

So there are some differences and similarities between the scholars Kilduff and Tsai (2003) and Lechner and Dowling (1999) concerning the evolution of the structural design. Both recognize that arrangements are made in the initial phase but the degree to which those arrangements are formalized cannot be derived. However, the indications that goals are formulated might also imply that these goals are influencing the interorganizational activities. Therefore the level of formalization is perceived as high in the initial phase. The evolution is equal, either the level of formalization decreases due to a change of the cluster or it sustains. There is a difference between the scholars concerning the level of centralization in the initial phase. According to Kilduff and Tsai it is present from the beginning, according to Lechner and Dowling it is not. But both scholars indicate that over time the level of centralization will be high. So it is the question whether centralization is high or low in the initial phase. The level of heterogeneity depends according to the scholars on the goals of the cluster and the environment in which it is settled, e.g. the industrial district. In the following table the evolution of the structural design is described:

<b>Dimension of “structural design”</b>	<b>Formalization</b>	<b>Centralization</b>	<b>Heterogeneity</b>
<b>Initial phase</b>	High	High or low	Depends
<b>Rationale</b>	Goals and the way to achieve those goals are likely to be formulated from the start	There is a contradiction; it is present or not	It depends on what type of members are needed, what the goals of a regional cluster are and the environment of the cluster.
<b>Evolution over time (± 5 years)</b>	Sustained or decrease of level of formalization	Sustains or increases	Depends
<b>Rationale</b>	It depends: new goals might lead to sustaining level of formalization. Change into a serendipitous cluster might imply lower level of formalization.	Over time the level should be high because central actors emerge	It depends because of the environment or conflicts over goals results in the breaking-up of clusters resulting in more homogeneous actors

**Table 2: Overview of main assumptions towards the evolution of the structural design over time**

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## 2.4 Influence of structural design on cooperation

Now the dimensions of the structural design are defined and the evolution is discussed, the influence of those dimensions on cooperation will be discussed. First, the concept and definition of cooperation will be discussed, and then the influence of the dimensions on cooperation will be discussed. The level of each dimension that is being discussed is equal to the expectations set in paragraph 2.3, Table 2. So the level of formalization is high, the level of centralization also (because it is expected that centralization will be high over time) and the level of heterogeneity will also assumed to be high in order to discuss the influence. Finally, an overview of the influence of the structural design on cooperation will be given.

There are many definitions of cooperation offered by different scholars. Most definitions are focussing on the process by which individuals, groups and organizations come together, interact and form psychological relationships for mutual gain and benefit (Smith et al., 1995). Tuomela (1993) splits cooperation in two dimensions, joint action and joint intention. There can be a joint action, for example singing a duet, and it can be executed with a strong we-feeling, so with a joint intention. A joint action with a joint intension requires a deliberate action between partners that execute that action with a strong we-feeling, so with a clear joint plan.

Also a continuum is recognized in literature between cooperation at the low end and collaboration at the high end. Cooperation and collaboration differ in terms of depth of integration, commitment, complexity and interaction (Thomson and Perry, 2006). *'Cooperation involves reciprocities, exchange of resources (not necessarily symmetrical). Cooperation for a mutual goal moves this to collaboration. The whole is greater than the sum of its parts. It may be achieving individual ends, but there's an additional outcome that is shared (though not mutually exclusive) separate from the individual ends.'* (Ibid, 2006:23). Collaboration is understood as *'a process in which autonomous actors interact through formal and informal negotiation, jointly creating rules and structures governing their relationships and ways to act or decide on the issues that brought them together; it is a process involving shared norms and mutually beneficial interactions'* (Ibid, 2006:23). Collaboration is perceived to be a higher-order level of collective action than coordination or cooperation.

In this research cooperation is understood as the process in which organizations come together, interact and form psychological relationships. Two types of cooperation will be distinguished; cooperation and collaboration, with collaboration being the 'extended version of cooperation'. So collaboration is compared to cooperation a process with more depth of interaction, complexity, commitment and integration between the partners involved in a cluster. The term cooperation is in this research used to indicate the process in general; when the term collaboration is used it refers to the higher-order level of cooperation.



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In this research the influence of the structural design on the cooperation processes is examined. The influence on cooperation here must be understood as in how far these dimensions **stimulate** cooperation processes. So when, for example, a high level of formalization positively influences cooperation this implies that cooperation is promoted by means of that dimension. When it is negatively influencing cooperation it implies that cooperation is hindered. Again it is remarked here that in this section each dimension will be considered as high in order to discuss the influence on cooperation.

In literature there is a strong contradiction between scholars concerning the influence of each dimension on cooperation. Some scholars indicate that the use of formal contracts or rules is a substitute for mutual trust and confidence and therefore negatively associated with cooperation (Klein Woolthuis, 1999; Williams, 2005). These scholars state that there is little or no trust between the partners and that therefore, and because the cooperation has a high risk, formal contracts are used. But these formal contracts undermine trust among partners and so negatively influence cooperation in a cluster.

Other scholars indicate that formal contracts might positively influence cooperation because it is used as a framework or coordination mechanism to guide the cooperation between the partners (Kilduff and Tsai, 2003; Faems et al., 2007; Klein Woolthuis, 1999). In this situation cooperation is positively influenced by a high level of formalization because action is coordinated by means of formalization, for example by a division of labour, providing procedures for the integration of the dispersed activities, simplify decision making and prevent disputes on how to achieve tasks (Faems et al., 2007; Klein Woolthuis, 1999). Organizations can also be punished by means of the high level of formalization when they do not achieve the set mutual goals (Kilduff and Tsai, 2003), so they are forced to cooperate with the other organizations to achieve the mutual goals. As made clear, there is a clear contradiction in literature concerning the influence of a high level of formalization on cooperation and the underlying assumptions explaining the positive and negative influence on cooperation.

There is also a contradiction concerning a high level of centralization. Williams (2005) discusses this contradiction, a high level of centralization is negatively associated with cooperation because organizations that are less central in a cluster want to maintain their autonomy. Therefore it is not likely that they want to cooperate in a cluster because then a central agent determines their own organization.

According to Kilduff and Tsai (2003) centralization might positively influence cooperation because 'attempts to avoid network hierarchy in the name of egalitarianism are likely to founder over the course of a network trajectory as the network consolidates around goal-directed leadership' (2003: 95). Thus a high level of centralization promotes cooperation by means of goal-directed leadership. Williams (2005) also discusses the positive effect that central firms have according to some scholars. These scholars are arguing that central firms

are needed for subcontracting and bringing organizations together. So a high level of centralization can be positively or negatively influencing the cooperation, there is a clear contradiction in literature between different scholars.

Concerning the influence of a high level of heterogeneity on cooperation there is again a contradiction in literature. When there is a high level of heterogeneity the partners are likely to be asymmetric to each other and the type of organizations in a cluster varies. A high level of heterogeneity can positively influence cooperation because they are able to learn from each other and the variety enriches the cluster (e.g. Stuart, 1998; Beckman and Haunschild, 2002). The concept of ‘cognitive distance’ provides an opportunity and a problem. *‘Cognitive distance is closely related to the notion of cognitive variety, but it is more specific. It indicates that people do not just have different thoughts, but that they have different abilities of perception, interpretation and evaluation, and thereby see the world differently, as a function of their experience.’* (Nootboom, 2001:4). The opportunity of cognitive distance is that the members of a cluster can escape their myopia of personal cognitive construction. So they can learn from others, based on the different cognitions that are present in a cluster with a high level of heterogeneity.

But cognitive distance also can cause problems because the greater the distance (the less people share cognitive categories), the more difficult it is to cross it (to understand the actions and expressions of a partner) (Nootboom, 2001). So the partners might not speak the same language which might negatively influence cooperation. Nootboom (2001) also suggest that there is some optimal cognitive distance: large enough for partners to tell each other something new, and small enough for comprehension. So a high level of heterogeneity can negatively and positively influence cooperation.

In the following table the different expected influences of the dimensions of the structural design on cooperation as discussed above are summarized:

<b>Dimension of “structural design”</b>	<b>High level of formalization</b>	<b>High level of centralization</b>	<b>High level of heterogeneity</b>
<b>Influence on stimulating cooperation</b>	Negative (Williams, 2005) (Klein Woolthuis, 1999)	Negative (Williams, 2005)	Negative (Nootboom, 2001)
<b>Rationale</b>	High formalization is predicted when there is low trust and high risk. The use of formal contracts undermines trust.	Organizations want to maintain their autonomy; a central agent can undermine autonomy of less central members.	A high level of heterogeneity can be perceived as negative because companies do not speak the same language, e.g. the cognitive distance is too large.

Dimension of “structural design”	High level of formalization	High level of centralization	High level of heterogeneity
<b>Influence on stimulating cooperation</b>	Positive (Faems et al., 2007) (Kilduff and Tsai, 2003) (Klein Woolthuis, 1999)	Positive (Kilduff and Tsai, 2003) (Williams, 2005)	Positive (Stuart, 1998); (Beckman and Haunschild, 2002) (Nooteboom, 2001)
<b>Rationale</b>	It provides a framework for the cooperation, e.g. a coordination mechanism. It can also contain ‘punishments’ and thus forces organizations to cooperate properly.	The presence of a central agent is implying that cooperation is stimulated in a goal directed network by means of goal directed leadership.	Partners in a cluster can learn from each other, and escape their myopia of personal cognitive construction.

**Table 3: Influence of structural dimensions on cooperation**

## 2.5 Overview

There are several definitions of a regional cluster, but they are too vague or formulated too general. In this research an own definition of a cluster is developed, based on the definitions of a regional network and regional cluster. A regional network emphasizes the number of partners of a cluster and agreements between independent organizations. A regional cluster, in general, often has a high number of members: almost every company is, in one way or another, linked to other organization(s) in their region. The definition of a regional network is more emphasizing the distinct number of partners. In this research clusters are understood as:

*“Arrangements between groupings of a distinct number of similar, related or complementary organizations in different fields that compete but also cooperate in a geographically bounded region. Sometimes it involves linkages to the knowledge field. The goal of a cluster is to gain or sustain competitive advantage.”*

Several types of regional clusters can be distinguished, but in this research the following types are distinguished:

- Horizontal/vertical clusters: similar or complementary organizations are cooperating with each other;
- Regional network: long-term, purposeful and deliberate arrangements ... (see section 2.1);
- Innovation cluster: organizations sharing knowledge and idea’s;
- Regional innovation network: more organized cooperation to enhance the innovation activity of organizations;
- Regional innovation system: more organized cooperation for knowledge development and diffusion

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The structural design is understood as how the partners are related to each other, their position towards each other. This is measured along three dimensions: formalization (whether formal contracts, rules or a regulatory body is present and the degree of freedom to execute the joint activities), centralization (if the locus of authority and decision making is dispersed or concentrated (e.g. parity based) in the cluster) and heterogeneity (whether the partners are (a)similar and the level of variety of type of partners in a cluster). The evolution of these three dimensions is not clear. Formalization is expected to be present from start and decrease or be sustained over time. Centralization is expected to be high from the start or be developed over time, however over time centralization will become high. The evolution of heterogeneity is difficult to determine because this depends on the goal of the clusters and on the results of the cluster. In general it can be said that there is no unity in literature about the evolution of structural designs of regional clusters and the influence of structural designs on cooperation processes.

A lot is written about interorganizational network and the effect on cooperation. Cooperation refers in this research to the process of organizations that come together, interact and form psychological relations in which they establish cooperative joint actions. The type, intensity and the outcome of the cooperation can vary.

The influence of the three dimensions and the suggested evolution is not clear in literature. Formalization, centralization and heterogeneity can both positively and negatively influence cooperation. In general it can be said that there is no unity in literature about the evolution of structural designs of regional clusters and the influence of structural designs on cooperation.

So it is necessary to investigate for each dimension the level in the initial phase of clusters, the influence of that level on cooperation and the evolution of the dimensions and influence of that evolution on cooperation. The reasons why also have to be examined in order to develop insights into the influence of the structural design on cooperation and the dynamics of those designs. The evolution over time of the structural design of a regional cluster needs to be investigated in order to develop insights about the dynamics in a cluster and implications for managing cooperation. This requires an empirical in-depth investigation of some regional clusters to deepen the understanding of the influence of a structural design on cooperation processes and the evolution of a structural design over time. In the next paragraph the specific research questions will be derived from this theoretical framework

## **2.6 Research Questions**

In order to answer the central question several research questions are developed based on the theoretical framework described above. First, it has to be examined what kind of initial structural designs are applied in regional clusters, therefore the level of the three dimensions (formalization, centralization and heterogeneity) will be described. It also has to be investigated why the particular design is chosen. This results in the first research question:

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**1. *What kind of structural designs are applied in the initial phase of regional clusters and why?***

Exploration of the initial structural designs on the three dimensions and identification of the reasons for that design. Structural design is defined as the structural relationship of partners in a cluster, e.g. a composition. This will be executed by investigating the level of formalization, centralization and heterogeneity. Formalization refers to the presence of formal contracts and the degree of freedom available to execute the activities compared to the extent of the rules. Centralization refers to the locus of authority and decision making, whether it is dispersed or concentrated. Heterogeneity is defined as high when partners are asimilar to each other and when there is a large variety of type of partners.

Second, the evolution of the structural design over time needs to be examined in order to develop insights into how and why structural designs tends to change over time in order to test the existing literature on the evolution of regional clusters. This results in the second research question:

**2. *How do the dimensions of the structural design evolve over time and why?***

Exploration of the specific changes over time of each dimension of a structural design and identification of possible reasons for those changes. The structural design is already discussed under the previous research question.

Third, the influence of those designs on cooperation needs to be investigated. In literature the influence of a dimension on cooperation in general is both positive and negative. Cooperation is here understood as the process of organizations that come together, interact and form psychological relationships. Also the influence of the changes of the structural design on cooperation needs to be investigated in order to develop insights on how the dynamic aspect of regional cluster influences cooperation. This results in the third research question:

**3. *How does the (evolution of the) structural design influence cooperation and why?***

Exploration of the effect on the dimensions on cooperation and identification of reasons why that effect occurs. Also the effect of the change of the structural design will be examined. Cooperation is understood as the process of organizations that come together, interact and form psychological relationships. The influence of the structural design on cooperation will be examined and will be compared to the contradiction in literature between a positive and negative influence of the structural design on cooperation. So a contribution will be made to the question if the dimensions of the structural design positively or negatively influences cooperation or that they might effect cooperation positively and negatively at the same time.

In the next chapter the methodology will be discussed, in which will be explained how and why these questions are answered using a multiple case study approach in a qualitative oriented research.

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### 3. Research Methodology

In this chapter the research methodology will be described. First, it will be described why I have used a qualitative approach. Then the use of case studies will be elaborated and explained. Furthermore it will be explained why the specific cases have been selected, and then a short description per case will be given. Also the method for collection of data will be given. Finally, it will be described how the data have been analyzed.

#### 3.1 Qualitative Research

In order to explore the influence of the structural design of clusters on cooperation, a qualitative field research approach seems to be the best way to conduct the research. The absence of a good developed theory on the structural design of regional clusters and the contradiction in literature about the influence of the dimensions of the structural design on cooperation implies that the research is inductive of nature. A qualitative field approach is also useful because it has several advantages (Babbie, 2007) compared to a survey or experiment. First, a qualitative research is purposeful in examining social processes. Second, qualitative research is flexible; it can be changed at any time. And third, it can be relative inexpensive. Also the internal validity is in general higher, but the external validity is in general lower. In this research I have made a trade-off between internal and external validity favouring internal validity because the need of a good developed and constructed theory is perceived as higher than the need for generalizability. Reliability can also be lower in qualitative research because the measurements might be very personal. In this research I have used a qualitative research; besides a field research also clusters have been examined that are described in literature.

#### 3.2 Multiple Case Studies

In order to answer the research questions case studies have been used. The technical definition of a (single) case study is according to Yin (2003:13) “...an empirical enquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident. The case study inquiry copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result relies on multiple sources of evidence, with data needing to converge in a triangulating fashion and as another result benefits from the prior development of theoretical propositions to guide data collection and analysis.”

Case studies are useful because they provide according to Yin answers to ‘how and why’ questions about a contemporary set of events over which the investigator has little or no control (Yin, 2003). An in-depth examination has been required in order to retrieve as much information as possible about the management of clusters. By using case studies it is very

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likely that the 'how and why' questions are elaborated and answered and thus give detailed information about a regional cluster in order to answer the research questions. The research questions are mostly how and why questions, thus case studies are appropriate to answer the research questions. Case studies have some advantages, especially in a field oriented research (Verschuren and Doorewaard, 2003). First, it creates the opportunities to develop a broad view (a 'big picture') of the phenomenon that is researched, however a pitfall is that the external validity may be less high because only a limited number of cases studies are conducted. But in this research a broad view is perceived as more important than external validity as already argued in the previous section. Second, it is flexible. And third, the results will be accepted easier by 'the field'.

In this research a holistic multiple case study approach has been used. Yin (2003) considers a multiple case study approach as a variant of a single case study in the same methodological framework; no broad distinction is made between a single case and a multiple case study. The difference in this research is that several cases are studied in a holistic manner. Because the theory is also holistic of nature, the research is executed from a 'helicopter' point of view without attention for subunits, e.g. the organizations involved in a cluster. So a cluster has been examined in its context with only one unit of analysis. A pitfall is that an entire holistic case study may be conducted at a rather abstract level without clear measures of data (Yin, 2003).

The purpose of multiple-case studies is to explore a phenomenon across multiple cases, in order to understand the phenomenon and so develop more sophisticated descriptions and more powerful explanations (Miles & Huberman, 1994). So next to a within case study, the cases also have been compared to each other in order to gain a deeper understanding of the management of clusters and identification of factors that explain choices concerning the structural design. This method is called comparative case study (Verschuren and Doorewaard, 2003) and will be further elaborated in section 3.6 'Data Analysis'. Because several cases have been examined the case studies might not be that in-depth as in a single case study approach (Faems, 2006). But 'the evidence from multiple cases is often considered more compelling and the overall study is therefore regarded as more robust' (Yin, 2003:46). It also creates more variance based on theory and divergence in the data, not to create more of the same. Such theory-driven variance facilitates analytical induction (Faems, 2006).

Cases studies have been executed by searching and selecting cases from literature and by studying cases in practice using a qualitative, retrospective field research as mentioned in the previous section. First, cases of clusters have been searched by a scan in literature on search terms as clusters, cooperation and case studies (which need to be longitudinal or retrospective in order to develop a clear picture about the evolution of clusters and the structural designs).

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Second, case studies have been executed as a retrospective field research. It is already discussed in the previous section why a qualitative field research has been used. These case studies have been retrospective of nature, which implies that only cases have been studied in the past. Ongoing processes have not been studied. There are some advantages concerning retrospective research (Faems, 2006): first, retrospective studies provide the advantage of knowing the ‘big picture’, how things developed, and the outcomes that ensued (Poole et al., 2000: 118). Second, in comparison with longitudinal data collection, retrospective data collection is more efficient, especially considering this is a graduation thesis. And last, in this way it is avoided that information about ongoing activities will become public.

### 3.3 Selection of cases

The selection of cases has been based on an overview of clusters in this region, other close regions and in literature and a sampling of cases based on some criteria. This is called a hierarchal method according to Verschuren and Doorewaard (2000), although this method is not used completely. First, it has been examined what type of clusters are available in this region and in the literature. Then the clusters have been selected on basis of variation of the type of cooperation and the variation of the structural dimension between the clusters, it also has to involve several types of clusters and cooperation and the partners of a regional cluster are supposed to be located in each other vicinity. Due to this variation it has been secured that theory-driven variance is present to facilitate analytical induction. The selection of cases and variation between the cases is further described in the next section (3.3.1 Sampling of cases).

In literature several clusters are described in articles and/or dissertations. One example of a regional cluster in Twente, and often mentioned in this region, is the TIMP cluster (Klein Woolthuis, 1999). However, there are several other clusters described in literature. Searching on the term “*regional network*” offered more results than searching on the term “*regional cluster*”. Several examples of clusters have been found especially biotechnology clusters in Europe and some regional networks in the USA concerning the wood industry. Despite this convenience sampling which in general leads to poor information-rich samples, a number of six cases have been selected from literature that met the criteria, as discussed, based on abstract and a first overview of the article and content (e.g. purpose of study, research method and conclusion).

In the region of Twente there are numerous clusters and networks, and also in the other parts of the Netherlands several regional clusters have been found. First, the networks in which the VMO is involved, or related to, have been investigated if they match some of the definitions of regional cluster or network as discussed in section 2.1, since the VMO is also a network in itself. Second, clusters have been examined that are described in the Twente Index (Twente Index, 2007). In this report several networks in this region are described. These networks also have been examined using their websites. Third, also other persons, the managing director of the VMO, people from the ADGEN Cluster and people interviewed during case studies that



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already have been selected, have been asked if they knew any other, possible interesting cases. After this process several clusters in this region have been identified and also one in the northern part of the Netherlands.

### **3.3.1 Sampling of cases**

After a first overview of the possible cases a selection has been needed because not every case is interesting or suited for this research and case studies are intensive and require an in-depth study (Yin, 2003). For selecting the cases in the field research, purposeful sampling has been used. *“Purposive samples should always be composed on the basis of a plausible, possibly theoretically founded, reasoning and look for the selection of information-rich observational units to be studied in depth, intensively and within its social context. The purpose should always be related to the research problem”* (Droogleever Fortuijn, 2004:8). However, the availability of cases and direct linkage to the VMO has prevailed because it then was easier to make contacts and sometimes more data was available. The cases have been sampled using the research design, goals and research questions derived from the theoretical framework. So the case must be a regional cluster or network, this implies that the organizations involved must be, to some extent, in the vicinity of each other. A not geographically bounded network or cluster thus is not suited for this research. Although it is not clear what can be understood as vicinity, e.g. how close the organizations must be located to each other.

From literature only three cases turned out to be suited, based on reading the articles closely and analyze them on the dimensions of the structural design, type of cluster, size and the presence of cooperation. Afterwards, it can be concluded that the articles that are selected are concerned either with cooperation or with the tensions between trust and control in interorganizational relationships. This is also logic because when, for example, an article is focussing on the performance of a cluster, the cooperation is not likely to be discussed in the article. In the selected cases information about the structure of the cluster and cooperation is present.

In this research the cases from practice have been selected on the dimensions of the structural design, type of cluster and size. Cases have been selected that vary in the initial phase on the level of formalization, centralization and heterogeneity. Although this sometimes only could be derived after the first interview. One case turned out to be not relevant after an interview. Also cases have been selected based on the sort of cluster, whether they are horizontal or vertical and if they involved institutions in the knowledge field or governmental related institutions. In this way both clusters that involved direct cooperation and platform based clusters have been selected. So cases have been selected that can be compared to each other and vary in order to facilitate induction in a later stadium. Most clusters that have been selected have had a successful outcome, but some clusters also have encountered some problems in the first years of their existence or lost its legitimacy after a couple of years. Size has also been important; none of the clusters involves more than thirty organizations in order

to stay as close as possible to the ADGEN Cluster. And, of course, the members of a cluster needed to be willing to participate.

In following table an overview of the variety of the cases is given. As can be derived most cases differ from each other.

	Name of cluster >	TIMP	InBroNet	Italian Consortium of Opera Houses	Prozess Kompetenz.eu	Focus Group Internationalization of the VMO
<b>Year</b>		1995-1998	1993-2004	2004-2007	2007-008	2003-2008
<b>Type of study</b>		Longitudinal single case study	Explorative, longitudinal	Longitudinal case studies (#3)	Explorative retrospective case study	Explorative retrospective case study
<b>Number of organizations</b>		10 (10)	7 (8)	3 (3)	3 (3)	4 (7)
<b>Level of formalization</b>	Initial phase	High	Medium	Medium	Medium	Low
	Evolution	Increase	Increase		Sustained	Sustained
<b>Level of centralization</b>	Initial phase	Medium	Low	Low	Medium	Low
	Evolution	Increase	Sustained	Sustained	Increase	Sustained
<b>Level of heterogeneity</b>	Initial phase	High	Medium	Low	High	Medium
	Evolution	Decrease	Increase		Sustained	Increase
<b>Type of cluster</b>	Initial phase	Regional innovation network; Vertical	Regional network; horizontal	Regional network; horizontal	Regional network; vertical	Regional network; horizontal
	Evolution	Regional innovation network; Vertical	Regional network; horizontal	Regional network; horizontal	Regional network; vertical	Innovation cluster

	Name of cluster >	Dutch Sigma	Mechatronica Valley Twente	“PCT”	TxU Network Program Compensation Projects
<b>Year</b>		2004-2008	2001-2008	1998- 2008	2003-2008
<b>Type of study</b>		Explorative retrospective case study	Explorative retrospective case study	Explorative retrospective case study	Explorative retrospective case study
<b>Number of organizations</b>		3 (3)	7 (12)	> 30 (<10)	15 (28)
<b>Level of formalization</b>	Initial phase	High	High	Medium	Low
	Evolution	Increase	Sustained	Sustained	Increase
<b>Level of centralization</b>	Initial phase	Medium	Medium	Medium	Medium
	Evolution	Increase	Increase	Increase	Increase
<b>Level of heterogeneity</b>	Initial phase	High	High	Medium	High
	Evolution	Sustained	Increase	Increase	Increase
<b>Type of cluster</b>	Initial phase	Regional network, vertical	Regional innovation system; horizontal	Regional network	Innovation cluster
	Evolution	Regional innovation network; vertical	Regional innovation system; horizontal	Regional network; vertical	Regional innovation network

**Table 4: Overview of case variety per case and dimension**

### 3.4 Description of cases

In this section a short description of the selected cases will be given. The history, purpose and the current state of the cluster will be described with the main issues of that cluster. It will also be indicated what type of cluster the selected case is.

#### 3.4.1 Case I: TIMP Cluster

The TIMP Cluster is examined during four years, as a longitudinal case study, and is described in the dissertation of Klein Woolthuis (1999). In this dissertation the relation between trust, dependence and contract is examined. TIMP stands for the Twente Initiative for the development of Medical Products. It is initiated in 1993 and is formalized in 1994. The cluster consisted of companies in the medical industry, and there different types of companies have been involved: engineering, production, sales, but also a rehabilitation centre and the University of Twente have been involved. The goal of the cluster can be best described by using the formulation of Klein Woolthuis:

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*“The goal of the co-operation is new product development for the home-care and rehabilitation market using each other’s complementary capabilities. Because of the proportional increase in the aged population, an increasing market for home-care and rehabilitation goods can be expected. To exploit this market opportunity a combination of technological capabilities, production skills, market knowledge and marketing skills is needed. In Twente, various companies and institutions were active in the medical field. Extensive theoretical knowledge was present at the university. Practical knowledge on state-of-the-art technologies and patient care was available at an international known rehabilitation centre, and technical and engineering capabilities were present at a number of regional technology-based firms. A combination of these competences could help the firms jointly exploit this market opportunity”* (1999: 66).

Nowadays the cluster still exists; they are in a “third phase”. Currently the cluster is focused on “Euregional” cooperation (cooperation between Dutch and German companies that are settled within the border region of Twente). In this research only the information from Klein Woolthuis is used, the current state is not examined. The cluster shows resemblance to a regional innovation network and is vertical of nature.

### **3.4.2 Case II: InBroNet**

The cluster “InBroNet” is described in two separate articles, although from the same author, based on a longitudinal case study of several years, between 1992 and 2002. The cluster has been formed by seven small and medium sized insurance brokers. The cooperation has been motivated by ...

*“the lack of expertise these small and medium-sized insurance brokers experienced in the face of increasingly complex commercial risks”* (Sydow and Windeler, 2003: 83) and was ... *“first, a reaction to the (then envisaged) deregulation and increasing competition accompanying the introduction of the Single European Market in the financial services; and second, seen by the brokers as a suitable means of counteracting the increased complexity of risks in the industrial insurance sector. Small and medium-sized brokers, in particular, increasingly lack the expertise to evaluate, manage and insure these kinds of risks. The opportunity for cost savings ranked only third as a motive for network-building.”* (Sydow, 2004: 208).

The size of the firms varies between four and thirty employees, all the companies are managed by entrepreneurs.

Sydow (2004) describes three major changes during the ten years of cooperation. The first is the number of network members; it has increased to eleven, including three passive members (members that cooperate in operational activities, but are not involved in strategic affairs). Also one partner has bought out a member partner and a new member is added. The second

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change is the level of cooperation. It has increased over the years, especially between six founders of the cluster. The third change is the link between one member and a fast growing network in the environment of InBroNet. This member has, because of its link position between the two networks, built a third network from its leading role. The cluster is an example of horizontal cooperation and is much alike a regional network.

### **3.4.3 Case III: Italian Consortium of Opera Houses**

The LLP consortium is a cluster consisting of three opera houses in Italy. It is described in an article of Mariani (2007), based on a research executed during two and a half years. The research is based on semi-structured interviews, observations and archival documents and press accounts. The opera houses are: the Comitato Estati Livornesi in Livorno, the Teatro del Giglio in Lucca, and the Teatro Verdi in Pisa, all located in the region of Tuscany. The cooperation has started to share resources and best practices at an operational level. It was imposed due to governmental policies and projects. In the article it is not mentioned whether the consortium still exists or not, a search on the internet also did not reveal any information about the existence of the cluster nowadays. The cluster is an example of horizontal cooperation in a regional network.

### **3.4.4 Case IV: ProzessKompetenz.eu**

ProzessKompetenz.eu is established in January 2007. The partners have met each other in a so called triatlon. This triatlon is developed by the “Verenigde Maakindustrie Oost” (VMO) and applied in a ‘Euregional’ project (a project in the Dutch-German border region, located in the Eastern part of the Netherlands). The goal of the triatlons has been to bring Dutch and German companies in contact with each other so that they jointly could seek expansion of their business activities. In a triatlon five till eight companies are set together in a cluster with the goal that companies start to know each other and that trust develops between the partners. The cluster meets every two to four weeks at one of the partners. A discussion leader organizes the meetings and directs the discussions. The ‘home-partner’ talks about its goals or difficulties, the visiting partners are reflecting on it and eventually a concrete action plan is established for the home-partner. Special knowledge is available when this is required to achieve a goal.

The partners of ProzessKompetenz.eu, Tumakon, TC Project Management and ESB Automations, have met each other in a cluster of “Euregio Toelevernetwerk” with the focus on cooperation in the branch of machine building and automation. After the triatlons the partners concluded that they had a match and wanted to continue their relation and transform it into a structural form of cooperation. They have established the name ProzessKompetenz.eu; the name reflects the complementariness of the partners. Together they master all the competences for the automation of production processes. Individually each company is too small to offer the same service. The accent lies on cooperation instead of

competition between the partners. ProzessKompetenz.eu is also guided by the Chamber of Commerce of Muenster as a result from the, already mentioned, Euregio project. They serve(d) as an external consultancy organization.

Nowadays the cluster still exists; the cooperation has become more intensive. The first projects are executed and more projects are currently executed or being acquired. There is no change in the number of partners. It is a vertical, regional network and has not (yet) transformed, it has started relative recently.

### 3.4.5 Case V: Focus Group Internationalization of the VMO

The focus group is established in 2004 after a survey held under members of the VMO. The group consisted in the initial phase of the chairman of the VMO and three managers from member-companies. After one month two other people from member-companies have been added to the focus group. Besides the chairman of the VMO all members of the focus group were active in the metal working industry. One of the members of the focus group was appointed as chairman of the focus group. Their main goal was to build competences under the members of the VMO concerning doing business on the international market. This can be related to different issues such as how to establish relations, how to behave in and cope with specific foreign cultures et cetera. In 2005 two more members have been added both from the same organization, a knowledge centre for metal, metalektro and plastics working industry. In 2006 two more persons have been added, one from the Chamber of Commerce and one from a regional Development Agency. In 2007 the current chairman has been added and installed into the focus group and others have left the focus group.

In the following table an overview of the members is given:

<b>Initials</b>	ML	JG	HV	ET	MO	MN
<b>Core activity</b>	Chairman of VMO	Metal working	Metal working	Metal working	Metal working	Metal working
<b>From</b>	2004	2004	2004	2004	2004	2004
<b>Till</b>			2007	2007		2007
<b>Initials</b>	DO	WL	HL	RL	RB	
<b>Core activity</b>	Knowledge Centre	Knowledge Centre	Development Agency	Chamber of Commerce	Metal working	
<b>From</b>	2005	2005	2006	2006	2007	
<b>Till</b>		2007	2006			

**Table 5: Overview of members of Internationalization over the years**

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After a couple of years from the start the goals have been met and the focus group became less active. The cluster had lost its legitimacy and was searching for new goals or legitimacy. In the spring of 2007 the focus group made a renewed start with a new chairman, besides the new chairman the group consisted of five members that also have been active in the “previous” focus group. The cluster is an example of a regional, horizontally oriented network and has transformed into an innovation cluster

#### **3.4.6 Case VI: Dutch Sigma**

Dutch Sigma is a cluster of three organizations in the field of optronical components and subsystems. Dutch Sigma is a short name for their official name: Sigma Dutch Optronic Initiative. The three organizations involved are different of size and activities. The organizations involved are:

- AstroTec: knowledge (optical), project managers and –engineers plane optics, optical system design and engineering. AstroTec is a subsidiary of “*Stichting Astronomisch Onderzoek Nederland*”, ASTRON. Located in Dwingeloo, Drenthe.
- Boessenkool: production of mechanical components. Located in Almelo, Overijssel.
- Sumipro: production of small to large series (spheres and a-spheres) based on diamond turning, coating of small to large series, development of coatings, assembly of smaller subsystems. Located in Almelo, Overijssel.

During the first negotiations also a fourth party was involved, however this organization decided not to join this initiative. The cooperation is established three or four years ago and was mainly initiated due to efforts of the managing director of Sumipro. One of the reasons was frustration about the education system of optronics in the Netherlands. Together with Oost NV, a regional business development and investment agency, possibilities to improve the education system were investigated. In the same period Astron offered classes in the field of optics. However, there was too little interest in these classes. But Sumipro and Astron investigated the potential benefits that cooperation might have for both organizations. Parallel to Astron, Sumipro also investigated the benefits of cooperation with Boessenkool at the same time. The organizations, then, concluded that they all were very competitive in their own specific fields. And that they would be able to acquire and execute large international projects together, for which they were too small individually. So they decided to make arrangements about cooperation in large projects they jointly could acquire and execute. The cooperation has become more intense, since two years. In the two years before, the cooperation has not been that intense.

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The goal of the cooperation has been to acquire and execute large projects for which the members individually are too small. Nowadays the cluster still exists, and the first results of the cooperation start to become visible. Besides the joint execution of projects they have also started the development of their own product. It has transformed from a vertical, regional network to a vertical, regional innovation network.

### **3.4.7 Case VII: Mechatronica Valley Twente**

Mechatronica Valley Twente (MVT) is established in 2001 by several companies in Twente. The professor Mechatronics of the University of Twente retired and the University was not able to secure a successor because of a lack of financial resources. Several companies thought this development was life threatening for their own business and they made arrangements to finance a professor jointly. In the initial phase it involved five companies, the regional development- and investment agency and the University of Twente. The main target was to secure good personnel, students for graduation projects and apprentices. There were also some secondary targets like enhance the mutual connections, organize an annual symposium on mechatronics and promoting the region of Twente as a high-tech region. In order to manage the financial resources, a foundation has been established named 'Mechatronica Valley Twente'. Each company was a member and had a direct vote and was thus a member of the board. There is an annual contribution of six thousand Euros a year per member. Because the foundation is a non-profit organization the annual contribution is totally spend on the targets mentioned.

The cluster still exists nowadays. Five companies are added to the foundation. They are all active in mechatronics. In order to keep the foundation manageable a change in the structure of the foundation has occurred. A daily board has been established with a chairman, secretary and treasurer. Other members are thus not member of the board but a general member. The increase of the number of members has not led to a change in the annual contribution. Nowadays more financial resources are available, which implies that more activities can be executed, for example, also another researcher is partially financed at the university.

MVT recognizes two pillars: research and business. The first is focusing on fundamental research on mechatronics by means of several research projects, the latter on promoting the region of Twente as a high-tech region and commercialization of the results from the research on mechatronics. The cluster is an example of a regional innovation system and, although the organizations are asimilar, is horizontally of nature.



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### 3.4.8 Case VIII: “PCT”

A large manufacturer of power applications decided to change its factory into an assembly plant in the late ‘90’s. All parts, except some critical parts, would be procured from suppliers. A company which already had supplying relations to the company, decided to offer its services. They have been selected for producing modules for which they have been obliged to use the suppliers of that company at that time. They have established long term relationships and arrangements between the customer and their suppliers. The number of suppliers has decreased. When it was initiated the number of partners involved was more than thirty. Nowadays the number of partners is less than ten.

Nowadays the cluster still exists, the cooperation is perceived as successful. Volumes are increasing and the cluster has become a tight and open cooperation between the different partners. The cluster is an example of a transformation from a regional network to a regional network that is more vertical of nature. The name “PCT” (Power Cluster Twente) is chosen to secure confidentiality for the organizations involved<sup>1</sup>.

### 3.4.9 Case IX: NOM TxU Network Program Compensation Projects

The N.V. NOM (*Investerings- en Ontwikkelingsmaatschappij voor Noord Nederland*) is a regional development and investment agency (and a public limited company) and focused on the three northern provinces of the Netherlands: Friesland, Groningen and Drenthe. One of their instruments is TxU Noord Nederland. TxU stands for Toeleveren x Uitbesteden, in English: Supply x Outsourcing. TxU is initiated by some companies in the northern part of the Netherlands. They were (are) anxious about their position in the value chain. The purpose is to enhance the competitive position of the companies. TxU is a non-profit organization and is initiated by the companies themselves. The programs offered are all based on demands and desires of the companies. The network programme Compensation Projects (hereafter named: CP) is established in 2003. It is based on an earlier program that was developed in 2000/2001. This program was a cooperation between the Ministry of Economic Affairs, the Chamber of Commerce and the NOM. Its purpose was to interest the regional SME’s in the offset market. The offset market is linked to the defence market. An (international) manufacturer that supplies to the Dutch Ministry of Defence may only supply if they subcontract the same amount to the Dutch SME’s.

However, this program did not show much progress. It was then decided to start a network program. This is a program based on the definition of an innovation cluster according to the European Union. It is seen as a platform to share ideas, advice, establish contacts and cooperation. The network program CP is concentrating on the offset market, the purpose is to build the right competences under northern SME’s so that they are able to function on that

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<sup>1</sup> More information cannot be given due to confidentiality restrictions. For more information the researcher can be contacted. The companies involved thus remain confidential.

market, e.g. acquiring and executing offset projects. In order to get involved companies must pay a substantial amount of money each year for which they get several things back. TxU also pays a similar amount of money per company per year to the network program.

Nowadays this network program still exists, over the years more companies have joined this program. “Phase 1” is completed, companies have been able to learn about the offset market and have been able to examine if this market is suited for their own strategic vision. At this moment the continuation of the program is discussed. Cooperation will be a main point and more concrete results are expected in the new phase. The Network Program has started as an innovation cluster and now steadily gets the characteristics of a regional innovation network.

### 3.5 Data Collection

According to Yin (2003) there are six sources of evidence in case studies: documentation, archival records, interviews, direct observations, participant observation and physical artefacts. In this research interviews have been held with people from the clusters and they, in some cases, also made documentation or archival records, such as minutes of meetings, available and in once case direct observation has been made possible. Also web-sites and articles in magazines or in newspapers and press releases have been obtained. Due to these different sources of data, triangulation has become possible. Triangulation is defined as an observation from at least two different points, data triangulation is collecting data from different sources, at different times, in different places or from different people (Flick et al., 2004). Methodological triangulation is a combination of methods, for example interviews and observation (Verschuren and Doorewaard, 2003). The main purpose of triangulation in this research has been the enhancement of validation of data that is obtained during the case studies in the field research. In following table an overview of data sources per case is given:

#	Case	Interviews			Documents	Direct observations
		Length	# words	# pages		
1	TIMP				1 Dissertation	
2	InBroNet				2 Articles	
3	LLP Consortium				1 Article	
4	ProzessKompetenz.eu	40:27	4.500	8	4 articles	-
		47:40	6.014	10	2 archival documents 1 leaflet	
5	Focus Group Internationalization of the VMO	25:14	2.117	5	> 10 archival records	2
		30:36	3.672	6		
		26:43	3.811	7		
		19:10	2.215	5		
6	Dutch Sigma	37:03	4.218	10	1 article,	-
		40:42	4.300	11	1 press release	

#	Case	Interviews			Documents	Direct observations
		Duration	Number of interviews	Number of interviewees		
7	MVT	25:40	3.152	7	1 article 1 archival record	-
		28:53	3.895	8		
		28:53	3.887	7		
8	"PCT"	1:00:00	9.000	14	-	-
		40:12	5.252	8		
9	TxU Network Program Compensation Projects	01:09:46	9.111	14	1 press release 1 product paper	-

**Table 6: Overview of data source per case**

### 3.5.1 Interviews

The main source of evidence are interviews that have been held with managers or managing directors from organizations that are involved in a cluster in the field research. Interviews provide a targeted and focused direction of the case study. However, poorly constructed questions can lead to a bias, and there is also the risk of a respondent bias, e.g. the interviewee says what the interviewer likes to hear. However, interviews are seen as an essential source of case study information (Yin, 2003).

The interviews have been semi-structured because some specific research questions must be answered and there is a contradiction in literature. In order to obtain as much information as possible a semi-structured method has been chosen. During the interviews also some space has been left for any additional information that is not included in the research questions in order to obtain as much relevant and useful information as possible in order to develop a broad view of the development and the cooperation in a regional cluster. Also the sequence of questions could be changed during the interviews depending on how the interview developed. See Appendix I for an example of the interview protocol.<sup>2</sup>

The interviews have taken place face-to-face in order to interview the persons in their natural environment. And the interviews also have remained confidential. This has had the advantage that the interviewees could speak freely. Before the interview has been executed the protocol was explained, including confidentially, and it was asked before each interview if the interviewee agreed that the interview would be taped. None of the interviewees refused taping. In total a number of fourteen interviews have been executed in which the length varied between twenty minutes and eighty minutes. In each case two or more interviews have been held, except in the case of TxU NWP CP, here because of the distance only one interview was held. The person, however, is the program manager and has a broad view of the cluster.

<sup>2</sup> After the interviews have been held it was decided not to focus on cooptation, but on cooperation because the term cooptation caused too much confusion. This explains why cooptation is mentioned in the interview protocol.

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The interviews have been taped and transcribed because it provides ‘a more accurate rendition of any interview than any other method’ (Yin, 2003: 92). For transcribing the interviews the guidelines described by McLellan et al. (2003) have been used. See following figure:

1. *Preserve the morphologic naturalness of transcription.* Keep word forms, the form of commentaries, and the use of punctuation as close as possible to speech presentation and consistent with what is typically acceptable in written text.
2. *Preserve the naturalness of the transcript structure.* Keep text clearly structured by speech markers (i.e. like printed versions of plays or movie scripts).
3. *The transcript should be an exact reproduction.* Generate a verbatim account. Do not prematurely reduce text.
4. *The transcription rules should be universal.* Make transcripts suitable for both human/researcher and computer use.
5. *The transcription rules should be complete.* Transcribers should require only these rules to prepare transcripts. Everyday language competence rather than specific knowledge (e.g. linguistic theories) should be required.
6. *The transcription rules should be independent.* Transcription standards should be independent of transcribers as well as understandable and applicable by researchers or third parties.
7. *The transcription rules should be intellectually elegant.* Keep rules limited in number, simple and easy to learn.

**Figure 2: Seven principles for transcription rules (source: McLellan et al., 2003: 65)**

The interviews have been transcribed literally in order to stay as close as possible to the taped interview. This enhances the accuracy of the transcribed interviews. All transcriptions only have been accessible for the researcher due to confidentiality matters. Because the interviewees most often were the managing directors or managers it has been chosen not to send full transcriptions back to the interviewees, instead a short summary and conclusion was send back for remarks, none of the interviewees objected to this. During the interviews it has also been indicated that some statements were considered to be confidential and could not be used in the research. During the interviews again the confidentiality has been stressed. In the transcriptions also the notes made during the interviews have been incorporated. The interviews have been executed, transcribed and analyzed by the same researcher which enhances the accuracy because the same person does all the work and no transfer of data occurs between different people. Transcribing interviews is an intensive job, besides preparation for interviews and executing them. The average size per transcription is nine pages, and contains on average some 5.000 words, so the information is quite massive per case because also other articles and observations have been used for an enrichment of evidence per case.

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### 3.6 Data Analysis

Since humans are not capable of processing large amounts of extended texts (Miles and Huberman, 1994), a selection of data has been needed. The data is analyzed using a two step approach, first analyzing the within-case data and second searching for cross-case patterns (Eisenhardt, 1989)

In the first step, a study is made per case in order to become intimately familiar with each case as a stand-alone entity (Eisenhardt, 1989). There is not a set approach to execute this step, however this process allows unique patters to emerge and gives the researcher the opportunity to become familiar with each case and so accelerate cross-case comparison (Eisenhardt, 1989).

In analyzing the within-case data the following procedure in each case has been used. First, a description has been made of the purpose and type of cluster in order to identify the type of cluster and to be able to compare it to other clusters. Second, the level of formalization, centralization and heterogeneity in the initial phase has been determined by using statements or other documentation obtained during the case studies. For each dimensions the data has been searched for specific words related to that dimension. Words related to a high level of formalization are *rules, arrangements, contracts, formal and sign*. As opposite, for indicating a low level, words like *informal, no arrangements* and the words used in a high level of formalization together with a negative verb like *no* or *not* are used. But the level turned out not to be as black and white as expected during the within-case analysis. Also a moderate form has been recognized. Therefore the level of formalization is high when formal rules and procedures are present to guide the cooperation and there is a limited degree of freedom to execute the activities in another way than prescribed. The level is medium when arrangement are present, but not signed. So there is more degree of freedom to execute activities but some arrangements have been made. The level is low when the cooperation is informal, e.g. no arrangements are made or when there is a high degree of freedom to execute activities.

A high level of centralization is indicated by words like *chairman, central position, and management organ*. It is low when negative verbs are used like *no* and *not* together with the words mentioned above, and by words like *equal*. Again, a moderate form of centralization has been recognized. Centralization is perceived as high when the locus of authority and decision making is concentrated in one central actor, it is medium when the locus is concentrated but owned by the partners (for example, a foundation in which each members has an equal vote). It is low when no central actor is present and the locus of authority and decision making is dispersed.

A high level of heterogeneity is indicated by words like *different*, *university*, *agency* and *asimilar* to indicate a variety of partners. It is low when partners are *similar*, have the *same* market or resources or when *no* universities or agencies are involved. Again a moderate form has been recognized. Heterogeneity is perceived as high when a variety of partners is present and the organizations are not similar. When organizations differ, but no universities or other specialized suppliers or related institutions are present the level is medium. The level is low when the organizations are similar and the variety between the types of partners is low. In the following table the levels of each dimension are summarized:

Dimension	Level	Description
Formalization	High	Formal rules or procedures are used, small degree of freedom
	Medium	Arrangements are made, however not signed. Relative high degree of freedom to execute activities
	Low	No rules or procedures, total degree of freedom
Centralization	High	Locus of authority and decision making is concentrated in one central actor
	Medium	Central actor(s) present, but locus of authority and decision making not concentrated
	Low	No central actor present or locus of authority and decision making is dispersed
Heterogeneity	High	Organizations are asimilar and a large variety of partners, e.g. university, trade associations or other agencies
	Medium	Organizations differ, but a lower variety of different type of partners
	Low	Similar organizations and a low variety of different type of partners

**Table 7: Overview and description of levels per dimension**

Third, the reasons for a particular level have been investigated by examining the reasoning for specific choices, in order to explain why a particular design in the initial phase has been chosen. And fourth, the influence of each dimension on cooperation has been examined using statements that reflected the process of cooperation. In those statements it is often indicated whether the cooperation went *well* or did *not* went *well*, so whether cooperation was positively or negatively influenced.

A similar approach has been used for the evolution of the structural design. A level increases when it becomes 'higher' than the original situation, it decreases when the level becomes 'lower' than the original situation. The results have been laid down in a form, a quick scan, developed by the researcher, see appendix II. In this way an in-depth understanding of a cluster is secured and the rationale per case for a structural design and influence on cooperation has become clear. The results also can be compared rapidly to each other because of the form. This improves the opportunities for comparison because now the cases can be laid down next to each other, without all underlying evidence from interviews and documentation, and the researcher has become more familiar with the cases.

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The second step has been to search for cross-case patterns. The tactic of selecting dimensions and to look for within-group similarities coupled with intergroup differences has been used (Eisenhardt, 1989). Cases that have the same level per dimension have been grouped and similarities and the different reasons for that have been explained. For example, the cases that have a low level of formalization in the initial phase have been grouped together and within-group similarities have been examined. Also the different groups have been compared to each other in order to explain the differences. So for example, groups with a low, medium and high level of formalization have been compared to each other in order to explain the differences.

The same tactic has been used for the evolution of the structural design per dimension and the influence on cooperation. Clusters with a similar increase or decrease per dimension have been grouped together and similarities or differences have been explained. For the influence on cooperation it has been indicated whether the level of each dimension had a positive or negative influence on cooperation and why. Again similar cases have been grouped and compared to other groups of cases. See Chapter 4 for the results of this analytical process.

Rationale can be compared easily and the foundation for theory building has been laid down by using this analytical tactic. One essential feature of theory building is a comparison of the emergent theory with the extant literature (Eisenhardt, 1989). In the conclusion the results of Chapter 4 will be linked to the theoretical framework by asking the questions what is similar to and what is in contradiction with the theoretical framework and why.

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## 4. Results

The results that have been derived from the data, gathered during the research, will be described in this chapter. The level of formalization in the initial phase, the evolution and influence on cooperation will be grouped and compared per group as described in the previous chapter. This will also be done for the level of centralization and heterogeneity. Also an explanation for the differences will be given based on the obtained data.

### 4.1 Level of formalization

In order to get an overview of the level of formalization in these cases first a description will be given of the formal structure in the initial phase per case. Then cases with a similar level will be grouped and compared to each other group. The differences will be explained by using statements. For the evolution and influence on cooperation a similar approach will be used.

#### 4.1.1 Initial phase

As indicated in the previous chapter three levels of formalization have been recognized: high, medium and low. The level of formalization is high when formal rules and procedures are used and there is a little degree of freedom when executing joint activities. It is medium when rules are present, but not formalized and when there is relative more degree of freedom. It is low when no rules or procedures are used and there is high degree of freedom to execute the joint activities.

There is a strong variation concerning the level of formalization when comparing the clusters. From the nine cases selected the level of formalization in the initial phase is in three cases high, in four cases the level of formalization is medium and the level of formalization is in two cases low. In the following table the level of formalization is indicated per case, with a short description of the formal structure of a cluster (the thick line in the middle of each table is meant to distinguish the cases from literature and from the empirical field research):

<b>Name</b>	<b>Level of formalization initial phase</b>	<b>Description of formal structure initial phase</b>
TIMP	High	Cluster was organized by means of regulations concerning the foundations and other procedures. Projects were executed by means of project specific contracts.
InBroNet	Medium	There were some highly institutionalized rules; however there are no indications that contracts were signed. A regulatory body was not present.



Name	Level of formalization initial phase	Description of formal structure initial phase
"Italian Consortium of Opera Houses"	Medium	For each production a 'Shared Title' was established
ProzessKompetenz.eu	Medium	Initial agreements were laid down, but were not signed. There was no regulatory body present.
Focus Group Internationalization of the VMO	Low	No rules or procedures present.
Dutch Sigma	High	A cooperation agreement was signed between the partners
MVT	High	The foundation was laid down in regulations; similar to TIMP.
"PCT"	Medium	Contracts in which the products were laid down, and the arrangements when a product was sold; however any amounts were not set in advance, contract only between main supplier and end-user, not for whole cluster
NOM: TxU Network Program Compensation Projects	Low	Product paper and annual plan; there was no regulatory body present.

**Table 8: Overview of level of formalization per cluster with short description**

In the cases of Internationalization and TxU NWP CP the level of formalization in the initial phase was low. In these cases no rules or procedures were established to guide the cooperation and there was a high degree of freedom to execute the joint activities because rules or procedures were not present. These clusters decided not to use contracts because they perceived it not as necessary or to have an added value for the cooperation, as can be derived from following statements

*“As soon as you use a formal contract it will be more difficult to get people inside. It is now already hard to get people for the board.” (Interviewee, Internationalization)*

*“We do not have a cooperation agreement ... why should we? It is not a problem.” (Interviewee, TxU NWP CP)*

These cases are very similar to each other; they are examples of informal cooperation. They are both platforms in which companies can meet or they organize activities in which companies can meet. Direct cooperation, for example participation and joint execution of projects, is not an issue in these cases. In both cases the purpose was to build competences, both on a specific subject. The subjects are / were knowledge intensive to a reasonable extent but it did not concern knowledge related to core competences of organizations but knowledge about the offset market or doing business abroad. Therefore a higher level of formalization was not perceived as necessary.

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In four cases the level of formalization was medium (i.e. InBroNet, Italian Consortium of Opera Houses, ProzessKompetenz and “PCT”). For example, in ProzessKompetenz initial agreements were laid down, but not signed so it did not have the form of a formal contract. In case of InBroNet rules were established but in the data it was not indicated whether a regulatory body was present, so there was relative much degree of freedom to execute joint activities. Three reasons for a medium level can be distinguished in this group: to keep the cooperation simple, uncertainty and a knowledge intensive cooperation. In the case of ProzessKompetenz a medium level was chosen in order to keep the relationship simple and the establishment of a new company, with the arrangements related to that new organization, was not the purpose of the cluster. The arrangements were perceived as too complex for their cooperation at that time. Following statement reflects this reason

*“... there are several reasons. A) it is simple, b) the start of a new organization formally is quite another thing and you have to arrange all kind of things. ... It was not our ambition to start a new company.” (Interviewee, ProzessKompetenz.eu)*

In case of “PCT” uncertainty prevented a more formalized structure because the contracts used between main supplier and end-user could not be guaranteed for the whole cluster

*“The cluster is always kept informal... because we had for products that we made a contract to our end-user...in that contract conditions and products were mentioned but not related to numbers. That was the only formal part ... we could not guarantee this to our subcontractors.” (Interviewee, “PCT”)*

In case of InBroNet there were shared rules, meant to guide the relationship (knowledge transfer and joint knowledge creation), however it cannot be indicated how institutionalized the rules were. The same goes for the Italian Consortium of Opera Houses.

*“Therefore, it comes as no surprise that these two subgroups of entrepreneurs were connected by a set of shared rules and resources leading to shared expectations concerning the benefits of forming a regional network, ... by becoming a knowledge intensive network, not only through knowledge transfer but also through joint knowledge creation.” (Sydow and Windeler, InBroNet)*

At first sight these cases have not much in common. The purpose and target of the clusters are different from each other. But the level of cooperation in all cases was not so intense in the initial phase. It involved direct cooperation but the depth of interaction, integration, commitment and complexity was relative low.

The level of formalization is high when arrangements are laid down there is relative a small degree of freedom. In three cases the cooperation was formalized in the initial phase, for example a foundation was established which required regulations to manage the foundation

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(TIMP, MVT) or a cooperation agreement was signed (Dutch Sigma). The reasons for this are not that different from each other. In case of Dutch Sigma formalization was perceived as needed, it emerged during the negotiations for the cooperation

*“At a certain point in time we said: ‘should it not be good to lay down the agreements that we have made and the expectations that we have spoken out towards each other and formalize it. .... So it was not said prior ‘we are going to form a new organization’. ... at a certain moment we felt the need for more structure.” (Interviewee, Dutch Sigma)*

In the cases of TIMP and MVT the structure of a foundation seemed the most logic form, in both cases financial resources were involved.

*“One needs to have a juridical structure because the arrangements must be organized. Because it is about money, a foundation is the most logic form.” (Interviewee, MVT)*

The three cases are all examples of cases in which the cooperation was close with other partners and involved financial resources or the cooperation was knowledge intensive, because knowledge is created or shared.

When the groupings of cases are compared to each other it can be recognized that the purpose and the outcomes of cooperation varied. Clusters that had a high level of formalization are compared to the other groups more knowledge intensive concerning the core competences of the organizations involved, or it involved direct cooperation and the distribution or management of financial resources between the partners. Therefore agreements have been used for structure; a framework has been used to guide the relationships. The group with a medium level of formalization was less knowledge intensive and less financial resources were involved compared to the cases mentioned above. In these cases a high level of formalization was not perceived as necessary due to uncertainty or to keep the cooperation simple and provide a framework without too much formalization. The two cases with a low level were not concerned or focusing on direct cooperation but more on building competences which have been focused on creating knowledge on specific subjects that were not related to the core competences of the organizations involved. In these cases any form of formalization was not perceived as necessary in the initial phase.

#### **4.1.2 Evolution**

Of the three cases with a high level of formalization, the level of formalization has increased in two cases. More formal arrangements have been made or the relationship has become more formalized due to the establishment of a joint venture (a new company). In the other case the level of formalization has sustained. In case of a medium level in two cases the level has sustained. And in one case the level has increased. One case with a low level of formalization has an increase in the level of formalization. The other case has sustained. So in four cases the level has sustained. In four cases the level has increased. In the case of ‘the

Italian Consortium of Opera Houses' the evolution could not be derived from the literature in which the cluster is described. See following table for a description of the evolution of the formal structure:

Name	Level of formalization initial phase	Description of evolution of formal structure
TIMP	High	Increase; more formal arrangements
InBroNet	Medium	Increase; more precise network rules have been put into effect
"Italian Consortium of Opera Houses"	Medium	Could not be derived
ProzessKompetenz.eu	Medium	Sustained; the ambition level became higher but no change in the level of formalization
Focus Group Internationalization of the VMO	Low	Sustained; no change has been necessary. The cooperation went well
Dutch Sigma	High	Increase; the cooperation evolved into a joint venture, it has become more formalized
MVT	High	Sustained; the structure is still a foundation. No changes have been made.
"PCT"	Medium	Sustained; "the formal structure has not changed"
NOM: TxU Network Program Compensation Projects	Low	Increase; the annual programs has become more important and more attention will be paid for achieving the goals.

**Table 9: Overview of evolution of the level of formalization per case**

The reasons why the level of formalization has sustained all can be deduced to one: the current level is perceived as good, there are no reasons to change the level of formalization, so these cases will not be discussed any further here.

However, in four cases the level of formalization has increased. This is understood as an increase in the amount of rules and procedures or a smaller degree of freedom concerning the execution of the joint activities. For example, in TIMP and InBroNet more rules have been installed, in TxU NWP CP the degree of freedom when executing the joint activities has decreased. The reasons for a higher level of formalization can be internal or external. Internal factors are managing the cooperation better in the cases of TIMP and InBroNet as indicated in the TIMP case (a similar reason has been derived from the data from InBroNet)

*"The breach of psychological contracts on norms of behaviour.... Thus, increasing formal regulations compensated for the failure of informal rules of behaviour." (Klein Woolthuis, TIMP)*

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Formalization can also increase because the ambition level increases and more control is required to achieve the goals of a cooperation, as indicated by following statement

*“We are going to make more agreements ... we are going to do this more tightly, but not with forms and things around them.” (Interviewee, TxU NWP CP)*

An external factor to increase the level of formalization is the need to create a legal entity for (potential) customers, as is indicated in the data of Dutch Sigma.

*“We have always said that as soon as a large project is acquired we have to formalize it in order to give the customer a legal partner” (Interviewee, Dutch Sigma)*

These cases have not much in common. In the cases of TIMP and InBroNet more rules have been because the existing rules turned out not to be effective enough or not covering the whole cooperation. In the cases of Dutch Sigma and TxU NWP CP the development of the cooperation forced the clusters to increase the level of formalization.

It can be concluded that clusters only seem to increase or sustain. They do not become less formalized, even after some years. But in only four cases the level has increased. And in one of them (TxU NWP CP) the increase is very minor. So in only three cases the increase has been significant. When the groups of clusters that have not changed and have increased are compared it can be recognized that a need has been identified to make the relationships more formalized as cooperation developed, in order to create a legal entity (external reason) or managing cooperation better and achieving the ambitions (internal reasons). It can also be recognized that the specific cooperation developed faster and more intense in the cases that have become more formalized. So besides encountering a need for a change, also the speed and intensity of the development of cooperation influences the need for more formalization.

#### **4.1.3 Influence on cooperation**

In this section the influence of the level of formalization on cooperation will be discussed. First, an overview will be given from the level of formalization in the initial phase and the influence on cooperation in the initial phase. Then the influence of the evolution of formalization on cooperation only will be discussed for those cases where the level has changed. Cooperation is thus understood as a cooperative joint action between organizations that come together, interact and form psychological relationships. The depth of commitment, complexity, integration and interaction can vary distinguishing cooperation and collaboration.

In one case (i.e. the Italian Consortium of Opera Houses) it was not possible to derive the influence on cooperation. In the other cases each level of formalization in the initial phase had a positive influence on cooperation, so cooperation was stimulated. In none of the cases the

level of formalization had a negative effect. See following table for an overview of the level of formalization in the initial phase and influence on cooperation:

Name	Level of formalization initial phase	Influence on cooperation
TIMP	High	Positive; obliged to cooperate due to signed letter of association in which was mentioned how to cooperate
InBroNet	Medium	Positive; shared rules and monitoring them constantly led to increase of trust
"Italian Consortium of Opera Houses"	Medium	Could not be derived
ProzessKompetenz.eu	Medium	Positively, contracts are negatively associated with trust, are not perceived as powerful
Focus Group Internationalization of the VMO	Low	Positive; voluntary agreements are perceived as better
Dutch Sigma	High	Positive; it was a cooperation agreement
MVT	High	Positive; purpose is incorporated in regulations of foundation
"PCT"	Medium	Positive, arrangements were made that were beneficial for all partners and prevented problems
NOM: TxU Network Program Compensation Projects	Low	Positive; it takes time to learn how to act in networks

**Table 10: Level of formalization in initial phase and influence on cooperation**

Since there are no differences in the influence on stimulating cooperation the tactic of grouping cases and discuss within-group similarity and cross-group differences between a positive and negative influence cannot be used. Therefore the influence on cooperation will be discussed by using the same groups as in section 4.1.1, so the influence of a low, medium and high level of formalization will be discussed and the process of cooperation in each group will be compared to the other groups.

In the cases with a low level of formalization (i.e. Internationalization and TxU NWP CP), any form of formalization was not perceived as necessary and even harmful for cooperation. The low level of formalization has positively influenced cooperation because

*"People that do something voluntary are more committed in my opinion." (Interviewee, Internationalization")*

And giving the companies a high degree of freedom to execute the activities has been perceived as more beneficial as indicated by following statement

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*“This sort of things needs time, in these networks companies also learn to act in networks.”  
(Interviewee, TxU NWP CP)*

In these two cases cooperation was not so intense in the initial phase. Organizations came together but the level of interaction was relative low because interaction and integration between the companies was not the goal of the cooperation in both cases. These cases are examples of cooperation in its ‘lowest form’, the level of interaction, commitment, complexity and integration was low.

The cases with a medium level of formalization (i.e. InBroNet, ProzessKompetenz, and “PCT”) also indicated a positive influence on stimulating cooperation; in short there are two reasons why their medium level has positively influenced cooperation. In the cases of InBroNet and ProzessKompetenz rules were established and monitored, but formalized to the necessarily level, in order to facilitate the development of trust

*“Because of the importance of the rule for securing business and the possibilities of controlling its violation, all InBroNet brokers constantly monitor the situation and thus create knowledge that may serve the purpose of increasing the level of trust or control. ... It does not seem to undermine the level of interorganizational trust found in the network but rather, via increased knowledge about maintaining the code of honor, it strengthens the base for more (global) knowledge-based trust.” (Sydow and Windeler, InBroNet)*

In the case of “PCT” the medium level of formalization resulted in arrangements that were beneficial for all partners, so cooperation was stimulated because organizations were eager to cooperate because of the good arrangements that were made for them

*“We have made an arrangement with our customer. ... We have a price set for a certain period. ... but also for our suppliers we have covered that so that we get no problems with them. ... So we have made some good arrangements.” (Interviewee, “PCT”)*

The level of cooperation in general in these cases was similar. There is some sort of ‘we-feeling’, and a clear collective action. The level of interaction was medium, but the integration between the partners was relative low. The level of complexity and commitment varied, in general it was not very high because the cooperation still was relative informal and in the initial phase.

In three cases the high level of formalization in the initial phase (i.e. TIMP, Dutch Sigma, and MVT) also positively influenced cooperation. Cooperation was stimulated in these cases because of the same reason: the high level of formalization provided a framework for the cooperation which facilitated the cooperation as indicated by following statements from TIMP and from Dutch Sigma (a similar indication has been derived from the data of the MVT case)

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*“In short, commitment was embodied in both formal and psychological contracts and, in that way, reinforced the conviction among partners that everyone was truly willing to invest in the relationship.” (Klein Woolthuis, TIMP)*

*“The arrangement was a clear cooperation-arrangement, in which was described what we were going to do.” (Interviewee, Dutch Sigma)*

These cases are examples of collaboration. The negotiations led to a structure governing their relationship and mutually beneficial interactions. The level of interaction was high, and there was a strong ‘we-feeling’. The level of complexity and commitment was also relative high in these cases. However, the level of integration varied, in Dutch Sigma and TIMP the level of integration was higher than in the case of MVT, this can be explained by the goal of MVT: to finance and secure the position of Mechatronics at the university. Therefore a high level of integration between the member-organizations was not necessary.

Comparing the groups, it can be recognized that the level of formalization is higher in cases where the cooperation had the characteristics of collaboration in the initial phase. In the cases with a low level of formalization (i.e. Internationalization and TxU NWP CP) cooperation was less complex and the level of commitment, integration and interaction was less than the cases with a high level of formalization (i.e. TIMP, Dutch Sigma, MVT) that showed cooperation processes as defined in the definition of collaboration. The cases with a medium level of formalization (i.e. InBroNet, ProzessKompetenz, and “PCT”) had a moderate form of cooperation. The level of interaction, integration, complexity and commitment was in general lower than the cases with a high level of formalization and higher than the cases with a low level of formalization.

The reasons why that specific level has positively influenced cooperation also varies between the different levels. In the cases with a high level of formalization it has been used as a framework for the collaboration. In the cases with a medium level trust has been developed and organizations have been made eager to cooperate because of the mutual benefits. In the cases with a low level of formalization any kind of formalization has not been perceived as necessary due to the low level and goal of the cooperation.

In the cases of TIMP, InBroNet, Dutch Sigma and TxU NWP CP the level of formalization has increased as already discussed in the previous section. In the case of Dutch Sigma only a (new) formal organization (a company) has been established. This has not influenced cooperation because the content of the rules and degree of freedom did not change; the cooperation agreement has been formalized into a new company. This will be discussed in section 4.2. ‘Level of centralization’. The increase in the level of formalization has positively influenced cooperation for two reasons: more rules and control facilitates the development of trust or the ambition level becomes higher.



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In the cases of TIMP and InBroNet an increase has resulted into more rules and control, so less degree of freedom to execute the activities, concerning the behaviour in the network which facilitated cooperation because trust has been developed as indicated by following statement from InBroNet (for TIMP a similar indication of the effect is derived from the data)

*“Only step by step do they generate and elaborate complementary sets of rules and resources for the network. This seems to indicate that control measures and increased knowledge had not undermined the interorganizational trust, but rather—as knowledge- and control-based trust—contributed to its positive development in the network.” (Sydow and Windeler, InBroNet)*

In these cases the level of cooperation also has increased, more interaction and commitment has emerged as the cooperation developed over the years. More rules and control has positively contributed to the development of the clusters.

An increase in the level of formalization can also enhance the effectiveness of a cluster, in order to become more successful, with a higher level of arrangements and less degree of freedom (so more control) cooperation can be stimulated resulting in more interaction as indicated by following statement

*“We now are going to make more arrangements. ... We are going to work harder with commitments to the annual program. ... You need to secure that they grow to the right level. We will also focus more on cooperation between the organizations, that they interact” (Interviewee, TxU NWP CP)*

So an increase is likely to have a positive effect, in all cases the interviewees have responded positive to the change of the level of formalization. In these cases the cooperation also has moved to a higher level, resulting in more interaction, integration, complexity and commitment between the partners in a cluster. So an increase in the level of formalization facilitates the development of cooperation into the characteristics of collaboration because trust is developed and the ambition becomes higher.

## 4.2 Level of centralization

In order to get an overview of the level of centralization in these cases first the level of centralization in the initial phase will be indicated and described through a short description. Similar levels will be grouped and compared to other groups in order to identify the reasons for the differences. For the evolution and influence on cooperation a similar approach will be used.

### 4.2.1 Initial phase

There are some differences between the levels. As mentioned in the previous chapter three levels have been distinguished. The level is high when the locus of authority and decision making is concentrated, it is medium when central actors are present but the locus is not concentrated. It is low when no central actors are present and the locus is dispersed. In the initial phase there are six cases with a medium level of centralization and three cases with a low level of centralization. No cluster in this research had a high level of centralization in the initial phase. See following table for an overview of the level of centralization per case in the initial phase and a short description of the centralization:

Name	Level of centralization initial phase	Description of centralization initial phase
TIMP	Medium	A foundation was established based on democracy in which decisions were made
InBroNet	Low	Cluster was parity based, no central actor
"Italian Consortium of Opera Houses"	Low	Cluster was parity based, no central actor
ProzessKompetenz.eu	Medium	A central management board was created, based on parity.
Focus Group Internationalization of the VMO	Low	Parity based, however a chairman was established.
Dutch Sigma	Medium	"Oost NV" played a central role as a process coach, but locus of authority and decision making was not concentrated
MVT	Medium	A foundation was established based on parity. Similar to TIMP
"PCT"	Medium	There were some key actors, however the locus of authority and decision making was not concentrated
NOM: TxU Network Program Compensation Projects	Medium	The NOM served as a process coach. It was the central actor and could made decisions but did this in consultation with the organizations involved

**Table 11: Overview of level of centralization in initial phase and short description per case**

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In the cases with a low level of centralization (i.e. InBroNet, Italian Consortium of Opera House and Internationalization) a central actor was not present or created (by means of a new organization for example, a foundation or company which serves as central actor). For example, in the case of InBroNet, an initiative to form a strategic network, thus with a central actor, failed. Instead organizations cooperated based on parity. In case of Internationalization a chairman was appointed but the locus of authority and decision-making was dispersed, all were equal.

It is difficult to determine why there was a low level of centralization. The cases that had a low level (i.e. InBroNet, the Italian Consortium of Opera Houses, and Internationalization) are all examples of cooperation between partners that are more or less similar or direct competitors. Parity, or a dispersed locus of authority and decision making, was perceived as important, according to the statements, because companies strived for their own strategic independence and a central actor was not perceived as necessary. So a parity-based cluster is also based on a need of organizations to stay independent, as indicated by following statement from InBroNet which also reflects the cases of the Italian Consortium of Opera Houses and Internationalization

*“InBroNet ... first evolved in 1992 as a response to an insurer’s initiative to set up a “strategic network” ... All three features — the information system base, the inclusion of semi-professionals, and the organizational dependence implied in a strategic network — did not comply with the interests of the insurance broker contacted that (have to) strive for strategic interdependence.” (Sydow and Windeler, InBroNet)*

But in other cases a medium level of centralization was encountered, for example in ProzessKompetenz a management board was created (a new organization, named ProzessKompetenz.eu) based on parity. And in TxU NWP CP the central actor played a coordinating role but decisions were made in consultation with the organizations involved.

In general two reasons are identified for a medium level of centralization. First, in order to manage a cluster some sort of management board or other central actor was needed, but in these cases (i.e. TIMP, ProzessKompetenz, MVT) parity was also perceived as important as indicated by following statements

*“We have said we will do it together. ... We have a board that consists of the three managers ... they meet every month and discuss the tenders and the actions that must be taken. This meeting is directed every half year by someone else.” (Interviewee, ProzessKompetenz)*

*“Which implied that decisions were made democratically and that a daily board had to be chosen by all the members. The daily board consisted of a chairman and two other members.” (Klein Woolthuis, TIMP)*

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A second reason for a medium level of centralization is the coordinating role that a central actor can have in a cluster. In the cases of Dutch Sigma, “PCT” and TxU NWP CP a central actor coordinated the cluster in the initial phase. It was perceived as beneficial in order to

*“assess the demands of a company and remove them if they were not realistic. It is better if this is done by a third party, or in this case a fourth party, that stands aside and is independent. They just mediated.” (Interviewee, Dutch Sigma)*

Another benefit of a coordinating role is that the cluster is monitored, as indicated by following statement

*“We monitor continually. ... In this way we keep a picture which companies are involved to what. ... We are the ‘pacemaker’ and on top of it, both. We are the organizer; we send invitations and write plans with their input.” (Interviewee, TxU NWP CP).*

In these cases the need for a central actor was perceived as necessary in order to manage the cluster. The cases in this group encountered the need for a central actor, either to manage the cluster or coordinate the cluster. Compared to the cases with a low level in these cases a central actor was present, or was created for example by creating a management board. It needs to be remarked here that in the cases of TIMP and MVT a foundation was established, which than is automatically a central organization in the cluster.

When the groups are compared one similarity can be recognized between the two groups: parity is perceived as important in a cluster even when some sort of central actor is established. The difference between the two groups is that the means how to manage a cluster is different. It can be recognized that the clusters involved in a medium level of centralization were more vertical of nature than the clusters that had a low level of centralization, which were more horizontally of nature. So in a vertical oriented cluster it is more likely that a central actor, based on parity, will be present to manage and coordinate the cluster.

#### **4.2.2 Evolution**

In only two cases the level of centralization has sustained. These are the cases that already had a low level of centralization in the initial phase of clusters (i.e. InBroNet and Internationalization). In one case (i.e. Italian Consortium of Opera Houses) the evolution could not be derived and so will not be discussed. In six of the nine cases have increased. This is understood as an increase in the locus of authority and decision making and / or an increase in the concentration of that locus. In the following table the evolution of the level of centralization per case is described:

<b>Name</b>	<b>Level of centralization initial phase</b>	<b>Description of evolution of the level of centralization</b>
TIMP	Medium	Increase, a core group of key actors emerged.
InBroNet	Low	Sustained, no change, a plan for joint venture has been postponed
"Italian Consortium of Opera Houses"	Low	Could not be derived
ProzessKompetenz.eu	Medium	Increase: a chairman has been appointed to direct the meetings and the new organization
Focus Group Internationalization of the VMO	Low	Sustained; no change in the level of centralization
Dutch Sigma	Medium	Increase: a joint venture has been created after a year for which a project manager has been appointed
MVT	Medium	Increase; a management board has been established and a member board
"PCT"	Medium	Increase; the number of partners has decreased and one company took the leading role in the cluster
NOM: TxU Network Program Compensation Projects	Medium	Increase; the NOM has become a more central actor and some central actors have emerged in the network

**Table 12: Overview of evolution of level of centralization per case**

In two cases the level of centralization has not changed. In the case of InBroNet there were plans to establish a joint venture, but this has been postponed due to not mentioned reasons. In the case of Internationalization a change has not been needed in the level of centralization because the cooperation is perceived as successful, as has been indicated during the interviews. These cases will not be discussed any further here, but it is remarkable that the cases with a low level of centralization in the initial phase and that are horizontally of nature (compared to other cases) have not increased.

In six cases however the level of centralization has increased over the years (i.e. TIMP, ProzessKompetenz, Dutch Sigma, MVT, "PCT" and TxU NWP CP). For example, in the case of Dutch Sigma a joint venture has been created so the locus of authority and decision making has become more concentrated, in case of TxU NWP CP the central actor desired more authority and some key companies that are capable of doing more than other have emerged over the years. Such key companies than also have some authority and decision making, so the level of centralization then increases.

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In general there are three basic reasons for an increase of the level of centralization:

- 1) management, e.g. efficiency, clearness, creating a legal entity or direct management of a cluster (ProzessKompetenz, Dutch Sigma, MVT, TxU NWP CP)
- 2) “engineered”, a company deliberately decides to become a central actor (“PCT”)
- 3) emergent, by trust or unintended. Some central actors emerge (TIMP, TxU NWP CP)

The first reason for an increase of the level of centralization is related to management. In order to increase the level of efficiency and management, the level of centralization has increased (ProzessKompetenz, MVT, TxU NWP CP) as indicated by following statements (a similar statement has been derived from TxU NWP CP)

*“We have established a chairman. That emerged after six months. ... Than you notice that the representative takes initiative, tells you what he has done and is going to do. That is the world upside down. Then we said ‘we establish a chairman that directs meetings and takes care of minutes of meetings.’” (Interviewee, ProzessKompetenz)*

*“We have decided to place everyone in the member board and three people in the daily board. You have to arrange a lot of things with each other, ... and all eleven must be present. This never succeeds. .... With three is it easier than with eleven.” (Interviewee, MVT)*

In the case of Dutch Sigma a joint venture (a new company) has been established in which the locus of authority and decision making has been concentrated because it made the cooperation clearer and a legal entity has been created (which is already discussed in section 4.1.2, so an increase in the level of formalization and level of centralization are linked in this case)

*“It is better to start a new company. It keeps it simple for everyone ... all managers are involved, every three months we have a meeting and discuss ongoing things.” (Interviewee, Dutch Sigma)*

A second reason why the level of centralization has increased is related to the intention of one organization. In case of “PCT”, an organization has created a central role for itself. Decision making thus has become more concentrated and more coordination has emerged because the organization wanted to, as indicated by following statement.

*“So we started to operate like a referee ... this are the problems ... we want to arrange everything. We are able to arrange everything ... this type of trajectories emerged when we became main supplier.” (Interviewee, “PCT”)*

The last reason why centralization has increased is related to the emergence of key figures in a cluster. In the case of TIMP it is related to trust. In the case of TxU NWP CP it is unintended and it is explained as a result of some companies being more capable than others as indicated by following statement

*“You also can recognize two groups more recently. ... there are companies that benefit from the program. That are the companies that are what more capable. ... they succeed in acquiring large orders.” (Interviewee, TxU NWP CP)*

Comparing the group that has increased to the group without an increase it can be recognized that the level of centralization in all cases with a medium level of centralization in the initial phase has increased. For this increase in the more vertically oriented clusters three reasons are identified: a need has been recognized for more management, it has been engineered to become a central actor or sometimes it just has emerged because of trust or because some organizations are capable of doing more than others.

#### **4.2.3 Influence on cooperation**

In this section the influence of the level of centralization on cooperation will be discussed. First, an overview will be given from the level of centralization in the initial phase and the influence on cooperation. Then the influence of the evolution of centralization on cooperation only will be discussed for those cases where the level has changed. Cooperation is understood as a cooperative joint action between organizations that come together, interact and form psychological relationships. The depth of commitment, complexity, integration and interaction can vary, distinguishing cooperation and collaboration.

In one case (i.e. the Italian Consortium of Opera Houses) the influence on cooperation could not be derived so this case will not be discussed here. In the other cases, except the case of TIMP, the level of centralization had a positive effect on cooperation; this is understood as stimulating cooperation. In the case of TIMP the (medium) level of centralization did not stimulate cooperation. Following table provides an overview of the level of centralization in the initial phase and the influence on cooperation:

<b>Name</b>	<b>Level of centralization initial phase</b>	<b>Influence on cooperation</b>
TIMP	Medium	Negative; only a few companies were involved and chairman abused power for own benefit
InBroNet	Low	Positive; there was a mutual evaluation of fairness and meetings
"Italian Consortium of Opera Houses"	Low	Could not be derived

Name	Level of centralization initial phase	Influence on cooperation
ProzessKompetenz.eu	Medium	Positive, management board stimulated cooperation
Focus Group Internationalization of the VMO	Low	Positive, a chairman was and is considered to be necessary for follow-up of actions
Dutch Sigma	Medium	Positive; had a stimulating role
MVT	Medium	Positive; needed for follow up of actions and take care of legal obliged actions
"PCT"	Medium	Positive; key actors served as a panel for feedback
NOM: TxU Network Program Compensation Projects	Medium	Positive; organizing things and follow-up

**Table 13: Level of centralization in initial phase and influence on cooperation**

In the case of TIMP, the medium level of centralization did not stimulate cooperation between all partners, because TIMP was of too much value for the chairman. He was both project champion and chairman of the foundation. He prevented the entry of other members and was only interested in doing things and taking decisions that would benefit his own company. This and more things resulted in conflict and third party arbitration. Cooperation was thus not stimulated because the chairman was also manager of Origin, the project champion. Because only a few partners were involved a lot of frustration arose

*“In practice though, only a few partners were involved in the projects. .... The engineering companies that had hoped to substantially increase their turnover were dissatisfied about the very dominant role of Origin and its limited effort to involve other companies in its project execution. ... This meant that a number of firms were just waiting for work without taking any initiative. The longer they waited, the more frustrated they got.” (Klein Woolthuis, TIMP)*

In this case the distribution of power and interest was not good enough to stimulate cooperation in the cluster. And the distribution of the benefits was not equal. The chairman had a big interest in the cluster and he had too much power to secure his own benefit(s).

In the other seven cases the level of centralization in the initial phase had a positive influence despite the different levels between the cases. Therefore first the reasons why a low level of centralization positively influenced cooperation will be discussed. Then the reasons why a medium level of centralization positively influenced cooperation will be discussed and compared to TIMP and the group with a low level of centralization.



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In the cases with a low level of centralization in the initial phase (i.e. InBroNet and Internationalization) the cooperation was stimulated due to different reasons. In case of Internationalization the chairman stimulated cooperation (despite he had little authority) as indicated by following statement

*“In the first year a lot has been achieved. ... The chairman was on top of it. ... There has been worked fast. ... Things were not led drifted.” (Interviewee, Internationalization)*

In case of InBroNet the absence of a central actor resulted in a careful observation of each other’s behaviour by the partners involved. Even without a concentrated locus of authority and decision making partners can check each other. They also could make use of each other, as indicated by following statement

*“The InBroNet brokers observed each other’s behavior carefully and checked whether the knowledge was not used against the interest of any network partner. ...When a firm is not able to control an event or action on its own, it can indirectly make use of the capacity of one or several partners to control the activity, judgment, or expertise of a colleague firm.” (Sydow and Windeler, InBroNet)*

In these cases the organizations did not need a central actor with much authority to manage their cluster and stimulate cooperation. They were able to cooperate with each other by themselves. The level of cooperation is also different. In InBroNet the cooperation involved more interaction than in the case of Internationalization.

In the cases of ProzessKompetenz, Dutch Sigma, MVT, “PCT” and TxU NWP CP the level of centralization in the initial phase was medium and had a positive influence on cooperation because of two reasons: the central actor played a coordinating role which stimulated cooperation, or central actors served as panel for feedback which stimulated cooperation between the partners.

In the cases of ProzessKompetenz, Dutch Sigma, MVT and TxU NWP CP the medium level stimulated cooperation because of the coordinating and management abilities of the central actor(s). In the case of MVT the chairman of the foundation and the foundation itself had a coordinating role, in the cases of Dutch Sigma and TxU NWP CP a development agency had a stimulating role. In the case of ProzessKompetenz a management board was established which promoted cooperation in each organization involved. Following statements derived from Dutch Sigma and ProzessKompetenz indicate the influence on cooperation (a similar statement about the central actor has been derived from the cases TxU NWP CP and MVT)

*“Some sort of negotiator [Oost NV] with a fresh view. If one of the organizations had unrealistic questions or demands they could erase it. They stimulated the cooperation” (Interviewee, Dutch Sigma)*

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*“We have a management board that consists of three managers from the companies. ... And he [the manager] manages this in his own company. ... What is important is that the three people judge this [competition], take a decision monthly and manage their organization accordingly.... So this needs to be discussable and you must and dare to correct each other.”* (Interviewee, ProzessKompetenz)

In the case of “PCT” the cooperation was stimulated because the central actors(s) could serve as a partner for feedback and so obtains a coordinating role which promoted cooperation because they promoted the interaction throughout the cluster. So the influence was positive because a coordinating role was obtained by means of a feedback function, as indicated by following statement

*“So that was a situation where they could not talk about internally because the machining had gone. Then you can function as feedback panel. It has had its advantages. ... So we acted as a director in order to manage the problems. ... And we promote that our suppliers develop plans and ideas for improvement.”* (Interviewee, “PCT”)

The level of cooperation in the medium group varies, there are no similarities. For example, TxU NWP CP and Dutch Sigma did not have the same level of cooperation, but they did have a similar level of centralization. The only similarity in this group is the fact that the cooperation was more vertically of nature compared to the cases with a low level of centralization.

When the groups are compared it can be recognized that a medium level of centralization can stimulate cooperation, but is however not a necessary condition. Also members of a cluster can do that. Only in TIMP the centralization had a negative effect due to too much centralization or an abuse of it by the chairman/project champion. Comparing the cases with a low and medium level of centralization it can be recognized that in general the level of cooperation does not vary with the level of centralization as is the case with the level of formalization. Instead, the nature of the cooperation, between horizontal or more vertical partners, is explaining the influence of the level of centralization on cooperation. In clusters that are horizontally of nature a low level of centralization was encountered, in the vertically oriented clusters a medium level of centralization was encountered mainly for coordinating the cluster and so stimulate cooperation.

In six cases the level of centralization has increased (i.e. TIMP, ProzessKompetenz, Dutch Sigma, MVT, “PCT” and TxU NWP CP) the locus of decision making and authority became more concentrated. The influence on cooperation in all cases was positive. Cooperation was stimulated because management improved, or the emergence of some key actors had a stimulating role or it was part of a strategy.

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In the cases of ProzessKompetenz, Dutch Sigma and MVT the increase has stimulated cooperation because the cooperation developed due to an increase in the level of centralization as indicated by following statement from the MVT case (statements with a similar influence on cooperation has been derived from Dutch Sigma and ProzessKompetenz)

*“It implies that meetings can be shorter and that there are more opportunities for exchange of information” (Interviewee, MVT)*

In these cases the level of cooperation (i.e. the level of interaction and commitment) has increased. There is a stronger ‘we-feeling’ between the partners and the cooperation has become more intense compared to the cooperation in the initial phase.

In the cases of TIMP, “PCT” and TxU NWP CP central actors emerged, intended or unintended. But in these cases the central actors have stimulated cooperation because these actors can provide work for the members and coordinate it as indicated by following statements from “PCT” and TxU NWP CP (a similar influence has been derived from data of the TIMP case)

*“We translated it [product contract] to our suppliers. ... We do not order on direct orders from the customer, but also on forecast. So we let our suppliers breathe, that they have a certain flow. ... For many parts in the mechanical field we can determine very well what the prices are.” (Interviewee, “PCT”)*

*“And lately this [cooperation between members of the cluster] is stimulated. ... The front runners score a number of tenders and then they start subcontracting to other members in the network. They know each other and trust is developed.” (Interviewee, TxU NWP CP)*

In the last statement also the last reason why an increase of centralization stimulates cooperation has been revealed. As a part of the strategy to promote cooperation between organizations after some years the level of centralization can increase in order to stimulate cooperation by having a more central and coordinating role and with more authority as in the case of TxU NWP CP.

In the cases of TIMP, “PCT” and TxU NWP the level of cooperation has increased. Organizations are interacting more with each other and the results become more concrete, for example in concrete product or financial rewards. The level of commitment also increases. This is however also the case in the other group of ProzessKompetenz, Dutch Sigma and MVT. So in general it can be said that central actors can emerge, unintended and intended, or that centralization increases in order to manage the cluster as the cooperation develops. Compared to the cases that showed no increase, these cases are more vertically of nature. So especially in vertical oriented clusters the medium level of centralization of the initial phase will increase over time.

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### 4.3 Level of heterogeneity

To get an overview of the level of heterogeneity in these cases first a description will be given of the level of heterogeneity in the initial phase per case. Then cases with a similar level will be grouped and compared to each other group. The underlying reasons for the differences will be discussed by using statements. For the evolution and influence on cooperation a similar approach will be used.

#### 4.3.1 Initial phase

As is mentioned in the previous chapter three levels of heterogeneity have been distinguished. It is high when organizations are asimilar and a large variety of partners, e.g. university, trade associations or other agencies, is present. It is medium when organizations differ, but the variety of different type of partners is lower compared to a high level. The level is low when organizations are similar and the variety of different type of partners is low. From the nine cases, five cases have a high level of heterogeneity in the initial phase. Three cases have a medium level of heterogeneity and in one case the level of heterogeneity is low.

See following table for an overview of the level of heterogeneity in the initial phase and a description per case:

Name	Level of heterogeneity initial phase	Description of heterogeneity in initial phase
TIMP	High	The partners involved were asimilar and a variety of partners was present (firms, government, knowledge institution)
InBroNet	Medium	They were all insurance brokers, but different resources and were not all similar to each other
"Italian Consortium of Opera Houses"	Low	Each opera house was similar to the other houses
ProzessKompetenz.eu	High	The partners have different resources and market, but some overlap. German governmental institution (chamber of commerce) also involved
Focus Group Internationalization of the VMO	Medium	All members were asimilar, had different resources and market. But were all active in the metal sector
Dutch Sigma	High	High complementariness and the government was also involved
MVT	High	Government and knowledge institution were involved. The companies involved had different resources and market but were all active in mechatronics

Name	Level of heterogeneity initial phase	Description of heterogeneity in initial phase
"PCT"	Medium	There was a large number of partners, no government or knowledge institution involved. All active in machining, but different resources and markets.
NOM: TxU Network Program Compensation Projects	High	There was much variety among the members of the network. All had very different resources and markets. Government was also involved.

**Table 14: Overview of level of heterogeneity in initial phase per case with description**

In one case (i.e. the Italian Consortium of Opera Houses) the level of heterogeneity in the initial phase was low. In this case three opera houses, that were located in the proximity of each other, cooperated to share resources. The Opera Houses were very similar to each other. There were no governmental or educational institutions involved in the cooperation. The government was only involved in stimulating cooperation by means of policies and programs, the cooperation was imposed and part of a program to stimulate cooperation between Opera Houses. This also explains why the level of heterogeneity was low.

In three cases (i.e. InBroNet, Internationalization and "PCT") the level of heterogeneity in the initial phase was medium. For example, in Internationalization organizations that were asimilar cooperated, but they were active in the same sector and the variety of different types of members was low. In InBroNet the members were all brokers but they were different and had different resources. The reasons for a medium level of heterogeneity in these cases are different. In the last case (i.e. "PCT") it was historical grown and part of the deal as indicated in following statement

*"because also existing relations were involved in the deal. For some specs more than thirty suppliers were involved. ... they [the procurers of the customer] also had several suppliers. That could be historical based. ... there were a lot of small companies involved, also large ones." (Interviewee, "PCT")*

In the first two cases (i.e. InBroNet and Internationalization) the partners decided to cooperate on a voluntary base because they were triggered by developments in their environment as indicated by following statement from InBroNet (a similar statement has been derived from the data of Internationalization)

*"The most important economic reason for the formation of InBroNet, however, was the fact that the financial services business had become very knowledge-intensive. ... For this knowledge reason in particular, the seven brokers formed a regional network in which each of them would take on a specialized role related to his or her particular expertise, competency, and capability." (Sydow and Windeler, InBroNet)*

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In the case of InBroNet the environment became more complex and an earlier initiative failed, but the attention of the companies on clustering and the advantages of clustering had been established. In the case of Internationalization the reason for the heterogeneity is also a historical one, the VMO was a result of an amalgamation of the VMT (*Verenigde Metaal Twente*) and the OKK (*Oostelijke Kunststof Keten*), and the involvement in Internationalization was based on a voluntary base. However, only companies of the former VMT decided to join this cluster. In these two cases the organizations (active in the same field in each cluster) in each cluster faced the same opportunities and threats (i.e. in the case of InBroNet the increase of necessary knowledge for insurers and in case of Internationalization the fact that companies in the region of Twente were unfamiliar with doing business abroad) resulting in the establishment of a cluster in both cases in order to cope with those opportunities and threats.

In five cases the level of heterogeneity was high in the initial phase, organizations were asimilar and a variety of partners was present. For example, in TIMP organizations that had different resources and different core competences were selected in the initial phase and the variety was high because engineering, production and sales organizations and governmental and knowledge institutions were involved. In Dutch Sigma the organizations were very different from each other and a development agency was involved in the initial phase. There are in general three reasons why a high level of heterogeneity occurred in the initial phase. The organizations were selected (TIMP and TxU NWP CP), or they met and saw the potential advantage and benefit of cooperation (ProzessKompetenz, Dutch Sigma), or organizations faced a common threat.

In the case of TIMP and TxU NWP CP the organizations were selected to form a cluster. The development of the clusters in these cases are thus engineered to a certain extent. In both cases the market determined the type of partners. Organizations were selected on their potential for the cluster and fit with the market as can be derived from following statements

*“In Twente, various companies and institutions were active in the medical field. ...Faced with ... the knowledge there would be a great potential in the region if well developed ... took the initiative to contact more companies. ... They contacted companies that were active in the medical sector and could supply complementary products or capabilities to fully exploit the network’s potential. ... TIMP was comprised of highly complementary partners.” (Klein Woolthuis, TIMP)*

*“Of course we have selected. ... We have made lists ... and there are similar companies ... that have the same market. ... So eventually it was not a competitor, only at first sight. We did not, of course, select four machineries. That has no use, we cannot satisfy them and it only produces competition. So we have looked ... that we get complementariness. ... we have looked where companies were located in the value chain.” (Interviewee, TxU NWP CP)*

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In both cases the cooperation in a cluster was initiated and promoted by a regional development agency which had the purpose to foster economical development in a region. The difference is that the level of cooperation varies, in the case of TAMP cooperation required more interaction and was more complex compared to the case of TxU NWP CP.

In the cases of ProzessKompetenz and Dutch Sigma the organizations have met each other in different occasions, started talking and discovered the opportunities and benefits of a cooperation because they would complement each other or would be able to achieve more if they started a cooperation as indicated by following statement (a similar statement has been derived from the data from Dutch Sigma)

*“We met in a triathlon, we have decided we all wanted to exploit the German market. ... It turned out that we, to a large extent, were complementary, but also some overlap. But mainly complementary ... we complement each other. The ‘Handwerkskammer’ [German Chamber of Commerce] Muenster was also involved. ... It was a consequence of the triatlons.” (Interviewee, ProzessKompetenz)*

These cases have in common that they consist of three companies and have had help of governmental related institutions. In one case (Dutch Sigma) it was a result of own initiative, in the case of ProzessKompetenz is it was a result of taking part in the so called triatlons. So beside the complementariness of the partners also linkages were made to government related institutions.

In the case of MVT, the level of heterogeneity was determined by an event in the environment of companies; the Chair of the mechatronics research retired and a new Chair was difficult to establish. For companies that used mechatronical knowledge this implied a threat because they were dependent on that knowledge and people who had obtained that knowledge at the university in order to execute their activities. Mechatronics are applied in very different fields and by very different organizations, as can be derived from following statement, it concerned a whole industry

*“In 2001, the professor retired. The university then, hesitated to give succession to that Chair. Then we, as industry, took the initiative to finance it. ... There are some very large companies involved ... no direct competitors. There are two other suppliers you could title competitors..... That field is so big, it is a question of to give and to take.” (Interviewee, MVT)*

So the type of Chair determined the type of organizations involved. Because it was a Chair at the university, the university was involved. Oost NV was involved because they “wanted to cooperate. Oost NV recognizes the importance of sustaining knowledge and the cooperation between the University of Twente and companies”.<sup>3</sup>

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<sup>3</sup> Source: [www.tvalley.nl/site/bestuursleden/00005/](http://www.tvalley.nl/site/bestuursleden/00005/)

When comparing the cases with a low, medium and high level of heterogeneity in the initial phase, it can be recognized that the cases with a high level of heterogeneity were engineered, or based on the observation and perception that cooperation between complementary partners could be beneficial, or an industry faced a threat. In these cases the cooperation was started for a particular reason. In the cases with a medium level historical factors were important, for example the inheritance of relations (“PCT”) or similar organizations face the same opportunities and threats (InBroNet, Internationalization) and the cooperation was voluntary based. The case with a low level (i.e. the Italian Consortium of Opera Houses) was the result of a governmental program which imposed Opera Houses to cooperate.

The level of heterogeneity thus depends. In the cases with a high level there was a need to involve knowledge or governmental institutions or these types of institutions took initiative to start up a cluster. In the cases with a medium level similar organizations faced the same opportunities and threats (leaving the case of “PCT” out of consideration), resulting in a horizontally oriented cluster. So the level of heterogeneity depends on the environment and goals of a cluster and the type of partners needed.

#### 4.3.2 Evolution

An increase in the level of heterogeneity is understood as an increase of asimilar organizations or an increase of different type of organizations. A decrease is understood as the reduction of asimilar organizations or less variety of different type of partners. From the five cases with a high level of heterogeneity in the initial phase, in two cases the level has sustained and in two cases the level has increased even further. In one case there has been a decrease of heterogeneity because a knowledge institution left the cluster.

All three cases with a medium level of heterogeneity have increased. In the case with a low level of heterogeneity there are no indications whether the level of heterogeneity has changed, this case will not be discussed any further. In total five cases have shown an increase in the level of heterogeneity, two cases have not changed, and in one case the level of heterogeneity has even decreased over the years.

In following table an overview is given of the evolution of the level of heterogeneity per case:

<b>Name</b>	<b>Level of heterogeneity initial phase</b>	<b>Description of evolution of level of heterogeneity</b>
TIMP	High	Decrease; the university stopped membership of the cluster. Another member also stopped and others joined the cluster. But same type of organizations
InBroNet	Medium	Increase; more members have been added to the cluster and one has stopped cooperation
"Italian Consortium of Opera Houses"	Low	Could not be derived from the data



Name	Level of heterogeneity initial phase	Description of evolution of level of heterogeneity
ProzessKompetenz.eu	High	Sustained; no partners added, governmental institution is now involved infrequently
Focus Group Internationalization of the VMO	Medium	Increase; the number of companies has been reduced, knowledge institution and Chamber of Commerce have been added
Dutch Sigma	High	Sustained, Oost NV nowadays only is infrequently involved. No organizations have joined this initiative
MVT	High	Increase; more different partners, with different capabilities have joined the foundation, all in the field of mechatronics
"PCT"	Medium	Increase, the number of partners has decreased. But the organizations that are currently involved are more heterogenic to each other
NOM: TxU Network Program Compensation Projects	High	Increase; more companies have joined the network

**Table 15: Overview of evolution of the level of heterogeneity per case**

In two cases the level of heterogeneity has sustained (i.e. ProzessKompetenz and Dutch Sigma). In these cases more partners or more different partners have not been perceived as necessary. The cases are very similar to each other. In both cases three organizations are working together that complement each other. So the number of partners is relative small, in this way they all benefit from the cooperation. These cases will not be discussed any further because the level of heterogeneity has not changed.

In the case of TIMP the level of heterogeneity has decreased. In this case two partners have left the cooperation. The first was an employee of a physiotherapeutic centre; the latter was an employee of the university. In return two members have been added but they were either engineering offices or product developers. So the level of heterogeneity has decreased because the variety of different types of partners has decreased. Looking at the motives to withdraw the membership it can be recognized that both members had a negative evaluation of the cooperation in TIMP. They were not much involved in the cooperation and did not agree with how the cooperation was established. So a negative evaluation is here the reason for a decrease of heterogeneity as indicated by the following citation

*“It took until 1998 before ... new members were accepted in the group. ... Joseph had joined TIMP ...All this him to give a negative evaluation on the TIMP potential and made him decide to withdraw his membership. Another partner that left the group was Albert from the Twente University. His enthusiasm for TIMP decreased as time passed. ... In Albert’s perception the companies did not understand what they themselves were doing, did not understand what*

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*their own problems were, and did not have the money for serious product development. ... In the course of 1997 he left the group on personal grounds.” (Klein Woolthuis, TIMP)*

In five cases the level of heterogeneity has increased (i.e. InBroNet, Internationalization, MVT, “PCT” and TxU NWP CP) as the cooperation developed over the years. For example, in the case of InBroNet the number of organizations has increased. In the case of Internationalization the variety of different type of partners has increased without an increase in the number of partners. Three reasons why the level of heterogeneity has increased have been identified. Companies wanted to join an initiative which results in an increase in the number of partners and more asimilar organizations (InBroNet, MVT, TxU NWP CP), or the number of partners has deliberately been reduced resulting in partners that complement each other (“PCT”), or the variety of partners has increased due to a need for more variety (Internationalization).

In the cases of InBroNet, MVT and TxU NWP CP the number of partners involved has increased. These new companies in all cases have asked if they could join the cluster. In all cases it has led to an enrichment of the cluster. So because the number of partners has increased the level of heterogeneity also has increased. In these cases there also have been some selection criteria for new partners. The clusters in all cases have given a fiat to the entrance of new members. See following citations about the increase of heterogeneity (a similar indication has been derived from TxU NWP CP)

*“InBroNet accepted two new members that asked for participation: B&B and C&C. Both members were active in the commercial lines and received the information about the network from insurers with whom InBroNet places business. The exit of one and the entry of these two new members increased the size of InBroNet to eight for the years to come.” (Sydow and Windeler, InBroNet)*

*“We are now with eleven; twelve, so one or two organizations are added per year. I have always had the opinion that we do not recruit. People have to voluntarily, ... they have to choose themselves. They have to make the best of it. ... It is just an enrichment that more organizations are added, of course it are companies that we know already and we appreciate them. ... It is formal discussed ... but it has never happened that ‘we do not want those companies’.” (Interviewee, MVT)*

These cases have in common that their cooperation became visible for other organizations in their environment as the cooperation developed over the years. Some organizations thus wanted to join in order benefit from cooperation in a cluster.

The case of “PCT” is opposite to the cases discussed above. The number of partners has decreased but the level of heterogeneity has increased. The number of thirty partners, at the start of the cluster, has been reduced to less than then. It also was decided to select partners

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from their own value chain and to select the partners on some criteria. So it has been engineered to reduce the number of partners. As a result a small number of partners has been established that were complementary to each other. As a result, and also intended, the product quality has become more constant, the production costs has been reduced, and the commitment of the partners has increased as indicated in following statements

*“We have started to source ourselves in order to find alternatives and spreading risk. ... It has resulted in the change of a large group to a small group, ... to look at the individual competences and ... it is better to lay a big volume at one partner.” (Interviewee, “PCT”)*

*“It becomes more interesting for a supplier because his volume increases. ... it had a great positive cost development as a result. ... On the other hand it also resulted in a more constant quality ... and the commitment has increased of the organizations involved.”(Interviewee, “PCT”)*

In the case of Internationalization the number of partners has not increased, but linkages have been made to institutions in the knowledge field and in the governmental field. The Stodt, a technological institution, and the Chamber of Commerce have been added to the cluster. This was an action from the cluster because they felt the need for these organizations to become a member of the cluster. The reason for these organizations to invite them to become a member was that they would enhance the performance of the cluster as indicated by following statement

*“Stodt has been added ... Stodt is capable of doing that [coordination], it is a coordinator of several activities that are involved. Next to them we have also made contact with the internationalization club of the Chamber of Commerce ... you notice that the need of the companies can be better synchronized with the things the Chamber of Commerce can offer than when individual companies contact the Chamber of Commerce.” (Interviewee, Internationalization)*

Comparing the case of TIMP to the group of cases that had an increasing level of heterogeneity, it can be recognized that in TIMP the organizations that left the cluster have not been involved in the cooperation. In the other cases all partners have been involved in the cooperation and even when the number of partners has increased all partners have been involved in the cooperation. As has been derived from the data of TIMP, the two organizations that left had a negative evaluation of the cooperation and they also were very different organizations compared to the other organizations that were involved in TIMP. In the other cases, with exception of ProzessKompetenz and Dutch Sigma, the level of heterogeneity has increased due to several reasons.

So why is there an increase or decrease in the level of heterogeneity? Based on an evaluation organizations have decided to withdraw or others have been asked to join the cluster (TIMP, Internationalization, “PCT”), or there has been no need for more or other partners (ProzessKompetenz, Dutch Sigma). Or organizations wanted to become a member of a cluster because they have become aware of the cluster and decided that they wanted to join the cluster and their entrance has been granted (InBroNet, MVT, and TxU NWP CP).

### 4.3.3 Influence on cooperation

In this section the influence of the level of heterogeneity on cooperation will be discussed. First, an overview will be given from the level of heterogeneity in the initial phase and the influence on cooperation. Then the influence of the evolution of heterogeneity on cooperation only will be discussed for those cases where the level has changed. Cooperation is understood as a cooperative joint action between organizations that come together, interact and form psychological relationships. The depth of commitment, complexity, integration and interaction can vary, distinguishing cooperation and collaboration. A positive influence is understood as stimulating cooperation, a negative influence is understood as hindering cooperation. The influence is neutral when it has not stimulated nor hindered cooperation.

In two cases (i.e. the Italian Consortium of Opera Houses and “PCT”) there were no clear indications in the data about the influence of the level of heterogeneity in the initial phase on cooperation. So they will not be discussed here. In one case (i.e. InBroNet) the level of heterogeneity had a neutral influence; it did not promote or hinder cooperation. In the case of TIMP the level of heterogeneity had a positive and negative influence on cooperation. In the other cases the level of heterogeneity in the initial phase had a positive effect.

See following table for an overview of the level of heterogeneity in the initial phase and the influence on cooperation:

Name	Level of heterogeneity initial phase	Influence on cooperation
TIMP	High	Positive; needed each other to achieve the goals Negative; not every organization was involved and different opinions about cooperation between firms and university (cognitive distance too large)
InBroNet	Medium	Neutral; easy imitable products and distrust
"Italian Consortium of Opera Houses"	Low	Could not be derived
ProzessKompetenz.eu	High	Positive; able to learn from each other and complement each other. But also different languages, way of working

Name	Level of heterogeneity initial phase	Influence on cooperation
Focus Group Internationalization of the VMO	Medium	Positive; open and informal cooperation
Dutch Sigma	High	Positive; learn from each other and needed each other
MVT	High	Positive; organizations could learn from each other Negative; cognitive distance between companies and university
"PCT"	Medium	Could not be derived
NOM: TxU Network Program Compensation Projects	High	Positive; learn from each other and with each other

**Table 16: Level of heterogeneity in initial phase and influence on cooperation**

In case of InBroNet the medium level of heterogeneity in the initial phase had a neutral effect because they all had imitable products, but the other members could use it. However, they checked each other frequently whether the imitation of products was abused. So imitation was promoted. But, because of a lack of trust, control was often used. So companies also tried to protect their own resources, as indicated by following statement

*“Insurance products, services, and practices ... are easy to imitate. In fact, brokers are used to copying successful products, services, and practices; at the same time, they try to protect their own resources against imitation by others. In the case of InBroNet and with regard to this problem, the agents accepted this and even promoted the imitation within the network. However, the InBroNet brokers observed each other’s behavior carefully and checked whether the knowledge was not used against the interest of any network partner.” (Sydow and Windeler, InBroNet)*

In the case of TIMP and MVT the high level of heterogeneity had a positive and negative influence on cooperation, with a strong accent on the positive effect on cooperation. On the one hand organizations could learn from each other and the organizations needed each other to achieve the goals of the cluster because no single organizations was able to do everything by themselves as indicated by following statement from TIMP

*“It took partners approximately one year to slowly overcome the hesitance towards ‘strangers’. ... As a group they could complement each other, making it possible to obtain larger and more complex projects from large, outsourcing companies. ... it would benefit their own turnover and growth. They were all willing to contribute to the realisation of this goal.” (Klein Woolthuis, TIMP)*

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However, the cognitive distance between all partners can be too big. Not all partners speak the same language. In TIMP and MVT especially the cooperation with the university is not always even good as indicated by following statement from MVT

*“We discover some positive things have developed, but very slowly. ... A university is publicly seen an organizations that is sensitive for hypes. And it has developed an own way of thinking that I do not understand.” (Interviewee, MVT)*

These cases have in common that they both involve or have involved a university, namely the University of Twente. And in both cases companies and the university interact, but the relation between the practice and the knowledge is not optimal. The cognitive distance between the university and practice is often very big, resulting in the case of TIMP to the withdrawal of the university.

In the case of Internationalization the cooperation was stimulated despite the medium level of heterogeneity because there was no fear of competition and due to the open communication the cooperation went well as can be derived from following statements (combined they explain why the medium level positively influenced cooperation)

*“Besides they were no competitors there was also little fear among the members.” (Interviewee, Internationalization)*

*“The cooperation went well. ... The ‘mood’ was informal and open. ... Nowadays the communication is very open and projects can be executed together.” (Interviewee, Internationalization)*

In the other cases (i.e. ProzessKompetenz, Dutch Sigma, and TxU NWP CP) the level of heterogeneity positively influenced cooperation because organizations needed each other, or could learn from each other because they were different. In the cases of ProzessKompetenz and Dutch Sigma the organizations needed each other, but it also took some time to become familiar to each other, as indicated in following statement from Dutch Sigma (a similar statement has been derived from ProzessKompetenz)

*“The cooperation went well. It is the power of it, that you complement each other. You can correct each other if necessary. ... First there were some problems, because the organizations needed to get used to do this. ... It took some time to discover which employees were needed for what.” (Interviewee, Dutch Sigma)*

In the case of TxU NWP CP the high level of heterogeneity in the initial phase positively influenced cooperation because organizations could learn each other and appreciate each other and in this way they even could provide each other with work as indicated by following statement

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*“One of the advantages of a network program is that companies can learn and appreciate each other. ...The joke is that ... they meet each other in this cluster and eventually they start to work for each other or refer to each other.” (Interviewee, TxU NWP CP)*

These cases (i.e. ProzessKompetenz, Dutch Sigma and TxU NWP CP) have in common that the cooperation became more intense over time. The level of interaction increases and after some period of getting known to each other organizations can learn from each other.

When the different groups are compared to each other it can be recognized that the cases in the groups differ on the level of cooperation. In the group with a neutral effect on cooperation (i.e. InBroNet, having a medium level of heterogeneity), the organizations interacted with each other but they became not integrated. However, a medium level of heterogeneity can stimulate cooperation when the cooperation is open and informal as can be derived from the other case with a medium level of heterogeneity (i.e. Internationalization).

In the group with a positive influence (ProzessKompetenz, Dutch Sigma and TxU NWP CP), the organizations were able to learn from each other, these cases had a high level of heterogeneity compared to the cases of InBroNet and Internationalization. However, it also took some time for the organizations to become acquainted to each other, because the organizations were different from each other or not used to cooperate. In the cases with a medium level the organizations were similar so they used the same resources and spoke the same language, but in case of InBroNet this also led to distrust and checking each other's behaviour. A high level of heterogeneity can also create a cognitive distance. Compared to the other cases it is recognized that in the cases of TIMP and MVT a university was (and is) involved in the cooperation. This implies that firms and the university were interacting with each other. However, this also caused 'problems' because the cognitive perceptions of firms and the university did not always match, they speak different languages and do not understand each other always.

In one case the level of heterogeneity has decreased (i.e. TIMP), but it can only be derived why the partners left and other were added. Not how this change has influenced cooperation. In the case of InBroNet the level of heterogeneity has increased but the influence on cooperation could not be derived from the data. In three cases the level has sustained or could not be derived from the data (i.e. the Italian Consortium of Opera Houses, ProzessKompetenz and Dutch Sigma). These cases will not be discussed any further here.

In four cases the level of heterogeneity has increased (i.e. Internationalization, MVT, "PCT" and TxU NWP CP) as mentioned in the previous section. In all cases the increase positively influenced cooperation due to two reasons. The increase of the level of heterogeneity results in an enrichment of a cluster and it results in more commitment and interaction between a limited number of partners.

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In the cases of Internationalization, MVT and TxU NWP CP the increase in the level of heterogeneity positively influenced cooperation because the increase in the variety of partners has resulted in an enrichment of knowledge in each cluster. Myopias of personal cognitive constructions can be broken because issues can be discussed from multiple points of view and from different perspectives as indicated in following statements (a similar statement has been derived from TxU NWP CP)

*“From different points of view something is exemplified. It is just a good composition. Everybody thinks somewhat different about something but that does not matter. ... I think it is a positive club and due to the composition it [the cooperation] works out.” (Interviewee, Internationalization)*

*“If a new member is added everybody is curious what is going on there and immediately searches opportunities for cooperation. ... So in this way the knowledge in the foundation is enriched.” (Interviewee, MVT)*

These cases have in common that the level of cooperation has increased. The organizations involved interact more with each other. However, in the cases of Internationalization and MVT direct cooperation (working together on products or in projects) is not an issue, in case of TxU NWP CP direct cooperation is only promoted since very recently and incorporated in the strategy of that cluster.

In the case of “PCT” the decrease of number of partners has positively influenced cooperation because more commitment has been created and the level of interaction has increased because for one part which is being outsourced, one supplier has been appointed as indicated in following statement

*“The suppliers have their own packets. So we do not have two suppliers for one packet. ... It resulted in a positive cost development, and on the other side it resulted in a more constant quality and the commitment, the performance, has increased. ... So companies are more committed.” (Interviewee, “PCT”)*

So the reduction in the number of partners, resulting in more complementary partners, has resulted in an increase in the level of cooperation. Organizations involved have become more committed, the level of interaction and integration has also increased.

The case of “PCT” is an example of direct cooperation compared to the other cases with an increase. The difference is also that in this case (“PCT”) the number has decreased while in the other cases (MVT and TxU NWP CP) the numbers has increased. So for direct cooperation a limited number of organizations involved in a cluster is perceived as better because more commitment has been created. When in a cluster in which the partners are not cooperating directly for a specific goal or customer, the number of partners can increase



resulting in an enrichment of a cluster. So with a limited number of partners more commitment can be created, but with an increase of number of partners a cluster can be enriched and issues can be discussed from different perspectives and different personal cognitive constructions.

#### 4.4 Overview

The data gathered during the interviews and obtained from documents have been valuable for this research as this chapter has made clear. The results discussed in this chapter show that there are some remarkable similarities and differences concerning the structural design in the initial phase and the evolution of the structural design despite the different clusters. There are also some similarities and differences related to the influence on cooperation. In following table the main findings of this research are summarized:

<b>Main findings research</b>		
<b>Dimension</b>		<b>Findings from research</b>
<b>Level of formalization</b>	<b>Initial phase</b>	Variety of different levels, the level seems to be related to the level of cooperation. The higher the level of cooperation, the higher the level of formalization is likely to be
	<b>Evolution</b>	The level sustains or increases as the cooperation develops
	<b>Influence on cooperation</b>	In all levels positive, because it facilitates trust or provides a framework
<b>Level of centralization</b>	<b>Initial phase</b>	A moderate and low level of centralization has been found
	<b>Evolution</b>	The level of centralization sustains or increases
	<b>Influence on cooperation</b>	Both negative and positive influences have been encountered in the cases
<b>Level of heterogeneity</b>	<b>Initial phase</b>	It depends on goals and environment of a cluster and the type of partners needed
	<b>Evolution</b>	It depends on goals and environment of a cluster and the type of partners needed
	<b>Influence on cooperation</b>	Both negative and positive influences have been encountered in the cases

**Table 17: Overview of main findings research**

In the next chapter the main findings will be linked to the theoretical framework in order to give additions to the current theory on the management of clusters. This will be done by comparing the theoretical framework and the results, and by answering the research questions. Also the limitations and possible further research will be discussed.

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## 5. Discussion and Conclusion

In this section the results from the research will be linked to the theoretical framework by comparing the results with the theory; to look for what is similar to and what is in contradiction with the theoretical framework and why, and by answering the research questions. Also a conclusion will be given with the main findings of this research. Next to this the limitations of this research and suggestions for further research will be discussed.

### 5.1 Discussion

A variety of regional clusters has been found in literature and in practice. There are different types and purposes of clusters defined in literature and the cases in this research all match one type or another. Also dimensions of the structural design vary per case; only three cases had similar dimensions in the initial phase (i.e. TIMP, Dutch Sigma and MVT). And only two cases have evolved in a similar way concerning the dimensions of the structural design (i.e. MVT and “PCT”). Both negatively and positively influences of the dimensions of the structural design on cooperation have been identified.

#### 5.1.1 The structural design in the initial phase

The first research question concerned the structural design of regional clusters in the initial phase. According to the literature, as discussed in chapter 2, the structural design in the initial phase should consist of a high level of formalization and a high or low level of centralization and the level of heterogeneity is ought to be dependent on the purpose of a cluster and type of organizations needed. But the results from this study do not always match the expectations derived from theory. See following table for a comparison of the theory and the main findings and a short explanation for the difference(s):

<b>Structural design in the initial phase</b>		
<b>Dimension</b>	<b>Theory</b>	<b>Findings from research</b>
<b>Level of formalization</b>	High	Variety of different levels, it seems to be related to the level of cooperation
<b>Level of centralization</b>	High or low	A high level of centralization in the initial phase has not been encountered because parity was perceived as important Instead a moderate versus low level has been encountered, especially in horizontally oriented clusters the level is low, in more vertical oriented clusters moderate
<b>Level of heterogeneity</b>	Depends	It indeed depends, the data offered some indications why it depends

**Table 18: Comparison of theory and results of the structural design in the initial phase**

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As indicated in the table, a variety of levels of formalization in the initial phase have been encountered instead of a high level in each case. The reason why the level is not high in all cases is related to the level of cooperation. Two types of cooperation can be distinguished on a continuum, cooperation and collaboration. These two types differ in depth of commitment, complexity, integration and interaction, with cooperation at the low end and collaboration at the high end of collaboration (Thomson and Perry, 2006). In the cases where cooperation was low in the initial phase a low level of formalization was used. In those cases with a high level of cooperation a high level of formalization was used. Cooperation was for example complex because financial resources between organizations needed to be managed or knowledge related to the core-competences of organizations was created or shared. The cases with a medium level of cooperation also had a medium level of formalization. Some arrangements were made, but there was still a relative high degree of freedom to execute activities. So not in each cluster the level of formalization was high in the initial phase. It depends on the level of cooperation that the cluster wants to establish in the cluster. It is likely that the higher the level of cooperation, the higher the level of formalization will be in the initial phase.

A high level of centralization has not been encountered in this research, although it was expected based on theory. In each case parity, or equality, between the partners of a cluster has been perceived as important in the initial phase. So organizations want to maintain their autonomy, this is also the reason why the level of centralization in the initial phase was expected to be low according to the theory. The assumption of Kilduff and Tsai (2003) that goal-directed leadership prevailed organizational autonomy in the initial phase has not been identified in one of the cases.

In this research a medium versus a low level of centralization has been identified. In a medium level of centralization a central actors was present, but based on parity or democracy. A medium level was perceived as needed in especially in clusters that were vertically oriented of nature. A low level is recognized in clusters that were horizontally of nature. This is in accordance with Grandori and Soda (1995); they suggest that a central agent often coordinates vertical interdependencies between firms and that a parity based network often is concerned with horizontal interdependencies. When clusters are more vertical of nature a central actor will be present, but it is likely to be based on parity because organizations want to maintain their organizational autonomy (Williams, 2005).

Also a variety of different levels of heterogeneity in the initial phase have been identified in this research. As indicated in the theoretical framework it depends on what type of partners are needed, the goals and the environment of a cluster. The data offered the reasoning and examples of these factors. In one case the cooperation was imposed resulting in similar organizations that had to cooperate. So it is the goal of a (governmental) program that results in a low level of heterogeneity because a program was imposing organizations to cooperate. Another reason is that the environment determines the composition of a cluster. For example, organizations in the same field can face the same opportunities and threats which resulted in cooperation in a cluster to cope with those opportunities and threats. It is also possible that an

entire industry faces the same threats or opportunities which than results in a high level of heterogeneity. Another example is that organizations can meet each other in their environment and recognize the potential benefits of cooperation.

Also different types of organizations can be selected based on the demands of the external market (and thus the environment) and the goal of a cluster. It is then not a coincidence that organizations meet each other but they are selected and asked to join a cluster.

So there is not one structural design applied in the initial phase, but it depends. In general it can be said that the level of formalization is higher when the level of cooperation also is higher, for example when a lot of money is involved, and/or the cooperation is knowledge intensive. The level of formalization is medium or low when the level of cooperation also is medium and low. Parity is perceived as important; the level of centralization turns out to be medium in vertically oriented clusters. The level of centralization turns out to be low in horizontally oriented cluster. The level of heterogeneity is low, medium or high, depending on the environment and goals of a cluster and the type of partners needed (based on goal and environment of a cluster) in a cluster.

### 5.1.2 The evolution of the structural design

According to the literature the level of formalization should be sustained or decrease over time because trust emerges or the purpose of a cluster is achieved and it is transformed into a serendipitous network. The level of centralization should be high over time, it either was high and has been sustained or it has increased because central actors have emerged. Again, as in the previous section discussed, the level of heterogeneity depends. But the results from this study do not always match the expectations derived from theory. See following table for a comparison of the theory and the main findings and a short explanation for the difference(s):

<b>Evolution of the structural design</b>		
<b>Dimension</b>	<b>Theory</b>	<b>Findings from research</b>
<b>Level of formalization</b>	Sustains or decreases	The level of formalization sustains or increases as cooperation develops
<b>Level of centralization</b>	Sustains or increases	The level of centralization has sustained in horizontally oriented clusters. It has increased in all vertically oriented clusters.
<b>Level of heterogeneity</b>	Depends; it decreases, sustains or increases	It indeed depends; a decrease and increase of heterogeneity has been recognized, and in some cases the level of heterogeneity has sustained.

**Table 19: Comparison of theory and results of the evolution of the structural design**

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The level of formalization has sustained in some cases because no additional rules have been perceived as necessary. The main difference is that instead of a decrease of the level of formalization, the level of formalization will increase over time as cooperation develops.

In none of the cases the level of formalization has decreased as was suggested in the theoretical framework. This can be explained by looking at the development of cooperation in clusters. It was expected in the theoretical framework that the level of formalization would decrease as the goals of clusters had been achieved and the cluster would transform in a serendipitous network. However, in none of the cases in this research this development has been recognized.

Instead of a decrease, an increase of the level of formalization has been found as cooperation evolves and develops. This increase is explained by the development of cooperation in a cluster. More rules or a less degree of freedom to execute the joint activities are perceived as necessary because it is recognized that the former rules had not been effective enough. Or a legal entity needs to be created in order to give a potential customer a legal partner when doing business with each other. So the level of formalization will sustain or increase in order to manage the cluster more effectively, a decrease of the level of formalization is not likely to happen because a cluster is not likely to change into a serendipitous network.

Not in all cases the level of centralization has increased. In the clusters that are horizontally oriented the low level of centralization has been sustained because more centralization was not perceived as necessary, in one case attempts to establish a central actor even failed, because organizations wanted to maintain their autonomy. In the vertically oriented clusters the level has increased, explained by following reasons:

- management, e.g. efficiency, clearness, creating a legal entity or more direct management of a cluster;
- “engineered”, one company deliberately decided to become a central actor and has planned and executed actions to become the central actor;
- emergent, by trust or unintended. Some central actors just seem to emerge because they are capable of doing more than other and establish relations with a selection of partners of a cluster.

So in horizontally oriented clusters the level of centralization is likely to stay low, in more vertically oriented clusters the level of centralization is likely to increase because more and better management is required, or central actors emerge either because it part of a strategy or unintended because some organizations just are more capable than other organizations. So over time it is likely that strategic regional networks will occur (Lechner and Dowling, 1999), which implies that a strategic centre emerges which coordinates a cluster.

In this research different evolutions of the level of heterogeneity have been encountered. As indicated in the theoretical framework it depends. The data offers the reasoning why the level of heterogeneity sustains, decreases or increases.

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The level sustains because no other partners are needed, this has been the case in clusters that consisted of three organizations. The level has decreased in one case because the cognitive distance between partners was too large. The partners did not speak the same language and there were different opinions about cooperation and the subject of the cluster. This led to a negative evaluation of cooperation in the cluster and the withdrawal of two organizations that were very different compared to the other, remaining organizations. So conflict results into a more homogeneous composition of partners in a cluster.

However, the level of heterogeneity can also increase because more organizations, located in the environment of the cluster, are added to a cluster. Either because the new organizations have asked if they could become a member, because they observed the cluster and decided that they wanted to join the cluster. Or organizations have deliberately been asked to become a member because of their competences and possible contribution as cooperation developed.

But the level of heterogeneity can also increase because the number of partners deliberately is reduced, resulting in a limited number of partners which are more asimilar to each other and thus an increase in the level of heterogeneity. So the evolution of the level of heterogeneity depends on whether each partners is satisfied with cooperation, more partners are needed or if more organizations want to join the cluster. Also a deliberate decrease of partners can increase the level of heterogeneity, because partners remain that are more heterogeneous to each other.

It cannot be said how a particular structural design evolves over time. However, some issues have become clear. The level of formalization either increases or sustains over time. It increases because more rules or less degree of freedom is perceived to be needed. The level of centralization sustains in horizontally oriented clusters or increases in vertically oriented clusters. The level of centralization increases when the cluster and cooperation evolves, so over time the level of centralization of a cluster is high. The evolution of the level of heterogeneity depends on whether each partner is satisfied with cooperation, more organizations in the environment want to join a cluster or the level of heterogeneity is deliberately increased.

### **5.1.3 The influence of the structural design on managing cooperation**

The final research questions is concerned with the influence of the structural design on cooperation, and the influence of the (evolution of the) structural design on cooperation. As stated in the theoretical framework there is a clear contradiction in literature whether each dimension of the structural design, with each dimension having a high level, positively or negatively influences cooperation. However, in this research, as became clear in the results, the structural designs do not consists of high levels for each dimension. Therefore the influence of each level of each dimension on cooperation will be discussed. See following table for a comparison of the theory and main findings and a short explanation for the difference(s):

<b>Influence of structural design on cooperation</b>			
<b>Dimension</b>		<b>Theoretical influence on cooperation</b>	<b>Influence on cooperation based on this research</b>
<b>Level of formalization</b>	<b>Low</b>		Positive, a high(er) level of formalization was not perceived as beneficial for this type of cooperation
	<b>Medium</b>		Positive, trust could be developed, and due to the content of the level of formalization uncertainty was mitigated
	<b>High</b>	Positive (provides a framework) and negative (distrust and high risk)	Positive because the high level of formalization provided a framework for collaboration
<b>Evolution of formalization</b>	<b>Increase</b>		Positive, more rules and control resulted in better cooperation
<b>Level of centralization</b>	<b>Low</b>		Positive, could take care of follow-up of actions despite little authority, or check each other which facilitated development of trust
	<b>Medium</b>		Positive, because of the coordinating role a central actor can have Negative, power and interests were too concentrated
	<b>High</b>	Positive (goal-directed leadership) and Negative (organizations want to main their autonomy)	
<b>Evolution of centralization</b>	<b>Increase</b>		Positive, because of the coordinating role or because of more management cooperation is stimulated
<b>Level of heterogeneity</b>	<b>Low</b>		Could not be derived
	<b>Medium</b>		Neutral, because similar products led to distrust but imitation was promoted Positive, because of open and informal cooperation between organizations in same field
	<b>High</b>	Positive (learn from each other and escape myopia of personal cognitive constructions) and Negative (cognitive distance too large)	Positive, needed each other and could learn from each other. But takes time to become acquainted. Positive and negative (with emphasis on the first) because needed each other and learn from each other, but cognitive distance between the partners sometimes too large
<b>Evolution of heterogeneity</b>	<b>Decrease</b>		Could not be derived
	<b>Increase</b>		Positive, can learn more from different organizations and / or commitment level increases

**Table 20: Overview of influence on cooperation of each level of each dimension**

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A high level of formalization was expected to have a negatively and positively influence on cooperation. However, the level of formalization varied and in all levels, whether it was a low, medium or high level, cooperation was positively influenced. But the different levels of formalization are related to different levels of cooperation. A low level of formalization is positively influencing cooperation because the (low level of) cooperation does not require more formalization. In the cases with a medium level of formalization and cooperation, the medium level of formalization positively influenced cooperation because trust could be developed and uncertainty could be mitigated. These reasons are exactly the reasons why a high level of formalization is negatively influencing cooperation according to the theory. So in order to facilitate the development of trust and mitigate risks a moderate form of formalization is chosen which then stimulates cooperation.

A high level of formalization positively influenced cooperation because it provided a framework for the cooperation, this is also the positive effect described in the theoretical framework (Klein Woolthuis, 1999; Kilduff and Tsai, 2003; Faems et al., 2007).

Some cases also showed an increase in the level of formalization. The increase of the level of formalization has had a positive influence on cooperation as has been derived from the data. The underlying reason is that more rules and control (less degree of freedom to execute the joint activities) has been perceived as needed as the cooperation developed. The ambition level can become higher, which promotes cooperation or additional rules can be set that stimulate cooperation because it provides a framework how to cooperate. So an increase has a positive influence because it provides a more accurate framework for the cooperation in a cluster (Klein Woolthuis, 1999; Kilduff and Tsai, 2003; Faems et al., 2007).

A high level of centralization was expected to have a negative and/or positive influence on cooperation. All clusters in this research have been parity based because it was perceived as important that each organization maintained its organizational autonomy (Williams, 2005). So because of the negative effect of a high level of centralization on cooperation, a moderate form is encountered. In the cases with a medium level of centralization, in vertically oriented clusters, the medium level of centralization positively influenced cooperation because of the coordinating role. However, in the case where interests and power were too concentrated, it negatively influenced cooperation because not all partners in a cluster than profit from the cluster. Even a low level of centralization positively influenced cooperation because organizations than are 'forced' to check each other or a chairman (with little authority) can take care of follow up of actions. So a high level of centralization is not necessary for a positive influence on cooperation, also a medium level of centralization can be sufficient for coordination in vertically oriented clusters.

In the cases where the level of centralization has increased (all vertically oriented clusters), in all cases it positively influenced cooperation because due to a coordinating role or because of more management cooperation has been stimulated.



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A high level of heterogeneity was said to have a positive and/or negative influence on cooperation. In most cases with a high level of heterogeneity in the initial phase in this research the influence on cooperation has been positive because of the same reason as indicated in theory. Organizations could learn from each other because they could escape their own personal cognitive construction. But another reason is that organizations need each other to achieve the common goal. The negative effect on cooperation also has been identified in this research. In two cases the cognitive distance between partners is perceived as large, but in only one case it led to the withdrawal of partners. Especially the cooperation between a university and companies is subject of a large cognitive distance. In other cases it took some time before the organizations have become acquainted. However, this was not perceived as problematic. In the cases with a medium level the influence of that level on cooperation varied. It can be positive because organizations speak the same language. But also distrust can emerge because products are too similar and organizations want to protect their own resources, however imitation was promoted in that specific case.

So in general, a high level of heterogeneity has a positively influence on cooperation because organizations can escape their own myopia of personal cognitive constructions. But, when the cognitive distance is too large, cooperation can be negatively influenced (Nooteboom, 2001).

An increase resulted in an increase in the level of cooperation because the number of organizations has increased or the number has decreased resulting in more complementary partners which stimulated cooperation because of two reasons. First, additional members enriched the clusters and created possibilities to escape the myopia of personal cognitive constructions. Second, a reduction of partners and increase of complementariness of partners can result in a higher level of commitment and therefore stimulate cooperation.

So in general it can be said that a high level of formalization is not necessary for stimulating cooperation. Also arrangements without the use of written contracts can stimulate cooperation because contracts or a formal structure are related to distrust and high risk. However, a high level also can provide a framework for cooperation which stimulates cooperation. An increase in the level is likely to stimulate cooperation because it provides a more accurate framework for the cooperation in a cluster. A medium level of centralization can have a coordinating role in vertically oriented clusters which positively influences cooperation. But in horizontally oriented clusters a low level of centralization also stimulates cooperation because an increase in the level of centralization positively influences cooperation because it results in better management and coordination of a cluster. A high level of heterogeneity stimulates cooperation because the partners can escape their myopia of personal cognitive constructions. In the initial phase it may take some time before members become acquainted to each other, but this does not hinder the cooperation because of the heterogeneity. Only the cognitive distance between companies and a university seems to be (too) large. An increase also stimulates cooperation because more members are added that can enrich the composition of a cluster and stimulate more cooperation since they are asimilar to the partners already present in a cluster.

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## 5.2 Conclusion

In the discussion the main findings that are answering the research questions and thus the central question have been discussed and compared to the theoretical framework. Several similarities and differences have been identified. The result from the discussion will be described here more comprehensively by answering the three research questions.

First, the structural design can vary among the clusters in the initial phase. Not in all cases a high level of formalization is present in the initial phase, it is likely that there will be a high level of formalization in clusters that have a high level of cooperation. Different levels of formalization are related to different levels of cooperation. A high level of centralization is not likely to be present in the initial phase of regional clusters because organizations want to maintain their organizational autonomy. Vertically oriented clusters have a moderate form of centralization; horizontally oriented clusters have a low level of centralization. The level of heterogeneity depends on the goals and environment of a cluster and on the type of partners needed.

Second, concerning the evolution of the structural design it is likely that the level of formalization will increase or be sustained. But it has not decreased in the cases studied. The reasons for an increase are that additional rules concerning the cooperation are needed or more formalization is needed. The level of centralization sustains in horizontally oriented clusters and increases in vertically oriented clusters because more management is required or central actors emerge, unintended and intended. In general the level of heterogeneity increases over time because partners are added that want to join or partners are deliberately chosen in order to enrich a cluster. For an increase of the level of heterogeneity an increase of the number of organizations is not always necessary. The level can decrease when the cognitive distance between partners is (too) large, resulting in conflict and negative evaluation of the cooperation and the withdrawal of partners which results in more homogeneous partners that remain.

And third and last, both negatively and positively influences of the (evolution of the) structural design on cooperation have been identified. A high level of formalization positively influences cooperation because it provides a framework. However, because of the negative influence (distrust and high risk), a moderate form of formalization is chosen in order to develop trust and mitigate uncertainty. An increase in the level of formalization stimulates cooperation because more additional rules are established in order to establish a more accurate framework for the cooperation. Because organizations want to maintain their organizational autonomy parity is perceived as important. However, a moderate form of centralization is perceived as necessary in vertically oriented clusters in order to coordinate and manage the cluster. But if power and interests in a cluster are too concentrated this negatively influences cooperation because not all organizations are profiting from a regional cluster. The increase of centralization (in vertically oriented clusters) results in more coordination of a cluster and so stimulates cooperation.

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A high level of heterogeneity can stimulate cooperation because the members can learn from each other and need each other in order to benefit from the cluster. The more heterogeneous a cluster becomes the more cooperation can be stimulated. However, when the cognitive distance is too large, it has a negative effect because organizations do not speak the same language. This seems especially the case in the relation between a university and companies. A medium level of heterogeneity has less positive influence on cooperation because organizations in the same field share, but also want to protect, their resources. An increase in the level of heterogeneity positively influences cooperation because more partners enrich a cluster (escape of myopia of personal cognitive constructions) or cooperation is stimulated because more commitment is created (when reducing the number of partners).

### **5.3 Limitations**

There have been several limitations in this research. But this is not something unusual; all research studies are likely to have limitations. In this section the main limitations and the influence on accuracy, reliability or validity will be discussed.

A first limitation is the selection of cases. Because mainly clusters in Twente are examined the external validity is not very high. It is questionable if the results will be the same for clusters in different regions like ELAt (Eindhoven Leuven Aken triangle) or in other parts of the country, not to mention regions in other countries.

Cases have been selected that vary on the dimensions of the structural design (i.e. level of formalization, centralization and heterogeneity) in the initial phase and that have evolved differently compared to each other. Also the number of organizations involved and the type of cluster varies as discussed in section 3.3 'Selection of cases'. In a number of cases the cooperation has not been successful or good all the time, there have been some periods in which problems and conflicts arose in a cluster. However, no cases have been selected in which a cluster turned out to be a complete failure and that have been aborted prematurely because of the failure. The reasons for failure could have indicated why cooperation was not successful and a comparison between cases that were successful and unsuccessful could have exploited the purpose of a multiple case study better and could have strengthened the external validity. But the problems that have been encountered in some clusters have enhanced the external validity because different situations have been examined.

Also the data available in the cases from literature sometimes has been a problem. Based on the content of the scientific literature not everything that is interesting for this research could be derived. However, those cases are still interesting because they are examples of horizontal cooperation, imposed cooperation or give insights into conflicts about cooperation and how was dealt with that.

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A second and last limitation is the use of interviews. First, it is questionable to what extent the results from the field research are reliable because interviews are only held with top management or senior management of the organizations involved in a cluster. So there is only one level of analysis, not a multi level of analysis researching the cluster at multiple levels in the organizations involved. Also not every member of each cluster is interviewed.

Second, because this research has been a qualitative research the interviewer is ought to be neutral and objective in order to prevent a respondent and an interviewer bias. This partially has been prevented by use of data triangulation. But during the reflection on the interviews it has become clear that the level of neutrality and objectivity was not even high in all interviews. So not all data may be even reliable, but large differences have not been recognized between the different interviews taken with people from the same cluster or between the interviews and data that has been made available. However, more research seems to be necessary as will be discussed in the next section.

The last limitation is the fact that the interviews have been held in the native language, in Dutch. It has been chosen to do so in order to get as much information as possible. People are likely to be able to express their feelings or opinions in their native language better than in a foreign language. However, the language of the thesis is English, so the citations from the interviews needed to be translated. This has influenced the accuracy because not every sentence in Dutch can be even easily translated into English because some citations are expressions that are only known in the Dutch language. Therefore every word in the translation has deliberately been chosen in order to be as accurate as possible. However, it also results in a bias because the researcher interprets the citations in order to develop a good translation. So this also can be seen as a limitation of this research.

## **5.4 Suggestions for further research**

This research has been a qualitative research because a good developed theory on the structural design of regional clusters is not present and there is a contradiction in literature about the influence of the dimensions of structural design on cooperation. In this research a contribution to science has been made by examining the structural design of regional clusters in the initial phase, the evolution of the structural design and the influence on cooperation and comparing the results to the theoretical framework identifying several similarities and differences.

Most obvious findings and differences between literature and this research concerning the structural design already have been discussed in the Discussion and Conclusion (Section 5.1.1, 5.1.2 and 5.2). The external validity of this research may be limited, as already discussed in the previous section. This implies that more qualitative research is needed. Then, there should also be more variety among the cases, located in different geographically bounded regions and having different purposes or activities and in different fields. And also known failures of clusters could be examined in order to develop the theory on the structural design of regional clusters further. The time horizon of the clusters should also be substantial

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in order to describe and understand the evolution of the cluster. For examining the structural design more variety is thus needed, the way how the structural design has been understood in this research is pretty much basic. Only the extent to which rules and procedures have been present and followed; the locus of authority and decision-making and the composition regarding the different types of organizations have been examined. But structural design can also refer to other dimensions that are related to the management of clusters and that influence cooperation. So more research is needed, incorporating more dimensions of a structural design. After a good theory is developed, based on a variety of cases and studies, a quantitative research can determine whether the theories are correct or need to be adjusted based on the observations and conclusions of the studies.

Concerning the influence on cooperation both negatively and positively influences of each dimension have been encountered as indicated in section 5.2 'Conclusion'. A definite answer if the influence is either positive or negative cannot be given. To understand cooperation, especially in regional clusters, more qualitative research is needed and at a multiple level so that the influence and organization of cooperation can be examined at all levels of cooperation. For this it is also necessary to measure cooperation in different ways and by different definitions in order to create a valid research. It is not necessary to execute this only in clusters, cooperation is also present in other forms of cooperation. Point is that cases are selected in which competitors are cooperating together because in these situation the tension of the benefits of cooperation and the risk of cooperation is likely to be high. Then, a quantitative research can create a theory with a good level of validity and reliability.

In only two cases an university, namely the University of Twente, has been involved in the initial phase, in another case an institution in the knowledge field has been involved. However, in one case the university has stopped its membership because of different opinions about cooperation and different perceptions about the field. In an other case the relation with the university is also not very good. There seems to be different opinions between the practice and the university, the cognitive distance seems to be too large. However, in my view practice relies on theoretical knowledge for executing their activities and theoretical knowledge is based on data from practice. It is a continuous correlation between the practice and the university, but the relation could and should be improved so that the university, based on the development in practice, gives education and executes research that meets the needs of practice and can enhance the performance of practice and the university can contribute to the regional, economical development of the region in this way. It, therefore, can be good to investigate to what extent the university is effective in supporting the regional development and what could be improved in the relation between the practice and the university in order to stimulate the regional development, for example by investigating how the cognitive distance between companies and the university can be decreased.

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## 6. Recommendations

Based on this research recommendations to the ADGEN Cluster will be given in this section. First, the problems of the cluster will be discussed. Second, the recommended structural design to cope with the problems will be discussed. Third, the influence on cooperation will be discussed. And last, implications for management of the cluster will be given; the change to the current situation will be discussed.

### 6.1 Problem setting

The “Verenigde Maakindustrie Oost” (VMO) is the branch organization for all industrial production companies and knowledge carriers in the production industry in East Netherland. The organization comprises more than 170 companies and knowledge carriers. These are all working in the production industry or related to that.

The goal of the VMO is to enhance the sustainability of the production industry in East Netherland in several branches such as: metalworking, metalektro, plastic, engineering and process industry and other branches. The VMO does this by:

- Enhance the cooperation between VMO members
- Mutual external promotion, both national and international
- Initiating and stimulating of education and development
- Stimulating of innovation and mutual knowledge transfer
- VMO clusters:
  - Aerospace / Defence
  - Automotive
  - Machine building and general subcontracting
  - Plastic
  - Engineering

The VMO takes care of the interests of its members, not only by a large number of initiatives but also by supporting the members directly in mutual company initiatives in order to create optimal chances and opportunities. This implies for the long-term a specific continuous care for the interests of its members, with a renewed vision on cooperation and a permeation of the mutual interests of the production industry. There is a strong focus on the eastern part of the Netherlands in executing this.

The research is executed for the Aerospace and Defence Cluster of the VMO. In this cluster a group of sixteen companies wants to cooperate with each other. These companies are both complementary and substitutable to each other. Also the size varies between small and medium enterprises and divisions of large national corporations. The group wants to cooperate for a specific market segment: Aerospace and Defence. In this segment there are

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specific quality standards and other regulations concerning security and confidentiality such as the AS/EN 9100 quality standard and ITAR (International Traffic in Arms Regulations). In this field there are some very large players such as Airbus, Boeing, Lockheed Martin, Bombardier and Stork Fokker. The companies have identified that they are in themselves too small to be a valuable partner for potential customers in this market because of their relatively limited resources. As a result of those stringent demands and relatively limited resources, it is ought to be a strategic choice of organizations to participate in this market and meet the demands of the market, according to some member-organizations. From the end of the year 2006 the cluster has tried to develop itself but they have not succeeded until this date.

In the past there already have been several attempts to cluster; one of those attempts to cluster is called the “Twentse Modulen Groep”. This cluster consisted of 140 companies that wanted to collaborate in the field of modules (complex components consisting of separate produced products). This turned out to be a complete failure and has resulted in distrust about cooperation as turned out during some interviews with members of the current cluster that also were involved in the “Twentse Modulen Groep” (TMG). The problems of TMG can be grouped around the following items: the companies did not adjudge each other orders (there was a strong asymmetry of division of work) and there was no central actor or central organization coordinating the cluster.

During interviews with several (five) members of the new cluster that have experience with previous clusters it turned out that in the new cluster some companies have distrust, or a negative experience with previous clusters, like the TMG<sup>4</sup>. On the other hand there are also companies that have a positive and good experience with cooperation in clusters. But there are also companies that are not experienced with cooperation in a cluster as defined by the definitions in the theoretical framework. Most companies only have experience with clusters through their production chain (suppliers and customers and sometimes a linkage to a knowledge institution). So because the companies have both negative and positive experience with clusters, or have no experience at all or were involved with or watched the (failure) of the “Twentse Modulen Groep”, they do not now how to cooperate in a cluster. During the interviews, mentioned above, also questions have been asked about their expectations and the problems they expected to occur. They expected to form a “body” in the market so that big customers would see their value and perceive them as a valuable supplier, this can be characterized as a “light” version. On the other hand they also expected that a close cooperation would occur with mutual respect and sharing knowledge on both product technical- and management level, this can be characterized as a “heavy” version, this requires more interaction and integration between the organizations.

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<sup>4</sup> The members have been selected on basis of their previous experience with other clusters. Questions have been asked about the number and experiences with previous clusters, how a cluster emerged, developed and whether it is perceived as (un)successful and why. Then questions have been asked about their expectations and problem they expected to occur in the new cluster. All interviews have been taped and transcribed. Each interview has been confidential. The result have been presented during a meeting of the ADGEN Cluster.

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But they also expected that some problems would occur if things are not managed in a proper way: no trust because the companies do not know each other that good, or because companies are only focusing on themselves and not on the cooperation. Also the division of work and how to manage that is perceived as a potential problem. Also the current size is perceived by some as problematic, because the size of sixteen companies is too large according to some interviewees: *“the quality of members is more important than the quantity”*.

Besides the interviews I also have attended three meetings in which I have been a participant observant. Presentations have been given about possible research opportunities and the case of TIMP has been discussed in order to illustrate some difficulties that occurred in TIMP. During these meetings it also has become clear that there are different opinions about the cooperation and how to start it. Some people immediately wanted to start, other first wanted to have some sort of framework to guide the cooperation. Until this date a joint vision of what they wanted to achieve and how has not been developed yet.

So the companies do not know how to cooperate with each other, because they have no experience or a negative experience with previous clusters. Also the failure of the “Twentse Modulen Groep” has resulted in hesitation about cooperation. The companies simply do not know what the best way is to cooperate and how to start it, there are different opinions in the group, and there is no unity amongst the members of the group.

## **6.2 Recommended structural design**

The structural design will be discussed, integrating each dimension since they can all be related to each other. For the current group of sixteen companies I would recommend not to use a formal structure as such in the initial phase. There is a high level of formalization used if the cooperation has the characteristics of collaboration, e.g. the cluster involves a lot of money, or when the cluster is knowledge intensive and has a high level of interaction. In the case of ADGEN it is not likely that ‘collaboration’ will be present at the start. I would advice to use an informal structure and make the ADGEN cluster some sort of platform to exchange experiences and knowledge related to the specific Aerospace and Defence market, like an innovation cluster as discussed in Chapter 2. Companies first have to learn each other and learn to trust each other. Besides, working in a network or cluster is something else than in a normal business relation because mutual goals are established. This also takes time to learn and using a formal structure is not likely to stimulate or promoting the learning process more than an informal structure. Forcing companies to cooperate is not likely to be effective.

However, some arrangements about cooperation have to be made in order to manage the cluster. For example, it is advised to use project contracts when projects are acquired and executed because a framework for cooperation has a positive influence on cooperation. In a framework a clear structure for the project execution can be established concerning who is responsible and liable for what. Also secrecy and the division of work can be settled by means

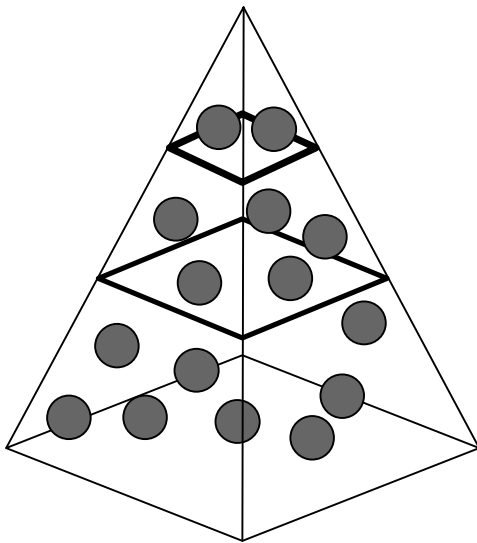


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of a project contract. So it can serve as a guide for cooperation and can help to develop trust between the partners in a cluster.

Concerning the level of centralization I would strongly recommend to install an independent chairman or an independent mediating / coordinating organization, which is financed by all members by means of an annual contribution of a substantial amount of money. In this way every company has a stake in the cluster and the financial contribution can serve as a commitment to the development of the cluster. Subsidies can be used to start up a cluster, but subsidies are likely to result in distrust and / or conflicts when it is not shared equally or transparent enough. Besides, subsidies are not present permanently. Later on, when the cooperation becomes more developed, organizations can have advantages by means of extra fiscal facilities for clustering depending on the progress of cooperation and the results of the cluster which can be measured. The task of a chairman should be to stimulate cooperation and other tasks like representing the cluster in public and promote the cluster. The current situation, one of the members being the chairman, does not seem to work out. It should be someone who has enough time for developing the cluster and must be capable of doing so and should not be related to one of the organizations at all.

Another issue concerning the level of centralization is the presence of central actors. In this case, the cluster consists of companies that are somewhat different to each other. Some have more capabilities than others. As can be derived from the cases studies (for example, the TIMP and TxU NWP CP cases) it is not likely that all companies will cooperate with each other. It is likely that subgroups will emerge, this can also be derived from the average size of a clusters that have do more or less the same, there are only a limited number of members, between the three and the eight. So it is likely that companies will 'find' each other in a cluster and start an intensive cooperation with each other, not involving all ADGEN members. Therefore I would advice to critically analyze the group and organize the cluster in different levels based on a scale like OEM (Original Equipment Manufacturer), first tier and second tier companies. In this way companies in the cluster can serve as project champions that can outsource their products in the cluster. The different levels can also be seen as a border. In the different levels there can be different demands. For example, an OEM'er and maybe also first tier companies are likely to be obliged, due to market demands, to be AS9100 certified. So not all companies in this cluster have to be AS9100 certified necessarily. Following figure represents a possible structure concerning the level of centralization (the thicker lines in the top two levels indicate that the demands to enter that group are higher than to enter the cluster or the bottom level):



**Figure 3: Possible structure for ADGEN Cluster**

In the top level the OEM'ers are present or the first tier companies that are capable of doing more than others. In the second level the second tier companies are present. In the third level the specialized suppliers, companies in related fields or institutions in the knowledge field or governmental related institutions can be present. Parity is considered to be important in the initial phase, as can be derived from the previous chapter, so it can be never emphasized enough: all organizations are and should be seen as equal in the initial phase, each organization is important and can have a valuable contribution in its own way to the development of a regional cluster. But for coordination and division of work this classification might be more convenient as also will be discussed in the next chapter.

It is likely that the level of centralization will increase over time. But this has to be a 'natural process' in order to prevent the negative influence of a high level of centralization on cooperation in the initial phase.

Compared to the empirical case studies, the current composition of the ADGEN Cluster seems to be relatively homogeneous at first sight. Most members are active in the field of machining, turning and milling. It is recommended to critically analyze what the market asks for and to what extent it is present in the current composition because it seems not to be very likely that every member will be satisfied in the current situation. So instead, in order to prevent dissatisfaction and conflict, only those members should remain that meet the demands of the market and have a valuable and qualitative contribution to the cluster. If the market asks for it, also other members should be sought in order to execute larger and more complex projects. For example, an OEM or first tier company is likely to be some sort of system integrator. Different components need to be integrated which asks for different capabilities and resources within the cluster for execution of projects which might not be present in the current situation. So more research or analysis should be done in order to examine if the current composition meets the demands from the market and, if necessary, what changes in the composition needs to be made in order to meet those demands. Also institutions in the

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knowledge field or governmental institutions could be included. For example, a university or school of higher professional education can help to improve organizations, or can help to develop technological knowledge. A Chamber of Commerce can, for example, help to establish contacts in foreign countries or have a similar role as in the focus group Internationalization of the VMO.

### **6.3 Influence on cooperation**

Having an informal structure implies that formal rules and procedures cannot stimulate cooperation because a framework is not present. When project contracts are used cooperation can be managed in a specific project, but the time horizon is then as long as the duration of a project. Instead, due to a relative low level of formalization trust can develop. For example, the ADGEN Cluster can be an informal meeting place to discuss problems and developments in the field. Also joint education and workshops on subjects in the field or a joint visit of international trades in the field of Aerospace and Defence can help to build trust because the different organizations become acquainted. So because of the recommended low level a framework to guide the cooperation is not present. But centralization and heterogeneity can also positively influence cooperation.

An independent chairman or independent organization can stimulate cooperation by evaluating and managing the cooperation in the cluster. Since they are independent they can take care of the development of the cluster based on the demands of the cluster of course. A parity based cluster is also important, so the chairman or organization should secure that each organization involved is satisfied with the cooperation. Subsidies can be used to start up the cluster, but by means of extra fiscal facilities for clustering cooperation can be stimulated because organizations need to make a profit instead of receiving money. If they need to make a profit they thus need to cooperate with each other in order to develop a successful cluster and profit from the cluster. The profit or the extent to which these extra fiscal facilities are applied by the individual organizations are then also a measurement of the progress of cooperation and results from the cluster.

The presence or emergence of central actors has as an advantage that those central actors can acquire work which they can share with members of the cluster. They can also have a coordinating role, so cooperation can be stimulated by distributing the work fairly over the members, in a transparent procedure, which facilitates the increase of the level of commitment and interaction. I would strongly recommend not to execute projects as the ADGEN Cluster in the initial phase. Trust needs to be developed first and companies must get to know each other in order to execute projects in an effective and efficient manner. Instead, some sort of project champion(s) could be appointed which serve as a main contractor and outsources within the cluster. But this does not imply that the name of the clusters does not have to be promoted. After a few years, when members of ADGEN have executed some joint projects, the cluster is likely to be recognized and a portfolio of executed projects has been developed.

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Increasing the level of heterogeneity results in less risk of conflicts about cooperation because more asimilar partners are selected. This results in organizations that can create synergy because they need each other to execute projects. They are also able to learn from each other because their own myopia of personal cognitive constructions can be escaped. However, it also needs to be mentioned here that when the cognitive distance between partners is too great, cooperation is not stimulated. So some sort of optimal distance should be created, e.g. organizations that have different cognitive constructions but still understand each other.

Close cooperation with each other is also a matter of behaviour. Having a mutual goal and annual contribution should create a mutual understanding because a success implies that the investment will be earned back. So cooperation is also stimulated. However, this also implies that the distribution of work must be executed fairly and managed by a central actor, such as an independent chairman, or if necessary to be judged by some sort of external arbitrary board.

#### **6.4 Managerial implications**

Comparing the current situation and problems, the recommended structural design and influence on cooperation, some discrepancies can be recognized having some implications for the ADGEN Cluster. Several managerial implications, things that should be changed or executed based on this research, are identified. The managerial implications also include practical suggestions; the order in which they are described here does not necessarily have to be followed when executing the implications.

First, an independent chairman or an independent organization needs to be installed which direct the meetings, organizes meetings and workshops or education on demands of the ADGEN Cluster. This independent chairman also can critically evaluate the cooperation in the cluster. The purpose is to create a prosperous development of the cluster, to serve as a process mentor and coordinator. This chairman or organization should, in order to be valuable, independent and not be related to any of the companies and have sufficient knowledge of this particular field of Aerospace and Defence. The most obvious choice is to hire a management consultant or organization which is experienced in coordinating clusters or networks of organizations.

Second, several arrangements have to be made. Unity must be created in which a joint goal can help to develop unity. Talking about websites is not very helpful when it is not clear for most organizations what the future plans are and which activities are being executed, as observed during meetings. Prioritizing the things to do creates a better overview of the cluster and the future plans. So a joint goal needs to be established: what do the members want to achieve together and how do they want to achieve that. A starting point can be to examine what the members cannot do alone, but what they can do when they cooperate with each other. On what points do the members complement each other or what added value has the

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cooperation for the cluster and for each member and more important: what is the added value for the environment of the cluster. Also the height of the annual contribution needs to be established or at least the arrangements for the annual contribution. Next to this procedures about internal supplying can be established, like for example a preferred supplier procedure in order to secure that organizations procure their products from the cluster. Also arrangements have to be made about joint execution of projects. Some organizations involved have examples of project contracts that can serve as a model. Also arrangements about secrecy could be made, but only if necessary. It takes time to establish a cluster and this particular field has a long term time horizon. Trust can only develop when organizations get to know each other, this can be done in several ways, by, for example, joint learning, during informal meetings or by outsourcing products not related to the Aerospace and Defence market. I would also recommend to circulate the location of the meetings, especially in the initial phase. Every time a different member can introduce itself, show its organization. In this way the members can become acquainted to each other, although openness and honesty is also a matter of behaviour.

Not only top management and senior management should become acquainted. Also the lower levels of the organizations involved should become acquainted in order to strengthen the cooperation, because they often really are executing the projects and thus must work together with employees from member organizations and an exchange of information can foster the cooperation and the development of trust in the cluster. However, this is more concerned with the long term, first top and senior management needs to become acquainted.

Thirdly and last, the current composition of the cluster should be compared to market demands. An increase in the level of heterogeneity is likely to stimulate cooperation and the cluster is then likely to be able to acquire and execute larger and more complex projects. The current composition is not optimal at first sight; more variety should be selected in order to stimulate cooperation. Also the composition needs to be examined whether there are OEM'ers, first tier or second tier organizations present which can lead and guide the other members in the Aerospace and Defence market. In the current situation there is much variety, at first sight, there is one OEM'er, two or three first tier organizations and some second tier organizations. But more variety in the type of organizations should be created in order to get a more balanced composition. There is also a need to select the members. The Aerospace and Defence market is a particular field which asks a lot of companies, for example the demands concerning quality management, traceability and confidentiality of data are very stringent. The time horizon is also longer than in other markets. Being active in this field is thus a deliberate, strategic choice and thus should be part of the strategy of members and they should be selected based on some criteria like their strategy, their long term vision, their experience and type of work in the Aerospace and Defence market, their intentions in the cluster and their capabilities and resources.

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- [www.txu.nl](http://www.txu.nl)
- [www.vmo.nl](http://www.vmo.nl)



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## List of abbreviations

ADGEN	Aerospace and Defence Group East Netherlands
ASTRON	Stichting Astronomisch Onderzoek Nederland
AS9100	Aerospace Standard (specific standard for quality management systems in the field of Aerospace)
CP	Compensation Projects
EC	European Commission
EN9100	European Norm (similar as AS9100)
EU	European Union
IP	Intellectual Property
ITAR	International Traffic in Arms Regulations
MVT	Mechatronica Valley Twente
N	Number
N.V. NOM	Investerings- en Ontwikkelingsmaatschappij voor Noord Nederland
NWP	Network Program
OECD	Organization for Economic Co-operation and Development
OEM	Original Equipment Manufacturer
OKK	Oostelijke Kunststof Keten
PCT	Power Cluster Twente
R&D	Research & Development
SME	Small and Medium Enterprise
TIMP	Twente Initiative for the development of Medical Products
TMG	Twentse Modulen Groep
TxU	Toeleveren x Uitbesteden
VMO	Verenigde Maakindustrie Oost
VMT	Verenigde Metaal Twente

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## List of figures

Figure 1: The ideal development process of networks (source: Lechner and Dowling, 1999) .....	10
Figure 2: Seven principles for transcription rules (source: McLellan et al., 2003: 65).....	33
Figure 3: Possible structure for ADGEN Cluster .....	87

## List of tables

Table 1: Different names and definitions of regional clusters.....	7
Table 2: Overview of main assumptions towards the evolution of the structural design over time.....	12
Table 3: Influence of structural dimensions on cooperation .....	16
Table 4: Overview of case variety per case and dimension .....	24
Table 5: Overview of members of Internationalization over the years .....	27
Table 6: Overview of data source per case.....	32
Table 7: Overview and description of levels per dimension .....	35
Table 8: Overview of level of formalization per cluster with short description.....	38
Table 9: Overview of evolution of the level of formalization per case .....	41
Table 10: Level of formalization in initial phase and influence on cooperation .....	43
Table 11: Overview of level of centralization in initial phase and short description per case .....	47
Table 12: Overview of evolution of level of centralization per case.....	50
Table 13: Level of centralization in initial phase and influence on cooperation.....	53
Table 14: Overview of level of heterogeneity in initial phase per case with description.....	58
Table 15: Overview of evolution of the level of heterogeneity per case.....	62
Table 16: Level of heterogeneity in initial phase and influence on cooperation.....	66
Table 17: Overview of main findings research .....	70
Table 18: Comparison of theory and results of the structural design in the initial phase.....	71
Table 19: Comparison of theory and results of the evolution of the structural design.....	73
Table 20: Overview of influence on cooperation of each level of each dimension .....	76

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## Appendices

### Appendix I: Interview protocol

Interviewprotocol
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“Evolutie van structuur van regionale clusters en management van coopetition”
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#### Inleiding:

Dit interviewprotocol is bedoeld om te inventariseren met welke structuur een cluster is gestart en hoe de structuur is veranderd gedurende een langere tijd. Het interview zal kwalitatief van aard zijn, dit betekent dat de vragen vooral vrij en open zullen worden geformuleerd. Een regionaal cluster is gedefinieerd volgens Porter als geografische concentraties van gerelateerde bedrijven, gespecialiseerde toeleveranciers, service providers, bedrijven in gerelateerde industrieën en gerelateerde instituties (universiteiten, handelsorganisaties etc.) in een specifiek veld die concurreren maar ook samenwerken (2000, 15). Deze definitie is vrij vaag omdat hier concrete samenwerking niet in voorkomt. Daarom wordt ook de definitie van een regionaal netwerk van Lechner en Dowling (1999) gegeven: regionale netwerken zijn lange termijn, doelmatige en bewuste afspraken tussen afzonderlijke maar gerelateerde profit organisaties in regio's, die er voor zorgen dat die betrokken organisaties “competitive advantage” verkrijgen of behouden te midden van hun partners in het netwerk. Coopetition is het simultaan samenwerken en elkaar beconcurreren, vooral de processen (input, activiteiten, output) daarvan zullen worden besproken.

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#### START

Kunt u een overzicht geven van de clusters waarin u de afgelopen jaren betrokken was?

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## **REGIONAAL CLUSTER (= onderwerp van case study)**

### **a. Ontstaan van de cluster**

- 1) Kunt u de ontstaansgeschiedenis van deze cluster eens beschrijven (hoe is men bij elkaar gekomen, wat was de oorspronkelijke doelstelling?)
- 2) Wanneer is dit cluster ontstaan?
- 3) Wat was uw rol in de ontstaan deze cluster?
- 4) Hoe verliepen de onderhandelingen voor deze cluster?
- 5) Kunt u de sfeer tijdens de onderhandelingen eens beschrijven (argwanend versus vertrouwensvol). Hoe kunt u deze sfeer verklaren?
- 6) Wat voor organisaties werden er bij de cluster betrokken (alleen kleine bedrijven; kleine en grote bedrijven, universiteiten/kennisinstellingen; overheidsinstanties, regionaal versus internationaal, gelijkwaardig of asymmetrisch?)

### **b. Initiële design van de cluster**

- 7) Wat was het doel van deze cluster?
  - a. Welke missie of visie is geformuleerd?
- 8) Kunt u de formele structuur van deze cluster eens beschrijven (start afspraken, regulerend orgaan, letters of association/intent, samenwerkingsconvenant, etc)?
- 9) Waarom heeft men voor een dergelijke structuur gekozen?
- 10) Werden er bepaalde contractuele afspraken gemaakt bij de start van de cluster (risicospreiding, kennisdelen, acquisitie/verkoop, juridische aansprakelijkheid, financiële structuren, samenwerkingsverbanden met kennisinstellingen)?
- 11) Wat is inhoudelijk in die contracten behandeld?
- 12) Hoe heeft dit samenwerking of competitie beïnvloedt tussen de partners?
- 13) Werd er een centrale actor benoemd of gecreëerd (focale firma, voorzitterschap of joint-venture o.i.d.)?
- 14) Hoe is dit inhoudelijk verder georganiseerd?
- 15) Hoe heeft dit de samenwerking of competitie beïnvloedt tussen de partners?
- 16) Hoe heeft de compositie (dus asymmetrisch of symmetrische of complementaire partners) van partners processen van samenwerking of concurreren, beïnvloedt in uw ogen?
- 17) Kunt u concrete voorbeelden hier van geven?

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c. Eerste jaar van de cluster

- 18) Kunt u eens beschrijven hoe de samenwerking binnen de cluster verliep tijdens het eerste jaar?
- 19) Was de cluster onmiddellijk succesvol of was er toch sprake van opstartmoeilijkheden (zo ja, beschrijf deze moeilijkheden)
- 20) Werden er initiatieven genomen om de samenwerking tussen de betrokken partners te stimuleren?
- 21) Kunt u eens de sfeer tussen de partners beschrijven?
- 22) Werden er tijdens dit eerste jaar aanpassingen aangebracht aan de samenstelling van de cluster (nieuwe leden, bedrijven die cluster verlieten)?
- 23) Werden er tijdens dit eerste jaar aanpassingen aangebracht aan de design van de cluster?
- 24) Waarom zijn die aanpassingen uitgevoerd?
- 25) Welke effecten hadden deze aanpassingen?

d. Verder verloop van cluster

- 26) Kunt u beschrijven hoe het cluster verder is geëvolueerd?
- 27) Is de sfeer tussen de partners nog substantieel veranderd? Zo ja, verklaar
- 28) Zijn er bepaalde kritische momenten geweest binnen de cluster, waardoor de goede werking van de cluster in gevaar kwam? (zo ja, beschrijf kort)
- 29) Zijn er nog belangrijke aanpassingen gebeurd in de samenstelling/design van de cluster?
- 30) Waarom zijn die aanpassingen aangebracht?
- 31) Welke effecten hadden deze aanpassingen?

e. Huidige toestand van cluster

- 32) Bestaat de cluster vandaag nog of is de cluster ontbonden (als het cluster ontbonden is, waarom?)

f. Algemene evaluatie

- 33) Als u terugkijkt op de geschiedenis van deze cluster, welke belangrijke lessen kunt u dan trekken?
- 34) Heeft u, achteraf gezien, de indruk dat het design een goed design was of is en waarom?
- 35) Zou, achteraf gezien, voor een ander design kiezen en waarom?
- 36) Heeft u verder nog opmerkingen of vragen?

Einde Interview

## Appendix II: Quick scan form

Quick scan for structural design and cooperation

Name network:.....

Dimension of "structural design"	Formalization	Centralization	Heterogeneity
"First" design			
Evolution over time (± 5 years)			

Dimension of "structural design"	... level of formalization	... level of centralization	... level of heterogeneity
Impact on cooperation			
Rationale			
Evolution of structural design Impact on cooperation, plus rationale			

**Figure II: quick scan form**