ORGANIZING INNOVATION

How policies are translated into practice

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To Olivia with love

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Marstrand, April 2008.

Fredrik Lavén

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CHAPTER 1

Introduction

> The development of innovation systems and clusters is a prerequisite for increasing the economy's competitiveness and thereby furthering regional development in all parts of the country.
>
> Ulrica Messing, former Swedish Infrastructure Minister, 2002.

Innovation as a political agenda

The idea that innovation is central for economic progress appears in a wide array of settings. We come across it when turning on the evening news reports on the economy, when listening to a CEO presenting a company's latest competitive strategy, or when reading an analysis comment in the Financial Times. In such settings, innovation is commonly paired with claims of success, and it is commonly taken for granted as something that occurs in the economy and wider society. This is also the case in economic policy and statements by politicians, like the one above by the former Swedish Infrastructure Minister. Indeed, the idea of innovation is equally commonplace in academic publications on economic development and management. And it is also frequently occurring in official reports and proceedings from, for instance, the European Commission and in economic policy recommendations from the Organization for Economic Co-operation and Development (OECD).

Innovation can of course have many connotations, and it is not my intention to arrive at a definition of what it ultimately is. However, when

consulting the etymology of the verb *innovate*, we find that it commonly refers to the introduction of something new, or the presentation of something *as if* new (Merriam-Webster Online Dictionary, 2008). In everyday language, innovation is often paired with the introduction and commercialization of new objects, such as technological products. But it can also be used to denote new methods, like a novel manufacturing process or service routine. Such innovations are repeatedly portrayed as cornerstones of economic development, and generally seen as a necessity for economic growth. Innovation is thus characterized as paramount for achieving economic development, which in turn is deemed necessary for improving standards of living and societal prosperity. In accomplishing such developments, there is a multitude of attempts at stimulating innovation. This thesis sets out to study one such example in which theories of innovation are translated into policy and then into practice in an initiative aimed at generating innovation.

Over the last few decades there has been a global innovation policy movement in which governments and international economic organizations and federations have sought to stimulate innovation in their desire to make their respective economies prosper. Examples can be found in the European Union's (EU) *Lisbon Strategy*.[1] Here innovation is said to play a central role in creating jobs and growth in the future, contributing to reaching a vision where the EU was to become the most competitive and sustainable economy in the world by the year 2010. According to the report *Innovation Tomorrow,* issued by the European Commission, innovation is characterized as a central matter of concern in the contemporary so-called knowledge-based economy, constituting the chief propelling force in economic development (Lengrand, 2002). In fact, the innovation concern is even more emphasised in the recently renewed Lisbon Strategy. Other instances, where similar priorities are communicated, include the United Nations Industrial Development Organization (UNIDO), as well as the OECD.

1 The overall Lisbon goal for the EU was defined accordingly: to become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion. For more details, consult "The Lisbon European Council – An agenda of economic and social renewal for Europe: Contribution of the European Commission to the Special European Council in Lisbon, 23-24th March 2000" and "Presidency Conclusions – Lisbon European Council, 23 and 24 March 2000".

Indeed, innovation is also common for national economic policies. In Sweden, for instance, the government went as far as setting up an Agency for Innovation Systems (VINNOVA) to fund research and develop so-called innovation systems.

Today countries compete on rankings of innovativeness and growth, where governments strive to obtain as high a position as possible, making it a chief concern in economic policy. The former Swedish Minister of Infrastructure, Ulrica Messing, expressively illustrated this in an address introducing the so-called *Regional Growth Programme* in March 2002. She began with comparing Sweden's international competitiveness by referring to various country rankings of innovativeness, growth potential and so forth, suggesting that Sweden's overall position was relatively good. However, she went on to point out that Sweden's growth had actually been lower than the OECD and European Union (EU) average. Sweden allegedly spends most money on research, relative to country size, and is often said to produce high quality results. The problem is that these research results do not seem to generate economic growth, a conundrum often referred to as the "Swedish Paradox". This is also noted in VINNOVA's Strategic Plan, which points to how the Swedish gross domestic product (GDP) had dropped from fourth to eighteenth place between 1970 and 2001 (VP 2002:4, p. 7). But as Ulrica Messing professed, and as VINNOVA's strategic plan also stated, this was to be remedied: Sweden was going for a medal position on the OECD's ranking again. The Regional Growth Programme was one of the instruments for achieving this, and was presented as following the goals set up in the EU Lisbon Strategy. In this endeavour, Ulrica Messing pointed to the importance of international and national frameworks, laws and regulations, taxes, research and education, infrastructure, and so forth, in pursuing this aim. And she also emphasised the mounting significance of regional development:

> …I am convinced that the place, the local and the regional level are of increasing importance. One often talks of the paradox of globalization. As national economies are integrated, the motives for division of work and specialization are mounting. Companies, regions and countries specialize themselves within areas in which they have largest opportunities to compete.

In this address the minister accentuates the regional level in terms of generating growth, but the purpose of most such efforts is ultimately to stimulate aggregated growth at the national level. However, seeking to further innovation is not a new phenomenon; similar attempts have occurred ever since the beginning of the 20th century. Economists and governments have actively sought to increase economic output and enhance economic performance and growth levels, primarily by stimulating science and technology development (see for example Williams, 1973; Nelson, 1993; Van de Ven, Angle and Poole, 1989/2000; Fagerberg, 2005, further outlined in Chapter 3). It follows that technical advances and introduction of new innovations, be it the spread of new products, services or manufacturing methods, are all seen as paramount in propelling economic development forwards.

In the pursuit of economic growth, innovation has become almost a mantra and normative ideal for contemporary economic policy. Recent examples of this are the emphasis on developing so-called *innovation systems* and *clusters*, often organized according to a *triple helix* model. These three concepts constitute theories of innovation. They accentuate inter-organizational constellations as the locus of innovation, which is why I have chosen to refer to them as theories of innovation-producing arrangements. What makes these theories particularly interesting is their relation to contemporary innovation policy movements, and particularly so in the country of Sweden. An innovation system is commonly referred to as a system of all actors relevant for producing innovation, whilst a cluster denotes a geographical concentration of firms in a specific industry that compete and collaborate in ways that lead to innovations. Triple helix also focuses on organizational constellations, but highlights the importance of interaction between industry, academia and the public sector for innovation.[2] These theories of innovation-producing arrangements have become integral parts in innovation policy developments, posing as instruments that governments and other public organizations utilize in seeking to stimulate economies. All of them emphasise that innovation arises from interaction between various firms and other organizations, be it

2 As I will show in Chapters 3, 4 and 5, these theories have been developed by economists in close interaction with policymakers, although innovation systems is commonly paired with the work of Freeman (1988), Lundvall (1988, 1992) and Nelson (1988, 1993), clusters with that of Porter (1990, 1998) and triple helix with Etzkowitz and Leydesdorff (1996, 2000).

in networks or systems, representing an increasingly popular trend in economic and innovation policies.[3] In Sweden, for example, there are programmes for both innovation systems and clusters, which partly fund initiatives seeking to promote such organizational constellations. This pairing of innovation, organizational interaction, and growth is for instance emphasised at the Swedish Agency for Innovation Systems (VINNOVA). An excerpt from VINNOVA's strategic plan illustrates this eloquently:

> Innovations, in the form of new products, services and processes, form the basis for sustainable growth. They in their turn are based on skills, the exchange of knowledge and interaction between the spheres of business, science and politics, which promotes mutual learning. Future growth in a globalised knowledge-driven economy is increasingly dependent on research-based knowledge.
>
> VINNOVA's role is to promote sustainable growth in Sweden by means of problem-oriented research and the development of effective innovation systems. VINNOVA promotes effective innovation systems at a national, sectoral [sic - e.g. relating to an industry sector] and regional level. The interaction between these different levels is a decisive factor in the development of strong, sustainable growth. For innovation systems to be effective, science, business and politics (the triple helix) must work together to set priorities and develop new initiatives within Sweden's important growth areas (VP 2002:4, p. 3).

These ideas are for instance put into effect in VINNOVA's VINNVÄXT programme aimed at furthering the development of regional innovation systems. As will become apparent, similar ideas also form the grounds for another joint agency programme, called VISANU, aimed at promoting both innovation systems and cluster initiatives. As we shall see, the programmes carry with them written instructions for how innovation initiatives should be organized, something that I have chosen to refer to as scripts.[4] Interestingly, innovation initiatives applying for financial support from the

3 These theories are outlined and discussed in Chapter 3, Reviewing Innovation Perspectives.

4 I will discuss the notion of scripts at greater depth in Chapter 2, where I present my frame of reference in undertaking the study. In so doing I will build on studies of science and technology (SST) by Akrich (1992), Akrich and Latour (1992), Joerges and Czarniawska (1998), Latour (1987, 1992) and Woolgar (1991), linking these to an organizing perspective (Czarniawska, 2004b; Weick, 1979).

innovation programmes are expected to follow these scripts if they are to be funded. This lies at the heart of this study, which intends to explore how innovation programmes and their accompanying innovation scripts are translated into practice in organizing an innovation initiative in western Sweden.

The emergence and development of an innovation initiative

It follows that much attention has been devoted to innovation throughout society, and particularly within the fields of economic theory and policy. Theories on innovation systems, clusters and the model of triple helix interaction are spreading across the globe as successful recipes for innovation and economic growth. In following this trend, the Swedish government has in fact initiated programmes for developing and financially supporting innovation systems and clusters initiatives, constituting a vital part of the nation's economic policy.

Innovation systems and clusters are commonly described as system or network arrangements of organizations, which interact in producing innovations. Much of the literature on such arrangements is often normative: cherishing ideals of network building, identifying organizations as entities with specific functions and positions in innovation structures.[5] Here, "organizational collaboration" constitutes a rather romantic view on how the economy develops, as well as being coupled to strong assumptions of how innovation is produced and how it generates growth and prosperity. Building upon similar arguments, there is a plethora of examples where governmental organizations seek to stimulate and finance the development of such organizational innovation systems and clusters; Finland, France and Sweden are just a few cases in point. But what does it mean to refer to something as an innovation system or cluster? Accounts of such arrangements are often abstracted from what actually goes on in such settings, providing general and rather idealistic portrayals of organizations as interacting in producing innovations. Thus, in order to understand innovation systems and clusters, we must attend to practice in settings

5 For a comment on the normative discourse on network building and its sustaining power/knowledge relations, see Knights, Murray and Willmott (1993).

described as such, investigating how they are organized. This entails exploring the relationships between innovation theories, policy and practice.

The purpose of this thesis is to investigate how theories of innovation-producing arrangements and innovation policy are put into practice in organizing an innovation initiative. This requires a two-way approach: firstly, it is necessary to investigate how theories of innovation-producing arrangements are employed and filled with meaning in innovation policy development. Secondly, one needs to explore what occurs in settings described as related innovation systems and clusters initiatives, or in other words, observe the practice of such phenomena. Following Weick's (1979) and Czarniawska's (2004b) reasoning, one way of doing this is by studying *organizing*, exploring the unfolding of events and the assembly of ongoing interdependent or linked actions.

This thesis sets out to describe how theories of innovation are put into practice in Swedish innovation programmes and their related initiatives. In pursuing this, I have studied how Swedish innovation policy and governmental programmes make use of theories and models of innovation systems, clusters and triple helix, in seeking to stimulate regional development and economic growth. And I have specifically explored how these theories and policies have been put into practice locally in a so-called innovation systems and cluster initiative, referred to as *Microwave Road*.[6]

The Microwave Road (abbreviated MWR) initiative is described by its spokespersons as a cluster, but also as a network, an association, as well as an innovation system. Some readers may object to this kind of mixing of theories and concepts, suggesting that they are not compatible or that some theories emerged as critiques of others. Nevertheless, these theories are used simultaneously and blend together in the field, both in the Swedish innovation programmes and in the MWR initiative. MWR is described as having 39 member organizations, comprised of microwave technology[7]

6 This study has been a part of a research project called *Organizing and Learning in Networks* (Drn: 2003-01730), located at the School of Business, Economics and Law at Göteborg University. The project included Torbjörn Stjernberg (project leader), Christian Jensen, Björn Remneland, Björn Trägårdh, and myself Fredrik Lavén. We greatly acknowledge the support of VINNOVA and the research programme "Kunskapsbildning och organisering" (Knowledge production and organizing) in funding the project.

7 Microwave technology is based on applications of microwaves, which are a form of electromagnetic radiation/waves. Microwaves are used in for instance radar, radio and television broadcasting, high-speed microwave heating, mobile telephones (Oxford Reference

companies, research institutions and institutes, as well as public organizations, most of them located in geographic proximity in western Sweden. MWR's aim is to further organizational collaboration in developing microwave technology products and technology platforms. As will become apparent, MWR is linked to the Swedish programmes for innovation, and exploring this relationship and its implications for organizing lies at the heart of this study. My interest has thus been to explore theories of innovation, the Swedish innovation programmes and organizing in the MWR initiative. The following research questions have guided me in the pursuit of this:

1. How are innovation theories and models employed in Swedish innovation policy and programmes?
2. How is the Microwave Road initiative organized?
3. How are the innovation theories and models, as well as the Swedish programmes for innovation, related to the organizing of Microwave Road?

When studying MWR I have sought to refrain from a priori assumptions about what the initiative actually concerns. I have therefore chosen not to define it as either an innovation system or a cluster beforehand. Instead I have attempted to follow Latour's (1987) suggestion that science and technology should be studied "in the making" rather than as something given. I consequently studied the unfolding of events in MWR, exploring how the initiative was organized, rather than seeing it as a ready-made innovation system or cluster with certain intrinsic qualities. This entails studying practice in the MWR initiative. By this I mean that I have studied the actual 'carrying out', or performance, of work and how actions are interrelated in the MWR setting. More plainly put, I have studied what is done, how and when, by employing an organizing perspective and engaging in fieldwork. This in turn has prompted my investigating literature on innovation theories, as well as documents related to the Swedish innovation programmes. In sum, this approach allows for studying efforts to organize innovation.

Online, 2005) and other wireless communication devices. Microwave applications are often encountered in the telecom, defence and space industries, for example.

What to expect in what follows

In this first chapter I have pointed to how ideas and theories of innovation have become popular for explaining and stimulating economic growth. Theories such as innovation systems and clusters are increasingly used, for example, in contemporary economic policy. This has led to the formulation of a research problem concerning how innovation theories are put into practice in Swedish innovation programmes and how this influences organizing in a related innovation initiative such as MWR.

Prior to embarking on a study on efforts to organize innovation, it is necessary to outline my research approach in more detail. This is dealt with in Chapter 2, where I discuss how to study the innovation programmes and the MWR initiative by taking an organizing perspective. There I also outline the notions of scripts, i.e. programmes-for-action, and editing, as they will become central to my argument in what follows. In addition to this I describe how I have used fieldwork techniques for studying and analysing efforts of organizing innovation.

In Chapter 3, I review perspectives on innovation and economic growth, particularly attending to what I call theories of innovation-producing arrangements. I begin with giving an account of theories on individual entrepreneurship and innovation, moving on to an outline of a company perspective on innovation, ultimately ending in research on innovation as occurring in systems and networks of organizations. The latter makes for a transition to illustrate how recent academic research describes innovation as occurring in *innovation systems*, *clusters* and *triple helix* constellations. These theories are interesting as they are particularly relevant for international policy development.

The issue on how innovation theories have been translated into innovation policy at the OECD, in the EU and in Sweden is introduced in Chapter 4, called *From Innovation Theory to Policy*. As the title of the chapter implies, it shows how innovation theories were translated, or rather inscribed, into an agency for innovation in Sweden and its policy activities. It shows how the agency, called VINNOVA, aimed at funding and developing so-called innovation systems and cluster initiatives. Interestingly, its policies carry scripts for how innovation systems and cluster initiatives, following a triple helix model, should be developed.

This discussion is developed in Chapter 5, where I describe two Swedish regional programmes for innovation. This chapter concerns how theories of innovation-producing arrangements were edited in *Preparing Local Innovation Scripts*, which also constitutes the title of the chapter. In so doing I particularly attend to how these scripts become prescriptions for organizing regional innovation initiatives, and the necessity of complying with the prescriptions in order to receive funding from the programmes.

In Chapter 6, *Arranging for Microwave Innovation*, I show how the innovation scripts are performed when they are translated into practice in the MWR initiative. I begin with describing how a VINNOVA innovation programme triggered the development of the MWR initiative. This is followed by an account of what was done in establishing MWR, pointing to how actions were geared towards furthering organizational collaboration for developing microwave technology. This primarily concerned grouping microwave organizations. This chapter thus highlights how the innovation programmes' scripts and prescriptions are performed in organizing Microwave Road, focusing on organizational structuring.

The following Chapter 7, *Microwave Road in Practice*, concerns the ongoing activities and actions in MWR. I begin with a short narrative on the Microwave Road kick-off and continue with outlining what is done in the initiative. This entails examining how microwave technology seminars and meetings are arranged, as well as describing the continuous quest for capital in MWR. I also depict the incessant efforts to make sense of the innovation scripts in MWR, attempts to strengthen the initiative, and endeavours to map the competence of its members. However, the chapter ends by pointing to missing activities; the initiative was supposed to further collaborative technology development, and I point to how tensions rose as its representatives struggled to find out what to do once the organization was established.

In Chapter 8, *Grouping vs. Acting for Technology Development*, I describe and compare two technology initiatives that were seen as solutions to Microwave Road's problem of lack of action concerning technology development. The first initiative, called Automotive Group, focused on attempting to bring the automotive and telecom industries closer together in order to further joint technology development. However, the group dissolved after receiving little interest from the automotive representatives. The second initiative, the Ceramics Substrate Project, was more successful

and enabled collective action since it built on past experiences and microwave practice that focused on work in a specific field of technology, as opposed to the focus on organizational structuring in the first initiative.

In the concluding Chapter 9, *Performing and Editing Scripts*, I discuss the findings from the previous chapters, exploring how the regional innovation programme scripts were first performed, that is enacted, and then edited in the MWR initiative. This is followed by a discussion where I argue that enacted innovation scripts become organizing scripts. And performing these scripts in MWR initially led to a structural precedence and inertia with regards to technology development work. This was supposed to be remedied first through the Automotive Group and then the Ceramics Project. Using these examples, I then discuss how the innovation scripts were combined and rearranged through a process of editing. I also point to how editing may allow for more locally adapted scripts that can be translated into relevant action. The chapter then discusses the characteristics of two different organizing scripts in MWR and their consequences for organizing action. Finally, I discuss the practical implications of the findings and present the conclusions that can be drawn from this study of organizing innovation.

CHAPTER 2

Organizing, scripts, editing and fieldwork

Theories of how innovation emerges and how it generates growth have been around well over a century. Such theories are in turn closely related to economic policies for how nations and regions should stimulate the emergence of innovations. Increasingly popular theories and policies of innovation address and advocate specific types of arrangements, typically of interacting organizations, in which innovation is claimed to be produced. Examples of this include theories of innovation systems and clusters, which constitute a basis for both innovation policy making and the numerous innovation initiatives that the policies seek to stimulate. Indeed, the dynamics between innovation theories, policies and initiatives is of particular interest when seeking to understand contemporary efforts of organizing innovation.

In this thesis I particularly seek to investigate how theories of innovation-producing arrangements are put into practice, both in innovation policy and in a related innovation initiative. And if we are to understand the unfolding of events in such settings, it is necessary to study processes of organizing (cf. Weick, 1979; Czarniawska, 2002, 2004b): considering how theories, policies and local action are interrelated. Before turning to the MWR initiative in particular, it is hence relevant to firstly explore, albeit briefly, how innovation has been viewed over time. In so doing I will review the shifting dominance of different innovation theories (Chapter 3). The second step is to investigate how these theories have been used in innovation policies and programmes (Chapter 4 and 5). Thirdly,

against this backdrop we can proceed to deal with the microwave innovation initiative MWR, describing and analyzing how it is organized (Chapters 6, 7 and 8). This allows for drawing conclusions regarding the characteristics of the initiative's relation to innovation theories and policy. Taken together, this three-way approach facilitates studying efforts organizing innovation.

To study organizing is to study processes of interlinked events and actions, and to see how these might be related to artefacts and actors. This is different from perceiving innovation initiatives as existing "out there" and being mirrored by innovation concepts and theories, such as those of innovation systems and clusters. The notion of an organizing perspective originally derives from the contribution of Karl Weick (1979; 1995), who advocated a shift in attention from studying organizations to investigating processes of organizing. Weick argued that organizing activities are relational and largely characterised by processes, where rules, routines and conventions influence that which becomes sensible. He also proposed that processes of organizing are continuously unfolding and re-accomplished. Barbara Czarniawska has developed these ideas further in her *action-nets* concept (2000; 2004b), where she concurs with Weick's call for focusing on organizing rather than organizations. The action-nets perspective involves studying organizing by following chains of events, or rather unfolding nets of actions, and how these may construct actors, or organizations (Czarniawska, 2004b). So instead of taking actors or organizations for granted, much can be gained by studying interconnected actions. Thus, actors and organizations are seen as resulting products that may emerge from the organizing that takes place within action-nets (Czarniawska, 2000). Referring to Weick's (1979) suggestion to shift our focus from structure to the process of organizing, Czarniawska also points towards the necessity of moving beyond the study of existing objects, placing interest on the verb organizing rather than the noun organisation (cf. Law's (1994) argument for a 'sociology of verbs'). To study organizing then is to assume a performative stance; we cannot describe an organization in *principle* but by studying organizing it is possible to do so in *practice* (Czarniawska, 2002). So instead of assuming that MWR is an innovation system or cluster in principle, I approach it by exploring how it is constructed in practice, addressing organizing actions in the MWR setting.

In this chapter I will continue to outline my frame of reference with regards to how I have studied innovation theories and programmes, and the MWR initiative. In so doing, I borrow from methodological approaches in the field known as studies of technology and science (STS) and combine these with an organizing perspective. The primary reason for this is that the STS tradition largely concerns symmetrical studies of innovation. This means that all actions, events and entities are treated as having equal potential relevance at the outset of studies of innovation. As with an organizing perspective, this concerns refraining from seeing entities such as theories and organizations as something ready-made. Assuming such a research approach has allowed me to observe a close connection between the MWR initiative and the Swedish innovation programmes, as well as how both these are interlinked with theories of how innovation is produced. In practice, this has prompted me to study textual documents related to the programmes, as well as academic publications on innovation, particularly related to innovation systems, clusters and triple helix interaction. In so doing I have found the innovation programmes and theories to carry instructions, or what I refer to as *scripts*, for how innovation initiatives should be organized. The notion of scripts is central to the study in its entirety, which is why I have chosen to proceed with explaining what I mean by scripts in this chapter. As will become apparent, however, I will return to this theme throughout the thesis in building my argument. And for the same reasons, I will also introduce the notion of *editing*, as it is important for how innovation scripts are prepared and put into practice. This is followed by an account outlining how the study has been carried out in employing an organizing perspective and engaging in fieldwork, introducing methods of participant observation, document studies and unstructured interviews, as well as how the fieldwork material has been analysed and is presented.

Studying efforts of organizing an innovation initiative

In understanding efforts to organize innovation systems and cluster initiatives such as MWR, we must refrain from *a priori* assumptions on what constitutes such phenomena. Otherwise we stand the risk of simply

restating the claims in the field and thus risk making *a priori* conclusions. Instead it is necessary to avoid taken-for-granted views on what MWR is and what happens in such a setting. Indeed, we know that MWR is referred to as both an innovation system and as a cluster, or simply as a network of microwave technology related organizations. But what does this mean, which actions are undertaken in such a setting, by whom and why? In order to answer these questions it is necessary to study how the initiative is organized, looking into practice. I have thus sought to avoid being tangled up in *a prior* assumptions and theoretical delimitations, which might have compromised the results of the study in directing the investigations in any given direction. Due to this I have chosen a rather neutral theme in suggesting that I have studied the organizing of what can be referred to as an innovation initiative.

My initial point of departure was to begin with studying organizing practice in MWR. This concerned studying what is done in the MWR setting, where its originators claim to support the development of microwave technology and innovation. The reason for choosing to study MWR was that I had an interest in innovation initiatives, the idea of organizational collaboration, and efforts to develop so-called innovation systems and clusters, and MWR was indeed described as such. And as I began my study of MWR I soon realized that both theories of innovation and innovation policy were closely related to the MWR initiative. For this reason I chose to examine academic literature on theories and models on innovation. I also proceeded to study texts and policy events related to both international and particularly Swedish innovation programmes.

My research approach has as mentioned entailed examining processes of organizing by engaging in fieldwork and collecting textual documents in seeking to study actions and how they are interlinked (cf. Czarniawska's (2000 and 2004b) notion of organizing in action-nets). This permits studying how an innovation initiative such as MWR is constructed in practice, as well as related theories of innovation-producing arrangements and governmental programmes for stimulating innovation. In so doing, it becomes important to follow the traces made by actors, exploring associations between actions, human and non-human actors (textual artefacts could exemplify the latter). This aspect of tracing the social as relations is inspired by an approach, or rather a method, which has become known as actor-network theory (see Latour, 2005 for an introduction).

Actor-network theory allows for studying the social world in motion, or in the making, rather than as being comprised by ready-made elements that can be explained through abstracted principles. The point of this is that researchers should minimize the taken-for-granted when studying a phenomenon, striving for symmetry in giving equal attention to actions and actors that might not have been anticipated at the outset of the study. For my purposes, this is important as I wish to refrain from prior assumptions of MWR as a cluster or system that exists "out there". What is more is that such a method allows for studying the 'messiness' that surrounds us in our everyday lives; the world is not divided up into neat categories and known causal relationships. Indeed, as Law (2004) argued, there is need for social scientists to follow this messy social movement, which is why there is a need for methods suited for studying the "the ephemeral, the indefinite and the irregular" features of the world. My approach is therefore to study organizing, as opposed to organizations, or other set organizational assemblies. In so doing, I have also found inspiration from actor-network theory's closely related field of investigation, commonly referred to as studies of technology and science (STS).

STS has its roots in sociology developed in the 1980s, which attended to how scientific knowledge and technology are constructed (see Latour and Woolgar, 1979/1986; Knorr-Cetina, 1981; Callon, 1986; Latour, 1986, 1987). Perhaps the strongest reason for actually relating my study to the STS field is the fact that it primarily concerns studying "innovation" symmetrically. A central book on this topic is Latour's (1987) *Science in Action*, in which he suggests that researchers interested in science and technology should study these "in the making", as opposed to something "ready-made". Latour exemplifies this by pointing to how people use artefacts in their everyday lives, such as methods, tools or machines, without having to consider the vast range of entities requiring assemblage in time and space for this to be possible. This probably helps us not to be completely confused in our undertakings, but sometimes it is worth considering how the taken-for-granted become just that.

Moreover, the assembly of artefacts is continuous and does not end with their being designed or produced; they are also constructed as they are put into use. And it is by no means certain that the artefact will be used as its designers anticipated, or what types of qualities or drawbacks they will come to be regarded as possessing. The same goes for qualities ascribed to

scientific facts, and as we shall see, this is relevant for the theories of innovation in this study. According to Latour (1987: 259), these facts are not only defined by those formulating them. Instead they are "in later users' hands; their qualities are thus a consequence, not a cause, of a collective action" (Latour, 1987: 259). Thus, in studying for instance innovation initiatives, we must refrain from seeing innovation systems and clusters as ready-made entities that exist and need not be questioned.[8]

"Society", according to Latour, is constantly shaped by collective action. It is not something that is already in place with a given origin that can explain behaviour. Instead, Latour suggests that society is better understood as being characterized by incessant definitions and debates that have great influence on us. Because of this, he goes on to say, it is important to go from ostensive definitions of society to performative ones. Now, what does this mean? An ostensive definition is a word that is related to, or is directly constitutive and demonstrative of, the thing or quality being defined (Merriam-Webster Online Dictionary, 2006). Latour (1986: 272) explains that ostensive definitions imply that "in principle it is possible to discover properties" of that which is defined, "though in practice they might be difficult to detect." So if we are interested in innovation initiatives and their related theories, concepts and models, it becomes important to trace their associations allowing for their presence in society, exploring how they come about, how they travel in time and space, and how they are put into practice. Indeed, this follows Latour's (2005) later argument that social scientists should refrain from taking social entities for granted; instead they should study associations, allowing for reassembling the social in a collective. In a similar way, instead of assuming that MWR is an innovation system or cluster, I wish to study how the initiative is organized and filled with meaning.

The widespread conviction is that innovation is necessary for propelling the economy forward, generating growth, and thereby contributing to societal development. This has been an area that has attracted the attention of economists, politicians, business people and others ever since the dawn of the market economy. Much attention over the last 20

8 Latour (1987) refers to this as black boxes, denoting something that is taken for granted, where inputs go into the box, resulting in outputs, without our contemplating what happens inside the darkness of the box.

years has been placed on understanding innovation as emerging in particular types of organizational constellations, such as in innovation systems and clusters of organizations. Indeed, these theories have formed the basis for several governmental innovation programmes, as I will show in Chapters 4 and 5. But if we are interested in how innovation initiatives are organized, we need to study the practice of such settings. Nevertheless, innovation initiatives, such as the MWR case, are often closely related to both theories of innovation-producing arrangements and policies for stimulating innovation initiatives. Interestingly, these theories and policies carry programmes-for-action, or rather "scripts", regarding how innovation should be organized. The following section develops the notion of scripts, adding to the frame of reference of the study, as well as forming an important basis for the subsequent arguments of the thesis.

On scripts as programmes-for-action

The word *script* commonly refers to something written, such as a textual document. It can also be an instruction, a plan or a programme-for-action, aiming to guide and control behaviour. The latter suggests that scripts carry norms for action, or authoritarian standards, pointing to how things should be done, as opposed to how things have been done. Most of us are probably familiar with the word *manuscript* in the realm of theatre and film making, constituting a set of texts instructing actors how they should act and what they should say. In that sense, a script can be a written instruction for what to do. Indeed, the etymology of the word script derives from Latin *scribere*, meaning to write (Merriam-Webster Online Dictionary, 2007).[9] However, scripts do not exclusively take the textual form. As we shall see, they can also be inscribed into technologies (cf. technology as text) and symbols.

9 One of the first instances when we come across the notion of scripts is some three thousand years ago when so-called scribes began writing down the "word of God" as communicated through prophets, poets, and legislators. Such religious inscriptions, or Holy Scripture, were then collected in the Old Testament, which in turn formed the Jewish canon. At the dawn of Christianity, these scripts were then combined with narratives in the apostles' gospels of the life of Jesus in the New Testament. These texts were ultimately put together in the Bible, which in fact represents one of the first collections of scripts (National Encyklopedin, 2007).

The opposite of scripted is unscripted, denoting something that can be characterized as sudden and unexpected, as if happening on that spur of the moment. Staying with the theatre and film analogy, this could be seen as an improvised dialogue that is not directed according to a manuscript. Something unscripted and extemporaneous can also be expedient, that it is guided by practical concerns and suited to an end in view.

Scripts have also been used in cognitive science and for understanding human thinking and knowing, as well as in social psychology and explanations for social behaviour. Writing on artificial intelligence, Schank and Abelson (1977a: 38) argue that scripts, plans and goals are key to human understanding. The way they see scripts is interesting, suggesting that a script is a *standard event sequence*, allowing for specific understanding of situations, stories, and causal chains of events. Moreover, such an understanding suggests that scripts determine behavioural patterns and sequences, instructing individuals how to act in specific situations, regardless of whether we are aware of it or not. Schank and Abelson exemplify this by using the example of acting according to a restaurant script: when a man comes into a restaurant, orders food from the waitress, eats, pays the bill, and then leaves, he acts according to a script, thus behaving understandably in the given situation. If he went into the restaurant, asked for the menu and ordered a shoe, he would not follow a recognisable script and the situation would probably be quite odd. Similarly, in a movie theatre, a script allows the visitor to know what to do with the instructions on the ticket; she will probably follow a script in locating the ascribed seat, following row and seat numbers so as to find her seat. Perhaps she asks somebody working at the theatre where the seat is, who answers: "second aisle on the right". As Schank and Abelson suggested, it would then be rather strange if she answered: "what about the one on the left?" as this does not follow the standard sequence of events in the given situation. Thus, in Schank and Abelson's (1977a) terms, scripts concern both roles and standard behaviours in specific situations. And according to such a view, scripts are not always inscribed in texts.

A script may indeed refer to a standard event-sequence: both Akrich (1992) and Latour (1992) see scripts as scenes or scenarios played by human and non-human actors. But, an important difference from Schank and Abelson (1977) is that any action programme, carrying a set of scripts, may encounter anti-programmes (Latour, 1992) and different interests. What is

more, actors may of course interpret the scripts differently, as well as choosing to comply or not with the scripts, regardless of whether they are prescribed or not. In addition, while most scripts are silent and institutionalized, we often encounter scripts with an instructive dimension, which are explicitly inscribed in texts. Taking these views together, scripts can be seen as inscribed in technology, practices, symbols, and texts. And that which unities these perspectives is that they all share a central characteristic in addressing how things should be done.

The notion of inscription is central to understanding scripts. It appears in the field of literary theory, but has also been given particular attention in science and technology studies, as we shall see in the following. Latour and Woolgar (1979), for instance, elaborated on inscription in their studies of the process in which scientific research is turned into publications. In so doing they acknowledge that the notion of inscription is borrowed from literary theory and the work of Derrida (1977). In their anthropological study they eloquently traced how beheaded rats were transformed, via apparatuses and inscription devices, into points, traces, histograms, numbers, and diagrams, which are used in writing scientific papers. And one of the central issues in their study was their incorporating the notion of inscription devices into their argument, signifying apparatuses that transform matter into written documents.[10] Indeed, the etymology of *inscribe* alludes to writing upon or into something.[11]

Woolgar (1991) proceeded with the idea of inscription in his studies on attempts to configure users of new micro computers. Here, he introduced the metaphor of machine-as-text to illustrate attempts to inscribe computer usage. He referred to such efforts as: "a set of design (and other) activities which attempt to define and delimit the user's possible actions" (1991: 61), which also involves processes of ascribing intentionality to actors as well as their roles and expected behaviours. In other words, Woolgar showed how technological inscriptions may in fact dictate particular behaviours. This is in line with Joerges' and Czarniawska's (1998) suggestion that technical norms and normalization constitute ways in which patterns of organizing

10 An example of an inscription device could be a machine measuring a chemical substance and producing diagrams pointing to changes in concentration, thus transforming matter into text.

11 Later, Latour (1987) proceeded with exploring science-in-action and how facts become stabilized and black-boxed as something ready-made and uncontroversial.

are inscribed in technology, as well as of how organizations produce technical worlds.

Similar ideas were developed by Akrich (1992), who studied how French engineers devised light appliances for less-developed countries, attempting to control how they were used. Her study focused on the role of designers in inscribing and prescribing specific actor qualities and behaviours (i.e. scripters inscribing scripts). Thus, Akrich showed how prescriptions may be employed as a means for enrolling actors and pushing them into specific roles. However, this does not mean that actors always comply and do as they are expected; they may or may not act according to the scripts.[12] She also pointed to instances when these scripts were de-scribed by users when adjusted according to their own interests and not necessarily to those of the designers. This means that the scripts are dismantled and are not performed as intended by their originators. In addition, the users may also choose to re-scribe them in constructing new inscriptions. Indeed, as the scripts are adopted they may be adapted, that is, they are translated (cf. Akrich, Callon, Latour, 1988/2002). And translation of theories into scripts, and scripts into actions, involves alteration. Latour (1986), who developed the model of translation, explains it by suggesting that:

> …the spread in time and space of anything – claims, orders, artefacts, goods – is in the hands of people; each of these people may act in different ways, letting the token drop, or modifying it, or deflecting it, or betraying it, or adding to it, or appropriating it (Latour, 1986: 266-267).

What this implies is that as artefacts are spread they are shaped and thereby translated according to people's own interests and projects. This allows the artefacts to move in time and space. One consequence of this view is that that which is translated is not simply transmitted, it is transformed and modified according to goals.

Czarniawska and Joerges (1996) developed this notion of translation in exploring how it is that ideas can travel from one place to another, emphasising the importance of objectifications. They argue that when ideas materialize into pictures and sounds, and objects and actions, they change:

12 See also Latour's (1992) and Latour and Akrich's (1992) overlapping work on a "Vocabulary of semiotics for human and nonhuman assemblies".

"unknown objects appear, known objects change their appearance, practices become transformed" (1996:20). This translation process, they argue, can be traced in repeated communication, where ideas are put into use. What this suggests is that objectification and materialization of ideas is necessary for them to travel:

> Ideas must materialize, at least in somebody's head; symbols must be inscribed. A practice not stabilized by a technology, be it a linguistic technology, cannot last; it is bound to be ephemeral. A practice or an institution cannot travel; they must be simplified and abstracted to an idea, or at least approximated in a narrative permitting a vicarious experience and therefore converted into words or images. Neither words nor images travel until they have materialized, until they are embodied, inscribed or objectified, as only bodies or things can move in time and space. (Czarniawska and Sevón, 2005: 9).

The point here is that scripts can indeed be seen as objectifications of ideas. Building on Latour (1992), Joerges and Czarniawska (1998: 371) suggest that "all organizing, in its symbolical and political and practical aspects, needs to be inscribed into the matter in order to make organizations [and organizing] durable." In addition, they also emphasise that organizations act as inscribers, or collective writers, of the technical worlds they produce, suggesting that: "the worlds around us are carefully and completely inscribed, much like the worlds of science, and [that] the majority of these inscriptions are author/iz/ed by organizations, not persons." And as will become clear, this is central to how Swedish innovation organizations and programmes introduce scripts for action in their efforts to stimulate innovation initiatives.

The notion of materiality, linking ideas and objects, is central to the realm of organizations, and as we shall see, it is also very relevant to scripts. A large number of the studies of scripts have focused on the design and use of technological artefacts, where particular behaviours or programmes-for-action are inscribed. But the link between scripts, organizing, and organizations is worth exploring further. Barley (1986) showed how novel technologies may introduce new scripts in organizations, contributing to the rearrangement of organizational patterns, i.e. how actions are interlinked. He described how the introduction of new x-ray technology in

a hospital setting provided occasions for structuring in and of the organization. Thus the technology can be seen as objectifications that resulted in new scripts that influenced behaviour and the construction of new organizational forms. This is interesting because it points to how scripts can contribute to the (re)arrangement of organizational structures and action patterns, something that will indeed prove relevant to this study.

It follows that scripts may function as ordering devices (Suchman, 2007), guiding actions to varying extents. Scripts may be explicitly inscribed as written step-by-step instructions for what to do, and how. Such scripts are perhaps better characterized as prescriptions, or normative guidelines for what should be done, or must be complied with. But not all scripts take the form of canonical, top-down, written instructions, inscribed in texts and symbols. Another perspective, akin to that of Schank and Abelson (1977a), is to see scripts is as behavioural grammars (Barley, 1986), implicitly embedded in stories and practices. Such a line of reasoning suggests that a script is not simply a single person's thinking about how to act in given situation. Instead, scripts that guide action are institutionalized and embedded in norms expressed in practices and cultures, which is why they tend to constitute something we take for granted and seldom reflect over (see for e.g. Scott, 1995 and Weick, 1995). A simplified version of such a script, relevant to this story on organizing innovation, is for example that innovation occurs in systems or networks of collaborating organizations, and that such arrangements are furthered by identifying and grouping key organizations. Moreover, as we will see in the case of the Swedish innovation programmes and MWR, such scripts can also be objectified and prescribed as specific instructions, suggesting specific actions have to be performed in a determined sequence to achieve certain results.

Even though I find the materialization of scripts central, I wish to move beyond focusing on the design and use of technology such as electrical or mechanical appliances, which has already been studied in the field of science and technology studies. What I want to do is to take the ideas of scripts and inscriptions and link them to organizing. Indeed, Barley's (1986) seminal work on technology as an occasion for structuring has introduced the notion of scripts within the realm of organization studies. Notwithstanding, I believe that there is more to add here, and this thesis will thus proceed to study efforts of stimulating innovation by exploring the links between scripts and organizing. This entails examining

both the preparation and enactment of innovation scripts, as well as exploring what implications this has for organizing innovation. In so doing, I will make use of the notion of editing as a form of textual translation, something that I develop in the next section.

Editing as a form of textual translation

The word *edit* refers to the assembly or rearrangement of for example texts or other media like photos or motion pictures. It alludes to the adaptation or alteration of something for a purpose or in relation to some kind of standard (Oxford Dictionary Online, 2008), such as a script.[13] I use the concept of editing for explaining how innovation theories and scripts, often taking a textual form, are altered and adapted in ways that are seen as appropriate. This occurs both in the Swedish innovation programmes and in MWR. In that respect, editing is similar to the model of translation (Latour, 1986) as outlined above. However, I see editing as a type of textual translation, and as will become obvious, this is particularly appropriate for understanding the preparation and enactment of scripts.

Sahlin-Andersson (1996) has worked with the notion of editing in showing how organizations imitate one another through the circulation of management models where "successes" are formulated and reformulated. She exemplified this by showing how success stories on science parks were circulated through: "a continuous editing process in which, in each new setting, a history of earlier experiences is reformulated in the light of present circumstances and visions of the future" (1996: 82). This means that the organizational models are not simply diffused; they are edited as they are translated in practice.[14] This is indeed similar to the argument of Akrich, Callon and Latour (1988/2001b: 208) that "to adopt is to adapt". What I want to stress with editing is that the adaption of innovation theories and

13 To edit is a backformation of *editor*, who originally was a person that published literary material. Editing also occurs within the realm of photography or film, such as when retouching a photograph or cutting of moving pictures or audio recordings. Indeed, scripts in the form of manuscripts are also central to theatre and film making, guiding how actors should act, much as the innovation scripts.

14 For a similar example on the spread of work systems between countries, and how they are adjusted in local settings, see Saka, 2004.

scripts refers to a two-way process; as the theories and models are edited they are altered and at the same time they alter that which is edited.

The reason for using editing, and not simply translation, is furthermore that the metaphor is particularly appropriate with regards to the alteration and rearrangement of texts and stories.[15] As I will argue, innovation scripts commonly spread through being inscribed in texts and symbols that are circulated. Indeed, they may also be reinforced and spread through communications, such as being told in stories, and when enacted in practice. Indeed, Czarniawska and Joerges (1996) argued that ideas often travel through being materialized as texts, which in turn are translated into new texts or actions in a recursive fashion. Building on this, Sahlin-Andersson suggested, "organizational imitation processes tend to involve distribution of written material" (1996: 82). This textual link is why the notion of editing is so fitting to the circulation of organizational models and innovation scripts: both can take the form of texts that are inscribed in, and carried by, documents and symbols. Indeed, editing can be seen as something that concerns the rearrangement of for instance texts, or scripts, and is thus a type of textual translation. Sahlin-Andersson argues that the translation process is "characterized by social control, conformism and traditionalism" (1996: 70-71). But this does not mean that "anything goes"; according to Sahlin-Andersson, translation is governed by editing rules given by the wider institutional setting. These include rules of context, formulation and logic. The first concerns the exclusion of context specificities when applying a model, the second how models are formulated in ways that attract attention and the third how the presentation of models follows a formal logic of rationality. When success models are imitated, it is not the practices or experiences that spread according to Sahlin-Andersson; instead she argues:

15 March (1994) has also written about editing as part of decision making processes. However, he described editing, along with decomposition, heuristics and framing, as a simplification process in individuals' and groups' information processing. This is interesting, but it does not so much concern the arrangement or adaption of something to fit local beliefs and desires.

> [W]hat [organizations] imitate are rationalizations /.../ What spreads are not experiences or practices per se, but standardized models and presentations of such practices. The distance between the supposed source of the model – a practice, or an action pattern – and the imitating organization forms a space for translating, filling in and interpreting the model in various ways (1996: 78-79).

This is interesting as innovation scripts can be seen as such standardized rationalizations of for instance how innovation systems and clusters are supposed to be organized. It follows that these perspectives on translation and editing are indeed relevant for explaining how innovation theories are inscribed as scripts and how these scripts are enacted in practice. But is it possible to study how the innovation theories are put into use in innovation programmes and local practice? The following section points to how fieldwork methods have been particularly useful for the purpose at hand.

Fieldwork methods

In studying efforts to organize innovation, I have employed fieldwork methods. This has entailed using ethnographically-inspired research techniques, particularly by carrying out observations, collecting texts, and conducting unstructured informal interviews. The study itself was carried out in longitudinal fashion, stretching between January 2003 and December 2006, with some additional material collected in 2008 (a timeline of the study, including the fieldwork and some key parallel innovation policy events and MWR activities, is found in Appendix 5). The benefit of these methods is that they can produce a rich body of material concerning what is done and how, allowing for the tracing of actions over time. When I first commenced studying the establishment of MWR I assumed an open stance to what it was that I was studying; at the time I was interested in the idea of "organizational collaboration". But I soon realized that policy and theories of innovation-producing arrangements were central to what I observed in the MWR initiative. This in turn led to my increased attention to how innovation policy and theories were put into practice in organizing MWR. Although observations and informal interviews have been central to studying the establishment and practice of MWR, I also found that textual

documents became of increasing importance as the study proceeded. In sum, this allows for exploring the theme of organizing innovation and attending to the relationships between innovation theories, policy and an initiative such as MWR.

Ethnographically-inspired fieldwork allows the researcher to explore what goes on in organizational settings, observing what people say and what they do, attending to both context and process (Silverman, 2001). In my case, this has concerned being close to practice, either by "being there" as it is played out, or by attempting to reconstruct what has occurred by studying documents or carrying out informal and formal interviews. This emphasises the importance of the researcher's ability to scrutinize not only what happens in the field but also the setting in which it occurs. As a result, both social (i.e. relational) and historical contextual aspects become important in portraying actions and narratives of actors. Fieldwork can also be understood in the light of "looking at the world and telling a story about a pattern or regularity" (Kunda, 1992). This refers to providing *thick descriptions* of phenomena in detailed accounts, attempting to bring the field to life (see Geertz, 1973; Van Maanen, 1988; Kunda, 1992). As much as I subscribe to this view, I want to clarify that I believe that the researcher produces meaning and interpretation from fieldwork material, rather than extracting it. Regardless of whether we extract or produce meaning, the fieldwork material must still be collected in telling a realistic story of organizing innovation.

Collecting fieldwork material

As I was interested in what was done in MWR I soon realized that much of the action in the initiative concerned arranging meetings. And observations have proved particularly useful for following what goes on in these settings. Between 2003 and 2006 I attended and observed 50 different MWR meetings, including board meetings, association meetings, MWR yearly meetings, technology project meetings, theme days, kick-off events, and so on. I also participated during informal meetings, such as planning meetings for funding applications, project planning meetings, various lunch meetings, dinners and other work group meetings. In addition to the observations, I also carried out formal and informal interviews, as well as

studying textual documents. All the fieldwork activities, including both observations and formal interviews, are listed in Appendix 3.

Observations

The observational method I have used is sometimes referred to as participant observation (Silverman, 2001), not because the researcher necessarily takes an active part but rather for the reason that it is not possible to be present in the field without being a part of it. However, when I attended meetings I generally assumed a passive role in observing what took place. The observational material was carefully transcribed in field journals. Here I wrote what happened, what was said, how it was said and by whom. Even though I attempted to write down as much as possible when observing, I do not think it possible or even fruitful to try and record everything that goes on. My research interest in how an innovation initiative was organized and how this was related to innovation programmes aided the collection of field material, so as not to get lost in the vastness of the observable. However, my ambition was to remain as open to the field as possible, studying how action unfolded, and refraining from *a priori* decisions of what is important and what is not. In many ways, the material that has been collected certainly represents my research curiosities, and as Silverman (2001) accentuates, even simply recording fieldwork material involves some variation of analysis. However, I have avoiding making theory-saturated field notes and have been careful in describing talk and interaction as neutrally as possible. When taking notes I always wrote down the initials of the person speaking and, as accurately as possible, what the person said. In so doing I collected stories of people's explaining, rationalizing, exemplifying, arguing, negotiating, quarrelling and prioritizing in the MWR setting. This included discussions of what was done in the initiative, what had been done in the past, and what the initiative should do in the future, as well as how this was related (or not) to innovation programme initiatives. I also transcribed what the participants actually did in the meetings.

While transcribing during the meetings I sometimes interpreted what the conversations concerned, which issues they spoke to, and related these to my own thoughts, categorizations and theoretical conceptualization. But whenever I did this I went to great lengths in making sure that I [bracketed] my interpretations, to avoid confusing them with my recordings of what

was said and done. Moreover, a majority of the formal meetings in the MWR setting were digitally recorded as sound data files.[16] I have consequently had the opportunity to go back to the recordings whenever I was unclear over what was said at specific meetings. Indeed, all the meetings were transcribed into field journals, but I have also used the digital recordings to transcribe about half of the meeting conversations word by word, allowing for closer analysis and presenting accurate quotes.

The MWR meetings were hosted by its member organizations and thus continuously moved between different places. And since my interest was in "organizing" as it happens, and how this is related to innovation policy and theories of innovation-producing arrangements, all these formal and informal MWR events and meetings have been central to studying organizing actions. It follows that MWR is situated neither in a specific organization nor in a particular department in an office building. Thus, in attempting to trace actions I have also followed the actors to their various meetings and activities. I have "shadowed" MWRs process leader, following him to member visits and other meetings. Czarniawska (2004b) calls this type of research mobile ethnologies, where the researcher follows people as they move around. But as Law (1994) pointed out, actions always happen elsewhere, and as a researcher, one cannot be at all locations at all times. Because of this, meeting observations and informal and formal interviews, with accounts of what has happened, are particularly important. Textual documents are for the same reasons also vital sources of fieldwork material; meeting protocols, technology specifications, applications for funding, emails, annual reports, press releases, marketing material, texts with MWR's vision and purpose, etcetera, have been incredibly valuable in following actions and studying the emergence and practice of an innovation system and cluster initiative.

16 However, this was not done at the board meetings since it was not allowed. During the first MWR board meeting I asked whether I was allowed to record the conversations so that these could be analysed retrospectively. This was disapproved since the board members did not feel comfortable with being recorded; somebody said they wanted an open environment and thought the recordings would hinder this. Unfortunately, this was setup became the norm for the board meetings. Nevertheless, by taking careful field notes I have still been able to map discussions and actions in the MWR board meetings.

Studying textual documents

When tracing actions in MWR I have often been led to Swedish economic policy and programmes for innovation; references to related innovation models and theories, and to innovation competitions, etcetera, are abundant in the MWR setting. I have consequently studied textual documents coupled with the programmes, such as innovation programme descriptions, government propositions, reports on successful innovation initiatives, and numerous other policy documents. This has also prompted my observing of a few related innovation system and cluster meetings and workshops that have been arranged by government agencies such as *The Agency for Innovation Systems* (VINNOVA) and *The Swedish Agency for Economic and Regional Growth* (Nutek). Several of these meetings were attended by representatives from MWR, and as we shall see, the links between the innovation programmes and MWR are plentiful. For this reason, I also interviewed the secretary for VINNOVA's most central regional innovation systems programme VINNVÄXT after I had left the field.

It follows that textual analysis of archival information is also useful for studying organizing. Actions can indeed be traced in MWR documentation and innovation policy texts, as well as in other media such as newspapers articles and comments in TV news programmes, the trade press, websites, and so on. Moreover, literature on innovation, and particularly theories of innovation-producing arrangements such as innovation systems, clusters and triple helix constellations, are central for both the Swedish innovation programmes and for the MWR initiative. And because of this, I have also studied theoretical literature on the economics of innovation. Such reviews of theories of innovation are hence a part of the study; the theories actually constitute field material and it is for this reason that I pay particular attention to them in Chapter 3.

Formal and informal interviews

In addition to focusing on observational techniques and textual analysis, I have also done semi-structured formal and particularly unstructured informal interviews. I have carried out three formal interviews with the MWR process leader (that is its managing director), one with its founding director, and one with each of MWR's two project leaders. I also interviewed the project leader for the MWR Ceramics Substrates project.

The MWR interviews focused on how the initiative was started prior to my joining the field, what the process and project leaders did and how they made sense of the innovation programmes, as well as how a particular technology project was organized. Including the later interview with the secretary for the innovation programme VINNVÄXT mentioned above, this adds up to eight official interviews (all listed in Appendix 3).

My primary focus, as indicated, has been on observational and textual material, as opposed to formal interviews. Nevertheless, my fieldwork has allowed me to engage in numerous conversations with people related to the MWR initiative. I have met and conversed with people during meetings, coffee chats, after-dinner conversations, in cars on the way to meetings, at trade fairs, and so on. During these occasions I talked with engineers, senior managers, industrial and academic researchers, public officials and policymakers, journalists, etcetera. And these conversations can indeed be seen as informal and unstructured interviews, which would imply that my interview material far exceeds the eight formal interviews. I have also spent many hours on the phone talking to the process and project leaders of MWR, asking for updates on what they had done and what had happened in the initiative. The phone calls also served as a means to clarify issues that I might not have understood in a meeting, for example. These informal interviews and conversations were also transcribed into my field journals. On the few occasions when I did not have a journal at hand, I would write down what had been said and done as soon as I could afterwards.[17] All this has proven to constitute valuable sources of fieldwork material.

Engaging in interviews and informal conversations allows for collecting stories of events and actions. Asking questions makes it possible to elicit emplotted narratives of organizing (Czarniawska, 2004a). In conversations and interviews alike, much can be learned by asking interlocutors to explain events, give examples of action and describe what occurs in relation to MWR. I have sought to keep the conversations and interviews as open-ended as possible, allowing the interlocutor to talk about what he or she finds relevant. Nevertheless, I would of course ask questions on issues that I found interesting, using follow-up questions to encourage

17 Sometimes this called for creativity. For instance, at one time, after having listened to an interesting discussion of the innovation programmes during a formal dinner, I excused myself and went to the bathroom to write down my recollection of the conversation.

the interlocutor to elaborate descriptions of events and actions. This brings us to the notion of interaction in the field.

Interacting in the field

When interacting with people and objects in the field, I almost certainly have an influence in one way or another. The idea of the researcher assuming a role as a "fly on the wall" does not work in practice. By simply being there, asking questions, perhaps choosing not to intervene, taking notes, etcetera, I have an effect on what occurs. This should not be overestimated however; I have got the impression that many of my interlocutors have become used to having me around.[18] Even though I have interacted with actors in the field, I have generally refrained from giving specific advice or other normative suggestions on what to do or how to solve problems. There is nothing wrong with doing this, but since I was undertaking an ethnographically inspired study, deliberately influencing the direction of action would not have been appropriate. Nevertheless, the interactions in the field were still opportunities to encourage reflection on behalf of the interlocutors. In asking questions, encouraging reflexivity and problematizing actions and events, the researcher can contribute to the phenomena he or she is studying. Indeed, I have found that the longer I have been in the field, the more open the discussions with the interlocutors have become, and they were increasingly keen to talk about events and issues; hopefully I have contributed to their making sense of their work.

Interpreting and presenting the fieldwork material

In my view, no research approach can reproduce the nature of things, providing a mirror image of reality, nor are universal interpretations of fieldwork material possible. Instead, I want to emphasize that I see the world I study as constructed and understood not only by the people I interact with (and others), but also by me as a researcher. But this does not mean that I construct whatever I please; I still have a realistic ambition in portraying organizing as it happens, using fieldwork material to build my arguments.

18 At one point a research engineer even referred to me as their "little ghost", as a friendly remark (I think) on the fact that I have turned up at most MWR events but assumed a rather passive role.

When I began interpreting the fieldwork material I started with sorting it in chronological order into five large paper folders. These folders include the vast majority of the material, stretching between 1998 and 2007, except for the material that simply would not fit into the folders, such as large information books and so on. When flicking to a ceramics project meeting in March 2005, for instance, collected email printouts, invitation letters, an agenda and participant list, technology specifications, presentation handouts, copies of my own field notes and reflections, can all be found in one place. This has helped me structure the material and has been very useful for generating an overview of what had happened in the MWR setting. Throughout the study, I have made reflection notes on what it was that I observed in the field and how it could be understood. Reading the chronologically sorted material, and of course the fact that I had been present at all those meetings, allowed me to generate an initial overall understanding of how the organizing of MWR had unfolded over time.

The material was then analysed by being categorized into themes of, for example, organizing. In so doing I have been inspired by Glaser and Strauss' (1967) grounded theory, which suggests that fieldwork material should be systematically coded and categorized with the purpose of building rather than testing hypothesised theory. I began with coding and re-coding the meeting transcriptions sentence by sentence. For instance, when coding a technology project meeting, I produced some 70 codes that I grouped into 13 categories. An example of such a category is what I referred to as *efforts of defining and framing*. This category included codes such as: defining what to do and what not to do, producing technology specifications, framing how the microwave industry operated, what microwave technology is and is not, why ceramic substrates are important in microwave engineering, the construction of boundaries, and so on and so forth. Another category was called *negotiating interests*, entailing codes such as the brokerage of meaning, mediation and moderation, disagreements, attempting to get one's way, conflict resolution, etcetera.

However, after a while I came to the conclusion that it was more valuable to ask myself which issues the different episodes, events, talk, or series of actions represented in the material, i.e. what issues these spoke to, or rather what they exemplified. I then labelled these issues according to some 20 themes of organizing innovation. These themes are my interpretations of what went on in the field and are thus of second order

character, although not directly linked to any other theories.[19] A few of the most central themes I produced, as well as what they exemplified, included:

- *The collaborative ideal* – the idea that organizations have to collaborate in order to generate innovations.
- *The theory-policy interface* – how innovation theories and policy making are highly intertwined; innovation systems theories are for instance prevalent in the construction of contemporary innovation policy.
- *Prescribing innovation guidelines* – more or less explicit instructions for how innovation initiatives should be organized, as expressed in texts and symbols related to the Swedish innovation programmes.
- *Structuring organizational groups* – how the innovation initiative MWR was organized initially.
- *The quest for capital* – incessant efforts in MWR to raise funds from various programmes and organizations.
- *Continuous recruiting* – efforts of recruiting organizations (or organizational representatives) to the MWR initiative, as well as ongoing efforts to make them stay members.
- *Missing actions* – how actors in the MWR initiative struggled to get to technology development work as they had established their organization.
- *Type of organizing logic* - how technology development initiatives were organized in different ways, such as focusing on either grouping organizational representatives (structure) or technology development work (action).

Themes such as the ones listed above have been used to compare similarities and differences in organizing, and ultimately for constructing my argument and assisting in telling a coherent story of organizing innovation. Indeed, the themes actually form some of the headings in the text and are thus central to how I have presented the fieldwork material.

It is important to mention that the initial themes were not linked to other theoretical ideas as they were produced. Instead, they exemplified

19 This is different from first order terms from the field, such as *innovation systems* and *clusters*. Ethnographers would call the first order terms *emic* and the second order terms *etic*.

what I interpreted as going on in the field. It was only later, when looking for other theories that could help explain what I had seen, that I turned to other theoretical ideas, like scripts and editing. Such links between my observations and other theories are found in the chapter discussions throughout the text, as well as in the final chapter.

Even though the research process might appear tidy in an account such as this, the actual work is characterized by complexity, and searching and grappling efforts to make sense of the field material. Indeed, as Law (2004) suggested, the messiness of the world calls for messier research methods. Nevertheless, in presenting my findings from the field, and sequencing actions and events in the MWR setting according to a plot (cf. Czarniawska, 2004a), I hope to contribute to producing meaning around innovation policy and innovation initiatives such as MWR. In so doing, I seek to tell a story about the world (Law, 1999) with my research, or more specifically, about the phenomenon of attempting to organize innovation. As my procedure, I have chosen to structure the text as a chronological narrative, accounting for both the unfolding of events in the Swedish innovation programmes and the emergence and practice of MWR.

Since this story concerns how innovation policy is put into practice, we will now turn to the notion of innovation and how it has been viewed over time. This is important, as theories and models of innovation are central to the construction of both the Swedish innovation programmes and organizing the MWR initiative. When studying the innovation programmes and MWR I have encountered innumerable references to what I call theories of innovation-producing arrangements, such as innovation systems, clusters and triple helix. And because of this they actually form an important part of the study; they constitute fieldwork material. The next chapter therefore seeks to trace these ideas in the theoretical literature, which indeed is intertwined with innovation policy development.

CHAPTER 3

Reviewing Innovation Perspectives

Talk of innovation is omnipresent. References to innovation appear in numerous settings, commonly paired with claims that innovation generates economic growth and thus plays a vital role in furthering societal progress. In this chapter, I set the scene for answering the first research question regarding how theories of innovation have been employed in Swedish innovation policy and programmes. I do this by reviewing different perspectives on innovation and how these have shifted over time. The question is answered in full in Chapters 4 and 5 on innovation policy and programmes, providing richer examples of how the theories are edited in policy practice.

Innovation is an inherently vague idea, encompassing a wide array of interpretations, which is why any effort to map the concept in its entirety is beyond the task at hand. However, since innovation lies at the heart of the phenomena studied, this chapter will present a brief overview of notions about innovation that have been developed and used over time, highlighting shifts of attention, as well as particularly examining recent theories and conceptualizations of innovation. I will consider the transitions from characterizing innovation as an activity carried out by individual entrepreneurs making innovative combinations, to portrayals of innovation as taking place within firms responding to market needs, and ultimately towards a view of innovation as occurring in networks and systems of organizations. Indeed, the latter ideas on networks and systems have in turn led to efforts to understand innovation as occurring in *innovation*

systems and *clusters* of firms, as well as taking place in *triple helix* structures of interacting firms, universities and public organizations. Since all three of these theories emphasise the interaction between organizations in innovation production, focusing on inter-organizational structures, I have chosen to call them theories of innovation-producing arrangements. These three theories are of specific relevance to this study because they are central to both the programmes for innovation and to the Microwave Road initiative, warranting their particular attention. By accounting for different perspectives on innovation, I do not wish to define what innovation is and how it occurs. Moreover, this chapter is by no means a theoretical frame of reference for how I have conducted my study.[20] Instead, my intention here is to review the literature on innovation because of its particular relevance for the studied efforts to stimulate innovation. In addition to providing an overview of innovation perspectives, I would like to stress that this chapter also presents field material. The reason for this is simply that the theories of innovation-producing arrangements, presented towards the end of this chapter, are particularly relevant for both how innovation policy is constructed internationally and in Sweden, as well as for how the MWR initiative is organized.

Why all this talk about innovation?

We often come across the idea of innovation in our daily lives, be it in media, work situations, education, or in everyday conversations. In general it comes with a connotation of something good: a novelty, an improvement, something original, an advancement or modernization, something which is desired. Innovation can be understood in various ways, but when exploring the etymology of the word, we find that it refers to the introduction of something new, or something presented "as if" new.[21] In the field of economics and policymaking, innovations are generally presented as generating new sources of income and thus contributing to economic

20 I described my frame of reference in Chapter 2 – Organizing, scripts, editing and fieldwork.

21 Records indicate that the word *innovation* was used in French as early as in 1297 and was later frequently used in English from the mid-16th century and onwards (Oxford Reference Online, 2007). In Sweden it appeared in the Collegii medic archives from 1696 (Svenska Akademins Ordbok, 2007). The word stems from Latin *innovare* which means renew or alter, comprised by *in* and *novus* (new) (Merriam-Webster Online Dictionary, 2007).

growth. And such economic development is rendered necessary for reducing poverty and increasing the overall prosperity in society. Apart from improving material standards, innovation is commonly seen as a driver of company profits, as well as resulting in the generation of new jobs, larger tax earnings, and so forth, all providing answers to why talk of innovation is omnipresent.

When confronted with the word *innovation* we often find that it is paired with prefixes, such as product, process, or service innovation. These types of innovations are commonly closely linked with advances in science and technology. Take for example the introductions of the steam engine, fertilizing methods in agriculture, the automobile, the personal computer, or the Internet; they all pass for what is commonly characterized as technological innovations. It follows that innovations are often regarded as improvements; making things better than before. But this has not always been the case. As Heilbroner (1967: 27-28) suggested, innovation has not been seen as something favourable at all times. In fact, he exemplified this by pointing to the consequences of alteration in the French 17th century textile industry: if a weaver chose to make changes in how to weave cloth, such as changing the number and length of threads, he or she could be downright punished; weavers had to get permission from town judges, who consulted senior guild members, to change their methods as they saw fit. And according to Heilbroner, it was only later in the age of Adam Smith, towards the end of the 18th century, that scientific curiosity and industrial and technological development were looked upon as favourable.

Even if the vast majority of innovation research has focused on technological and product innovations in particular (see Kline and Rosenberg, 1986; Van de Ven, 1986), this is not always the case. In the field of organization studies for instance, innovation can also refer to less material entities like new ideas and ideals, administrative routines or procedures, the introduction of information technology systems, analytical models, public and company policies, to name but a few. This is by no means a new thought however; the sociologist and psychologist Gabriel Tarde published work on how innovations spread through social acts of invention and imitation at the end of the 19th century. Tarde discussed innovations as appearing in the forms "…. of words, in mythological ideas, in industrial processes, etc. (1888/1969:177)", which indeed exemplifies a view that goes beyond the term's traditional technological heritage.

Another researcher with an interest in how innovations diffuse was Rogers (1962). He departed from Tarde's (1888) work, albeit with a somewhat different take, arguing that an innovation is an idea that is perceived as new by the individual, irrespective of whether it is "objectively" new or not. According to Rogers, "social movements, clothing fads, the twist, compact cars, and the steel ax [*sic*] (1962: 13)" can all constitute examples of innovation.

Nevertheless, as indicated earlier, innovations are predominantly seen in the light of technological progress, which in turn is deemed essential for economic development (Williams, 1973). In fact, such advances are commonly depicted as the central feature of capitalism, and have been characterized "as an engine of progress" (Nelson, 1993). This view is indeed prevailing, as Landau and Rosenberg conclude in their overview of innovation:

> Research in the past 30 years has conclusively established the critical role played by technological change in generating long-term economic growth. While considerable differences persist in attempts to quantify the contribution of technological change to such growth with any real precision (partly because there are basic conceptual problems as well as narrow measurement problems), there is broad agreement to its dominating importance (Landau and Rosenberg, 1986: viii).

And it is arguably the promises of growth and progress that have contributed to the all-pervading talk of innovation, and why it is deemed so important for organizations, companies and governments. The introduction of new innovations is commonly presented as having potential to increase industrial efficiency and generate new income, thus spinning the wheels of the economy, and thereby creating economic growth and contributing to societal development (Fagerberg, 2005). This underlying assumption that innovation is correlated with growth is indeed central to the unfolding of events in this story, warranting its further examination.

Assumptions of innovation and growth

On the whole, there is a widely spread and strong belief that innovation constitutes the propelling force of economic growth. This is by no means

controversial; instead it is something that we commonly take for granted, treating it more or less as an axiom.

The idea that technological progress causes economic development goes all the way back to the development of economics as a field of enquiry during the 18th and 19th centuries. Marx (1867/2001: 548), for example, argued that the introduction of machinery and technological progress, such as the spinning Jenny, the steam engine and the telegraph, lay at the heart of the industrial revolution, which allowed for rapid growth in production capacity and economic expansion. But it was Schumpeter's (1911/1934) work on creative destruction and economic development that really directed attention towards innovation in the economy, influencing both economic theory and policy. Later, Schumpeter (1939) stressed that it is the fact of innovation that is the basis for economic change. He argued that innovation is what allows for the setting up of new production functions, changing cost curves, causing disequilibria and upsetting existing industrial structures, and thus bringing about economic evolution. But this does not mean that innovation has been at the centre of economic attention ever since; traditional neo-classicist economists have often taken innovation as a residual factor, suggesting that it is primarily labour and capital that drive economic growth. In fact, innovations have predominantly been seen as existing "out there", ready to be harvested much like mushroom picking, and few economists were concerned with how they actually developed. But over the last 50 years, attention has increasingly been placed on technological advances as the drivers of economic growth, explaining the differences between national growth rates (see Landau and Rosenberg, 1986; Fagerberg, 1988).

Now, growth is a measure of increase over time. And economic growth is generally measured as the annual change in the aggregate value of a country's total production, or sometimes as production plus income from abroad (Gross Domestic Product and Gross National Product respectively). Larger growth rates increase a country's wealth, which is generally seen as necessary for societal wellbeing and prosperity. But why must an economy grow? Well, the common idea is that growth is necessary for increasing company profits, employment levels and tax incomes, which in turn is required for reducing poverty and increasing prosperity as the population expands. And this idea builds on the assumption that people perpetually consume new products. Simply generating new products may

increase GDP but not the levels of income; for that, products or services have to be purchased. Landau and Rosenberg (1986) exemplified this view by arguing that ingenious and technically feasible inventions are not enough for economic development: in order to become successful, innovations have to fulfil needs expressed in a marketplace. More straightforwardly, they have to be sold! In illustrating their point, the authors compared aeroplane innovations, suggesting that from a technological point of view the supersonic and expensive Concorde was more spectacular than the Boeing 747 Jumbo–jet, although the test of time proved the latter a more commercially successful innovation, with its superior trade off between price and performance, as well as in the satisfaction of market needs (ibid.). The commercial side is hence of central importance in innovation theory and in a world guided by capitalist ideals of profit maximization. Writing on the history and philosophy of economics and capitalism, Heilbroner suggested that growth is needed because companies' profits cannot be maintained unless the economy grows. Linking the work of Smith, Ricardo, Mill and Marx, he suggested that:

> Profits are both the hallmark of capitalism and its Achilles' heel, for no business can permanently maintain its prices much above its costs. There is only one way in which profits can be perpetuated: a business – or an entire economy – must grow (Heilbroner, 1967: 149).

And since innovation is deemed necessary for economic growth, this closes the circle; innovation is said to cause growth, which in turn is presented as necessary for profits, employment and prosperity. Against this background, it is hardly surprising that governments go to great lengths in their efforts to stimulate growth, particularly emphasising the importance of innovation.

When growth levels between countries are compared, economists have traditionally departed from the so-called production function, suggesting that incomes are a function of capital and labour, natural resources, and other factors. However, some 30 years ago, a debate among economists began, where some suggested that the traditional factors of production were not sufficient for explaining growth differences between countries. Writing in the widely cited anthology "Technical change and economic theory", Fagerberg (1988) identified three different takes on why growth rates differ between countries. The first approach he called the catch-up

analysis, which suggested that countries that lagged behind imitated others' technology to increase their growth levels. However, to Fagerberg, this approach focused on technology gaps and the diffusion of technology rather than on innovation. The second approach concerned growth accounting, and was more of an observational rather than explaining character. Here, economists put prices on input factors such as labour and capital and compared these with output growth, i.e. of levels of production. Growth was thus explained as a function of increases in capital and/or labour. But, Fagerberg argues, when comparing the results of different countries, economists found that these factors only explained half of the growth divergences between countries. With the help of econometrics and production-function studies, these economists identified a technology difference between countries with low and high growth. And technology change was regarded as the primary residual accounting for these differences (research, education, and economies of scale were other tentative answers).

This exemplifies a shift in economics where increasing attention was placed on innovation as a driver of growth. Nevertheless, as Fagerberg emphasised, despite the spreading view that technology change was a major driver of growth, few theories could explain where this change came from. Indeed, economists have traditionally seen innovations as something that exists "out there", which simply needs to be identified and harvested. However, the economists of innovation, including the proponents of innovation systems and other theories of innovation-producing arrangements, focus on the emergence of innovation as a driver of growth, something which indeed lies at the heart of the innovation policy development too.

Reflecting on the certainty of economics

The claim that innovation has a direct causal relationship with economic growth could almost pass as an axiom today. Indeed, at face value it does seem like a plausible assumption. After all, studies have shown correlations between registered patents and increases in national income levels (see e.g. Fagerberg, 1988). And it is reasonable to believe that if a company introduces and sells a patented product, it will probably accrue revenues. But this does not mean that national growth increases by default, let alone

that it improves standards of living. Economic growth as a result of technological change might well be distributed across several countries, and is probably painstakingly difficult, if at all possible, to identify and measure.

Perhaps there is reason to question the air of assertiveness and theoretical assumptions suggesting that innovation is the prime factor explaining growth. One problem is that the claims for innovations' bearing on growth are rather abstract, often focusing on correlations between registered patents or R&D spending and increases in GDP, using statistical data from for instance the OECD and the International Monetary Fund (IMF) (see Fagerberg, 1988 for an example). But what does the correlation between patents and growth actually mean? Having written on the rhetoric of economics, McCloskey (1985) pointed to the importance of being cautious with what type of conclusions we can draw from the use of such statistical analyses. Just because two things happen at the same time, there can be no absolute certainty that one causes the other, as in the case of the number of patents correlating with growth. Still, it does seem plausible to assume that innovations, like new technical product applications or service offerings, could increase a company's sales volume for example, thereby contributing to the growth of its income. It is also conceivable to assume that technological improvements may make manufacturing more efficient, allowing for larger volumes of saleable outputs, which in turn also might increase growth. In fact, I believe that both these statements could be true. But it is a different thing to say that innovation is produced in particular types of arrangements, such as clusters, which generate growth.

Even though economic theories often present claims of certainty, the everyday references to innovation that we come across in our lives are commonly quite general; innovation can indeed refer to many things. Still, we find that innovation repeatedly appears as an ideal in economic theories and models, commonly employed by economists, policy makers, managers, consultants and journalists alike, which seek to stimulate economic development. Indeed, these ideas are central to the Swedish innovation programmes, which form an important part of this study. But in order to understand what is meant by innovation, and how its theories are related to practice, we must study how it is used in the field, something which the later chapters will deal with. First, however, I will provide a brief overview of theories of how innovation occurs and how they have shifted over time.

Shifting views on innovation

In this section I will outline some trends in how innovation has been characterized over time. In so doing I will present perspectives that highlight entrepreneurs as innovators, moving on to approaches suggesting that innovation occurs within firms, and ultimately to views proposing that innovation happens in networks and systems of organizations. These perspectives present different takes on how innovation is thought to be cultivated. I say "cultivated" because these perspectives see innovation as furthered by actors — in this case individuals, organizations or organizational constellations. As we shall see in the next chapter, the notion of cultivation also fits well with the idea that innovation can be nurtured and harvested with the help of innovation policy and programmes.

The entrepreneur as an innovator

For many years, technological change was seen as a residual factor in generating economic growth, and innovations were seen as simply existing "out there". However, this was about to change. At the beginning of the 20th century, the focus was increasingly placed on individual entrepreneurs as those who actually made creative combinations of resources in producing innovations. These ideas were introduced by Joseph Schumpeter in his 1911 (in English 1934) *The Theory of Economic Development*, in which ideas on the importance of innovation, influential to this day, were presented. Schumpeter suggested that it is innovation that pushes economic development forwards in a discontinuous fashion, introducing the notion of *creative destruction*. However, to Schumpeter (1911/1934: 65-66), economic development does not concern introducing new elements, but rather the combining of materials and forces. According to Schumpeter's wide view on economic development and innovation, this could include the introduction of a new good (i.e. product), a new method of production, opening of a new market, a new source of supply of raw materials, or new organization of any industry. He develops this by arguing that "the carrying out of new combinations means, therefore, simply the different employment of the economic system's existing supplies or productive means" (Schumpeter, 1911/1934: 68). And this activity is said to be carried out by individual entrepreneurs (ibid.). This suggests that the entrepreneur

becomes the innovator, or innovation actor, causing creative destruction in the economic equilibrium by introducing innovations, and thereby contributing to economic development. But the entrepreneurial activity was not simply mechanistic combinations of elements, it was also seen as a development processes characterized by trust and relationships between entrepreneurs and capitalists or creditors. It is interesting to note that Schumpeter's early work distinguishes between inventions and innovations, suggesting that inventions that are not put into practice are "economically irrelevant" and that too much attention has been placed on invention of for example new technologies or methods. Instead, the entrepreneurs carry out combinations (possibly of inventions, but not necessarily) that form innovations. Schumpeter clarifies this by arguing that:

> Although entrepreneurs of course *may* be inventors just as they may be capitalists, they are inventors not by nature of their function but by coincidence and vice versa. Besides, the innovations which it is the function of entrepreneurs to carry out need not necessarily be any invention at all. It is, therefore not advisable, and it may be downright misleading, to stress the element of invention as much as many writers do (Schumpeter, 1911/1934: 88-89, italics in original).

It follows that Schumpeter really placed the entrepreneur at the centre of economic development. However, as much as Schumpeter's early work (1911/1934) largely focused on entrepreneurs as innovators, his later theories (1939, 1942) tended to focus on innovation in large bureaucratic firms (Freeman, 1988a). In fact, Fagerberg (2005) pointed to how Schumpeter himself implied that his theory of entrepreneurial activity needed development at the end of his career. Perhaps this shift was due to changes in the economy, where economic transaction became increasingly complex, or perhaps it was simply because it was becoming more popular to examine organizations. Irrespective of which, it can be argued that innovation research first focused on the individual entrepreneur as key in introducing new ideas that could be capitalized upon. And ever since

Schumpeter's theory, the role of entrepreneurs has become a field of research that has attracted much interest, and still does.[22]

Firms as innovation hothouses

A few decades later, the focus shifted towards seeing companies as the producers of innovation, responding to market needs and engaging in research and development in order to produce new goods and services. This shift of attention could be seen as a result of observations that economic transactions became increasingly complex with the extensions of the economy in the beginning of the 20th century, stretching beyond the cognitive abilities of an individual. As this happened it was deemed more efficient to effectuate economic transaction within organizations that were constituted by rational social arrangements (see Coase, 1937). Indeed, following the path of Schumpeter's (1911/1934; 1942) later work, innovation research also began characterizing innovation as carried out within firms, particularly manufacturing ones (Nelson, 1988; Fagerberg, 2005).

According to Utterback, who defined innovation as an invention that has reached market introduction (i.e. a product innovation) or as "first use" in a production process (i.e. process innovation), a technical innovation should be seen as a process with three sub-processes: namely that of idea generation, problem solving and implementation, possibly followed by subsequent diffusion:

> The idea generation phase results in origination of a design concept or technical proposal, perhaps via synthesis of several pieces of existing information. The problem-solving phase results in a technical solution, or an invention. The implementation phase results in market introduction of the original solution making it an innovation as defined above. Diffusion is the mechanism of communication and increasing use through which an innovation comes to have a significant economic impact (Utterback, 1971: 78).

22 For a historical account of perspectives of entrepreneurship and the role of entrepreneurs in the economy, see Landström (2005).

In effect, such a view of the technical innovation process presumes that companies recognize and act upon needs in the environment, often in a linear fashion. This might entail the initial recognition of a need, followed by the identification of the technical means to satisfy the need, which in turn is succeeded by the formulation of a proposal, goal setting, design and evaluation of alternative solutions. Ultimately, this results in a solution that is implemented through engineering and manufacturing, and spread. Utterback adds that the stages in the innovation process are also embedded in what he calls the current state of technical knowledge, including scientific research and the current economic and social utilization of the particular innovation (ibid.). Such rational descriptions of innovation processes are characterized by linearity (Kline and Rosenberg, 1986), typically claiming that market demands should first be scanned and analysed, resulting in plans for action to satisfy these demands. These plans should then lead to the allocation of the necessary resources for the tasks at hand, and ultimately implementing the plans in order to, for example, develop, produce and market a new product.

Innovation perspectives placing the firm at the centre of such processes can be characterized as focusing on firms as hothouses where innovations are carefully grown according to perceived needs. That is, companies are seen as providing the necessary hotbeds, nutrition, water, sunlight and carbon dioxide for innovations to blossom, allowing for more efficient harvesting and thus greater returns. This places emphasis on a purposeful nature of innovation, as well as on innovation production as taking place in a controlled environment. The companies are presented as having experts who carefully cultivate products and services, providing the right sustenance for their perfection. The ready innovation is then marketed and sold, thereby generating income.

Innovation as occurring in organizational networks

It follows that much of the traditional innovation research has primarily studied innovation as a linear process occurring within companies, following applied science logic. However, such views assume an overly simplistic chain of causation, as Kline and Rosenberg argue:

> Models that depict innovation as a smooth, well behaved linear process badly misspecify the nature and direction of the causal factors at work. Innovation is complex, uncertain, somewhat disorderly, and subject to changes of sorts (Kline and Rosenberg, 1986:275).

According to the same authors, the linear models ignore the feedback loops and "iterative fitting and trimming of the many necessary criteria and desiderata" within an ongoing innovation process (1986: 286). Rather than being linear, innovations can have unforeseen implications and be adopted across industries in ways that are difficult, if not impossible, to anticipate and let alone trace (ibid.). In addition, Klein and Rosenberg also point out that it is difficult to measure the impact of any one particular innovation. Importantly, they also add that despite the substantial critique against the linear model, it still constitutes a predominant paradigm, as in Kuhn's (1967) terminology, and continues to be influential in conversations and not least political debates (Kline and Rosenberg, 1986). Disregarding whether feedback loops is a suitable metaphor, this nevertheless suggests that innovation does not necessarily go by linear chains of activity and is more likely to follow more precarious and recursive processes. This also challenges the perspective of individual firms as hothouses where innovations are grown in controlled environments.

At the end of the 1980's, attention gradually shifted towards understanding innovation as taking place in arrangements of interacting organizations, such as in organizational systems or networks. The rationale for such collaborative ventures was that it would allow for better resource sharing, specialization, exchange of knowledge, access to technology, larger customer bases and market shares, and last but not least, an environment in which the production of innovation is allowed to flourish.

Indeed, over the last few decades there has been a shift in attention towards understanding innovation as occurring in networks or systems of companies and organizations, sometimes located in geographic proximity. Von Hippel (1988), for instance, pointed to the dominant view of understanding product development as occurring within manufacturing companies, suggesting that such a perspective is insufficient. Instead, he argued that the source of innovation lies in the relationships between manufacturing companies and their suppliers and, particularly, their customers. Similarly, Normann and Ramirez (1994/1998) argued for

understanding businesses in the light of value constellations, as opposed to Porter's (1990) value chain, where organizational relationships are presented as the location of innovative co-production of value.

Organizational relationships have indeed received increasing attention within the field of innovation research. Such relations have commonly been understood in light of the network metaphor, where organizational interdependencies are represented by ties connecting various entities. For instance, according to Håkansson and Ford, writing on industrial marketing and networks, the general idea behind a network approach is "a structure where a number of nodes are related to each other by specific threads" (2002:113). In conformity with this view, a business network could for instance entail interconnected firms such as suppliers, manufactures and retailers. These relationships do not merely represent simple transactions. Instead, the authors suggest that they are complex interactions of diverse characteristics, where the nodes and links are encompassing resources, knowledge and various understandings. The implication of such a perspective is that firms cannot be seen in isolation. For example, if something happens in a relationship between a supplier and a customer, it is likely to affect other firms that have other relationships with either of the two firms. Håkansson and Ford also emphasised that there is much variety in network relationships and interactions, depending on the context in which they take place (ibid). Furthermore, in an attempt to link industrial networks with strategic management issues, Gadde, Huemer and Håkansson (2003) suggested that firms' resources are not exclusively internal but also reside in the relationships between firms. They go on to contend that company activity is not confined within specific actors; instead "actions cut across the boundaries of several companies and form chains of activities, such as distribution channels and supply chains" (ibid, p. 360). And, they argue, the networks are not necessarily perceived similarly by all actors. Nevertheless, they hasten to add that network development is not random, and that there is always an underlying network logic, even though it might be difficult to identify. In sum, these network ideas are often associated with the Uppsala school, which suggests that given actors have specific relations in structural networks.

Networks are sometimes used synonymously with systems in characterizing innovation. In fact, networks of companies and inter-organizational relationships in the biotechnology industry have been

regarded as the actual locus of organizational knowledge and innovation (Powell, Koput & Smith-Doerr, 1996). Powell and Grodal even go on to suggest that:

> Interorganizational networks have grown considerably in importance over the recent decades. Networks contribute significantly to the innovative capabilities of firms by exposing them to novel sources of ideas, enabling fast access to resources, and enhancing the transfer of knowledge. Formal collaborations may also allow a division of innovative labour that makes it possible for firms to accomplish goals they could not pursue alone (Powell and Grodal, 2005:78).

The emphasis on formal collaborations exemplifies how networks are primarily seen as inter-organizational structures. Another example of this is the occurrence of so-called strategic alliances. Child and Faulkner (1998) suggested that organizations engage in such alliances to actively pursue joint research and development activities so as not to fall behind competitors in terms of innovativeness. Oliver (2001) similarly found that alliances in the biotechnology industry are vital for firms' survival, especially in their early life cycle stages, whilst inter-organizational networks were characterized as increasingly important for learning in their later development phases. Indeed, phenomena of inter-organizational collaboration and network relationships are often described as increasingly central to economic activities, facilitating innovation and learning. Clegg and Hardy (1999), for instance, pointed to the increasing occurrence of particularly strategic alliances, as well as of joint ventures, network organizations, modular corporations, virtual organizations and industrial clusters. In fact, the term network is widely used as a metaphor for explaining our economic and social world (c.f. Castells, 2000), not least by business gurus and in popular management literature. By and large, traditional arguments in favour of networked organizations have centred on the alleged benefits from focusing on core competencies, improved flexibility, enhanced access to know-how and information, as well as on the advantages of resource sharing and risk spreading (Clegg and Hardy, 1999). However, theories that have tried to capture network complexities commonly point towards positive aspects of organizational networks and often fail to address potential negative aspects in relation to society,

organizations and individuals. This aspect was questioned by Hellgren and Stjernberg (1987; 1995), who suggested that networks are inherently rigid and difficult to control, contrary to much of the more mainstream network literature. The reason for this, they argue, is that there is no single hierarchical top in a network because networks lack delimitations; each member may choose to invite new ones and thus extend the network.

These network ideas are moreover close to the systems perspectives on innovation, which are by no means new. In fact, even the early work on innovation introduced similar ideas. In Schumpeter's later work (1939), for example, he extended his theory of economic development and made the following analysis from his observations of innovation processes:

> First, that innovations do not remain isolated events, and are not evenly distributed in time, but that on the contrary they tend to cluster, to come about in bunches, simply because first some, and then most, firms follow in the wake of successful innovation; second, that innovations are not at any time distributed over the whole economic system at random, but tend to concentrate in certain sectors and their surroundings (Schumpeter, 1939: 100-101).[23]

On a similar note, Fagerberg (2005: 5) goes as far as suggesting that "innovation is by its very nature a systemic phenomenon, since it results from continuing interaction between actors [people in his view] and organizations." He also goes on to claim that an innovation "is often the result of a lengthy process involving many interrelated innovations" (ibid). Issues such as these have led many to take what has become referred to as a systems perspective on innovations. Such an approach implies that innovations are collective achievements, i.e. having a systemic nature, and not just taking place inside specific companies. Fagerberg (2005) continues with suggesting that such systems can be delineated according to industry, sector or technology, but also geographically, such as national and regional systems of innovations.

23 See Freeman, Clark and Soete (1982) for work on "technology systems" and the idea of clustering of technology innovations.

Recent theories of innovation-producing arrangements

During the 1980s and 1990s, research on inter-organizational relationships and the systemic nature of innovation took off, offering new perspectives on how innovation occurs. This research led to the development of three theories and models of innovation, namely those of *innovation systems* (Freeman, 1988; Lundvall, 1988, 1992; Nelson, 1988, 1993), *clusters* (Porter, 1990, 1998) and *triple helix* (Leydesdorff and Etzkowitz, 1996; Etzkowitz and Leydesdorff, 2000). In brief, innovation systems refer to all the interactions between organizations and institutions needed for the development, diffusion and use of innovations (c.f. Edquist, 2005). Clusters in this setting denote geographical concentrations of firms in related industries that collaborate and compete in ways that stimulate innovation. And triple helix refers to innovative interaction between the spheres of universities, firms and the state. What joins these theories together is the view that innovations are produced through interaction in networks and systems of organizations. For this reason, I have chosen to refer to them as theories of innovation-producing arrangements. As we shall see, these theories have in turn become integral parts in innovation policies around the world, not least in the Swedish programmes for innovation. They are also influential in the organizing of the Microwave Road initiative, making them particularly relevant for this study. Below follows an account of these three theories of innovation-producing arrangements, outlining their origin and main characteristics.

Innovation Systems

At the end of the 1980s, economic innovation research increasingly began to concentrate on the co-development of firms and technologies, viewing innovation as taking place in evolutionary systems, so-called innovation systems. The argument was that innovations are not simply outcomes of individual entrepreneurship, nor the result of intra-firm activity. Instead, innovation processes in a country, for example, were depicted as having a systemic nature, encompassing a multitude of interactive determinants.

In an often-cited anthology, Dosi, Freeman, Nelson, Silverberg and Soete (1988) continued on the path that Schumpeter (1939) had embarked

upon in his later work. They extended this by adding technological and institutional change in their economic analysis, introducing the idea of national innovation systems. This was contrary to mainstream economics as it refrained from treating technology as an exogenous or residual factor that potentially could affect the economy (Freeman, 1988). Dosi (1988), for instance, proposed that technological development is closely linked to scientific advances, rather than seeing separated scientific research as the source of innovation. He also suggested that institutions characterize the innovation process. For example, habits and routines in certain industry segments were presented as guiding search and combination activities. In effect, firm behaviour and industry structure are presented as shaping one another (Nelson, 1988), thereby introducing the notion of systemic innovation. The word *system* refers to the combination of items in an interacting or interdependent group. Its etymology witnesses to relatedness with Greek's *to stand* in a specific position, or *to combine* various elements or items in a system (Merriam-Webster Online Dictionary, 2008). To say that something is systemic then is to refer to something that is characterized by having a coherent set of elements that are seen as interacting.

An underlying assumption in a systemic perspective on innovation is that technical change and innovation are characterized by evolutionary processes (Nelson and Winter, 1982). In line with this, Nelson (1988) suggested that capitalist national innovation systems, in contrast to the Soviet type of system at the time, were characterized by profit incentives from privatization of technology, rivalling sources of technology and market selection processes. In such an evolutionary perspective, firms are described as producing a *variety* of technological innovations, some of which the market *selects,* and ultimately become *retained* by institutional structures and result in technological trajectories (Dosi et al., 1988).[24]

Initially the innovation systems tradition concerned national systems of innovation. The term *national innovation system* was, according to both

24 These ideas of variety, selection, and retention are derived from Charles Darwin's theory of evolution, first presented in his book The Origin of Species in 1859. Darwin observed that finch populations in the Galapagos Islands remained stable over time, despite the potential for exponential increase in numbers. His studies led him to formulate a theory of natural selection, suggesting, "slight variations among individuals significantly affect the chance that a given individual will survive and reproduce" (Darwin, 1859, as cited in Purves et al., 1998). This "natural selection" suggests that the gene variations caused by chromosome mutation, that best fit certain environments, are selected. Through reproduction and genetic drifts, this then causes heredity and the "survival of the fittest".

Miettinen (2002) and Edquist (2005), first published in Freeman's (1987) studies of technology policy and economic performance in Japan. This has, however, been debated. Freeman himself (1995) suggested that the term was first used by Lundvall in his 1985 book *Product Innovation and User-Producer Interaction*. But it does not end here; when tracing it further new "origins" are revealed. Lundvall has in turn gone to great lengths in suggesting that Freeman used the term first in an unpublished OECD report in 1982, called *Technological infrastructure and international competitiveness* (Lundvall, 2004). This report was never printed by the OECD; the official explanation was that the printing capacity at the OECD was overloaded at the time (Lundvall, 2004). There might have been more to the issue than this, however. According to Sharif (2006), who has studied the construction of the National Innovation Systems concept[25], Freeman's arguments were too controversial in criticizing the dominant view of innovation as a linear process. Nevertheless, Freeman's report discussing national innovation systems and differences in countries' technology infrastructures has been (re)published in the *Journal of Industrial and Corporate Change* (1982/2004). Here, Freeman suggested that the concept of national innovation systems is largely related to the work of the late economist Friedrich List, who wrote about the *National systems of production* in 1841.

Freeman (1987) defined national innovation systems as "the network of institutions in the public and private sectors whose activities and interactions initiate, import, and diffuse new technologies" (Freeman, 1987, as cited in Edquist, 2005). Here innovation is largely associated with the systemic interaction between industrial and technological developments. Such interactions were proposed as the cause of Japan's comparatively high economic growth during this period. And according to Freeman (1988), the Japanese case runs rather contrary to the evolutionary ideas presented above, as the country's government played an active role in forecasting and interacting with companies on issues of research investments, education, and training. Nelson's (1988) findings on the innovation system in the USA differed in this respect, although he did observe an increasing US government interaction in defence related industries. This highlighted

25 Sharif uses the word *concept* when referring to "national innovation systems". However, the notion of concepts is quite ambiguous and as mentioned previously, I have chosen to refer to *innovation systems*, *clusters* and *triple helix* as theories of innovation-producing arrangements.

government interaction as an important element in innovation processes, although it did not mean that the evolutionary perspective was discarded. As Freeman (1988: 345) suggested: "…there is [nevertheless] widespread agreement with Nelson's thesis that successful fundamental research probably flourishes most in an environment which stimulates controversy, and pluralism, and when it is conducted mainly in universities and published in open scientific literature."

It follows that the notion of interaction between organizations in innovation processes was a central argument in the innovation systems tradition. Lundvall (1988) developed this, suggesting that producer-user interaction, learning and cooperation between companies are crucial aspects in the innovation processes of national systems of innovation. Again, this reemphasises the idea of innovation as co-evolution mentioned above. Lundvall also suggested that cultural and geographical distances might be the reason why national systems develop in different ways (ibid). Both Nelson and Lundvall later developed their ideas of national innovation systems along similar lines as those accounted for above (see Lundvall, 1992; Nelson, 1993).

There are clearly overlaps between the work of these economists, and it is interesting to note that several of them were also affiliated with one another in terms of place. Lundvall and Freeman worked together on an OECD project in the beginning of the 1980s; a few of them were also connected to the Science Policy Research Unit at the University of Sussex in Brighton, led by Freeman. They were also associated with the Maastricht economic and social research and training centre on innovation and technology (MERIT) at the State University of Limburg.

So far I have focused on the early studies of innovation systems that were aggregated at the national level, resulting in the development of the term national innovation systems. Although, as Sharif (2006) concluded, the notion of an innovation system is indeed flexible, and because of this it carries various connotations; it can be interpreted in different ways. Later developments have tended to differentiate between *national*, *sectoral*, and *regional* innovation systems (Fagerberg, 2005; Edquist, 2005), and some have emerged as a critique of earlier versions. Cook, Uranga and Etxebarria (1997) suggested that national innovation system analyses can become overly abstracted and conceptual, and argued that if one is to study

innovation systems, it is better to follow the operations of innovation systems on regional levels.[26]

Recent developments have provided even wider definitions of innovation systems. Edquist (2005: 182) defined the innovation system determinants as: "all important economic, social, political, organizational, institutional, and other factors that influence the development, diffusion and use of innovations". Such a definition is of course profoundly broad, and it does not help us understand what an innovation system is. Nevertheless, interrelated organizations are still characterized as the main actors of innovation systems. But as Edquist emphasised, "twenty-five years ago it would have been natural to exclude the interactions between organizations as a determinant of innovation processes" (2005: 183). Organizations, presented as "[f]ormal structures that are consciously created and have an explicit purpose", are considered as the "players" or "actors" (2005: 182) that contribute to the function of the entire system through purposeful activities. And these organizations may be all types of firms, be they suppliers, competing producers, distributors or other, as well as universities, institutes or government agencies.

Clearly this outline of innovation systems does not arrive at a single definition or uniform description, something which Edquist acknowledges as its primary weakness. Instead it points to a tangled and sprawling concept that in fact turns out to be rather vague when scrutinized. Nevertheless, the distinguishing feature or characteristic in the academic literature on innovation systems is the emphasis on organizations as being interlinked in networks, interacting with institutions in systems of innovation. Systems are comprised by interacting entities, and these entities in innovation systems are primarily taken to be organizations. The organizations can be both private and public, although emphasis is generally placed on interacting companies and research institutions in the origination, development and diffusion of innovations. Indeed, similar ideas also appear in other innovation theories of innovation-producing arrangements, such as clusters and triple helix.

26 As we shall see in Chapter 5, VINNOVA employs the concept of regional innovation systems in its VINNVÄXT programme, which is of particular relevance for the Microwave Road initiative as is evident in Chapter 6.

Clusters

Clusters, or geographic concentrations of companies in a specific industry, are other settings that can be characterized as innovation-producing arrangements. The notion of clusters has been popularized by one of the most influential writers on competitiveness in our time, namely Michael E. Porter. His focus was set on investigating why some nations were successful in particular industries, something which he studied by exploring how firms created and sustained competitiveness advantages in different countries (Porter, 1990). As a result, Porter was interested in the competitive advantage of both nations and firms, which he links to innovation. ”Firms create competitive advantage by perceiving new and better ways to compete in an industry and bring them to market, which is ultimately an act of innovation” (Porter, 1990: 45). To Porter, innovation is largely manifested by changes in products or processes, or due to new forms of marketing or distribution. And his point is that innovation results in shifts in competitive advantages, be it through the introduction of new technologies, new buyer needs or industry segments, or changes in government regulations.

Even though Porter was interested in national advantages, he argued that successful firms are situated in geographic units smaller than nations. In fact, one of his chief arguments was that geographic concentrations of firms, i.e. clusters, are of central importance for the competitive advantage of nations. He was clear on this, suggesting that globalization does not reduce the importance of the “home base”. Here Porter also claimed that government plays an important role, influencing competition through local and state government policy (1990).

So, according to Porter national advantages and economic development derive from industry and firm competitiveness. This is summed up in his “Determinants of National Advantage”, commonly referred to as the diamond model. The model illustrates a systemic interplay between *factor conditions* of production, such as skilled labour and infrastructure, *demand conditions,* relating to home demand for products and services, the presence or absence of *related and supporting industries*, and what Porter refers to as *firm strategy, structure and rivalry*, which represents how firms are created, organized, and managed, and how they compete (Porter, 1990: 71).

These components or determinants of competitiveness are described as being interdependent. And it is, Porter argues, this "systemic nature" that "promotes clustering of a nation's competitive industries", linking successful industries by both vertical and horizontal relationships (1990: 148-149).[27]

In a footnote, Porter acknowledged that Leamer (1984) first used the term *cluster* to explain aggregates of commodities. He also suggested that similar ideas have been represented in Dahmén's (1950, 1988) observations of vertically interlinked companies in *development blocks* in Sweden. The development blocks point to the importance of relations between industries, signifying that some industrial sectors may be able to develop in other industries (Porter, 1990: 789-790).

But what does Porter's reference to clusters mean? The etymology of the word suggests that *cluster* has its origin in the old English word *clyster,* being akin to *clot*, which denotes a substance adhering together in a thick non-descriptive mass. A cluster is largely analogous with a clot, although referring more to similar things occurring together. An example would be a cluster of stars in the night sky, closely grouped together, or a group of buildings that are built in proximity to save space. The transitive sense of the word refers to collecting or assembling entities into a cluster (Merriam-Webster Online Dictionary, 2006). This suggests that space and proximity are central features of the word, something that Porter emphasises as well. In a later article, he describes clusters as "geographic concentrations of interconnected companies and institutions in a particular field" (Porter, 1998: 78). Thus locality, being a dimension of space, is constitutive of clusters of similar or related companies. Porter (1990:148) illustrated this point by the use of examples. In so doing he points, for instance, to the Danish health related industries, such as those of pharmaceuticals, vitamins and medical equipment around Copenhagen. He also accentuates the interconnected industries of wood, pulp, paper and paper-mill machinery

27 Porter (1990) characterizes vertical relationships between firms as those between buyers and suppliers, whilst horizontal relationships occur when firms have common customers, technology or distribution and marketing channels, and so forth. Traditionally, vertical integration usually refers to the combination of firms at different stages of production, such as in Porter's (1990) value systems, which links value chains of suppliers, producers, distributors and buyers. Horizontal relationships and integration relates to the combination of firms in an industry at the same stage of production, often paired with possibilities of economies of scale and scope (See Oxford Reference Online – Dictionary of Economics, 2006).

in the north of Sweden, the Italian ski boot industry around the city of Montebelluna, as well as German automotive manufacturing between Stuttgart and Munich, to name a few.

The importance of geographic proximity for competitive advantages is not a new idea though; similar notions can be found in Alfred Marshall's (1890) *Principles of Economics*, in which he accentuates the importance of industrial districts for national advantage:

> When an industry has thus chosen a locality for itself, it is likely to stay there long: so great are the advantages which people following the same skilled trade get from near neighbourhood to one another. The mysteries of the trade become no mysteries; but are as it were in the air, and children learn many of them unconsciously. Good work is rightly appreciated, inventions and improvements in machinery, in processes and the general organization of the business have their merits promptly discussed: if one man starts a new idea, it is taken up by others and combined with suggestions of their own; and thus it becomes the source of further new ideas. And presently subsidiary trades grow up in the neighbourhood, supplying it with implements and materials, organizing its traffic, and in many ways conducing to the economy of its material. (Marshall, 1890: 225)

From these ideas, it becomes apparent that *place* plays an important role for developing competitive advantages, but also interpersonal relationships. As Marshall argues, the locality of an industry allows for the sharing of skilled trade and work in a way that unveils the mysteries of trade, and thereby creates mutual benefits. Others have indeed picked up this argument in later works, such as by Porter (1998) in his new economics of competition and in Saxenian's (1994) research on regional advantages in Silicon Valley. Porter, for example, added a collaborative element to the competitive agenda by arguing that the advantages of clusters arise from their promoting both competition and cooperation, stimulating increased productivity, the direction and pace of innovation, and formation of new business (Porter, 1998). Notwithstanding, place is still presented as a decisive factor: "the enduring competitive advantages in a global economy lie increasingly in local things – knowledge, relationships, motivation – that distant rivals cannot match" (1998: 78.).

Similar ideas were developed in Saxenian's (1994) study of regional advantages. Building on Granovetter's (1985) argument on economic activities' social embeddedness, Saxenian (1996) set out to compare firm activities in Silicon Valley and along Route 128 in Massachusetts, USA. She began by pointing out that much of the research on competitive advantage in regional clusters draws upon the theory of external economies. According to Saxenian, these theories assume that firms are atomistic units, separated by boundaries, and fail to account for what she calls "the complex and historically evolved relations among the internal organization of firms and their connections to one another and to the social structures and institutions of a particular locality" (1996: 42). Consequently, she argued in favour of a network approach to understanding regions and industrial adaptation. However, she extended her argument to include social structures, something that Porter did not emphasise to the same degree. In her comparisons of the two industrial districts, she points to the change in the economic performance after the economic decline in the 1980s. Route 128 lost its dominance and was outgrown by Silicon Valley in terms of employment, growth in number of firms as well as in capital investment and total revenue. The reason for this change, Saxenian argues, is that Silicon Valley's network-based industrial system is more flexible and hence better at adapting to environmental changes, compared to the rigid hierarchical structures of vertical integration in Route 128. Silicon Valley, generally considered a huge success, was thus seen as having the most suitable industrial structure, in terms of both organizational form and supporting social and technological structures (Saxenian, 1996). In sum, Saxenian (1994) found that the comparative success of Silicon Valley stems from its regional network-based industrial system, as opposed to an independent firm-based system. Similarly to Porter (1990; 1998), she also described how companies in Silicon Valley were competing intensively and at the same time engaging in collaborative practices. This type of setting purportedly promotes collective learning and experimentation, where innovation is made possible by social networks, porous firm and functional boundaries as well as by its open labour market (ibid).

Saxenian's building on Granovetter's (1985) embeddedness argument is interesting. Granovetter also argued that any single-firm perspective on economic activity is limited. The embeddedness argument criticises overly rationalistic accounts of economic activity, because these perspectives see

actions and decisions as mechanically carried out by atomized actors (ibid). This clearly stands in contrast to a perspective where separated firms are seen as those producing innovations. Instead, Granovetter suggested that it is necessary to pay attention to the historical and structural embeddedness of social relations and culture in order to understand economic activity. The implication of this is that all firms, at all levels of transactions, are connected by networks of personal relations; mixing business with the social. The embeddedness perspective on organizational and economic activity therefore questions the importance of authority and formal structure as well as firm boundaries. In that respect, Granovetter (1985) begins to criticize the suitability of structural organizational perspectives, such as networks and systems, in making sense of economic activities. Indeed, this is somewhat contrary to organizational network perspectives, as well as the theories of innovation systems and clusters, which emphasise formal relations between companies or organizations more.

The arguments in favour of clusters and regional competition and collaboration, within and between related industries and firms, are plentiful. There is no mistaking the competitive advantages of clusters, and their contribution to national economic development, in Porter's argument:

> Nations succeed not in isolated industries, however, but in clusters of industries connected through vertical and horizontal relationships. A nation's economy contains a mix of clusters, whose makeup and sources of competitive advantage (or disadvantage) reflect the state of the economy's development (Porter, 1990: 73).
>
> /…/
>
> As clusters develop, resources in the economy flow toward them and away from isolated industries that cannot deploy the resources as productively. As more industries are exposed to international competition in the economy, the more pronounced the movement toward clustering will become.
>
> National competitive advantage, then, resides as much at the level of the cluster as it does in individual industries. This carries important implications for government policy and company strategy (Porter, 1990: 152).

These priorities are very much part of economic development policy, and not least for the attempts to stimulate regional innovation and growth. I will

develop what I mean by this in Chapters 4 and 5 on international innovation policy and particularly the Swedish innovation programmes for growth. Before that, however, we will deal with yet another innovation theory and model called *triple helix*, which has also proven to be incredibly influential for innovation policy. Triple helix is similar to the innovation systems concept in its focus on the interaction between different types of organizational actors. This idea is evidently central to clusters as well, although the latter tends to focus on relationships between companies and academia, whilst the triple helix model extends this view to include state and public organizations as well.

Triple helix

During a workshop at an academic conference in 1996, Etzkowitz and Leydesdorff introduced the *triple helix* model to illustrate an alternative perspective on the dynamics of innovation (Leydesdorff and Etzkowitz, 1996). A helix is something having a spiral form, such as the double helix shape of DNA molecules. Etzkowitz and Leydesdorff use the helix metaphor to demonstrate a triple spiral where industry, academia and state are seen as interacting in an evolutionary fashion, allowing for new innovative re-combinations (Leydesdorff and Etzkowitz, 1996; Etzkowitz and Leydesdorff, 2000).

The triple helix argument is, according to its originators, derived from a need to extend the traditional views on how innovation takes place. Much like the proponents of innovations systems, Etzkowitz and Leydesdorff began by suggesting that neoclassical economics has depicted innovation as linear processes, accentuating input and output relations in markets of individual rational agents (or people). In simplified terms, this perspective suggests that market forces drive the direction and pace of innovation (cf. Mowery and Rosenberg, 1979); if buyers in a market demand new products or applications, this elicits responses where firms innovate to supply such things (see section 3.2.2 on Firms as innovation hothouses). Etzkowitz and Leydesdorff then proceed to maintain that traditional evolutionary perspectives on economics describe firms and technologies as co-evolving (cf. Dosi, 1982), something that is also advocated in the *National Innovation System* perspective (Freeman, 1988, Lundvall, 1992, Nelson, 1993) described above. Here the market and sciences are portrayed as interacting in what

could be called a double helix, where innovation is carried forward primarily by firms. What is common for both the linear and evolutionary systems perspectives is that the state is seen as separated from both academia and industry, in a *laissez-faire* model without government intervention (Etzkowitz and Leydesdorff, 2000).

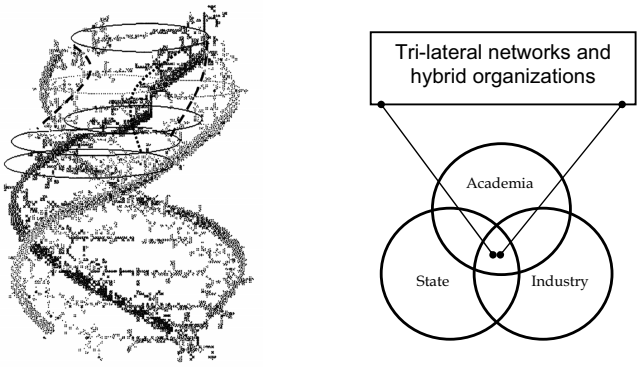
The problem with both these perspectives, according to Etzkowitz and Leydesdorff, is that they build on an assumption of differentiating the nation state and the economy. In appraisal of this division, the authors noted an increasing coordination between industrial policies and science and technology policies, as well as a greater interaction between what they call the institutional spheres of university, industry and state. Ever since the famous economist Keynes, government intervention has been an issue of debate within economics.[28] Etzkowitz and Leydesdorff argue that governments in fact affect the innovation dynamics, either through changing the "rules of the game", such as passing laws and regulations, by actively creating new markets, or by establishing new organizations for funding technological innovation.[29] Their proposition is thus to change from a double to a triple helix, which includes the state as an important player in innovation dynamics, and particularly so in knowledge-based societies. The triple helix is hence a way of modelling relationships between university, industry and government, which Etzkowitz and Leydesdorff (ibid) claim to be increasingly occurring in one form or another in most countries and regions (although the evidence for this seems somewhat scarce). In terms of the relationships, they suggest that the interactions between the three helices allow for dynamic innovations, indicating that the structure is by no means stable, through combining elements in the various spheres.[30] This is illustrated in Etzkowitz and Leydesdorff's (2000) figure depicting a DNA

28 Keynes was an economist and politician in the UK who argued (1936) in favour of government spending to push a receding economy, such as the UK during the depression in the 1930s, towards a full employment equilibrium and economic growth. Fiscal policies, i.e. government policies, are often related to Keynesianism. This type of government intervention stands in contrast to monetarism, personified by the famous American economist Milton Friedman, who argued (1957) for a laissez-faire economy without government intervention, using primarily monetary policies (Oxford Reference Online, Dictionary of Social Science, 2006).

29 Such government interventions are indeed prevalent in Sweden and form a central part of this story. See Chapter 5 for a detailed account of the governmental and regional innovation programmes for growth.

30 This combinatory idea does indeed bear resemblance with Schumpeter's (1911) view on innovations, although focusing on the three helices in particular.

inspired spiral, representing interactions among the three strands. The spirals, as well as a simplified picture of the author's triple helix, are present below.



Models of triple helix interaction (Etzkowitz and Leydesorff, 2000)

In the left model, the horizontal ellipses represent communicative interaction between the three co-evolving helices, which in turn allows for what the authors refer to as the reconstruction of institutional arrangements. The second model represents a simpler repackaging of the triple helix model, illustrating the interface between the three helices, as well as suggesting that innovative hybrid organizations or networks comprised of academic, industrial, and state entities emerge in such interfaces.

In the end, the benefits of triple helix interaction are many, according to Etzkowitz and Leydesdorff (1996), as they allow for combinatory innovations and internal reorganization of the spheres and knowledge infrastructures:

> In our opinion, the knowledge-based economic regime has made the distinction between *laissez faire* and active-state intervention obsolete: governance nowadays means codifying high-quality selections that set free new areas of activities as zones of recombination (cf. Etzkowitz, 1994b). One expects the new opportunities (and new jobs!) to emerge not in existing institutions, but in careful recombinations that are based on knowledgeable reconstructions. An economic and science policy analysis that fails to consider these potentials for recombination of elements among the helices will miss the lessons of several decades of experience in knowledge-based economic developments (Leydesdorff and Etzkowitz, 1996).

This clearly points to a reintroduction of the state as having an important role in the economy and innovation processes. Irrespective of whether this is the case or not, this idea has become increasingly influential in innovation policy and efforts to stimulate the economy.

Discussion – theoretical descriptions of innovation

In this chapter I have reviewed perspectives on innovation. I began with pointing out how innovation is commonly seen as key for economic growth. Even though this is a generally accepted assumption, I also showed that the dominant views on how innovations are produced have been shifted over time. There are of course overlaps between the perspectives, making any chronological ordering a precarious venture. Nevertheless, from this literature review, traditional innovation research can be seen as beginning with focusing on the activity of individual entrepreneurs as identifying opportunities and combining resources in innovative ways. Later, focus gradually shifted towards focusing on manufacturing firms as the originators, developers and implementers of innovation, responding to the needs of the environment. This was then extended towards seeing organizations as embedded and inter-related in structural networks and systems of innovation. These changes in how innovation has been characterized can, to some extent, be explained by the rendering of economic activities as progressively more complex over time, shifting the

focus from entrepreneurs, to firms, and ultimately to networks and systems. This is indeed what is proposed by the more recent innovation theories, which I have referred to as theories of innovation-producing arrangements. Another explanation for these shifts could be that these latter theories simply have become fashionable, constituting the latest trend on how innovation is produced and is best stimulated.[31]

The theories of innovation systems, clusters and triple helix constellations all share kinship with economic theory, such as evolutionary economics and theories of competitiveness. But that which truly affiliates them is their mutual emphasis on inter-organizational arrangements as a necessity for innovation. Entities such as firms, scientific institutions, governments, agencies, research institutes, etcetera, are portrayed as connected nodes in innovation networks or as interrelated in systems. The table below exemplifies some of the key characteristics of what innovation entails according to the three theories of innovation-producing arrangements.

The theories of innovation-producing arrangements in brief

	Innovation Systems	**Clusters**	**Triple helix**
Innovation: what?	Co-development, diffusion and use of innovations, particularly new technologies	Changes in products and processes due to new forms of marketing or distribution	Re-combinations: governments can affect innovation dynamics by changing laws /regulations, creating new markets and funding organizations
Innovation: how?	Systemic and evolutionary interaction between organizations and institutions, e.g. between firms and public institutions	Geographic concentrations of competing and collaborating firms in related and/or supporting industries	Evolutionary and dynamic interaction in a complex network system of university, industry and government relations

31 See Czarniawska and Sevón (2005) for examples of how fashion guides imitation and translation.

It follows that these theories of innovation-producing arrangements have a tendency to abstract key determinants of innovation phenomena in providing general and ideal types of models for how innovation occurs. And when academics describe innovation, they put their observations and analyses into written text. Innovation thus becomes packaged into generic accounts, suggesting that innovation is produced in inter-organizational arrangements.[32] And in so doing, researchers also produce normative theories for how innovation is said to occur and how it is best stimulated.

The notion of descriptions and norm-ing is interesting and deserves further attention. To describe something is an act of writing something down, to copy or transcribe it. Thus, to describe is to write it anew in another place. Of course, a description can indeed be verbal, but academic publication commonly concerns written texts. Thereby, when describing how innovation phenomena take place and how they should be promoted, normative renderings are transferred into written text or scripts. And as I outlined in Chapter 2, a script can be something written regarding how to act, such as a text that describes how innovation should be stimulated. Indeed, examples of such scripts are found in the theoretical literature on innovation-producing arrangements. In the subsequent chapters, I will show how these innovation theories play important roles as they are inscribed into innovation policy, having implications for how Swedish innovation programmes and the related initiative Microwave Road is organized.

32 Indeed, in telling my story of innovation programmes and the Microwave Road initiative, I too attempt to describe the unfolding of events, putting my observations into text and making it available to readers. Be it noted, however, that it is not my ambition to produce a new innovation theory.

CHAPTER 4

From innovation theory to policy

Considering that innovation is commonly seen as key to economic development and prosperity, governments and firms continuously seek to stimulate it. In so doing, they follow fashions in how innovations are thought to be produced. Theories of innovation-producing arrangements, including *innovation systems*, *clusters* and *triple helix* constellations, are indeed such fashions, and are highly influential at the global innovation policy scene. As I showed in the previous chapter, these theories highlight inter-organizational constellations, like networks and systems, as settings in which innovation is produced.

In this chapter I will show how the theories of innovation-producing arrangements are related to innovation policy. This chapter is thus closely linked to the previous one, continuing with answering the first research question: *How are innovation theories and models employed in Swedish innovation policy and programmes?* In so doing I will begin with presenting a brief outline of international innovation policy development, beginning with innovation policy development at the OECD and the EU in particular. This is followed by an account of the establishment of an "agency for innovation systems" in Sweden (VINNOVA) and its task of developing innovation systems. In so doing, this chapter traces how innovation theories travel in both time and space (cf. Czarniawska and Joerges, 1996), moving from innovation economics to policy practice. This forms a bridge to the subsequent Chapter 5, which will take up how innovation theories and

policy practice has been translated into two Swedish programmes for regional innovation systems and clusters (VINNVÄXT and VISANU).

A global innovation agenda

One of the starting points of the international innovation policy movement can be traced back to the establishment of the *Organization for Economic Co-operation and Development*, commonly known as the OECD, some 45 years ago. The OECD's original members were wealthy European and North American countries, which now have been complemented by a few Asian counties as well. One of the organization's chief tasks has been to achieve the highest possible sustainable economic growth and employment for its member countries. In so doing it also has an ambition of developing the larger world economy. One of the ways the OECD claims to do this is by developing economic policies "that work" (www.oecd.org, 2006). One such policy came out of employing a systems approach to innovations and economic performance, emphasising the importance of interaction between actors in technology development (OECD, 1997). By referring to theoretical work and studies of national innovation systems by Freeman (1987), Lundvall (1992), Nelson (1993), as well as to Porter's (1990) ideas of competitiveness, the OECD describes national innovation systems in the following way, acknowledging that there is no singe definition of the concept:

> The concept of **national innovation systems** rests on the premise that understanding the linkages among the actors involved in innovation is key to improving technology performance. Innovation and technical progress are the result of a complex set of relationships among actors producing, distributing and applying various kinds of knowledge. The innovative performance of a country depends to a large extent on how these actors relate to each other as elements of a collective system of knowledge creation and use as well as the technologies they use. These actors are primarily private enterprises, universities and public research institutes and the people within them. The linkages can take the form of joint research, personnel exchanges, cross-patenting, purchase of equipment and a variety of other channels (OECD, 1997).

In following such a systems approach, the innovative capacity of firms is presented as being dependent on having access to appropriate networks. In addition, the above excerpt indicates that the main actors of the national innovation system are companies, universities and research organizations, and there is little mention of public organizations. Moreover, rather than simply focusing on R&D activities as innovation policy purportedly did in the past, contemporary policy must, according to the OECD, consider network and systems aspects with regards to innovation.

> New types of policies are needed to address systemic failures, particularly policies directed to networking and improving firm absorptive capacities. **Networking** schemes put emphasis on improving the interaction of actors and the interplay of institutions within national innovation systems. Such policies stress the role of joint research activities and other technical collaboration among enterprises and with public sector institutions; schemes to promote research and advanced technology partnerships with government are valuable in this context. These policies give prominence to high levels of co-patenting, co-publication and personnel mobility, and implement intellectual property rules, labour market policies and exchange programmes to facilitate such collaboration. These policies recognise the importance of informal flows of knowledge and access to technical networks; supportive information technology policies and infrastructures are thereby implemented. They see the value of encouraging the development of innovative clusters and close producer-user relations among firms, and thus establish appropriate competition policy frameworks. In general, these policies seek to augment innovation networks and to design these flows, linkages and partnerships in the most efficient manner (OECD, 1997).

Similarly to the theories of innovation-producing arrangements presented in the previous chapter, the OECD innovation policy recommendations highlight the centrality of systems and networks of actors. The OECD also links the development of innovative clusters to innovation systems and networks in its innovation policy recommendations, combining the different theories. This is an interesting issue to which I will return when presenting the emergence of VINNOVA and the regional innovation programmes.

The OECD perspective on networked innovation systems reappears in later OECD reports focusing on the management of innovation systems. In 1999 the OECD published the results of its *Committee for Scientific and Technological Policy*. Some of the observations in the report particularly emphasised the importance of effective interaction between the science base and the business sector, the need for companies to innovate more rapidly, and new demands of increased interdependencies between innovation systems due to globalization. In terms of the importance of networks of collaborating firms for innovation, the OECD takes a clear stand:

> Networking and collaboration among firms are now more important than in the past and increasingly involve knowledge-intensive services. Competition provides incentives to innovate, but networking and collaboration at local, national and international levels are often necessary to build the capabilities to do so. Clusters of innovative firms and other private and public knowledge-based organizations are emerging as drivers of growth and employment (OECD, 1999: 9, italics in original).

The organization is also clear on the implications of these observations, suggesting that one of the key objectives of technology and innovation policy is to focus on promoting networks and clustering in particular:

> Technology and innovation policy should not focus on single firms in isolation but rather on their ability to interact with other enterprises and organisations. Governments should reduce obstacles that prevent the formation of networks and ensure that the public research infrastructure works in close collaboration with business. They can also nurture the development of innovative clusters through schemes to stimulate knowledge exchange, reduce information failures and strengthen co-operation among firms (OECD, 1999: 11).

What this illustrates is that much emphasis is placed on the interaction between organizations in producing innovations, something which is exemplified in the use of terms such as *innovation systems*, *clusters* and *networks*. In this respect, the OECD policy work has built on theories of innovation-producing arrangements, as outlined in the previous chapter. And in producing international innovation policy recommendations,

policymakers have often worked in close interaction with innovation economists.

This development is not limited to the OECD; similar cluster and network development programmes have also been initiated at the *United Nations Industrial Development Organization*, focusing for instance on the textile industry in certain geographic areas in India (www.unido.org, 2006). What is more, efforts to stimulate innovation are central to the competitiveness and sustainable growth goals in the European Union (EU) too, as exemplified in the EU Lisbon Strategy agreed upon at the Lisbon summit 2000.[33] These ambitions have re-emerged in the recently renewed Lisbon Strategy, suggesting that innovation is vital for "keeping up the pace of change" (COM 803, 2007). This is largely pursued by attempting to improve what is commonly referred to as framework conditions, such as removing barriers of investment and mobility between countries, developing innovation-friendly laws, as well as utilizing tax incentives, subsidies and public procurement procedures to foster innovation. Perhaps even more significant are the continuous attempts to stimulate the EU member countries to increase their spending on R&D investments, hoping that the research results will diffuse to industry and the development of new technologies. In fact, many of the EU's policies have traditionally focused on research and technology development in particular, and there are numerous initiatives regarding the establishment of public-private partnerships like Joint Technology Initiatives or establishing joint technology platforms. What is more, EU policy has recently placed cluster development and support at the centre of innovation policy concerns. At the end of January 2008, European ministers met at the EU Presidency Conference in Stockholm to sign a new cluster memorandum to set the stage for future innovation policy. Interestingly, Michael Porter was there to discuss the necessity of supporting innovative clusters, reemphasising how innovation economics and policymaking are highly intertwined, just as we saw in the previous chapter. The link between innovation and clusters is particularly evident in the memorandum, which suggests that "Innovation is the driver that will shape the European vision of growth and prosperity" and that "clusters can be powerful catalysts in this process" (The European Cluster Memorandum, 2007:1). In fact, the memorandum suggests that it is

33 See footnote 1.

no longer enough to increase R&D spending and hope this will result in innovation. Instead, the cluster approach is presented as a necessary and more holistic approach:

> Clusters – regional concentrations of specialized companies and institutions linked through multiple linkages and spill-overs – provide an environment conducive to innovation. They enable "open innovation", the creation and refinement of new ideas in networks of cooperating companies and institutions. And they lower the barriers for transforming new ideas into businesses and capturing the benefits of globalization. In modern competition, all clusters need to be innovation clusters (The European Cluster Memorandum, 2007:2).

All in all, these examples illustrate that there has been a global innovation policy movement geared towards developing innovation systems and clusters. This progress has also been observed by Miettinen (2002), who analyzed the emergence, development and use of the term "national innovation system" in Finland's science and technology policies. Sharif (2006) discussed a similar development based on his studies of the international emergence and use of the same concept. Moreover, innovation policy in France also stresses innovation systems and clusters, and the telecom valley Sophia Antipolis in southern France is often submitted as a successful example (www.industrie.gouv.fr, 2007).

Interestingly, this points to how the theories of innovation-producing arrangements constitute fashions that are imitated around the world and translated into innovation policy aimed at furthering innovation, and thus economic growth. These policy winds blew over Sweden too, changing the nation's organization for research and development. More specifically, it led to the formation of new governmental agencies and innovation programmes for economic growth, which were to have a profound effect on the funding of innovation and research in the country. In the light of the previous account of the emergence of the innovation systems and cluster theories, we now turn to exploring how these ideas are practiced in the Swedish setting. In so doing, attention is specifically placed on how the theories of innovation-producing arrangements translated into establishing a new agency for innovation, and particularly into local programmes for innovation.

The rise of an agency for innovation systems

The Swedish take on the global innovation policy advancement was no less than establishing an entire agency for *innovation systems* in 2001, called VINNOVA.[34] This was a direct response to tackling the "Swedish Paradox", suggesting that "despite substantial R&D investments, Sweden still has weak long-term growth" (VP 2002:4, p. 7). VINNOVA's task was thus to increase the returns on R&D investments and stimulate economic growth in Sweden by cultivating innovation and thereby contributing to a prospering country. The rationale was to take a systems approach on innovation, advocating the importance of interplay between actors. A first hint of VINNOVA's espousal of this innovation idea is eloquently illustrated in the quote below, introducing a theme that will reappear in various guises throughout this story.

> "Sailing is necessary" was the catchword when trade across the seas determined the growth and prosperity of a nation. In the technology and knowledge-based society of today, in which international competitiveness is more important than ever, the catchword should probably be "innovating is necessary". However, innovations do not arise in isolation but in systems where the interplay between various actors and research and development are vital elements. (Information Brochure: VINNOVA - for an innovative Sweden! VI 2005:06.

VINNOVA's establishment in Sweden came at a time when the innovation systems analyses and policy developments at the OECD had gained much acceptance and were imitated across nations.[35] This also occurred in conjunction with the Lisbon summit in 2000, where the EU's heads of states had decided that innovation policies must constitute the foundation for all economic growth policies. This heritage is acknowledged on VINNOVA's website, with clear references to the OECD's analytical work on innovation

34 VINNOVA is an abbreviation of "Verket för Innovationssystem" in Swedish, which translates into The Agency for Innovation Systems.

35 See for example Miettinen (2002) for an eloquent analysis of the development of the national innovation system term and its influence for Finnish technology policy.

systems, suggesting that this has become important in developing politics for renewal in most developed economies.[36]

When tracing the origin of VINNOVA, one is promptly led to various government propositions on supporting innovation in Sweden.[37] One such proposition, called *Research for the future – a new organization for research funding*, was presented to the Swedish Riksdag[38] in March 2000. As the name suggests, it included plans for developing a new so-called agency-organization, that is an organization of agencies related to Research and Development funding in Sweden, for "initiating and financing needs-oriented research and development" (Prop. 1999/2000:81). One radical proposal in this was to form a new agency for innovation, which was to be inaugurated under the *Ministry of Industry, Employment and Communications*, specifically aimed at supporting national (i.e. Swedish) innovation systems. These plans also implied changes in the already established agencies. For example, the Agency for Industry and Technology Development (Nutek) was to focus more on economic and regional growth, yielding many of its previous research funding activities to the new agency. A significant implication of this was the shift from "calls for research" in specific areas of technology development, to attempts to develop systems of innovations. In a sense, this was moving from specific research topics, which Nutek had administered previously, to more aggregated systems building.

Overall, the proposition claimed that the previous research organization had functioned well and contributed to the development of businesses and prosperity in the Swedish society. But changing times requires new measures: "The society of the future nevertheless poses partly new and larger demands. Capacity for innovation is an important factor behind economic growth, ecologically sustainable development and societal change" (Prop. 1999/2000:81, p. 35). Similarly to the OECD and the EU states, effective innovation systems are presented as increasingly important in achieving this, and the "innovations perspective" is said to permeate the economic growth policies, where the driving force allegedly has been "the

36 This can for instance be found in the section "Prerequisites for growth" at www.vinnova.se, 2007.

37 In Sweden, the Social Democrat party led a minority government with support from the Environmental party and the Left party 1994-2006.

38 The Riksdag is equivalent to The Swedish Parliament.

low growth rate and high unemployment that have permeated Europe since the end of the 1970s" (Prop. 2001/02:2, p. 6).

It follows that the Agency for Innovation Systems (VINNOVA) was subsequently founded in line with these propositions in January 2001. In 2007 VINNOVA employed some 160 people and its budget amounted to approximately SEK 1,5 billion (about 150 million Euro), which is comparatively much for Swedish agencies. Nutek for example, employed 221 people in 2005, with a budget of about 240 million (Nutek Annual report, 2005). But what does an agency for innovation systems do? In the following we will inquire into how VINNOVA describes itself and its task.

Cultivating the innovation garden

VINNOVA often describes itself as playing an important role in Swedish research and development, and of course in stimulating innovations. Such claims are interesting as they point to how people at the agency view VINNOVA and how they understand themselves in relation to others. One metaphor that VINNOVA uses to describe the agency's role is that of *innovation gardeners* (VI 2005: 6), which indeed fits the idea of cultivating innovation that I introduced in Chapter 3. The notion of innovation gardeners alludes to the portrayal of the agency as playing a central part in making Sweden flourish, in caring for the national innovation "flora". In order to do this, VINNOVA conducts analyses to single out which areas have the biggest growth potential, and then strives to link research and development with innovation in order to produce "successful products, services or processes with a scientific base" (ibid.). And, when considering that VINNOVA administers the largest amount of research funding in Sweden, these screening processes have a wide influence as an exercise of power over which research projects should be endorsed and which innovation systems should be supported.

The following excerpt from an information brochure, provides a summary of how VINNOVA's role is communicated, highlighting its innovation gardening ambitions. As might be recognized from what has been said before, this encompasses aspects supporting the development and utilization of research results, prioritization of fields according to the largest growth potential, and last but not least, the work with developing innovation systems.

> VINNOVA is a government agency whose central task is to get Sweden to flourish! In concrete terms, this means that we strive to increase growth and prosperity throughout the country. This is an objective we share with many others, but the way we go about achieving it is very much our own.
>
> Our particular area of responsibility is innovations linked to research and development – i.e. ground-breaking, successful products, services or processes with a scientific base. Our tasks include funding the problem-oriented research that a competitive industry and a flourishing society require, as well as strengthening the networks that are a necessary element of this work.
>
> However, one important part of our assignment starts long before this. First, we have to analyse and establish in what areas there is real potential for innovations and growth. Where are the opportunities greatest – in the fields of IT or biotechnology, or in more strictly defined areas such as wood manufacturing? In order to be able to focus our efforts and achieve as great an impact on growth as possible, we also have to understand what is lacking and what obstacles stand in our way.
>
> All of the actors and stakeholders that interact to produce, disseminate and use innovations form what we call an innovation system. By developing effective innovation systems, VINNOVA helps to create a better breeding ground in which new ideas can develop and become commercially viable on the market – and to create a flourishing Sweden!
>
> (Information Brochure: VINNOVA - for an innovative Sweden! VI 2005:06).

So VINNOVA assumes the rather ambitious role of acting as "innovation gardeners" in making Sweden blossom and prosper. The metaphor is quite illustrative, especially when extended, in that the agency is said to identify the most promising plants in the garden, attempting to cultivate them by providing nourishment in the sense of capital funding, hoping that the sun would shine and allow the plants to grow and bloom in splendour. The above citation illustrates this well in its speaking of the necessity for innovation, growth, competitiveness, research funding, networks and innovation systems for achieving a burgeoning country. The importance of these issues is continuously emphasised as necessary aspects in developing

the Swedish economy. However, as the observant reader might have noted, there are few examples of how to develop such systems of innovation.

When investigating descriptions of what VINNOVA does, we find that the agency has seven programmes, sometimes interchangeably called instruments, for carrying out its task of furthering innovation and growth in Sweden. In the first instance, the agency administers *Programmes for funding R&D in specific fields*, which aim to utilise research findings in the innovation systems. Examples of these programmes include support areas such as Information and Communications Technology, Biotechnology, and Transports, to mention a few. Another instrument is the so-called *VINN Excellence Centres*, where competence centres are financially supported to strengthen internationally acclaimed research and innovation environments. The third programme is called *VINNVÄXT* and seeks to develop innovation systems from a regional perspective. And this programme is of outmost importance to this study, because of its relevance for the formation of the Microwave Road (MWR) initiative.[39] In all these instruments and programmes, innovation systems are the common denominator, and their development is portrayed as of chief importance. Although VINNOVA's task is of a national character, there are few references to the national innovation system. When consulting VINNOVA's Strategic Plan for 2003-2007, we find that descriptions of its role have become slightly more geared towards developing innovation systems in the plural, as opposed to a national innovation system:

> VINNOVA's role is to promote *sustainable growth* in Sweden by means of *problem-oriented research* and the development of *effective innovation systems* (VINNOVA Policy VP 2002:4, p. 3, italics in original).

These concepts can indeed be recognized from the literature on innovation, as reviewed earlier. Yet, as in this literature, VINNOVA's descriptions of its programmes for innovation systems and the use of innovation concepts are still very abstract. It is hence necessary to pay further attention to how VINNOVA uses the concepts.

39 In addition, VINNOVA also works with instruments aimed at strengthening research institutes in a similar fashion to that of the centres of excellence, as well as financially supporting companies with future growth potential. The agency also engages in support of so-called incubators and seed financing for new start-up companies (VINNOVA Information, 2005:3).

VINNOVA's take on innovation systems

VINNOVA follows two major paths in furthering innovation, namely funding applied research and developing innovation systems. Indeed, a guiding principle is that research is necessary for creating new knowledge, innovations and growth. But rather than engaging in basic research exclusively, VINNOVA claims to support research that is directed towards immediate needs and applied to current problems. According to VINNOVA, "high standards of scientific quality" must be paired with cooperation between actors, so that mutual interaction and learning can be achieved and innovation made possible. This in turn is claimed to produce "internationally outstanding scientific results, effective innovation processes and growth" (VP 2002:4, p. 6). Even though this exemplifies VINNOVA's ambition of converting research into innovations, it does not tell us much of how this is to be achieved. Cooperation between actors is nevertheless emphasised as a necessary aspect in producing innovations, something which is emphasised by the systemic approach to innovation. Indeed, this idea constitutes the foundation of VINNOVA's work with developing innovation systems, which becomes a solution for achieving competitiveness, innovation and growth. A basic assumption in this line of thought is that innovations are not developed by single firms, but rather in webs of organizations and people. Words such as *interplay*, *collaboration and cooperation*, *inter-linkages*, and so forth are recurring metaphors for illustrating this, and are all grouped under VINNOVA's overarching systems perspective. Indeed, the agency presents innovation systems as methods for sustainable development and growth (www.vinnova.se, 2002). This is by far the most prevalent concept used by VINNOVA, although sometimes documents tell of extended views on systems of collaborating actors. For example, VINNOVA defines an effective innovation system as "consisting of actors from science, business and politics, who interact to develop, exchange and apply new technologies and new knowledge in order to promote sustainable growth by means of new products, services and processes (VINNOVA Policy VP 2002:4, p. 3)". This exemplifies how theories of innovation-producing arrangements, and particularly that of *innovation systems,* outlined in Chapter 3, are explicitly portrayed as methods for sustainable growth and development, although occasionally described in somewhat varying ways. A common denominator in the

definitions, however, is the repeated allusion to system as well as network metaphors, as this account from VINNOVA's website suggests:

> By **innovation systems** we mean such *networks* of organisations, people and rules of the game within which the innovative exploitation of technology and other knowledge take place. When the interaction works well, new knowledge is created and comes into use rapidly. Such interaction becomes hotbeds for innovation and attracts investment (www.vinnova.se, 2005, my translation, italics added).

At a first glance, this definition of innovation systems has a normative tone in its casual description of how innovation comes to be. Later definitions appearing on the website emphasise the necessity of "systems of collaborating actors" for growth-generating innovation development (www.vinnova.se, 2006). These takes on innovation systems are indeed similar to the policy recommendations we saw at the OECD. Even though VINNOVA's definitions have changed somewhat over the years, the idea of innovation's dependence on the interplay between organizational actors still stands tall.

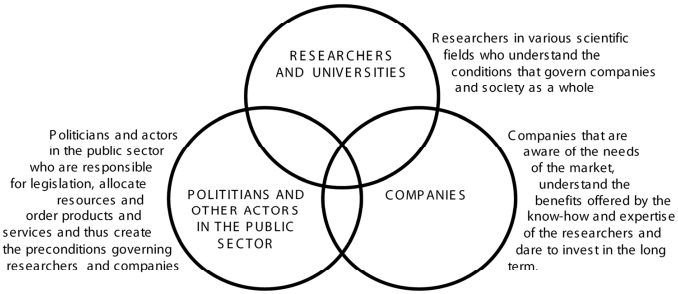
In VINNOVA's terminology, innovation systems are characterized as national, regional or sectoral (VINNOVA Policy VP 2002:4, p. 8).[40] Such views suggest that innovation systems can be found at different levels. In addition, according the same strategic plan, each innovation initiative must consider aspects appearing at all these levels, and take into account Sweden's comparative characteristics in terms of its "actors, framework of conditions, structures, resources and innovative capacity" (VINNOVA Policy VP 2002:4, p. 9). VINNOVA also states that the innovation initiative must consider the uniqueness of each system, acknowledging that different sectors or technical fields have distinctive prerequisites, development processes, driving forces and obstacles, as well as being adapted to "the different requirements for innovation and growth within each region (ibid)". This exemplifies some of the early guidelines stipulated by VINNOVA, although the most central ones are of course the necessity of systemic inter-organizational interaction in triple helix constellations.

40 Indeed, similar categorizations of innovation systems have been made by Fagerberg (2005) and Edquist (2005), exemplifying how policy and innovation economics are intertwined yet again.

The triple helix imperative

Another central feature of VINNOVA's programmes for innovation systems is the idea of interaction in what has become known as the triple helix. The concept of triple helix, as described in Chapter 3, is a model of university-industry-politics relations in innovation activities (Leydesdorff and Etzkowitz, 1996; Etzkowitz and Leydesdorff, 2000). Interestingly, this has been incorporated into VINNOVA's ideas and programmes, where interaction between three types of organizational actors – from business, science and politics — is advocated in producing effective innovation systems. However, VINNOVA chooses to change the order in which the triple helix actors are presented, often mentioning businesses before universities, as if rearranging the importance of the respective actors. Interestingly, triple helix is not part of the OECD's recommendations, nor is it common in Finnish policy. This thereby points to how VINNOVA has chosen to incorporate an additional innovation theory, combining it with innovation systems, in its efforts to further growth.

Triple helix has indeed become one of VINNOVA's most important working models. It is presented as essential for "commercially viable innovations", and a strong triple helix structure is a requirement for receiving support from VINNOVA's funding programmes. In fact, Etzkowitz even published a book in 2005, called "Triple helix – The new innovation model", in which the Swedish General Director for VINNOVA, the Vice Chancellor of Chalmers University, and a well-known Swedish CEO presented their views as representatives for the three helices. The figure below from a VINNOVA brochure illustrates how the agency views the triple helix, which of course is strikingly similar to the Etzkowitz and Leydesdorff (2000) model presented in Chapter 3:



The triple helix according to VINNOVA (Information Brochure: VINNOVA - for an innovative Sweden! VI 2005:06)

According to VINNOVA, triple helix interaction among these spheres is a requirement for innovation systems to be effective. And mutual understanding of the respective roles turns out to be a central theme in VINNOVA's take on triple helix interaction. Here, researchers ought to know the needs of businesses and society, while companies should adhere to market demands and at the same time know how to utilise research findings. Last but not least, the public sector is presented as an actor that lurks in the background, although playing an important role in its legislative and resource allocating duties. This version of the triple helix model clearly points to a normative tone in VINNOVA's message; effective innovation systems are obliged to organize themselves according to this rationale. The implication is obvious: VINNOVA seek to foster innovation systems to interact in specific patterns. Considering that the agency is the largest research funding body in Sweden, which identifies, prioritizes and funds research initiatives and innovation systems, it also exercises power in proclaiming the necessity of, for example, triple helix constellations.

Again, the triple helix idea clearly points to a reliance on creating specific organizational structures in advancing innovation. Explicit references to the concept are plentiful, and the model is taken as an unquestioned premise. But why is triple helix in particular deemed so important for innovation? The following excerpt provides an explanation of

the triple helix rationale and its contribution to transforming knowledge into innovations:

> In order to be able to turn new knowledge into innovations quickly, there must be effective interaction between the private and public organisations which produce, distribute and apply new technologies and other new forms of knowledge. Studies show that the majority of innovations are developed as a result of interaction between different actors. In order to create the right conditions for sustainable growth, it is essential that there is a high level of interaction above all between businesses, research bodies and political institutions. These three areas are generally referred to as the triple helix.
>
> Growth is ultimately a result of a competitive business community. The business community is heavily dependent on investments made and regulations imposed by public bodies. For this reason, effective interaction between private and public bodies is essential, in particular with regard to priorities, initiatives and regulations (VINNOVA Policy VP 2002:4, p. 6-7).

This text carries several assumptions on the importance of triple helix constellations and its causal relationship with innovation and economic growth. Still, little is offered in terms of explanations of why this is the case. Indeed, Etzkowitz and Leydesdorff's (2000) model has become increasingly popular. But there are few studies that actually point to how university-industry-state arrangements are drivers of growth. Yet, in VINNOVA's terminology, triple helix is portrayed in the light of some general truth that obtains in all innovation settings. In a sense, the model is adopted from the researchers who developed it and then repackaged into a recipe, or rather a script, for how innovation activities should be organized. Furthermore, in employing the triple helix model public organizations such as VINNOVA ascribe themselves important roles in innovation activities, recalling that the model reintroduces the state as one of the vital helices. In effect, by employing a triple helix perspective, organizations such as VINNOVA become constructed as necessary players. The triple helix model thereby fits their interests well. With this background, it can be argued that the triple helix model is thus used for legitimizing VINNOVA's existence; after all it is built upon "scientific discoveries" of how innovation takes place, irrespective of the fact that this can be questioned.

Discussion – translating, editing and inscribing theories into policy

In the previous chapter I showed how theories of innovation have been translated over the years, shifting from entrepreneurial theories, to company centric perspectives and to the increasingly common theories of inter-organizational innovation-producing arrangements of today. In this chapter, I have proceeded with describing how the theories of innovation have been translated into other objects and localities. Building on Czarniawska and Joerges' (1996) perspective that ideas are translated as they travel, I have illustrated how innovation theories and models have been made into innovation policy and agencies. This illustration began in Chapter 3 when I described how innovation perspectives have come to accentuate innovation-producing arrangements. These theories then gradually became part of the global innovation policy agenda, beginning at the OECD in the 1990s, where reports on innovation, policy documents and other guidelines on innovation systems and clusters were formulated as a step towards increasing economic growth. And this development is closely linked to the view that innovation occurs in particular types of innovation-producing arrangements. In fact, this chapter has specifically shown how theories like innovation systems and triple helix have become incorporated in the construction of innovation policy development. As we know from Chapter 3, Freeman first introduced the concept of national innovation systems in 1982 in an unpublished OECD report, and the theory was further developed in close interaction between academic work and policymaking, merging the two fields. As indicated earlier, Sharif's (2006) study of the emergence and development of the National Innovation Systems concept pointed to similar findings. He described how innovation systems researchers worked closely together with policymakers at for instance the OECD, sometimes as advisors or consultants.[41]

It follows that the theories of innovation-producing arrangements are collectively constructed. Economists did not simply observe phenomena that they analysed and reformulated into innovation theories, ready to be implemented by policymakers. Instead, they worked together with policymakers, and the theories were continuously constructed after their

41 At one point, Lundvall was even Deputy Director of the OECD's Directorate for Science, Technology and Innovation (DSTI).

publication in academic texts. This chapter has also pointed to how the theories were translated into other theoretical texts and particularly policy documents, as well as into an agency for innovation. This suggests that the theories of innovation-producing arrangements are not simply academic theories. As they are translated into policy documents and practices, widely spread around the world, they gradually become institutionalized and transform into generally accepted "folk theories" of how innovation is best furthered.[42]

In this chapter I have shown how theories of innovation-producing arrangements and the related innovation policies at the OECD and in Finland were imitated in Sweden. In doing this, however, the Swedish politicians and policy-makers altered and extended the scope of the policies, not least by forming an entire agency for innovation systems. The innovation systems theory, which already was becoming fashionable in international policy practice, was thus appropriated in forming a dedicated innovation systems agency. It can therefore be argued that the innovation system theories in particular have been translated, and thus transformed, into a basis for establishing an entire agency for innovation systems. But when comparing innovation policy documents from the OECD and VINNOVA, we find that the references to innovation systems theory are more explicit in the OECD documents. At VINNOVA the theories are quickly translated into the agency's own unique methods. They employed the theories of innovation producing-arrangements as if they were their own, and paid little heed to theoretical acknowledgements. Indeed, a policymaker at VINNOVA even suggested that they assumed an innovation systems approach, rather than following the innovation systems theories to the letter (Interview with policymaker at VINNOVA, 20080108). This suggests that VINNOVA does not dogmatically adhere to the theories; instead they edit them to fit their own interests, making them more general, removing details and specificities, in producing their own take on innovation systems. For example, VINNOVA made its own categorization of innovation systems, playing down the national level. The agency also appropriated parts of the triple helix model and used it to strengthen its

42 Take the notion of clusters for instance, many professional business people or government officials will have ideas of what this concerns, perhaps referring to Silicon Valley as an example. However, few of them are likely to have even glanced in for instance Porter's (1990) book "The competitive advantage of nations".

own role as well as a recipe for how innovation should be fostered. And as we shall see in the next chapter, VINNOVA builds heavily on theories in preparing their innovation programmes, and as such VINNOVA acts as idea-carrying organizations (cf. Czarniawska and Joerges, 1996:36) in advocating the necessity of, and promoting, innovation systems development.

Editing innovation theories

It is interesting to see how VINNOVA actually combines theories that are incompatible according to their originators, such as when mixing innovation system and triple helix. It follows that, when inscribing the theories into policy, VINNOVA (collectively) appropriates and adapts the theories so as to fit the desires and beliefs of the agency. And as the theories are translated into policy, they are also changed. This is a textual translation process to which I refer as editing (cf. Sahlin-Andersson, 1996), for reasons that will become clear.

VINNOVA certainly acknowledges that its ambition to strengthen growth is shared by many others, but as the excerpts in this chapter suggest, the agency claims that this is done in their own unique way. However, as the comparisons of earlier policy developments in other localities would suggest, it is not an entirely novel approach; VINNOVA has imitated innovation theories and polices that are deemed successful. But this does not mean that they are simply copied and implemented; VINNOVA's policymakers alter the theories, rearrange them, add to them, combine them, and reject parts of them, in writing their own policy texts. In that respect they edit the innovation theories. An illustration of this is found in VINNOVA's combining of features from theories of innovation systems and triple helix interaction into a new policy aimed at promoting innovation systems organized according to the triple helix model. Here the agency pays little attention to the fact that Etzkowitz and Leydesdorff (2000) developed their triple helix model as a critique of the innovation systems theories. Moreover, VINNOVA does not accentuate Etzkowitz and Leydesdorff's notion of hybridized networks. Instead, the agency appropriates the part that points to the necessity of interaction among the three helices of academia, industry and state. And by employing the triple helix model, VINNOVA furthermore constructs a role for itself as an

important actor; the model clearly illustrates that government organizations have a central role in stimulating new innovation constellations. Due to the general acceptance of the research and theories of innovation, as well as its widespread use in innovation policy, VINNOVA actually legitimizes (cf. Meyer and Rowan, 1977; DiMaggio and Powell, 1983/1991) its very existence and activities by using the theories in its policy documents. By referring to, and building its activities around, the innovation systems, cluster, and triple helix concepts, VINNOVA justifies its role.

There are yet other instances indicating how the innovation systems theory was edited. For example, the early work at the OECD and in Finland focused on national innovation systems, while VINNOVA suggested that a country could have several innovation systems, more or less independent of one another. VINNOVA clearly builds on the OECD's and Finland's use of the national concept, but renamed it as *effective innovation systems*. In addition, this also stands in contrast to Finland, for example, where the term *national innovation system* continues to be the one used (Miettinen, 2002). The difference might seem of little importance, but nevertheless bears some relevance, particularly since VINNOVA has chosen to focus on regional aspects of innovation systems. Indeed, as we know from the first chapter, the Swedish Minister of Infrastructure had just launched a Regional Growth Programme, and there is no mistaking the linkages between these two policy initiatives. This is interesting because it points to how VINNOVA edits the theories of innovation-producing arrangements for a better fit with other Swedish economic policies and programmes. Moreover, VINNOVA also combines the development of innovation systems with its past role of funding what is referred to as needs oriented research.

Apart from actually translating theories into an agency, much of the activity of designing innovation policy involves the editing of texts. As theories of innovation-producing arrangements are reformulated in the light of local desires and beliefs, they are edited into normative policy instruments for stimulating innovation and growth in Sweden. This editing is characterized by policy-makers' combining and mixing of ingredients, such as innovation systems, applied research, and the triple helix imperative, in preparing a local recipe for innovation. And these recipes constitute scripts for how innovation is supposed to be furthered, often

expressed textually in policy documents such as the ones quoted in this chapter.

Inscribing fashionable innovation scripts

Since these increasingly popular innovation ideas are presented as new ways of stimulating innovation, as opposed to traditional linear perspectives, they can be understood in the light of fashion. Indeed, as Abrahamson (1991; 1996) suggested, swings in the popularity of management techniques, governed by management norms of rationality and progress, constitute both the process and outcome of fashions. And as I have pointed out in this chapter, innovation systems as a policy tool, originally developed at the OECD, have indeed become increasingly popular. These policy tools have been imitated across the globe, and seem to emerge in more and more localities, Finland and Sweden being two examples.

But why is fashion relevant for explaining this? Writing on the travel of global ideas, Czarniawska and Sevón (2005) suggested that:

> …guided by fashion, people imitate desires or beliefs that appear as attractive at a given time and place. This leads them to translating ideas, objects, and practices, for their own use. This translation changes what is translated and those who translate it (Czarniawska and Sevón, 2005: 10).

In this chapter we have indeed seen how fashionable theories of innovation-producing arrangements and policies have been imitated and translated into new policies, agencies and innovation furthering activities. What were deemed to be relevant theories and useful policies have thus been translated into other objects and actions in different places. In Sweden, new policies were written and a new research organization called the agency for innovation systems was established. And in the process, academic and policy texts were edited by being combined, altered and rearranged into new policy texts at VINNOVA.

So why do they do this? Well, it seems to be that the theories and policies are thought of as instruments for innovation; the policymakers at VINNOVA for example have a desire for growth, and believe that innovation is what gets you there. And in achieving this they imitate what

is believed to be successful innovation policy, which in turn is edited from theories of innovation-producing arrangements.

One aspect that allows these theories and policies to travel is the fact that they are objectified as texts and models, appearing in academic publications and policy documents. Indeed, as Czarniawska and Joerges argued: "the simplest way of objectifying ideas is turning them into linguistic artefacts" (1996: 32).[43] And this is what has happened in the field of innovation economics and the innovation policy movement. Here the innovation theories are translated by being edited and inscribed (cf. Latour and Woolgar, 1979/1986) into policy documents; VINNOVA collectively "writes" innovation systems and triple helix ideas into innovation policies.

Now, although we have examined the official accounts of innovation, systems, and VINNOVA's role in this, we have only dug up a host of ideas on how innovation occurs and the need for supporting these phenomena. VINNOVA's role is to act as gardeners of innovation, cultivating innovation so that the nation will bloom. But relatively little is said about how the agency is actually supposed to further innovation and growth, leaving the descriptions of innovation activity and its determinants fairly abstracted. So what does VINNOVA do? One of its chief tasks is to administer programmes for innovation systems, thereby inscribing how innovation should be furthered. We will now turn to examining two such programmes, which are closely related to the MWR initiative, to learn more about how the theories of innovation-producing arrangements are inscribed and prescribed as scripts for how to further innovation.

43 This argument refers to Czarniawska's earlier work (1990) on linguistic artefacts at the service of organizational control.

CHAPTER 5

Preparing local innovation scripts

In 2002 and 2003, three governmental agencies in Sweden began putting the systems, clusters, and triple helix theories into practice by launching two programmes for regional innovation. In so doing they prepared local scripts for how regional innovation initiatives should be organized. The plan was to develop and support innovation systems and clusters.

VINNOVA assumed its new research-funding role by initiating a competition for regional innovation systems, called VINNVÄXT, in 2002. A year later, the agency also co-founded the so-called National Programme for Clusters and Innovation Systems, referred to as VISANU, together with the *Invest in Sweden Agency* (ISA) and the *Swedish Agency for Economic and Regional Growth* (Nutek). Put together, these two programmes reflect how theories of clusters and innovation systems, as well as the triple helix model, have been translated into policy programmes for developing collaborative innovation initiatives. These theories would indeed be seen as incompatible by many of their academic originators, and I am well aware that they differ in some respects. Nevertheless, they can still be categorized as theories of innovation-producing arrangements, simply because of their focus on inter-organizational relations. The point is that policy-makers at VINNOVA and the VISANU programme combine and rearrange the theories when translating and inscribing them as their own, new, local innovation scripts. As I will argue, they edit the theories in preparing scripts. The programmes are indeed similar in their focus on how innovation is furthered, but they are different in that VINNVÄXT focuses

on regional innovation systems, while VISANU combines clusters and innovation systems perspectives in promoting regional innovation. Still, both programmes concern attempts to guide the development of innovation initiatives. This can be seen in the light of attempts to *programme* innovation action by *prescribing scripts* for how innovation initiatives should be organized.

In this chapter I will scrutinize these two programmes for regional innovation systems and clusters in particular. The reason for this is that they provide a richer picture of how the theories of innovation producing arrangements are translated into policy practice and edited as innovation scripts. Moreover, they are particularly relevant as they are closely related to what is done in the MWR initiative. This chapter thus continues to answer the first research question, namely how innovation theories and models are employed in Swedish innovation policy and programmes.

First I will investigate VINNOVA's VINNVÄXT programme and the VISANU programme, primarily by examining textual documents. In order to widen the fieldwork material, I will then turn to investigating policy practice related to the VISANU programme. This is done by studying policy activities, a kick-off meeting and a cluster management training workshop, which can be seen as preparing and promoting the combinatory VISANU programme and its innovation script.

VINNVÄXT – a competition on innovation

VINNOVA assumed its new research-funding role in 2001 and announced its programme for regional innovation systems in 2002. The full name of the programme was "Growth in regions through dynamic innovation systems", but later on it became known as VINNVÄXT.[44] The VINNVÄXT programme was designed as a competition, where contributions from initiatives to develop so-called regional innovation systems would compete for funding to further innovation. The initiatives deemed as having most innovative capacity were singled out as winners and were financially supported to enhance their capability of generating innovations. The aim was to improve Sweden's international competitiveness and thereby its

44 An English translation of VINNVÄXT can be *Win-growth*, which also alludes to the competition element of the programme.

ability to generate economic growth and prosperity. The rationale in the programme clearly resembles the arguments used in the establishment of VINNOVA, including those regarding the necessity for taking a systems and triple helix perspective on innovation, although the emphasis on regional development is more explicit in VINNVÄXT:

> Innovation systems are systems consisting of links and support structures that facilitate the path from idea to commercial products. It is these systems that VINNOVA intends to support at the regional level in this programme. Experience and research show that geographic proximity and density bring competitive advantages as regards collaboration, learning, access to competence and collaboration in development and business exploitation. Regions that realise this, and have the ability to renew themselves, can consciously develop their competitive advantages. Increased growth and international competitiveness in the regions thus contribute to the global growth level in the country. /…/ The aim of the programme is to achieve efficient collaboration in each region between companies, research, and politicians and public organizations (triple helix) (VINNVÄXT - VINNOVA Fact leaflet, May 2005).

Geographical proximity and local collaboration are presented as key for enhancing competitiveness and growth. Explicit references to academic work on innovation-producing arrangements are scarce, but it is clear that VINNVÄXT builds on the theories of innovation systems, competitiveness, and regional and triple helix collaboration. Further tracing of such innovation programme texts, often including policy documents, leads directly to studies on innovation systems, competitive advantage, triple helix, and so forth, as outlined in Chapter 3. VINNVÄXT has no explicit link to clusters, but its emphasis on regional interaction between organizations has clear similarities with this. Again, these references to innovation theories and research accentuate the academia/policy interface, also providing the programme with legitimacy.

The first VINNVÄXT programme invitation was published in January 2002. It followed the by now familiar views of innovations and growth, albeit with the added emphasis on regions. The motive for the regional complement is put straightforwardly: "(g)rowth takes place in new or existing companies, all of which are situated in a region" (VINNVÄXT

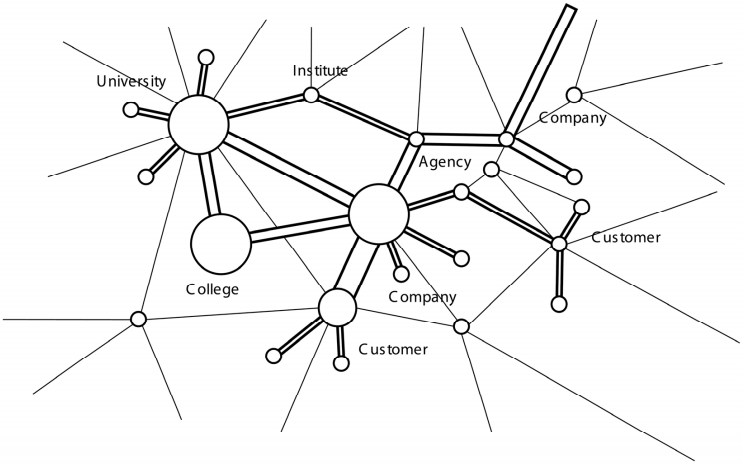
Invitation – short programme description, 2002), which forthrightly claims to legitimize VINNOVA's focus on innovation and growth in regions in particular. According to the programme description, international competitiveness of these regional innovation systems can only be achieved through building high international standards of research and development, effective learning between competencies and organizations, and investments in infrastructure by all three parties in the triple helix (ibid.).

The competition form, according to VINNOVA, was chosen to attain mobilization and collaboration in regions. In a later interview with the VINNVÄXT programme secretary, it became clear that this design was imitated from what was regarded as successful programme initiatives in Germany. Initially, so-called idea sketches were requested, which if successful received a financial contribution for development of a full proposal for a regional innovation systems initiative. The winning proposals, between 5-10 in number, were promised between 200 000 – 1 million Euro per year for developing regional innovation systems. The selection criteria included aspects such as "the largest growth potentials" and "the highest standards of international competitiveness", not surprising given VINNOVA's general ambition. However, when examining these early VINNVÄXT documents I was struck by the difficulty to understand what it was that constituted these regional innovation systems. In a more detailed guide on how to apply to the first VINNVÄXT round, VINNOVA identifies possible actors that can apply for the programme, provided that they live up to its purpose and goals. Examples included: company networks; colleges, universities and research institutes; county administrative boards or other regional organizations (such as Region West Götaland or Business Region Göteborg) and municipalities; organizations working with higher education's third assignment (i.e. societal contacts in addition to education and research); and regional technology and development centres. And those who apply for the programme are made aware that it requires building strong leadership and anchorage in all triple helix spheres. This implies that the innovation systems initiatives were supposed to be hosted and represented by organizations or groups of organizations, possibly speaking for a specific industry or technology. Apart from financial contributions to the winning proposals, VINNOVA also supported and co-financed activities such as triple helix-led

development, co-financing future technology scenarios, project leadership, strategy development, engagement of expert competence on learning and network organization and leadership, as well as developing the necessary conditions for learning and innovation.

When contemplating these types of potential actors and activities suggested for innovation systems development, it becomes clear that much attention is placed on organizational groups and networks, or on triple helix interactions, which indeed build on theories of innovation-producing arrangements. Having said that, in the official programme announcement, VINNOVA states that there is no standard solution for how successful regional innovation systems are build: "this is simply not possible, as different regions have in many ways different prerequisites" (VP: 2002:3, p 3). However, this is somewhat paradoxical, as the programme communicates the necessity for a systems perspective on innovation, the importance of geographical proximity and organizational networks, and particularly triple helix interaction, which are all prescribed as prerequisites for being funded.

Even illustrations in the VINNVÄXT invitation demonstrate the evolution of a dynamic network with triple helix actors. The evolution starts with the common gain from interplay between universities, institutes, companies, agencies and customers, moving to deepened knowledge exchange and transformation, as well as progressively broadened network ties. Taken together, such interactions between actors are portrayed as resulting in strong innovation systems with a living infrastructure (VP: 2002:3, p 6-7):



An illustration of an evolved strong innovation system (VP: 2002:3, pp 6-7, my translation).

The illustration above clearly highlights how different types of actors are interlinked in an innovation system. Organizations are represented as nodes in a structural network, tied together with links. This indicates how ideas of systems and networks are blended in their depiction of innovation constellations. The illustration clearly points to which type of actors an innovation system entails. One conclusion that can be drawn from this is that even if VINNOVA might not push for a standard innovation systems recipe, the agency certainly communicates the desired ingredients.

Three VINNVÄXT competitions have been arranged to date. The first round in 2002 began with an invitation to submit idea-sketches. VINNOVA received 159 such sketches, out of which 25 received so-called planning funding of 50.000 Euro to develop a full VINNVÄXT application. In total, the first VINNVÄXT round received 53 full applications from innovation initiatives. Three of these were appointed winners and were each granted up to about one million Euros per year for 10 years to pursue their so-called growth schemes. In addition, each of the regions would contribute an equal amount of capital in matching financing (VINNVÄXT - VINNOVA Fact leaflet, 2005). A successful VINNVÄXT initiative could hence potentially

receive as much as 22 million Euros over the course of 10 years. In addition, seven of the losing initiatives were given so-called 7-up financing of 150.000 Euros to develop their promising but not fully laudable initiatives. The second VINNVÄXT round in 2004 received 23 applications, of which five were funded. The setup was similar to the 2002 competition, although the winning initiatives received somewhat less, about 600 000 Euros each per year for 10 years.[45] The third and last VINNVÄXT announcement in 2005, which is still not complete at the time of writing, focused on innovation systems initiatives that were in their early development phase. Here VINNOVA received 83 applications, and 10 of these were given about 10.000 Euros in planning funding. In total, the 2005 competition received 26 full applications, of which five were appointed winners and given about 200.000 per year each, plus matching financing. These winners are now going through a second evaluation phase where two initiatives will be selected for continued financing (www.vinnova.se, 2008).

The first VINNVÄXT competition in 2002 is of most relevance for this study and the MWR initiative, which is why I have chosen to focus on this in particular. In total, the entire VINNVÄXT budget for the 2002 competition amounted to Euro 61 million and VINNOVA's overall yearly budget is about Euro 140 million. This suggests that the development of innovation systems constituted a large part of VINNOVA's undertakings. The VINNVÄXT competition encouraged regional innovation systems initiatives to submit applications for support. Perhaps it is necessary to re-emphasise here that the initiatives might or might not be actual innovation systems, but this is of lesser importance than the fact that they are presented as such. Indeed, it is actually VINNOVA that decides what constitutes a suitable candidate, i.e. constructed as an innovation system initiative, and what is not.

In summary, VINNOVA assumed its new research-funding role by arranging competitions for regional innovation systems, launching the

45 Examples of winning initiatives in the 2002 competition include *UppsalaBIO*, focusing on the Uppsala and Stockholm regions' life-science industry, and the *Robot Valley*, focusing on robotics in Mälardalen in the middle of Sweden. In 2003, the winners included *Triple Steelix,* specializing in steel manufacturing related activities in Bergslagen in the middle of Sweden, and an initiative called *Biotechnology developments in the west of Sweden,* which goes under the name *Göteborg BIO* today, directed towards developments in cardio-vascular metabolism and biomaterials.

VINNVÄXT programme. The regional turn focused on geographical proximity of actors and organizational networks within a specific area that constituted an innovation system. In preparing this regional innovation systems programme, VINNOVA and its policymakers clearly build on the theories of innovation-producing arrangements. Here, theories of innovation systems and triple helix were translated into the programme, taking the new form of scripts for how innovation initiatives should be organized. In effect, the VINNVÄXT programme constituted a tool for furthering VINNOVA's innovation policy agenda as described in the previous chapter.

The voice of an innovation systems editor and scribe

Having perused official documents of the VINNVÄXT programme, let us now turn to consider the views of a representative for the VINNVÄXT programme. In January 2008 I interviewed the secretary for the VINNVÄXT programme to obtain a broader, albeit retrospective, account of VINNOVA's VINNVÄXT initiative. He described himself as the person "holding the pen", but added that he was part of a wider group of policymakers at VINNOVA who worked together in designing the programme. And as a secretary, he could be described as a *scribe*, or an official writer, who participated in preparing a local innovation script. And as such, he also acted as an editor in that he used theories of innovation systems and triple helix, as well as experiences from other innovation policy programmes, in inscribing VINNOVA's own innovation script.

According to the secretary, they acquired inspiration from innovation programme initiatives in Germany, and it was from this country's policies that they imitated the competition form. The idea behind the competition was that it would generate added value on a broad front, as both winners and losers in the programme would mobilize actors. So even if only eight of hundreds of applications were funded, VINNVÄXT would still have made an impact by encouraging the development of innovation initiatives, many of which applied to all VINNVÄXT competitions and still exist despite not having received funding from VINNOVA. In the words of the VINNVÄXT secretary, the competitions stimulated innovation systems development on a much wider plane, not limited to those initiatives that were funded.

In evaluating the innovation applications, a triple helix panel was set up, concentrating on the growth potential, triple helix leadership, research strength and development potential. He also acknowledged that the panel groups, representing public organizations, academia and industry, fought for their individual perspectives and their favourite applications in the evaluation process. This was indeed their task, the secretary added, and it was entirely legitimate. Nevertheless, it points to the centrality of the theories of innovation producing arrangements, such as triple helix, and how this influences the design of the programme and its evaluating board. This also means that the theories are edited and rewritten as both instructions and evaluation criteria.

Parallel to the development of VINNVÄXT, a similar programme focusing on innovation systems *and* clusters was launched in Sweden. The new programme was called VISANU, and this time around three different agencies joined forces in promoting innovation. This was also important, according to the VINVÄXT secretary, since it provided an alternative source of funding for the rejected initiatives. As we shall see, both these programmes were closely related to the MWR initiative and are particularly interesting inasmuch as they prescribed guidelines for how to work with innovation.

VISANU – a combinatory innovation programme

In February 2002, the Swedish government gave VINNOVA, the *Invest in Sweden Agency* (ISA) and *The Swedish Agency for Economic Regional Growth* (Nutek) the task of developing a programme proposal concerning regional development and offsetting regional differences in Sweden (Regeringsbeslut, N2002/85/RUT, 2002.09.12). ISA has the government assignment to market Swedish competencies in attracting foreign investments to Sweden. Nutek's task is to stimulate business development and regional growth. And according to a government press release in March 2002, the rationale for the programme was to further strengthen regional politics that the Swedish Parliament had decided upon in 2001 (see prop. 2001/02:4, bet. 2001/01:NU4, rskr. 2001/02:118). The programme,

which later became known as VISANU[46], focused on regional innovation initiatives and departed from the so-called Regional Growth Programmes in Sweden. Regional innovation initiatives were indeed prioritized by the Swedish government, which was emphasised by the infrastructure minister at the time, Ulrica Messing, as introduced in Chapter 1.

It follows that VISANU was formed in line with the proposal from the three agencies in January 2003, and was granted a budget of SEK 70 million (about 7 million Euro) from the government, stretching between January 2003 and December 2005. The programme was, similarly to VINNVÄXT, designed as a competition to which innovation initiatives could submit applications for funding. The full name of the VISANU programme was "A national programme for developing innovation systems and clusters", something which also epitomizes its chief task. VISANU too highlighted the necessity for developing systems, as well as clusters, which were organized according to triple helix logic. We know how VINNOVA sees innovation systems, but what is a cluster in VISANU's terminology? The following provides an answer:

> Within VISANU clusters are seen as geographical concentrations of related companies and actors that are discerned by mutual need and influence on each other, without direct demands on interplay with research and other knowledge environments (The cluster concept – A deepened definition, www.nutek.se, 2005.12.14, my translation).

According to such a definition, clusters seem to primarily concern local agglomerations of companies that are related to one another. A cluster has hence no requirements of triple helix interaction among companies, research institutions and public organizations. However, other VISANU texts introduced the innovation systems theories, as well as stressing triple helix interaction as playing an important role in innovation activities:

46 The name VISANU was made up by composite letters of its three host agencies, where V-ISA-NU represented VINNOVA, ISA and Nutek, indicating that it was a joint programme. This could be read as "Visa nu" or "Show-now" in English

> Within a regional innovation system the interplay between actors of different character occurs. A model for describing this is the so-called triple helix model, which builds on active participation and interplay between regional actors within research, politics and business in all its forms (www.visanu.se, 2004).

In fact, the triple helix model is so important that "a developed and functional triple helix" stands out as a specific criterion for initiatives to become funded by the VISANU programme (www.visanu.se, 2004 – The Triple Helix Model). Having said that, it appears as if VISANU is dictating these conditions somewhat less forcefully as compared to VINNVÄXT, opening up for a looser linkage to the innovation theories.

Other descriptions of clusters on VISANU's website suggested that the core in the cluster concept concerns a "geographically delineated system of actors which creates value", where the development of products and services is said to occur in relationships with customers, suppliers and competitors. This implies that clusters, in VISANU's terminology, could be viewed as a system with clearer geographic demarcations. Still, much of the textual material from VISANU, let alone its full name, "A national programme for developing innovation systems and clusters", suggest that systems and clusters are used more or less interchangeably in this innovation programme.

The VISANU programme thus builds on combining ideas of clusters, systems and triple helix in its attempt to further innovation. The three concepts have similarities in that each focuses interaction in geographical regions and the necessity of collaboration in furthering economic growth. Clusters and innovation systems become the tools with which the government and its agencies seek to stimulate regional growth. What is more is that the concepts are further bound together by Porter's (1990) theories of competitiveness and clusters, as well as by adopting what is referred to as a "systems view" as well as a "network perspective". The textual VISANU documents make explicit reference to for instance Porter's (1990) work in its deepened cluster definition. Indeed, VISANU's definition of clusters is more or less identical to Porter's, who referred to clusters as: "geographic concentrations of interconnected companies and institutions in a particular field" (1998: 78). What is more, the VISANU programme also makes clear references to the innovation systems policies at the OECD. It is

apparent that the VISANU programme has translated both innovation systems and clusters as its key building stones in furthering innovation. However, triple helix was a relatively late addition to the programme.

In the first VISANU programme proposal, published in June 2002, there was no mentioning of triple helix. Nevertheless, by the time of the launch in 2003, a triple helix component was added and strongly emphasised in VISANU. Why was this so? VISANU's official reason for focusing on innovation systems, triple helix, and clusters together, was that they represented two logics of the participating agencies in the joint programme (ISA, Nutek, VINNOVA: Proposal for a programme for innovation systems and clusters, 2002). It follows that VINNOVA makes use of the innovation system theory and the triple helix model, whereas Nutek and ISA employ the cluster theory. The result is a compromise of all three:

> The proposed programme should support development of clusters and innovation systems in regions. These concepts have emerged in different scientific domains and have subsequently been spread successfully within economic policies.
> For this programme we do not find it fruitful to make any strict academic differentiation between the concepts, but seek to unite them when it comes to turning them into practical actions. The agencies have from their respective agency assignments different roles and different focuses with their activities that also are mirrored in how they practically have come to interpret the concepts. In this programme the point is that these will complement each other in the common task of furthering sustainable growth in regions (ISA, Nutek, VINNOVA: Förslag till Program för innovationssystem och kluster, 2002: 4, my translation).

So combining and blending the innovation theories rests on pragmatic grounds: accommodating the desires and beliefs of people at the three agencies. Moreover, as I concluded in Chapter 3, all three perspectives are linked in their emphasis on the importance of systemic and networked interaction between organizations in producing innovations, something which is evident in the VINNVÄXT and VISANU programme texts as well.

The term *cluster* was both Nutek's and ISA's contribution to the programme, on top of VINNOVA's systems and triple helix. In fact, Nutek seems to be the agency that is most central to the new programme. When examining the official government decision to form VISANU

(N2002/85/RUT), we can read that although the programme was a joint initiative, its SEK 70 million (about 7 million Euro) budget was allotted to Nutek, who in collaboration with VINNOVA and ISA directed the allocation of funds. In that respect, VISANU was more Nutek's and ISA's programme, whilst VINNVÄXT was VINNOVA's. An exemplification of this is that the majority of the VISANU meetings where hosted by Nutek. This has also been reinforced by people I have encountered in the field, such as by policymakers at VINNOVA.[47]

It can thus be argued that, similarly to VINNOVA's VINNVÄXT programme, VISANU is yet another example of how theories of innovation-producing arrangements are translated into innovation policy. Both programmes portray innovation as key in producing growth and that this can be furthered through the development of innovation systems, as well as through clusters. This translation process exemplifies how innovation theories are edited, that is how they are combined and rearranged to fit a purpose, as they are inscribed into innovation programmes and new policy texts. This is a central point for the argument of this thesis, and I will return to this issue in due course.

The VISANU programme texts acknowledge that clusters and innovation systems can emerge without active efforts to develop them. Nevertheless, the programme still aims at supporting and developing "structured initiatives where actors from different sectors collaborate for increased international competitiveness and sustainable growth" (VISANU, 2005, my translation). These descriptions are particularly interesting in their idealizing tone, providing a rather romantic picture of how innovation is best furthered. Akin to the VINNVÄXT programme, VISANU documents are laden with optimistic descriptions of the benefits and characteristics of innovation systems and clusters, and how it is possible to develop such constellations. In actual fact, these ideas and theories of how innovation is produced form guidelines for how innovation initiatives that are supported by the two programmes should be organized, particularly concerning the development of inter-organizational networks. More precisely put, they constitute scripts that are prescribed by the innovation programmes. And

47 Moreover, when VISANU came to an end in December 2006, Nutek announced that it was launching a new *Regional cluster development programme*, which builds on the VISANU programme. Nutek's website is also the place where all VISANU documentations are hosted today (see www.Nutek.se/sb/d/725/a/2779).

these scripts have to be performed in order for an innovation initiative to receive funding.

So far the investigation of the VINNVÄXT and VISANU programmes has primarily involved attending to textual documents describing takes on innovation and its stimulation. But what happens in practice? The next section studies the VISANU programme's more elaborate activities, before turning to the programmes' relationships with the MWR initiative in the following chapter.

Programme activities

VISANU's central features were to engage in what was referred to as *process support*, *knowledge development* and *international marketin*g of innovation systems and cluster initiatives (www.visanu.se, 2005). The process support was particularly aimed toward efforts at furthering cluster and innovation systems development. This was claimed to be done by "mobilization of regional actors and resources, departing from the region's needs and priorities" (ibid.). The intention of process support was also to develop competence and abilities for managing innovation systems and clusters so as to increase international competitiveness, and for this VISANU had training programmes. The process support activities also included promoting company co-operation and guiding process leadership (i.e. the management of the cluster initiatives) of the innovation initiatives.

In order to be eligible for process support funding from VISANU, the competing initiatives had to be anchored in the Regional Growth Programmes, as well as being driven by companies' interests. Similarly to VINNVÄXT, all initiatives that received funding from VISANU required 50% additional co-financing by the relevant regional government authority. The process support activities are of most interest for the unfolding of this story. But it is worth mentioning that VISANU also had two other activities: knowledge development and international marketing. Knowledge development entailed utilizing regional experiences and spreading them nationally to other innovation systems, clusters, regions, government agencies and departments. The international marketing activity was aimed towards marketing Sweden's strength areas in order to attract foreign investments and competence to the Swedish regions.

Interestingly, the descriptions of VISANU's programme activities were the first that actually touched on how innovation system and cluster development should be supported, and its activities appear to be more elaborate than those in the VINNVÄXT programme. Nevertheless, the activities are still rather general in their encouraging of meeting arenas for involved actors, financing process leaders, spreading knowledge and experiences, as well as marketing the cluster initiatives. Both programmes still appeared rather vague, and since I was interested in understanding what it was that the innovation programmes prescribed in more detail I consequently proceeded with observing two VISNAU activities directly; the programme kick-off and a cluster training workshop. The following thus provides a more "thick description" of policy practice, contextualizing the textually inscribed innovation scripts.

A revivalist meeting

VISANU's kick-off meeting for the new national programme for innovation systems and clusters took place in February 2003. The meeting was held at a hotel nearby Arlanda airport outside Stockholm to allow for easy access for people arriving from distant parts of Sweden. And the participants did come from afar; over 100 people were there, most of whom represented various regional administrative organizations throughout the country. Delegates came from other government agencies and academic institutions, but few industry representatives were present.

The meeting was opened by one of the programme leaders, who suggested that previous development initiatives had been fragmented, with little coordination between regional and national levels. But the new national innovation systems and cluster programme VISANU was to remedy just that. This was followed by presentations and panel debates on the importance of creating sustainable economic growth in regional systems, as well as through spreading the ideas of clusters and innovation systems. The programme leaders also spoke of economic theories of the past as focusing on separate companies, whereas the new views presented ideas of simultaneous collaboration and competition. In furthering this cause, VISANU was a change programme, aimed at altering mindsets in both business and public organizations. Collaboration among the three programme hosts VINNOVA, Nutek and ISA was promised, and the

participants at the kick-off were encouraged to act as spokespersons for innovation systems and clusters in their respective home regions. This was accompanied by presentations of a cluster example on geographic information systems, as well as outlines of the VISANU programme's activities in process support, knowledge development and international marketing of innovation systems and clusters. Still, attention was primarily placed on clusters and not innovation systems during the meeting, something which also was reflected in the VISANU documentation.

Some critical voices were raised however, mainly by academics questioning the possibilities of actually creating clusters, let alone controlling them. One researcher even commented that "all structuring is really wrong structuring". A person from VISANU replied to this by suggesting that the public organizations cannot create clusters, but they can eliminate problems and create opportunities. However, as repeatedly shown in the textual documents, both VINNOVA and VISANU describe themselves as actually developing and supporting innovation systems and clusters with their programme tools.

As the meeting was wrapped up, the general director for VINNVOA surprised the participants by announcing that they were about to hear from the cluster guru Michael Porter himself, via a telephone link that was broadcasted to the auditorium. There was a murmur of awe in the audience as this grand finale was announced. This was a clear signal from the VISANU administration that the programme had serious ambitions with regards to cluster development. After all, to many Michael Porter is a respected figure in fields of strategy and competition, well known to business practitioners, policymakers and academics alike. Undeniably, he is also commonly recognized as the originator of the cluster concept and the ideas of competitive advantage. During the conversation, Porter spoke about cluster development in Sweden, referring to a large study he was undertaking. He pointed to natural and well-developed Swedish clusters in automotives and IT, although suggesting that Sweden was a little behind in formal creation of clusters in comparison with for example Finland, the Netherlands and the US. In terms of advice for Sweden and those working with these issues, he explained that the notion of clusters is broad, that there are many forms of collaboration, coming to the conclusion that clusters and innovation systems are in fact the same. He also said that firms must understand this and that clusters are more than merely network

relations; they encompass skills, R&D, competence, asset creation and so on. Porter then went on to suggest that "all three groups have important roles", by which I assume he is referring to the triple helix actors. However, he also added that "government should not control, nor universities; they should listen. It is the firms that are most important." He continued by saying that institutions other than the previous three also play important roles, suggesting that trade unions and chambers of commerce are increasingly active. In so doing, he expressed some criticism of the triple helix perspective, which I presume he knew formed a central part of the Swedish innovation policies. On a final note, except for making sure to announce his upcoming Sweden visit at a conference the next autumn, Porter explained that "(g)overnment programmes can, perhaps, start momentum but not create clusters". This is somewhat contrary to his earlier comments, but what I think he refers to is that government programmes must not try to control the development of clusters too much. Instead, he suggested that it is important to create the right supporting environment, adding that the process will take time.

As a matter of fact, many texts from the government agencies involved in VISANU correspond to the view communicated by Porter. Nevertheless, despite acknowledging that innovation systems and cluster initiatives can be developed without organized support, the agencies chose to endorse what they call structured initiatives "where actors from various sectors collaborate for increased international competitiveness and sustainable growth" (VISANU Report: Att Växa Tillsammans, 2005, my translation). Again, it is the "feeding hands" who decide on what is structured or not, and which initiatives sufficiently answer to the ideals of clusters, innovation systems and triple helix constellations.

Cluster training – collaborate or die!

In addition to VISANU's three activities of process support, knowledge development and international marketing, the programme secretariat also arranged seminars and workshops on the theme of developing clusters and innovation systems. These seminars were to provide more concrete advice on how to develop clusters. I attended one of these workshops in spring 2004, called "The force in creative clusters". The workshop had 22 participants, who typically came from economic development departments

in municipalities and counties, often from remote parts of Sweden. Overall, there were few representatives from industry and universities, similarly to the VISANU kick-off event a year earlier. This is curious, as it exemplifies how such policy practices seem to lack the involvement of industry representatives. Indeed the triple helix script prescribes the necessity of participation from all spheres of industry, academia and state. And the absence of industry representatives is potentially awkward as they are the ones who are supposed to drive the development of innovations.

After talking to some of the participants during the morning coffee at the workshop, I gathered that most participants worked with cluster related issues in one way or another and that they sought hands-on techniques for cluster development. A cluster consultant from New Zealand had been hired to teach and discuss tools and models for managing clusters. He built his rather persuasive arguments on practical examples and relied heavily on Porter's (1990, 1998) cluster theories. As his PowerPoint slides suggested, the message to the participants at the workshop was clear: "collaborate or die!" (Cluster consultant, 2004).

The consultant continued his descriptions of clusters by providing examples of company concentrations and interaction across the world, suggesting that clusters are no new invention; they have been around for a long time. Not surprisingly, *Silicon Valley* in California was brought up as a successful example, as often happens in the innovation discourse. He then went on to the main part of the workshop, namely to interactively discuss cluster development processes. The workshop and the teaching material build on the consultant's cluster development model, which was broken down into five phases and 12 steps:

Cluster Development stages and steps (Source: Cluster Navigators: Cluster Manual, 2004)

Stages	Steps
1. Mustering Support	1. Introducing the relevance of a clustering approach 2. Identifying and prioritising local clusters
2. Building the Base	3. Initial cluster analysis 4. Building the leadership group
3. Creating Momentum	5. Establishing the preferred future 6. Identifying the stepping stones 7. Immediate action agenda
4. Extending the Base	8. Launching the clustering initiative 9. Formalising the cluster
5. Sustaining Momentum	10. Upgrading the strategic agenda 11. Process review 12. Linking the cluster

The model clearly follows a step-by-step procedure, beginning with identification, prioritization, and analysis. This is followed by leadership group formation and outline of activities to be launched, formalized and extended. In other words, cluster development is depicted as a process starting with information gathering and analysis of actions, followed by implementation and review, comparable to classical linear strategy development processes. Moreover, the phases are interestingly characterized as "mustering support, building and extending a base" as well as "creating and sustaining momentum". This follows what March (1994) would call the logic of consequence, where actions are chosen on the basis of rational procedures in which action alternatives are evaluated on the basis of expectations for their future effects. In this case, the expected future consequences are innovative clusters, which the steps are believed to result in. In a sense, this table represents a recipe for how clusters are developed, representing a set of sequential actions in a rational process. And as such, the steps exemplify an innovation script that innovation

initiatives were supposed to follow in developing and strengthening innovation systems and clusters.

Much emphasis was placed on departing from existing competencies, i.e. what one is good at, be it producing aluminium in Sweden or textiles in Italy, and then trying to establish links with other firms and government organizations. The so-called cluster facilitator (sometimes referred to as process leader) was also introduced as playing a vital role in cluster development. This is the person who is supposed to work with facilitating inter-linkages between companies, academic institutions and public organizations, acting as a form of cluster manager.

During the workshop, the participants were rather quiet at first, asking only a few questions regarding the cluster tools' applicability to the Swedish context. The interactive dialogue became more of a lecture, and the participants appeared to buy the consultant's arguments and his promoting of clusters. I made an attempt to contribute to the discussion by raising some reflexive and problematizing issues with regards to the claims that effectively were preached. However, the consultant quickly dodged my questions, and most of the participants seemed reluctant to pick up such a discussion. Having said that, later that evening I ended up in a bar with a few of the participants from the workshop, and some of them were joking about the day's seminar, playing down any omnipotent innovation scripts. One man even picked up a guitar and started composing a song based on Evert Taube's "Änglamark" (Angel-land) melody, singing and playing: "Call it clusters or innovation systems if you want... [followed by laughter]".[48] And perhaps this kind of irony is a natural way of distancing oneself from idealised and dominant concepts and ideas that become fashionable and spread across the globe. Nevertheless, during the day, the participants seemed motivated to learn what this cluster thing was all about, as well as finding tools for their regional development tasks at their respective organizations.

This workshop epitomizes how innovation scripts, such as the above tools for cluster development, are presented as successful models and recipes for innovation. It is almost as if they are attributed with a religious dimension by their prophets and their preaching — promising absolution

48 Taube's song "Änglamark", translating as Angel-land, goes: "Call it angel-land or heaven-earth if you want, the earth that we inherited..." It is a folksong about the necessity for taking care of the environment and making sure that it is not destroyed.

and salvation in contributing to a better world. And in order to receive support from the innovation systems and cluster programmes, one has to confess one's faith and become a fellow believer in systematizing innovation. Still, people present at workshops such as this work with regional development and seek to solve problems of urbanization, unemployment, economic decline, etc. And the cluster idea might well assist them in providing "success examples", and theoretical concepts to relate their work to, as well as providing some concrete suggestions on various activities they can pursue in their daily tasks.

Discussion – inscribing and prescribing hybridized innovation scripts

This chapter has explored the preparation of two local innovation scripts by studying two programmes for regional innovation, VINNVÄXT and VISANU. And in so doing it extends the view of how theories of innovation-producing arrangements have been translated into innovation policy and programmes. This is indeed similar to what we saw in the previous chapter; however, this chapter has focused on how theories and policy have been edited and inscribed as scripts for how innovation initiatives should be organized. And these scripts are prescribed through the innovation programmes, and performing them is obligatory for receiving funding.

The fact that these theories are used by economists and policymakers reemphasises that they are not only academic theories. In many ways they constitute an innovation policy fashion, gradually becoming institutionalized as "folk theories" on how innovation occurs and should be furthered. This is made possible through the interface between academia and policy making, evident in both the VINNVÄXT and VISANU programme texts, where the references to theories of innovation systems, clusters and triple helix are plentiful. And the use of famous academics, like Michael Porter, the chief proponent of cluster theory, is prevalent in both documents as well as practices. The VISANU programme texts and its kick-off day provide vivid examples of this. Innovation theories, and their spokespersons, have in fact been heavily relied upon in constructing the Swedish innovation programmes (let alone the agency VINNOVA). What is

interesting in this chapter is that the theories of innovation-producing arrangements are edited and inscribed as local innovation scripts (programmes-for-action), aimed at guiding the development of innovation initiatives. In other words, the academic texts have been translated into policy texts, which form textual scripts for how to further the development of innovation systems and clusters.

Examples of such inscriptions entail the directing of action toward furthering inter-organizational collaboration, network formation, regional interaction, ensuring a triple helix representation, as well as taking a systems perspective in furthering innovation. It follows that these inscriptions are prescribed scripts for how innovation initiatives should be organized. And the VINNVÄXT and VISANU programmes are used as instruments for programming or guiding innovation.[49]

The VINNOVA's VINNVÄXT programme exemplifies how innovation initiatives are scrutinized according to clearly stated requirements for what constitutes successful innovation systems, such as a well developed triple helix interaction, clearly stated growth potentials, and focusing on the arranging of groups and networks of organizations. All these requirements, or desired ingredients, are mixed together in scripts for how to organize innovation. Initiatives that join the competition, that is proposals that are introduced as contestants, must hence convince VINNOVA that they have the necessary characteristics of a system or cluster, and observe the triple helix imperative. We find similar requirements in VISANU, although this programme combines these with adding the development of scripts to its agenda. It follows that the policymakers at VINNVÄXT and VISANU edit theories of innovation-producing arrangements and thus adjust them to fit their interest. With the programmes, two new local hybridized scripts were prepared, focusing on the stimulation of regional innovation systems on the one hand and combined innovation systems and clusters on the other, both supposed to be organized according to triple helix logic. The economists writing their theories in the first place might or might not approve of such blending, arguing that their theories are different from one another and therefore not

49 The use of the word *programme* is also curious in this setting. In a sense, these initiatives can also be referred to as efforts at *programming* innovation. A programme can denote a public notice, or a printed plan or outline, and programming can represent a process of instructing something, which indeed fits the VINNVÄXT and VISANU ambitions well.

compatible.[50] But this matters little in practice, as the policymakers take liberties in blending them into their own recipes or scripts for how innovation should be furthered, just as a food recipe has a list of ingredients that should be combined in preparing a meal. And by editing the innovation theories and policies into new scripts and inscribing them into innovation programmes, the policymakers translate them to fit their local interests and practice.

Now, a script can be seen as a type of instruction, implicit or explicit, for guiding and controlling action, or aiming to do so.[51] When such scripts are expressed in policy documents they are attributed with a normative dimension, transforming the innovation theories into *prescriptions* concerning the necessity of developing innovation systems organized according to network and systems principles, highlighting interactions among organizations. The triple helix concept and its organizational model exemplify this candidly in prescribing interaction among three particular types of actor spheres in furthering innovation, namely those of industrial, academic and public organizations. In so doing, the triple helix script is used for enrolling actors and pushing them into roles, something which Akrich (1992) also concluded in pointing to how scripts can ascribe actors with roles. As a result, the descriptions of innovation systems and clusters become authoritarian and canonical, instructing as well as controlling certain behaviours and actions.

The scripts can thus be interpreted as being coercive, as they must be adhered to in order to be categorized as a winner, qualified for innovation systems and cluster funding and support. However, the scripts are not only inscribed in texts. In this chapter I have also shown how they are communicated through policy practices, for example in innovation workshops. The scripts are linked to success stories of innovative regions, and are reinforced by references to theoretical work, by inviting academic heroes such as Porter to speak at meetings.

The inscription of innovation scripts in the programmes is indeed a way for VINNOVA and VISANU to attempt to control the actions of the initiatives that join the competitions, thus allocating funds to candidates who are deemed appropriate. This makes VINNOVA and VISANU

50 In fact, Lundvall expressed his concerns on VINNOVA's enforcing of the triple helix theories during a seminar at the Institute for Growth Political Studies in Stockholm 2007.
51 See Chapter 2 for an outline of "Scripts as programmes-for-action".

inscribing organizations (Joerges and Czarniawska, 1998) in that they seek to guide and control the behaviour of others.[52] Indeed, this introduces a power relationship where specific theories and scripts are canonically enforced.[53] But the inscriptions are by no means ends in themselves; VINNOVA's and VISANU's desire and belief is that innovation initiatives should act on their scripts in developing innovation systems and clusters.

In sum, the innovation programmes VINNVÄXT and VISANU exemplify how local innovation scripts are prepared by editing and inscribing internationally fashionable theories and policies on innovation-producing arrangements in policy programmes. The programmes also illustrate how these scripts are prescribed in seeking to guide the development of innovation initiatives. A central issue in this is the scripts' focus on structural features of systems and networks of collaborating organizations in furthering innovation. And this theme will prove to be of specific relevance for the Microwave Road initiative, which the next chapter continues to explore, illustrating how the scripts are performed.

52 And it is important to note that the in-scribers at VINNOVA and VISANU are not single policymakers; the writers work collectively in construing innovation scripts.

53 But actors do not necessarily comply with scripts and prescriptions; as Latour (1992) reminds us, every actor confronted with a programme-for-action can have an anti-programme, and they might not comply with the scripts and prescriptions.

CHAPTER 6

Arranging for microwave innovation

Having outlined the emergence of regional innovation programmes in Sweden, and how they carry inscriptions of theories of innovation producing arrangements, we now turn to the central purpose of examining how the theories and programmes are related to the so-called Microwave Road (hereafter MWR) initiative. More specifically, this chapter scrutinizes how the innovation programmes and their scripts are put into practice in MWR. The previous chapter highlighted the programmes' collaborative ideals, and their suggesting that systems and networks of organizations must be developed to strengthen Sweden's innovation capacity. The programme texts encourage the formation of innovation initiatives and make it clear that successful initiatives will receive substantial capital funding and support, allowing them to develop as fully fledged innovation systems and clusters. As we shall see, the promise of capital certainly triggers action, much as honey attracts bees.

This chapter will particularly concentrate on the emergence and formation of MWR. The point of departure is the meeting between the first VINNVÄXT programme and the desire to strengthen the microwave technology industry in western Sweden. This also provides an initial introduction to the everyday activities of microwave management, which are given particular attention in the subsequent two chapters.

The triggering VINNVÄXT competition

In 2001, a handful of industrial researchers and engineering managers at research institutes and electronics companies in western Sweden met to discuss how to strengthen the Swedish electronics industry. This happened at a time when the telecom industry had just suffered a substantial crisis and economic downturn, beginning in 1999, with unprecedented drops in incomes and large redundancies; the large Swedish telecom company, Ericsson, actually halved its entire workforce. The meeting group included five people and was partly made up by an industrial researcher and the previous electronics division manager at the Industrial Research and Development Institute (IVF), as well as another industrial researcher from the IMEGO Institute.[54] The other two participants included an industrial manager employed at SAAB Ericsson Space, a company that utilized microwave technology in their satellite communication devices, as well as another manager working at Ericsson's production facility in Borås, producing radio links for communication, used in mobile telephony for example. Their plan was to strengthen the microwave technology industry by attracting capital and engaging in technology development, and thus increase the prospects for generating economic growth.[55]

As we now know, these times were characterized by changes in national research policy and funding; new agencies were formed and the procedures for applying for research funding went from "calls for research" to "competitions" for national grants. VINNOVA's VINNVÄXT competition was part of this development and attracted the interest of the group of microwave researchers and engineering managers. They decided to submit an application to VINNVÄXT and were granted SEK 500.000 (about 50.000 Euro) in planning support from VINNOVA to prepare an application. In a sense, the researchers and managers were looking for ways

54 At the time IMEGO was an abbreviation for The Institute for Microelectronics in Gothenburg, which was to become a member of the MWR initiative. However, the Microelectronics part was later exchanged for Micro and Nanotechnology, a shift that also might have contributed to the fact that IMEGO left the MWR initiative later on.

55 As described before, microwave technology is based on applications of microwaves, which are a form of electromagnetic radiation. Microwaves are used in for example radar, radio and television broadcasting, high-speed microwave heating and mobile telephones (Oxford Reference Online, 2005). Microwave applications are often encountered in areas like the telecom, defence and space industries. Simply put, the microwaves can also be seen as replacing cords and wires, making wireless communication possible.

to strengthen and develop their industry, and VINNVÄXT looked like an alluring way of pursuing this.

Reportedly, this discussion had begun long before this, however. Members of the group had had talks with people from Region West Götaland, VINNOVA, IVF and Chalmers University of Technology, concerning an attempt to gather electronics production and research under some sort of central umbrella. As the talks intensified, the industrial researcher at IVF, called Ove[56], who initiated the application process, recalled a change and a new direction:

> …[T]hen VINNVÄXT came along, and we discussed if we [i.e. the centre] could fit there, but we thought it [electronics] was too vague, no focus. So we discussed and came to the conclusion that the microwave industry in the region is strong…, and we went in with an application [to VINNVÄXT]. We thought that because of the conditions specified there should be growth potential, strong technology, there should be research within academia... And this fitted into the microwave area. There was Chalmers, a strong industry in Ericsson Microwave, which was the locomotive, and SAAB Ericsson Space. All these components existed and we had this old network [of microwave engineers and companies]…. (Ove, Interview, 2004.03.26).[57]

Those engaged in the dialogue had all worked with microwave technology-related issues in the past. Microwave technology was also seen as a specific enough area to fit into VINNOVA's requirements. The above quote also points out some organizations viewed as important players; one was for instance described as a locomotive for the industry. And all these organizations constituted what were seen as necessary components for an application to VINNVÄXT. Moreover, Ove's referral to "having an old network", fitting the VINNVÄXT competition, exemplifies how existing ways of working are located in a new setting. This suggests that relations with microwave affiliated organizations or their representatives were presented as if they could be turned into an innovation system initiative.

56 All the personal names in the text are pseudonyms to protect the anonymity of the interlocutors.

57 When SAAB AB acquired Ericsson Microwave Systems in 2006, its name was changed to SAAB Microwave Systems. The joint venture Saab Ericsson Space also changed to SAAB Space for the same reason.

And the reference to "the conditions that were set up" shows an adherence to, or at least consideration of, VINNOVA's innovation scripts. However, at the same time the meaning of an innovation system was made to fit the interests of developing an industry that was seen as rich in experiences.

As the industrial researcher Ove went on, he continued by narrating the work of anchoring the application among microwave companies in the region:

> It was mostly I who ran the first application, and anchoring it at companies primarily. I went out and talked to them, microwave companies…, Ericsson... I actually contacted Ericsson almost last. /…/ …[I]t is always hard to find your way at Ericsson. So I took them late but contacted the smaller companies and those that we had had contact with first... Oh right, we did have a good contact with Ericsson in Borås as well. /…/ No, so I got a reasonably good anchorage amongst the companies when we had written the pre-application. So there was a lot of selling to them, that is the idea, for the first two months more or less...

This suggests that rallying industrial support was deemed important, not least to have the most relevant companies on board. Such a gathering-of-blessings for the application procedure would support the argument that the researchers and managers attempted to muster support for their cause in obtaining financial backing for developing the local microwave technology industry. Indeed, Ove speaks specifically of "anchoring" and "selling" the idea. This entailed using personal contacts, phoning old colleagues and acquaintances, visiting companies and so on, explaining the purpose of a microwave initiative, as well as obtaining endorsements for the cause. Industrial support was rendered crucial for formulating an application. What is more, some companies, such as Ericsson, are depicted as being of particular importance to this initiative, and saving them for last. The reason for this was probably that Ove wanted to rally the support from other companies first, in order to be able to point to existing support and thus increase the likelihood of Ericsson's endorsement of the application. And not having Ericsson on board was just not an option for a microwave initiative in West Sweden; the company was simply deemed as being too important a player to not be involved.

Indeed, the telecom industry is often portrayed as one of the most important Swedish industries, in media as well as by VINNOVA and the Department for Industry and Trade.[58] And, Ericsson, being established in the beginning of the 20th century, is commonly characterized as a symbol of national industrial heritage. This is specifically so in the sectors of telecommunications and what is now usually referred to as information and communications technology (ICT), encompassing microelectronics and microwave technology.

But why would they seek to group together in this fashion? Ove explains that the basic reason is "[t]o obtain a stronger constellation, so that one can use the strength of the group to sell projects and so on". Another reason is of course the alluring potential of gaining access to new sources of capital. In addition, innovation programmes, such as VINNVÄXT, specifically require attention to the issues of organizational collaboration. And grouping organizations was seen as important, not only for developing technology but particularly for receiving funding from the programmes and from matching financing from regional agencies and public organizations, such as Region West Götaland.

Ove continued by explaining the rationale for grouping together in an initiative like MWR:

> If one is to, for every project, pick up companies' engagement and motivate this, it takes a lot of time. With a strong network, where one has strong relationships, it is much more flexible and quicker. Because it is about selling trust all the time. That is what one does, with all selling work. /…/ In Microwave Road, or anything…, these particular constellations and groups are strong because one can go in and apply for money, and get money. So VINNVÄXT is a bit like a *Shangri-La* [smiling]; where one can get a large amount of money and where one can work goal-orientedly within a group. And this is of course the strong motivation.

58 See for example the document "IT and the Telecom Industry – a part of Innovative Sweden" (2005), issued by the Swedish government and the Department for Industry and Trade.

Interestingly, the industrial researcher refers to VINNVÄXT as a *Shangri-La*[59], with a touch of irony, where financial dreams could come true, allowing for technological development. This is perhaps crassly put, but it implies that the researcher states that *money* is a main reason for building a microwave technology constellation. However, he goes on to emphasise that these networks are not created just for fun; "they have to be of utility for those involved", and here an interest in technology development was rendered as the "cement" that bound them together. It is intriguing, however, that the researcher repeatedly emphasised the importance of anchoring and creating strong relationships with people in preparing an innovation initiative; a theme which we will return to.

A microwave innovation systems application

Against the backdrop of the talks on strengthening the microwave technology industry, the group of microwave researchers and engineering managers began formulating an official application to VINNVÄXT. Ove had received pre-funding from VINNOVA to prepare an application and was the principal author of the text. The application sought support for strengthening the microwave technology industry in western Sweden, building upon claims of its strong radio frequency competency.

The application and the initiative were named *Microwave Road* (MWR). Originally the name referred to the national highway R40 that stretched across western Sweden, between the cities of Göteborg and Jönköping, along which microwave technology firms and research organizations were located. The "road" was described as being both real and symbolic in connecting microwave organizations located in geographical proximity with the municipality of Mölndal and the cities of Gothenburg, Borås and Jönköping.[60] The "road" thus produces a symbol for MWR, which contributed to the materialization or objectification of the initiative, as well as provided some form of basis for unification of those participating in the initiative. Of course, this can also be seen as an imitation of the names of

59 *Shangri-La* is James Hilton's fictive Himalayan valley, which has become known as a dreamland beyond all the troubles of the world, appearing in his novel *Lost Horizon*, published in 1933 (National Encyclopedin, 2006).

60 Later on, as the initiative grew in number of members, sometimes located beyond the highway, the "road" in MWR was more associated with "the road to the future wireless society", as opposed to national road R40.

successful clusters in the USA that are affiliated with physical entities or geographical areas, such as Route 128 in Massachusetts or Silicon Valley in California.[61]

The explicitly stated vision in the MWR application was to "create an internationally leading region for education, development and production of microwave products" (MWR VINNVÄXT Application, 2002). The application also stressed that competency and businesses were to be developed through effective cooperation between actors in the region and by creating joint technical platforms for new microwave applications. Indeed, these visionary words closely follow VINNOVA's VINNVÄXT guidelines, emphasising inter-organizational collaboration.

Technology development is presented as a key to achieving this vision, clearly illustrated in the following excerpt from the application's section called "Action plan for implementation":

> The central concept is development of technology platforms for microwave products. The platforms should be as diversified as possible, so that the technology developed can be used in different products and by as many companies as possible. They should help fill in the gaps in competency and be an engine for developing new companies that provide a more complete infrastructure in the region (Microwave Road VINNVÄXT application 2002, my translation).

Such platforms were moreover said to be comprised of competences in circuit design, radio design, substrate design, production techniques, material techniques, measurement techniques, antenna technology, and simulation techniques. Particular attention was also given to the potential of higher frequencies and bandwidths, as highlighted in the possibilities of new applications in automotive systems, such as automotive radars.

We can also learn from the application that the ambition was furthermore to double the number of employees, establish more and larger companies as well as to increase the turnover fivefold in a ten year period in

61 In addition, the R40 road actually figured in an idea of creating a test-stretch for using microwave technology in traffic safety infrastructure, aimed at being put on display at the European Athletics Championship in 2006 as a marketing effort of MWR. This idea never materialized however, and the R40 gradually lost its centrality as a symbol for MWR, as we shall see later on.

the "microwave region" (ibid.). This in turn was an attempt to respond to VINNOVA's ideal of generating economic growth, which appears explicitly in the VINNVÄXT scripts. In outlining these ambitions, the authors of the MWR application explicitly introduced their grand ambitions, and thereby also produced expectations on behalf of those related to the initiative, not least financers and the potential microwave company members.

From this it becomes apparent that much focus in MWR's "strategic idea and vision" was directed towards developing technology, something which was not as prevalent in VINNOVA's more general VINNVÄXT outlines. As we know from the previous chapter, VINNOVA accentuates the importance of innovation and generating economic growth, but the agency makes few references to generic technology development in particular. The MWR application illustrates attempts to address the issue of growth, albeit in a fairly general fashion, as exemplified in the following excerpt:

> Despite its relative maturity, microwave technology can offer outstanding growth potential. Many applications [of microwave technology] in the 5 GHz area [higher frequencies] *may* result in a large breakthrough within 10 years (MWR VINNVÄXT Application 2002: 2, my translation and emphasis in italics).

Later on in the document, one can also read that there is "every reason to believe that large as well as small companies can find operative areas that have very large growth possibilities" Much faith is hence placed upon potential microwave breakthroughs, be it through "effective and cheaper products", or new emerging markets such as in automotive radar applications.

The rationale for submitting an application to the VINNVÄXT competition was to get financial support for establishing a constellation or an assembly of organizations, interchangeably referred to as both an innovation system and a cluster in the application, which can sustain and develop the microwave competency in the region. This is, at least in part, a result of how the VINNVÄXT programme is framed, with its aim of developing effective innovation systems organized according to the triple helix model. Here references to networks and the collaborative ideal are

plentiful. This was exemplified by the VINNVÄXT guidelines, for instance in answering the question of "who can apply for grants?"

> All companies/organizations/networks/collaboration-coalitions that consider themselves capable of living up to the programme's purpose and goals, and to mobilizing the resources and the collaboration with strategic actors that an application within this programme requires. /…/ Applicants should be aware that he/she assumes great responsibility in ultimately creating a strong leadership with anchorage in business, research, as well in politics and public administration (triple helix) (VINNOVA VINNVÄXT Guidelines, 2002: 5, my translation).

These rules and guidelines that are part of VINNOVA's programme are certainly prescriptive with regards to how a VINNVÄXT candidate, such as the MWR association, should be organized. In line with the emphasis on inter-organizational relations, MWR was described as being constituted by microwave-related firms and research institutions, as well as by supporting public organizations. The influence of the prescribed VINNVÄXT innovation scripts is particularly evident in the MWR application's inclusion of the triple helix idea and the talk about regional growth. However, it seems as if the triple helix script was performed somewhat superficially in authoring the MWR VINNVÄXT application, as the following excerpt suggests:

> A not-unessential renewal effect within Microwave Road is to create a channel for information via the third triple helix leg, that is politicians and the public. The microwave industry in the region is surprisingly anonymous and deserves a clearer identity. The microwave industry has certainly received deserved attention through the VINNVÄXT programme, but significant marketing is needed to spread knowledge about the strength and importance of the industry in the region (Microwave Road VINNVÄXT application 2002, my translation).

Here, the public helix is presented more as something that should act to support the microwave industry by making it more visible. Indeed, in the application it is also written, "for a long time there has been a well established double helix between Chalmers [University of Technology] and primarily the large companies in the region [such as Ericsson and Saab]"

(ibid.). Little is said with regards to close interaction among the three helices, i.e. businesses, academia and the public sector, which VINNOVA emphasised as being a central concern. And references to triple helix were indeed loosely linked to the technology development that was envisaged in the application. Still, the application reproduced many of the innovation scripts for how to organize that are found in the regional and national programmes discussed previously. Examples illustrating this include descriptions of MWR as being situated in a "functional region", having a "triple helix" structure, and the labelling of the initiative as a cluster and innovation system, and so on and so forth.

There was evidently a normative aspect to this, as exemplified by the authors' choosing to dress the MWR initiative in terms that match the scripts in the innovation programmes. Having a triple helix structure was seen as mandatory for being eligible for financial innovation support. Another, less coercive interpretation, could be that the authors representing the microwave industry adhered to the terms opportunistically, simply to receive funding. Irrespective of which, the outcome is the same; there is no refuting the centrality of triple helix, both as theory of innovation and as a model of organization. These scripts were explicitly stated in the VINNVÄXT guidelines. In a later interview, the programme secretary for VINNVÄXT explained that the three panels evaluated whether the triple helix was satisfactorily represented in the applications, something which indeed was entirely legitimate and part of the evaluator design (VINNVÄXT Secretary, 2008.01.08). Thus, referring and conforming to the triple helix script consequently became a prerequisite for becoming a successful VINNVÄXT candidate. Indeed, the MWR application outlined its organization, as well a board of directors, as being comprised of representatives that symbolised a triple helix constellation. The proposed board included the four people who had assisted with the early pre-application, as outlined in the beginning of this chapter. It also included two other microwave engineering managers from a small and a medium sized company, as well as an academic researcher, and two representatives from the public sector. This exemplifies how the triple helix script was performed in presenting MWR's proposed organization.

A first introduction to the role of Microwave Road…

The role of MWR, as expressed in the application, outlines the initiative as interlinking the actors in the so-called primary value chain for microwave products. The production chain was described as stretching from basic research to application studies, prototypes and demonstrators, and all the way to product development and production. Different types of organizations were mapped against the production chain. However, the interlinked organizations only encompassed universities and research institutes in addition to microwave companies. Public actors were placed outside the chain and presented as being part of the context, with tasks such as investing in infrastructure. MWR was characterized as an actor underlying the product development chain, binding all the different organizations together.

According to a questionnaire study that the representatives for the MWR application had done in preparing their contribution to VINNVÄXT, the microwave industry was found to be of outmost importance to the region and its economic growth:

> A questionnaire shows that about 30 companies, colleges and universities, and institutes related to the microwave industry has an estimated turn-over of 8,8 billion SEK [equivalent to about 880 million Euro] and employs 6 600 people, out of which 3 500 have university degrees. In the last three years the companies have launched 58 new products and turned in 20 patent applications. (Microwave Road VINNVÄXT application, 2002).

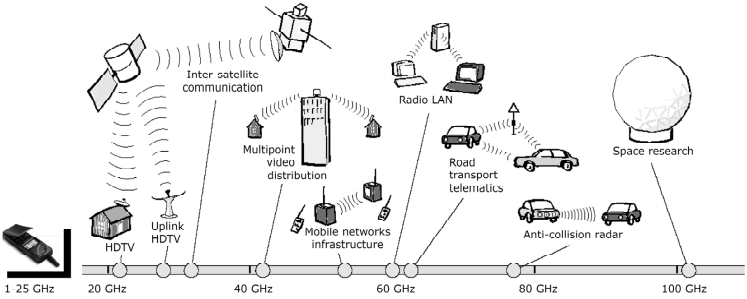
This concentration of organizations was furthermore depicted as corresponding to the concepts of regional innovation systems and clusters as described by VINNOVA. This suggests that the microwave industry, as described in the MWR application, is made to fit VINNOVA's description of innovation systems. Indeed, the application described MWR as a facilitating organization, linking different organizations and activities together in the development chain of microwave products, similarly to the ideas of an innovation system. The plan was to form a strong constellation that would benefit its members, as well as to coordinate and systematize research, development and production in the microwave technology field. And as we shall see in the next section, technological projects were outlined

as the main means for strengthening the industry. With regards to the development chain, public actors are fairly decoupled, just as they are in the other previous descriptions of the initiative. Instead, the relationships between basic and applied research on the one hand, and product development and production on the other, were emphasised. Irrespective of this, the initiative is still presented as having a triple helix structure.

…**and representing (((microwave))) technology**

Microwave technology certainly lies at the heart of the MWR initiative. It is something that was commonly taken for granted and was considered unproblematic by researchers, engineers and managers engaged in the application procedure. However, it was probably not as self-explanatory for the public officials reading the VINNVÄXT application. Hence, the application text had a designated section explaining what microwave technology entails. When I first started studying MWR I was quite clueless myself concerning what microwave technology was all about, and perhaps the readers would benefit from an outline in the words of the engineers themselves. Below follows an excerpt and figure from the application text, summarizing what microwave technology is about, exemplifying how the application writers chose to represent their technology:

> Microwaves concern electromagnetic waves with a frequency in the area between 300 MHz up to 30 GHz. Microwave technology, in turn, encompasses a wide range of disciplines: materials, components, circuits, antennas, construction techniques, systems, transmissions, measurement technology, etc. Wireless communication is a field where microwave technology has proven to be exceptionally successful, for example mobile telephony systems and wireless networks. But microwave technology also has important applications within defense, space navigation, automotive technology, sensors and medicine. The figure below shows frequencies in existing as well as potential applications. Today's volumes lie in the lower bands, 5 GHz and downwards. Examples are found within NMT, GSM, UMTS, GPS, Bluetooth, WLAN, and microwave ovens. At companies directed at the commercial market, microwave systems up to 38 GHz are usually constructed. Within defense and space electronics the applications can stretch beyond 100 GHz.



Applications within the micro- and millimeterwaves field as a function of frequency

Despite its relative maturity, microwave technology can offer extraordinary future growth potentials. Many applications in the 5 GHz field and upwards may have a great breakthrough within 10 years. For frequencies of 30 GHz and upward there are already small market niches as of today. But even here, new markets may emerge, for example automotive radars. At the same time a strong development within established frequency bands is moving towards more effective and cheaper products. Microwave products have traditionally been associated with expensive and largely manual manufacturing, but in the future we can expect low-cost products. This is motivated by higher circuit frequencies which can be achieved through construction in future semiconductors (silicon), more effective design tools, and new generations of electronics building techniques specially developed for high frequency applications. (Microwave Road VINNVÄXT Application 2002, my translation. The figure in the MWR application is adapted from Chalmers University of Technology).

The text and the figure particularly highlight wireless communication applications of microwaves, where frequencies and bandwidth are central components. The field is acknowledged as being mature, but is nevertheless represented as having great growth potential, particularly in the higher frequency span. One of the problems of visualizing microwave technology

is that the microwaves themselves cannot be seen by the eye. In addition, microwave applications are often embedded inside products, making them yet more invisible to the users. In other words, microwaves are very abstract, and this makes representation a tricky issue, particularly when attempting to explain to public officials why they should financially support microwave technology development. The issue was also a matter of discussion when MWR was to choose a logotype for the initiative: how do you visualize microwaves? At first they thought about having a road in the symbol, but since they gradually replaced highway R40 with the "road to the future wireless society", this was no longer an option. Depicting a microwave mast was not preferred either, as this had too many connotations of what could be perceived as dangerous radiation. The result was simply the name and some expanding half circles in amiable colours, symbolizing microwaves.

Filling the form with past experiences – the IVF heritage

Now, it is curious to see how the application text fills the innovation systems form with contents, particularly with regards to how a system or network of microwave-related organizations is represented and what type of activities it is supposed to entail. In the MWR application, this is done partly by presenting a structure, or rather a network-structure, of actors, which is seen as interacting in developing microwave products. The actual development, and the source of growth potential, is said to take place in technology projects. There is an interesting heritage to this in that the MWR initiative shares some characteristics with previous projects in firm networks at the IVF Institute, an organization from which the initiating research engineer and the later so-called process leader (also called managing director) both come.

This calls for further attention: IVF is run as an institute, owned by its over 100 industrial company members and the Swedish Government. Its purpose is to support the members' competitiveness in carrying out "applied research and development in close conjunction with industry" (www.ivf.se, 2006). These types of activities often involve applying for various forms of governmental research and development funding, such as answering so-called "calls" for technology development. On a question concerning the type of experiences and lessons learned from this, and how

they can be of use in an initiative such as MWR, the IVF researcher, who co-authored the MWR application, continued by narrating his experiences:

> Well, we can say that…, if we take the Nutek era, at that time we carried out a lot of these group projects. We gathered a number of companies, they put in a sum of money and we received 50% from Nutek or similar. And we had loads of these projects during the whole of the 1990s. And when VINNOVA was established and Nutek disappeared, the prerequisites for this type of project… [made gesture of his hand in the air – as if something disappeared]. So we cannot actually run these types of projects… Today there are calls, and the calls are small, or anorectic [i.e. meagre], as I would put it. It doesn't work. So because of that, this thing of the cluster idea, and the money that can arrive from cluster cooperation, is important for us (Ove, Interview 2004.03.26).

In a sense, the changes in research funding suddenly made cluster and innovation systems programmes a viable and alluring option for obtaining technological research and development funding, perhaps in particular to a research institute like IVF, which is dependent on both industrial and governmental funding. Previous examples of IVF technology projects, involving several firms, are exemplified in the work on eliminating hazardous Freons (i.e. fluorocarbon chemicals) used in cleaning processes of circuit cards, due to the arrival of new legislation. Ove, the industrial researcher at IVF, recalls the work on previous IVF technology projects.

> It is a very efficient way; cost efficient for the companies. One attacks a problem that is shared. What I worked with when I started here [at IVF] in…, in 1992, was the dismantling of the use of Freons as a cleansing fluid in the electronics industry. And here we actually got a large Nordic project, where we gathered all Nordic [companies]…, and had a large budget for working with these questions... and this was a question which concerned everyone, and it was easy to collaborate. /…/ The companies went in with I think 2-300.000 [SEK, equivalent to 20-30.000 Euro] each. /…/ The Electronics Industry Association sponsored this too. /…/ We addressed research questions, or problems, and did shared solutions for that, sketched on various research projects that people worked on… So it is not the type of project that innovation systems perhaps address

> directly. Here, it was a problem which occurred because of a legal change and it was very focused, with dates and…

This provides an illustration of highlighting previous experiences from working in joint technology projects with several organizations involved at IVF; I call this *the IVF heritage*. This project practice is also documented in the VINNOVA VINNVÄXT application and presented as a solution for developing technology and innovating, and thereby contributing to innovation and growth. Thus, forming an inter-organizational network association and facilitating joint technology projects constituted MWR's take on innovation activities. In other words, this made up a textual representation of the content with which to fill the innovation systems form in the VINNVÄXT application, exemplifying one of the ways in which MWR was portrayed as an innovation system. This is interesting as it exemplifies how actors in MWR attempt to translate their experiences into the VINNVÄXT form by editing them into a new innovation systems text. Nonetheless, as mentioned above, VINNOVA ultimately strived at achieving growth, and it is not entirely clear how this is achieved through technology projects as exemplified by the IVF heritage, judging from the MWR VINNVÄXT application. According to Ove, this is a matter of great concern, suggesting that the MWR projects must "address a problem which has a value, so to speak… And to create growth perhaps poses other requirements on the project than what a problem-solving project would." He went on to say that this is not easy, and pondered the rhetorical question "how can the technology projects within Microwave Road be structured so to generate growth", looking somewhat puzzled and leaving the answer open-ended.

The rejection

Ultimately the MWR VINNVÄXT application was rejected; the initiative was unsuccessful in obtaining financial support for forming the MWR initiative. Why was this the case? VINNOVA's official rejection decision claimed that the initiative did not adhere to the programme idea and its criteria sufficiently to become prioritised as a winner in the competition. The evaluation of the application, which was carried out by a programme

council and indeed three evaluation panels representing triple helix actors, is summarized in the rejection decision accordingly.

> The growth potential is not presented concretely in the application. Strategic idea and vision are undeveloped. The triple helix leadership is weak with regards to politics/society. The research component is described imprecisely, although this appears to be a regional strength area of world class and where the programme council estimates there is a large growth potential for new products (VINNOVA Rejection Decision, Drn: 2003-00096, my translation).

Interestingly, the decision acknowledged that there was a growth potential in the microwave field in western Sweden. However, there was criticism regarding how this is (re)presented and how MWR would contribute to growth. It is claimed that it is not concrete enough, perhaps referring to a lack of estimation of growth indexes, predicted increases in employment, etcetera. As described earlier in this chapter, these issues were indeed vaguely addressed in the MWR application, something that Ove also acknowledged. Having said that, estimating how much economic growth an industry will achieve due to the establishment of a so-called innovation system and cluster initiative is likely to be rather challenging and complicated in practice. It assumes a causal relationship that might or might not exist. And even if such a relationship is present, it is most likely hard to predict the effects thereof.

Another more specific criticism of MWR was its "weak triple helix leadership". This objection points to the centrality of this innovation theory in the VINNVÄXT programme. And as we know from the previous chapter, triple helix was also an organizational model, prescribing how a regional innovation system ought to be structured, to use VINNOVA and VINNVÄXT's terminology. The MWR application was obviously not seen as living up to these prescriptions, and was therefore not selected as a VINNVÄXT winner. The verdict was clear: if you are not a winner you are indeed a loser. This exemplifies how the innovation scripts are prescribed through the use of innovation programmes. The scripts have to be satisfactorily followed, and hence they are canonical, imposed top-down from the agency to the initiatives.

In a written comment a few months after the rejection, MWR's process leader similarly identified the VINNVÄXT rejection as being caused by MWR's "lack of political engagement at top levels [the third triple helix], low growth potential and research ambitions, as well as the absence of coordination with Region West Götaland's other initiatives and the Regional Growth Programme" (MWR Process Leader, 2003.06.10). He also added that ultimately MWR's board of directors had to "decide whether to continue building an industrial network or proceed with creating a regional innovation system and cluster". According to the process leader, if they were to pursue the latter and strive to become a winner in the next VINNVÄXT competition in 2004, substantial work effort and funding were necessary. Nevertheless, he also mentioned the other clusters and the innovation systems programme VISANU as a potential source of such funding, and a new application procedure was indeed undertaken soon after the first VINNVÄXT rejection. MWR was thus at a crossroad. Either they could continue meeting as a group of people with an interest in microwave technology, representing microwave related companies and research organizations, or they could proceed to rearrange their initiative so as to better fit VINNVÄXT 2004 or VISANU's guidelines, developing a stronger triple helix constellation and their relationship with the regional development agenda. The chosen course of action will be apparent in what follows.

A second attempt and continued development

In spite of the VINNVÄXT failure, a meeting with the representatives from organizations that had expressed an interest in the cluster initiative was arranged in May 2003. It took place at IVF's premises in Mölndal. Its purpose was to try to revitalize the Microwave Road initiative, regardless of the failure in the VINNVÄXT competition. The idea was to generate renewed interest for the microwave technology collaboration idea and to muster further support for establishing Microwave Road.

About 30 people were present at the meeting, most of whom were engineers from companies working with products and applications somehow related to microwave technology engineering, though some people also presented themselves as coming from industrial institutes,

research institutions, as well as from municipalities and regional development organizations. Interestingly, the invited representatives still followed the triple helix script despite the fact that MWR had been denied funding from the VINNVÄXT programme. Some of the representatives had already expressed their interest in the MWR association, whilst others came to see what it was all about. The meeting invitation was sent out to those who had been, to varying degrees, involved in the 2002 VINNVÄXT application, as well as their contacts who were seen to have an interest in the development of the microwave technology industry. Despite the spread of backgrounds and organizational home grounds, the majority of the people present at the meeting actually worked with microwave-related issues in their daily activities, suggesting that the participants had engineering competency with regards to applications of radio frequency technologies.

Ove, the same IVF researcher who had worked with putting the VINNVÄXT application together, opened the meeting. And in so doing he framed the interaction; he set the scene by saying that all the present participants had a common interest in microwave technology and a wish to create an internationally competitive region in western Sweden. He then proceeded to tell the audience about their work with the application, explaining that the VINNVÄXT contribution was unfortunately unsuccessful and did not result in any capital funding for a microwave initiative. MWR was not chosen as one of the winning innovation systems. However, he quickly added that they were going ahead to form an association anyway.

> We will show them, /…/ there are ambitions, there is competency! Is there anyone who wants to be in and form an association? We want more companies and we *are* going to establish Microwave Road (Ove, resarcher at IVF, 2003.05.22).

What followed was a discussion about whether an initiative such as MWR was of interest. The participants seemed to agree that a microwave association was useful, both for technological development and for furthering regional interests.

Ove introduced Karl, with a past in telecom and electronics, as a suitable candidate for the role of process leader. He stressed that Karl has a

good personal network and that he has built similar collaborative constellations before. The participants at the meeting unanimously elected him as MWR's process leader. Karl gave his view on the situation and talked about the possibilities of applying microwave technology in the automotive segment, whether MWR was sufficiently visible in the market, addressing the problem of how MWR could obtain a clear market profile, and so on. In relation to the innovation programmes, Karl explained that the idea of MWR came before this new idea of developing innovation systems and clusters. He claimed that they already had a good anchorage in industry and academia but were rather weak in the public domain. He proceeded to excuse the failure of the application by saying that its "triple helix" structure was too weak, and that the region and the municipalities should have supported them more, hinting that the selection process could have been "political" and concluded, "we have something good!" What he meant by this is clarified in a reflective document that Karl wrote after the so-called VINNVÄXT day a month later, where VINNOVA provided further information with regards to its decisions. Karl's interpretation of the participants' views during this meeting was that only already established "clusters", which had been around for some 10 years and therefore seen as "safe bets", were appointed winners. He also added that none of the "new areas", where he included MWR, were successful in the competition. He also suggested that MWR's high level "political" activity had not been strong enough.

As the MWR meeting at IVF proceeded, the participants continued to discuss the need for supporting effective collaboration and to visualize the microwave industry both regionally and nationally. A discussion concerning another regional initiative called "Telematics Valley" also emerged.[62] The engineers at the meeting seemed to agree that the latter was much more market oriented, whilst MWR is technology focused. They came to the conclusion that there was no competition between the two initiatives; instead they were regarded as complementary. This comparison also illustrates how MWR was an initiative centred on technology development. In other words, another initiative was used to demonstrate what MWR was

62 Telematics Valley is another interest organization, seeking to strengthen the more service and software oriented telematics industry in western Sweden. *Telematics* is the branch of information technology that deals with the long-distance transmission of computerized information (The Concise Oxford English Dictionary, at Oxford Reference Online, 2006).

and what it was not. Karl continued with pondering on the necessary steps ahead:

> We have to go from words to action; we need tangible projects, /…/ it is important to be concrete, not to space out… like we did in the application. It is important to quickly get to utility /…/ We have to get up on the track before we start accelerating, cutting costs, developing microwave platforms, that everyone can apply. /…/ We have to have a customer who is paying,… but the companies' own willingness to put in money is important. /…/ The association will be formed, and that in itself is a gigantic project, the first of August [2003]… that's when we're starting.

Here Karl sets the scene for the initiative's future actions by stressing the importance of starting technological projects, manifesting what he calls going from words to actions. Tangibility and concreteness, as expressed here, are recurring virtues that seem to be common in engineering traditions; to work with technology and hardware is in other words seen as a premiered and decent activity.

The meeting was wrapped up by approving the board of directors, followed by two presentations, the first on a new possible construction technique by a microwave engineer from "Aluwave", and the second on high frequency communication by a researcher at Chalmers CHACH institute. This was to be common themes at later meetings, letting companies present their concerns. Microwave Road was formally registered as a non-profit economic association in August 2003.

Succeeding as cluster/innovation system

In conjunction with the formation of MWR in 2003, MWR's board decided to submit an application to the VISANU programme. In recalling the programme outline (see Chapter 4), VISANU was a joint agency programme that focused on the development of triple helix-organized innovation systems and clusters combined. This time around, MWR was successful and came out as a winning initiative, receiving funding for developing their cluster/innovation system. The initiative received SEK 750.000 (about 75.000 Euro) in start-up capital from the VISANU programme. This in turn allowed for an equal amount in matching

financing from West Region Götaland, adding up to SEK 1.5 million (about 150.000 Euro). So MWR did not receive full funding for developing an innovation system from VINNVÄXT, but did receive enough capital from VISANU to develop the initiative further. This was enough to keep the idea afloat, and the MWR initiative could thus be developed further. What is more is that after the VINNVÄXT rejection, MWR representatives talked more about VISANU than VINNOVA, and increasingly began describing the association as a cluster as opposed to an innovation system.[63] It follows that the MWR board began translating the initiative more as a cluster rather than as an innovation system. This is interesting because it points to how the funding innovation programmes influence how the initiative was characterized.

Assembling an organizational group and a management team

The vast majority of the organizational representatives present at the first MWR meeting at the IVF institute joined the initiative as members of the economic association. MWR could thus display a member register with some 30 organizations at the time. This catalogue of organizations was to become vital input into how MWR was constructed as an innovation-producing arrangement.

One of the first activities in establishing the MWR association was to appoint a board of directors, largely along the lines presented in the VINNVÄXT application. The idea of the board was that it should represent MWR's member organizations. It included one engineering manager from each of the following companies: Ericsson AB (EAB), Ericsson Microwave Systems AB (EMW), Saab Ericsson Space (SES) and Kitron Development AB. Ericsson operates within the telecom industry, whilst EMW is in the defence industry and SES in the space industry. Kitron, on the other hand, offers services in production and manufacturing processes. The board of

63 In fact, MWR also applied to the subsequent VINNVÄXT round in 2004, grouping together with other innovation initiatives in western Sweden to form what was called *AutoCom Region*. Here *MWR*, *Telematics Valley*, *Lindholmen Science Park*, and *Innovatum* in Trollhättan joined forces in an attempt to build an even stronger constellation, linking telecom initiaives and automotive ones in a greater system of innovation, and thereby hoping to increase the chances of funding. AutoCom Region was unsuccessfull in VINNVÄXT 2004 however; a Biotechnology initiative in western Sweden was premiered instead.

directors also included an engineering manager and co-founder at Omnisys Instruments AB, a satellite communications company. Indeed, members of the board also represented the research community, including researcher from Chalmers University of Technology and the CHACH institute for high-speed communication, as well as two industrial researchers at the research institutes IMEGO and IVF. Finally, the board also encompassed three business and regional developers from the Mölndal City municipality, Business Region Göteborg AB, and Region West Götaland. The latter organization is not a member of MWR but was nevertheless included to represent public interests and issues of regional development, due its role of jointly financing the initiative. Not surprisingly, this group of people represented a triple helix constellation, just like the suggested board of directors in the MWR VINNVÄXT Application (2002). So despite being rejected by VINNVÄXT, the initiative followed the original script. The majority of the directors represented the microwave industry, whilst the others represented industrial research institutes, an academic institution, and public organizations.

So what does the board do? The representatives regularly meet four times per year as well as during occasional extra meetings. They are all very active in discussing the purpose of MWR, what type of activities the association should pursue, where to look for money, what the members want, as well as discussing the demands from the likes of financers such as VINNOVA and West Region Götaland. Service to the board is on a voluntary basis and does not pay any fees to the directors. I have heard the board described as an "operative board" on several occasions. Judging from my observations during the board meetings, this refers to the fact that the directors are involved in the operation of MWR's activities and in decision making. The constitution of the board was evaluated during a meeting at the end of 2003, and the directors expressed satisfaction with the fact that the board had a mixed composition, and suggested that the triple helix had been successful. The "operative" characteristic was deemed as valuable, meaning that it acted more as a management team, rather than being comprised by big-shots too distanced from microwave engineering.

Karl was (and still is) the managing director, or so-called process leader, of MWR. Prior to taking this position, he worked as a production planning manager at Ericsson AB and later as manager for the electronics division at IVF. Karl is the only person who has been continuously

employed by MWR since the start in 2003. However, two project leaders have worked for MWR via a public programme for reallocating unemployed engineers in companies (see www.vinnvinn.se, 2004). David stayed for about a year but left when he was offered another job and was replaced by Anders, who worked with Karl between 2004 and 2007.[64] MWR's "operative" board of directors and process leader are the ones that represent, manage, administer, promote and speak for the initiative, which is why I occasionally refer to these people as both representatives and spokespersons for MWR.

An interesting observation is the fluidity of the MWR organization, not being located in any one place and without formally salaried employees on a long-term basis. Karl has a consultancy contract and works either from a borrowed office at The Swedish National Testing and Research Institute in Borås, from his home, or from Business Region Göteborg's (BRG) premises at Lindholmen in Göteborg. That is when he is not moving around, visiting members, attending meetings and so on. Anders also had a temporary desk at the BRG office.[65]

MWR has 38 members, commonly categorised according to three types: microwave technology companies, public organizations and research organizations, as the table below illustrates. The first and significantly largest category consists of 29 microwave companies. They range from small one-person consulting firms, to small and medium sized microwave technology R&D firms such as the space communication company Omnisys Instruments, and ultimately to the large telecommunications company Ericsson AB. Other medium sized microwave communication companies include SAAB Ericsson Space and Ericsson Microwave Systems; the former is a space equipment supplier and the latter a wholly owned Ericsson subsidiary that develops defence systems. Kitron Development is a different type of organization, assisting their customers in developing and manufacturing electronic products. Public organization members include both municipalities such as Borås and Mölndal, as well as Business Region Göteborg. The latter is a business development company owned by the 13 municipalities that together comprise the Gothenburg region. MWR's

64 At this point MWR had difficulties raising the necessary capital to employ Anders, who was made redundant as a result of this. As of 2008, Karl is still the only one working for MWR on a continual basis.

65 The office space constitutes indirect financial support from BRG.

members also consist of academic research institutions such as Chalmers University of Technology and its CHACH institute — The Centre for High Speed Technology. Other research organizations include ACREO, carrying out contract research and development in optics and microelectronics, as well as IVF. All members pay annual membership and service fees depending on type of organization and number of employees. The membership fee is approximately 1000 SEK (about 100 Euro) and the service fees range from 3.000 to 20.000 SEK (from about 300 to 2000 Euro), depending on size in terms of number of employees.

Microwave Road's Members (adapted from www.microwaveroad.se, 2006)

Companies

- Ageto AB
- Albax System AB
- Allgon Microwave AB
- Armeka International AB
- Combitech Systems
- Comhat AB
- Efield AB
- Elmatica
- EMC Services AB
- Ericsson AB
- FABEC AB
- Food Radar Systems AB
- FRONTSIDE Electronics AB
- Holders Technology AB
- Huntsman Advanced Materials
- Kapsch TrafficCom AB
- KAR Design AB
- Kitron Microelectronics AB
- Norbit
- Omnisys Instruments AB
- Plansee Nordic
- PMJ Automec Sweden AB
- Ranatec Instrument AB
- Saab Microwave Systems AB
- Saab Space AB
- SAF Tehnika Sweden AB
- Sivers IMA
- Trigtek Systemutveckling AB
- Wireless Solutions AB

Public organizations

- Mölndal City – Municipality
- Business Region Göteborg
- Uddevalla Municipality

Research

- Acreo AB
- Chalmers University of Technology
- SP – Swedish National Research and Testing institute.
  IVF –Industrial Research and Development Corporation
- SIK - Swedish Institute for Food and Biotechnology
- FOI - Swedish Defence Research Agency

Again, the MWR member representation corresponds to a triple helix script. However, this does not mean that there is an even distribution amongst the three helices. Industrial microwave companies constitute a majority by far, followed by research organizations, and there are only three public sector organizations. Indeed, as the microwave researchers and managers expressed earlier, their past experience was more geared towards collaboration between companies and research organizations. This was referred to as a "double-helix" with little or no involvement of the public sector.

In sum, the members, i.e. those that had enlisted to join MWR, represented that which was described as interconnected actors in a microwave technology network, as well as a cluster and an innovation system. Again, they had many labels for their initiative, which with more neutral words could be described as a group of organizations which pursued a purpose of collaborative technology development.

Discussion – performing the innovation scripts

This chapter, called *Arranging for Microwave Innovation*, has told of attempts to enact the innovation-producing arrangement scripts in the Swedish innovation programmes by translating them into actions of grouping organizations for microwave innovation. The MWR initiative has been called many things, but is commonly referred to as an association, an inter-organizational network, or as a combined cluster and innovation system, aimed at collaborative technology development. This chapter has addressed the second research question in describing how the Microwave Road initiative was constructed and organized. In approaching this, I have shown how Microwave Road (MWR) was formed in conjunction with the Swedish regional innovation programmes through attempting to perform their prescribed innovation scripts. I have argued that performing the innovation scripts has implications for how MWR was established. As a result, this chapter has also begun to sketch an answer to the third and last research question: how the theories and programmes of innovation-producing arrangements were related to Microwave Road and what implications they had for organizing the initiative.

The description of actions relating to the arrangement of MWR illustrates how economic theories of innovation on the one hand meet with

a desire for obtaining capital funds to develop the microwave technology industry on the other. Constructing the MWR initiative entailed organizing actions related to formulating a microwave application to the innovation programmes VINNVÄXT and VISANU. In order to be eligible for funding from the VINNVÄXT programme, certain conditions, guidelines and instructions, which I have chosen to call scripts, for how to represent and organize the initiatives had to be enacted. To repeat, the scripts may be objectifications that have been translated from theories of innovation, commonly taking the shape of text and symbols. Examples of such scripts include the necessity of taking a systems perspective on innovation, including organizations and institutions involved in innovation activities, and particularly collaborating organizations located in geographic proximity. It also entails explicating predicated growth potentials, and promoting what is referred to as triple helix interaction. These are indeed the normative features of the scripts that make them prescriptions aimed at controlling how the initiatives are organized. In translating the idea of MWR into an application to VINNVÄXT, the authors represented their initiative along with the innovation scripts. MWR was presented as an "innovation system", as well as a "cluster" located in a "functional region", as if showing compliance with the scripts was thought to increase the chances of receiving funding.

The application procedure also entailed mustering support for MWR, seeking to establish legitimacy towards a wide host of parties, as well as structuring a network of organizations said to represent triple helix actors in the microwave technology industry in western Sweden. The early arrangement of MWR points to how its organizing was highly influenced by the innovation scripts for how to organize such initiatives. These scripts were hybridizations of translated theories of innovation-producing arrangements, including innovation systems, clusters and triple helix, which had been inscribed in the VINNVÄXT and VISANU programmes. And these innovation scripts were performed, i.e. put into action, in organizing the MWR initiative. This enactment of the innovation scripts was characterized by an editing process where the MWR initiative was constructed and inscribed (in the application texts) as a combined innovation system and cluster. Furthermore, in performing these scripts, past experiences and ideals of joint technology development projects and microwave engineering practice were edited into presenting and forming

MWR as a combined innovation system and cluster initiative. Thus, MWR's originators performed the innovation scripts by translating them into actions, firstly by authoring an application text and then by mobilizing interest for the MWR idea, followed by the arrangement of a triple helix-organized innovation system and cluster initiative.

This also illustrates how actions and texts are translated into new texts and actions in a similar manner as Czarniawska and Joerges (1996) described in their account of how ideas travel. Economists' ideas and observations are translated into theories of innovation, which are translated into innovation policy. These policies are translated into innovation programmes and scripts, which in turn are translated into the MWR VINNVÄXT application and actions of arranging the MWR initiative. The latter is indeed also a translation of ideas of collaborative microwave technology development and past experiences of joint technology projects in the microwave industry in western Sweden.

The VINNVÄXT programme was launched in 2002 as a competition for furthering regional innovation systems, and it posed as an attractive source of funding for innovation and technology development initiatives. This VINNVÄXT competition triggered the work on establishing an innovation systems initiative called Microwave Road. The conditional promise of funding that VINNVÄXT offered was desirable and attractive for the co-authors of the MWR application. In fact, it offered encouragement to earlier talks of organizing a centre for electronics and microwave technology. This in turn prompted efforts to utilize old personal relationships, or "networks", for grouping people as organizational representatives around "microwave engineering". Together with past experiences from working with joint technology projects at the IVF institute, these representatives and the practice of microwave engineering were inscribed into the MWR VINNVÄXT application.

The process of writing the VINNVÄXT application also entailed efforts to heighten awareness and muster support for the initiative amongst microwave technology practitioners. The rationale was to arrange a strong constellation of microwave-related organizations, focusing primarily on industrial companies and research organizations. The purpose here was to facilitate collaborative technology development and thus generate innovations. This was claimed to contribute to strengthening the regional microwave technology industry and generating economic growth.

Reportedly, this demanded meticulous work on achieving good "anchorage" amongst microwave technology representatives, and continuous efforts at "selling" the initiative, which in turn is indicative of the ongoing construction of MWR. It follows that MWR is not something that simply exists out there; its process leader, directors, as well as its member representatives all need to convince others of the initiative's importance and make sure to keep its relations in place, much as in Callon's (1986) "sociology of translation", where actors try to get other actors to comply with their programme of action. This is indeed similar to Akrich's (1992) study, where engineers attempted to ascribe specific roles — much as MWR's representatives sought to convince others of the relevance of their innovation initiative.

The aim of the MWR initiative was furthermore to strengthen what was already a "mature" industry and increase its growth potential. In this, microwave engineering was represented as the binding force in the VINNVÄXT application and in what was to come. Much emphasis was placed on the collective microwave competency in western Sweden, where engineers, managers and researchers were joined in a shared community. And the tool for strengthening this competency and generating technology development and innovation was presented as collaborative technology projects.

Interestingly, MWR's list of members and its suggested board representatives are also indicative of having a triple helix structure, something that is also explicitly referred to in the application. Moreover, following the VINNOVA and VINNVÄXT focus on generating economic growth, this potential is also included, albeit in vague terms. Thus, when taking this into account it can be argued that forming MWR also entailed being formed as the scripts are enacted. People affiliated to MWR might indeed find that the agglomeration of microwave firms in western Sweden does resemble a cluster, or that the entire industry has features that are constitutive of what an innovation system is perceived to be. Irrespective of which, in applying to VINNVÄXT the authoring industrial researchers and engineering managers act on the programme's innovation scripts in ways that affect how the MWR initiative is represented and organized. This means that in representing MWR as a cluster and innovation system, its process leader and directors *subscribe* to the scripts and thus act upon them in ways that influence how the initiative is formed. Nevertheless, as the

scripts are acted upon, they are also translated. It is not as if the microwave representatives dogmatically follow a step-by-step procedure exactly the way in which some agency dictates. Instead, they combine different concepts and ideas, edit them to fit their view of the microwave industry and assign them meaning by relating them to past experiences. However, they are not free to edit the scripts in whichever way they want. The first VINNVÄXT failure exemplifies just this; they have to perform the scripts to a satisfactory degree to be deemed a winner in the innovation competitions, and MWR was not successful in such an endeavour.

This account of arranging for microwave innovation thus tells of reciprocal processes of formation, or rather of editing. In the efforts of forming an application for funding the advancement of microwave technology and strengthening an industry, the authors of the application enacted the VINNVÄXT and VISANU programme's scripts in ways that influenced how the MWR initiative was represented and arranged. Likewise, the local microwave industry, previous ideas of collaboration for technology development, microwave engineering practice, and past experiences, were rearranged as an innovation system and cluster. In a way, the innovation scripts thus edited the initiative, and at the same time, these scripts were edited so as to fit the local setting of microwave organizations. Still, focus was certainly placed on attempting to perform the innovation scripts by arranging an inter-organizational microwave network, aimed at stimulating technology development and hence also economic growth. Similar translations and processes of editing of the innovation scripts continued to guide the later organizing of the MWR initiative. In the next chapter I will explore MWR in practice, that is, the actions and activities that went on in the initiative once it had been formally established as an innovation system and a cluster.

CHAPTER 7

Microwave road in practice

Now that MWR was formally established, it was considered paramount to get going with the initiative's intended activities, fulfilling the stated purpose of strengthening the microwave industry in western Sweden. This chapter begins with the initiative's grand "kick-off" event where people with an interest in the microwave industry were invited to join the Microwave Road journey, or at least become aware of it. This is followed by an account of how MWR's role is (re)presented as the initiative was up and running. This sets the scene for examining MWR in practice, and the chapter proceeds with investigating what has and has not been done in the initiative. In so doing, this chapter continues with investigating the organizing of MWR and how this is related to the innovation programme scripts.

The kick-off

On the 5th of December 2003 MWR had its kick-off. It was a large event at Ericsson Microwave System's premises in Mölndal. Speakers from firms, government organizations, and research institutes were invited to talk about microwave technology, the strength of microwave competency in the region, about related initiatives, the small-firm perspective and so forth. Above all, the event cherished the collaborative ideal by emphasising the possible gains derived from organizations working together to develop microwave technology. However, little was said about how this was to be carried out in practice.

There were about 100 people at the kick-off, and the large auditorium felt busy, filled with anticipation. The majority of the people were middle-aged men, most of whom were engineers, informally dressed, except for the speakers. Karl, the process leader for MWR, began by introducing the kick-off programme, after which the managing director for Ericsson Microwave Systems (EMW) presented the company and their view on MWR. He began by describing the history and background of the Swedish microwave industry, starting with Ericsson's responsibility for developing radars after the Second World War. He pointed to how they had succeeded in their production of radars, microwave communication links, antennas, base-stations for mobile telephony and so forth. He continued by expressing his views of the bright future of microwave technology:

> In today's kick-off programme for Microwave Road we can see a diversity of ideas and applications within the microwave area, witnessing to the technology's possibilities. I have heard whispers in some situations that microwave technology represents an old field: do we really need to invest there? This is of course completely wrong. We see heaps of areas of use for microwave technology in society and in the service of the individual citizen. Of course there are development possibilities within the area, such as cheaper technical solutions, the spectrum, antenna-technology for mobile phones, logistics as well as completely new areas which we might not have thought about yet. Within Ericsson Microwave Systems we are looking for new areas for our competence. The world has changed, we are not only in the defence industry, we no longer see the world in black or white, war or peace, but in grey zones. Concepts that are on the rise are public safety, security in society, and there are more and more interesting investment areas, not just in Sweden but also in the world.

This address arguably concerns the possibilities for reinventing and finding new applications for an "old" valuable technology. It is also a speech that cherishes the legacy of a historically successful industry, which is still perceived as having much potential. Moreover, it was also a speech which gave approval to MWR. Indeed, the director explicitly said that "it delights me very much that the cluster initiative MWR has been established". He also offered that EMW could act as "an advisor and engine in the west Swedish network Microwave Road". This endorsement was important, as

the MWR board of directors often expressed the necessity of having Ericsson Microwave Systems as a "locomotive", pulling the MWR initiative forward.[66] In addition, he also explained how he saw the support from the region and local politicians as something very positive and encouraging, wrapping up his address by suggesting that "together we can make something really good of this…, let's go for it!"

In a way, this can also be seen as an attempt at revival or even resuscitation, injecting new life into a declining industry. Ericsson Microwave Systems has had large contracts with the Swedish defence industry in the past. However, as government spending on defence and military is drastically decreased, the company is thus seeking a new role and new unexplored markets. I have indeed come across similar narratives in several other MWR settings, not least in the attempts to link microwave technology with the automotive industry. Representatives for the "mature" microwave technology struggle to renew their industry, searching for new innovative combinations and markets. They commonly describe the past, present and desired future situations, albeit with little focus on immediate actions and what to do.

The Ericsson manager's speech was followed by presentations spanning topics such as regional development, the history of the microwave industry, the research frontier in high speed communication and microwaves, the use of microwaves in the food segment, as well as regional microwave technology company presentations. Not surprisingly, the speakers represented firms, research institutions and institutes, and public organizations, just like the triple helix in MWR. Although the emphasis was placed on microwave business and research, the regional development director from Region West Götaland was also there. He highlighted the importance of a two-way strategy in furthering economic development, innovation and creation of new business on the one hand, and the development of strong clusters in western Sweden on the other:

66 See for example references to the importance of achieving "anchorage" at Ericsson Microwave Systems for the VINNVÄXT 2002 application in section 6.1 - *The triggering VINNVÄXT competition.*

> …this with clusters is very popular right now. In reality there is nothing new with clusters, to cooperate between different competencies, between companies, research institutions… what is new is perhaps that one lifts these questions particularly. /…/ One can identify these clusters in different ways, but I would like to say that we have 9 to 12 clusters, at least, in western Sweden. The ones that are in a class for themselves, are these six, which were objects of trial in VINNOVA's initiative [i.e. VINNVÄXT], about a year ago. Microwave Road is in this group, and I think it is in this group that we will see a few lifting... and hopefully to be developed further and made even sharper. This is the type of initiatives that we from the Region are ready to give the strongest support we can within our capacity. But this demands a strong culture, and that there is credibility in this system, so that we really can see that there is potential for a forceful development. /…/ We have ourselves put resources for process development in these six, and we will continue to do this, of course, but in a dialogue depending on… we still have these different prerequisites, and they will not become less important… [He then pointed to the following points on a PowerPoint slide]:
>
> - Clusters cannot be organized from nothing
> - Active company participation
> - Close connection to needs oriented research
> - Triple helix
>
> … active company participation, and Microwave Road is a good example where there is a powerful participation, and also close connection to needs oriented research, is also a very important thing. And that we can manage a functioning cooperation between the businesses, a strong research system, and the public sector [i.e. referring to a triple helix structure]. It is necessary that we identify problems, or bottlenecks in the system, so that we can cope with them.

This voice is important as it represents the public sector and one of the chief funding bodies for MWR. The regional development director tries to win sympathies among the microwave engineers by saying that "this with clusters" is not really something new, praising MWR for its active and powerful company participation. However, he did mention that some issues required addressing in the system, such as making sure that the triple helix cooperation functions well. This account is also interesting

because it suggests that Region West Götaland regards MWR as an important initiative, and endows the initiative legitimacy as a cluster-initiative. Still, it is also made clear that the endorsement and the capital funding from Region West Götaland also comes with requirements and prescriptions.

Despite the fact that the kick-off event took place in a sizeable auditorium with large number of participants, there was a lot of interaction between the presenters and the audience; comments and questions were frequent and the participants frequently asked direct and sometimes critical questions. The kick-off event certainly stimulated a discussion on microwave competency and the industry's future. And the event seemed to be characterized by high spirits and there were several examples of back-patting, lively applause, and technical engineering jokes. The "beauty of technology" was cherished over and over again, and it was almost as if the whole event was like a revivalist meeting. Words like: "together we can do it", "MWR is the solution but we have to help each other", and "the future is bright" filled the auditorium.

The MWR directors also introduced themselves during the kick-off meeting: emphasising their "triple helix" constellation as well as pointing to the potential of microwaves and their applications. Again, Karl proposed that MWR existed for creating growth in western Sweden and for its members. He went on to explain the purpose of MWR, suggesting that the focus is on developing technology platforms. The task was hence to tie specialized partners together in line with such a focus; that is partners who specialize and collaborate. Karl went on to say:

> This with collaboration is incredibly important for creating competency; one creates some sort of critical mass. And that is what we are trying to do in this field. We have to have a common goal; the core [microwave] technology is the same. /…/ What is it that creates growth, well it is you who sit here, creating growth together… we have to go back to basics.
>
> /…/
>
> Now, why Microwave Road…, well we looked at this nationally and saw that, here there is a concentration in companies and a history and base to build on. /…/ Production is essential to be able to create value in

> society…, we cannot build up our society without production. If one cannot understand this, then we are in trouble. 40 percent of the world's production of radio base-links, probably more, takes place here [here he refers to Ericsson AB's production facility in Borås]. Isn't that fantastic? /…/ There is an enormous competency here.

Karl's address celebrates the microwave industry and its achievements, and uses this as a basis for creating enthusiasm with regards to the MWR initiative. He places particular emphasis on the vast microwave competency in the region, and in so doing he tries to motivate the audience, and particularly representatives for the microwave community.

During the lunch I noted that many of the participants seemed to recognize one another. They chatted about past experiences, discussed what they were currently working on and so forth. As with MWR's later events, the participants were typically engineers or technicians, and their conversations commonly included technological storytelling, talking about technology and their engineering practice. It seem as if the participants are engaged in, or at least familiar with, some form of microwave practice. After the kick-off the participants were invited to join study tours of Ericsson's new antenna measurement range and their seismic centre. I attended the first tour together with about 20 engineers, all of whom were keen to discuss microwave related issues and took great interest in Ericsson's new measurement facilities. In the end, the MWR kick-off event was considered a great success by its board of directors.

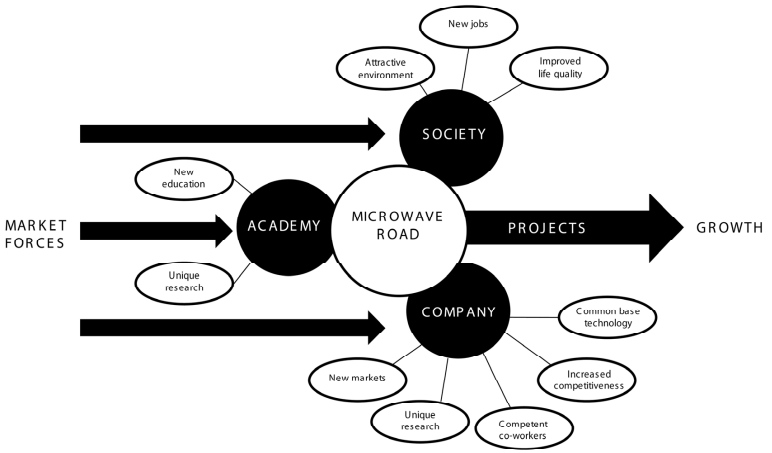
(Re)presenting the role of microwave road

By now we have been introduced to several descriptions of Microwave Road (MWR) and its purpose. But it is nevertheless interesting to place additional attention on how the initiative is portrayed and how its role is presented after the VINNVÄXT application procedure and the establishment of the initiative. MWR is commonly described as an initiative with the aim of furthering technological development and generating economic growth. But the nature of the initiative is somewhat equivocal, and during my interactions with people associated with Microwave Road, I have heard the initiative portrayed in as wide terms as an association, an

innovation system, a cluster, a network, and regional platform for collaboration. This plethora of labels is in itself interesting, and points to a polyphony in how the nature of MWR is constructed. MWR's vision or purpose was also something that kept changing over time. In 2005-2006 one could read the following description of MWR at its official website:

> Microwave Road is a regional platform for national and international collaboration concerning microwave technology for industry, public administration and universities. The purpose is to develop products based on microwave technology through collaboration.
>
> Microwave Road pursues activities that promote the regional collaboration between stakeholders within microwave technology. The association will also actively place western Sweden on the world map as one of the leading regions in the world within microwave technology (www.microwaveroad.se, 2006).

The basic idea was that there is microwave technology competency in western Sweden, which can be further capitalized upon by stimulating collaboration between various organizations, particularly through technical projects. The rationale was hence that MWR would initiate joint technology projects on microwave technology materials or components, as well as on sub-systems construction and production. Results from these projects were then intended to be incorporated into technology companies' own system and product development, be it in automotive, telecom, space, defence or other industries (Microwave Road Brochure, 2005). This of course corresponds to what was written in the MWR VINNVÄXT application 2002, as well as to what I have referred to as the IVF heritage of joint technology projects. The model below summarizes these lines of thought, illustrating how market forces are presented as stimulating technological projects, which are guided by companies, academia and public organizations, and facilitated through MWR, ultimately creating economic growth.



Joint Development Generates Growth (Reproduced from MWR Brochure, 2005).

The figure represents an input–output model, where MWR is placed in the middle, surrounded by the triple helix spheres. Everything starts at market forces that are channelled via academia, society and business, into MWR. Here these forces are presented as being transformed into technology projects, which result in growth. MWR and projects are depicted as central for stimulating microwave technology development. The model resembles the "product development chain" from the MWR VINNVÄXT application, where MWR is portrayed as the organization that binds relevant actors together. However, one difference compared to the VINNVÄXT application's production chain is that this model relies much more on the triple helix spheres in the furthering of product and growth development. This suggests that the original development chain has thus been adjusted to fit the innovation programmes better; triple helix now forms a central part of MWR's purpose.

As we know from the previous section, a recurring narrative in the MWR setting concerns the idea that there is a substantial amount of microwave technology development competency in the region of west

Sweden. This alludes to the geographic concentrations of firms along the "Microwave Road", that is the national highway R40 between Mölndal and Jönköping, running via Gothenburg and Borås. However, in a board meeting in 2005, it was decided that MWR should not be overly profiled as following national highway R40. Today MWR has members that are located outside Region West Götaland, and the "road" is now said to be more symbolic, sometimes referred to as "the road to the future wireless society" (as stated in for example the MWR Brochure 2005). The regional aspect of clusters and innovation systems has thus been extended in MWR; welcoming participants with interest in microwave technology from all across the nation. So all organizations engaged in microwave technology with competency in this field are welcomed, and the geographic proximity and regionalism that the innovation programmes envisaged became less important over time.

MWR was increasingly portrayed as an initiative for creating some form of structure for sustaining and developing microwave competency, capitalizing on existing capabilities as well as creating new technologies, and thereby generating economic growth. An official and also stylized example of this is found in MWR's promotional material, reproduced below, representing "voices" of people related to MWR that are viewed as important.

> We consider West Sweden one of the leading regions in microwave technology. The collaboration within Microwave Road provides us with opportunities to work with qualified partners, including companies as well as researchers, to undertake joint technology and process development. In addition, our co-workers get access to a professional network.
> **Erik Löwenadler, Managing Director, Ericsson Microwave Systems**

> Region West Götaland sees cluster operation like Microwave Road as an important regional tool for generating growth. Through active collaboration in triple helix, the roles of industry, academia and society cooperate in a very positive way. As a societal party in the work, Region West Götaland [VGR] participates with board [of directors] work, regional coordination, as well as financial support for cluster development and concrete development projects.
> **Bertil Törsäter, Regional Development Director**

For a small company it is important to have a competent network of colleagues in the business. Shared resources and technical projects give shorter lead times and reduced risk. Microwave Road is also an important informational channel on the regional plane.
Tomas Ornstein, Managing Director, Ranatec Instruments AB

Microwave Road represents the largest collected Swedish competence within the field of microwave technology. Business Region Gothenburg has a long and positive experience of cluster work that strengthens and clarifies regional competence and thus growth. The growth contributes to start-ups of new and innovative companies, rising investments, and to the development of existing companies, colleges/universities and research institutes, as well as to the creation of new supplier structures.
Lennart Olausson, Managing Director, Business Region Göteborg, BRG AB

Through participating in Microwave Road, our researchers at Chalmers receive valuable contact interfaces towards west Swedish industry, research institutes and society. These in turn can be offered concrete collaborations with the internationally recognized research environment within high frequency and microwave technology at Chalmers.
Johan Carlsten, Vice Chancellor and responsible for company relations, Chalmers University of Technology

(Excerpt from Microwave Road Brochure 2005, my translation)

These "testimonials" clearly highlight the centrality of themes such as collaboration, competency, shared resources and growth in relation to MWR. They also exemplify the rationale for establishing MWR and illustrate how the process leader and directors of MWR wish to portray the initiative. The spokespersons above have also been characterized as "heavy names", i.e. people who are seen as authoritative and influential in the microwave industry, and their statements thereby act to legitimize the MWR initiative. Needless to say, as so many times before, they also represent voices from all the three helixes of industry, the public sector, and academia. Informal conversations with MWR board representatives suggest that MWR representatives have "polished" the contents of these particular statements to some extent, since they are aimed at marketing the initiative.

Nevertheless they have agreed to both the form and content regarding "their" views on the MWR initiative, thereby contributing to how MWR's identity is constructed. Interestingly, the accounts by the industrial managers highlight the centrality of joint process and technology development, the importance of networks with personal contacts in the microwave industry, whilst the public administration directors emphasise the importance of MWR as a competence and growth generating tool, with positive triple helix collaboration. Indeed, this suggests that there might be different takes on the use of the initiative.

Microwave activities

In terms of MWR's activities, or the running practice of the initiative, these chiefly concerned organizing meetings and arenas for interaction for microwave-related organizations. In addition to this, Karl and Anders at MWR also actively kept MWR's members informed by sending emails with microwave news, such as when one company called Omnisys Instruments received a big order from the European Space Agency, or when SAAB bought Ericsson Microwave Systems, and so on. The emails also included tips on seminars, workshops and courses, such as in microwave construction techniques. However, these tips do not exclusively regard microwave technology; sometimes they concern information on new government funding programmes, seminars arranged by other organizations such as Telematics Valley, and so on. Emails are also used for announcing MWR's yearly meetings and association meetings. A webpage with information on MWR, its members, contact information, as well as meeting protocols, reports, press articles, and other information was also set up.[67] Furthermore, Karl and Anders also conducted member visits and kept contact with member representatives over the phone. They also spend a considerable amount of time communicating with all the representatives for the innovation agencies and their programmes. Other central activities concerned the ever-recurring quest for capital, searching for potential financial resources from primarily public organizations and innovation programmes. Another activity has also been attempts to map the

67 For the public content on MWR's website, see www.microwaveroad.com.

microwave competency in the region. But above all, the most central activity in MWR was arranging meetings. This section describes organizing in MWR once established as an association, exploring the initiative's activities.

Microwave meetings

Much of the activities in MWR concerned arranging various kinds of meetings. Sometimes they were formal, such as the board meetings, association meetings, technology project meetings, and so on. But they could also be informal, such as when MWR's process leader Karl went out to visit member companies or financers, or when Karl and some of the directors met to prepare application texts.

The board meetings were particularly central to what was done in the MWR initiative. Here much attention was placed on accounting for what had happened in MWR since the last meeting. This usually included reports by MWR's process leader, discussions concerning the innovation programmes, sources of funding, and last but certainly not least, debates on what it was that MWR really should do. The discussions commonly concerned questions of the association's identity and its purpose. A typical answer to these questions was that MWR should "act in the members' interests, focusing their utility", and the directors often came to the conclusion that the initiative should facilitate technological development projects. Other central topics included aspects of recruiting organizational representatives to the initiative. Examples of this would include the enlisting of members, as well as the idea of setting up an advisory board with "heavy names", i.e. spokespersons from high management or government positions, who would support the initiative. The advisory board was never formed however, mainly because the MWR directors thought it better for MWR to be operatively managed, that is, run by themselves.

The MWR process leader Karl emphasised the importance of the network once when I visited him at his borrowed office at The Swedish National Research and Testing Institute outside Borås. He suggested that "the social is the most important [aspect for MWR]… the projects will fix themselves, by the members". There was hence a belief that as long as people working with microwave technology got together to discuss their

practices, problems, interests and common denominators, this would stimulate companies grouping together in technology development projects. And this would hopefully be useful to the industry as a whole. And this is the reason why meetings and arenas were seen as so important for MWR.

MWR's yearly meetings provided an opportunity for member representatives to meet, present ideas and simply "talk technology" with likeminded people. One such occasion took place at the end of April 2004, when 33 of MWR's member representatives met at Saab Ericsson Space's sports cabin on the Kallebäck hill, overlooking Gothenburg, for an annual meeting. The chairman of the board and the process leader of MWR welcomed the guests and gave a brief update of the status of the association and its undertakings. This was followed by presentations by member representatives, including topics such as production technology, construction techniques for frequencies of 60 GHz and over, a communication platform for the intelligent road, and so on. It also included talks on a new research centre on high-speed communication, as well as a technology competition on the new Galileo satellite system. A representative from Region West Götaland also provided a view on MWR from a regional development perspective, exemplifying what the regional organization wanted in return for supporting the initiative, along similar lines as the VINNVÄXT programme. During the meeting the participants listened, some flicked through the brochures that had been handed out, others were active in asking questions and so forth. Again, microwave engineering was presented as an interesting field with a lot of potential. Many of the participants appeared to have met each other before, updating themselves on who and what they were currently working with.

Later on, a Chalmers researcher took the initiative on behalf of MWR to arrange a theme day on "Microwaves for Growth" in November 2005. This presented another type of microwave meeting, where the participants would try to look to the future and anticipate new fields of application of microwave technology. And this is particularly important since the technology is generally described as relatively mature, albeit seen as having unutilized growth potential. The event was held at Saab Ericsson Space and attracted some 80 people. There were presentations and discussions around application areas described as having great potential, such as security, automotive, medicine and food. A common view was that being able to

master higher frequencies would open up new possibilities. When observing the meetings, it actually appeared that the higher the frequencies, the greater the enthusiasm and thrill for the engineers. In general there was great confidence in the technology and engineering competency; the problem was in finding new applications, or in other words, identifying new "uses" for the microwaves. Automotive radar was presented as one such promising application, as we shall see in Chapter 8.

What is interesting about all these meetings is that they provide opportunities for microwave researchers, engineers and managers to meet and discuss their work and microwave technology. Many of the meetings are located at the premises of any one particular member, often allowing for study tours of the respective companies. As I have already pointed out, many of the engineers seem to know each other from before, perhaps having studied or worked together in the past. Again, this is indicative of the fact that many of MWR's members do have microwave engineering as something in common, suggesting that in one way or another they belong to a community of microwave practice.

The quest for capital

Much of the discussions in the MWR board meetings were about securing a stable financial ground for the association. Despite of a history of collaborative projects at the IVF institute, the funding for such initiatives, according to Karl and Ove, was increasingly difficult to raise. Indeed, as Karl once said, "collaborative initiatives such as MWR do not come for free", making the question of financing a pressing issue. Consequently, MWR's process leader and directors spent much effort on applying to the innovation programmes. This in turn had the consequence that they attempted to adhere to the programme's prescriptions. One reason for this might indeed be that they found the innovation system, cluster and triple helix scripts useful for developing their industry. It could also be that they desired funding for something that they had wanted to do for a long time, and cared little for the innovation scripts. Regardless of which, the innovation programmes offered a potential source of funding, and to be eligible for this, an innovation initiative such as MWR had to adhere to the programme prescriptions. To be sure, MWR was in need of money to run their initiative, and this proved to be an uphill struggle. It follows that

much of MWR's activity can be characterized as incessant attempts at raising funds, something to which I refer as *the quest for capital*.

Karl and the directors have consequently focused on securing a financial foundation for MWR. This has entailed applying for financial support from the national and regional programmes of innovation, investigating the potential of European Union projects, collecting membership fees, and so on. MWR's expenses generally involve two types of costs: firstly the "process leading", i.e. salaries for the process leader and the project leader, as well as other administrative costs; and secondly for running technological projects. I have often encountered frustration as Karl and the directors express that too much energy goes into attempting to raise capital. Moreover, MWR's funding is typically short term, with only a few months or half a year's coverage at a time, and Karl kept saying things like: "we have to have more long-term financing in order to work with technology development". The lack of a stable source of capital had the implication that Karl keep "putting out fires", as he expressed it. Action in MWR was thus constantly occupied with financial issues; even news-emails to members have included open questions to members regarding hints for how to fund the up-start of the initiative.

Over the time period 2002-2005 the association received 500.000 SEK (about 50.000 Euro) in planning support from the first VINNOVA VINNVÄXT competition, 750.000 SEK (about 75.000 Euro) in cluster development support from VISANU, and from Region West Götaland MWR received 750.000 (about 75.000 Euro) in co-financing, as well as 2.000.000 SEK (about 200.000 Euro) for running a technology project. MWR also received support for member activities from Business Region Göteborg. In addition, MWR collected yearly fees from its member organizations, but this by no means covered the running costs of the association. MWR's yearly budget has varied over time, 2004/2005, for example, it amounted to 2.800.000 SEK (about 280.000 Euro).

Furthermore, both the VINNVÄXT and the VISANU programmes require co-financing at a local administrative level. This means that Region West Götaland, for example, is required to co-finance a regional initiative with an equivalent amount of capital received from the innovation programmes. Taking this into account, MWR's major financial contributors are Region West Götaland and its Regional Development Programme, the VISANU programme, as well as start-up contributions from Business

Region Göteborg and VINNOVA. After the field study I also learned that MWR had received money for furthering the business development issues from Nutek's new cluster programme.[68] This suggests that MWR was heavily reliant on public financial support from innovation programmes such as VINNVÄXT and VISANU. Indeed, Karl once explained that public funding typically makes up for 90% of MWR's budget. And this alone might explain why the programmes' innovation scripts became so highly influential in what was done in MWR. The process leader and the directors did attempt to perform them in ways that they thought would bring them financial support and possibly also develop the microwave industry.

One problem with this was that much attention was placed on applying for funding rather than working with technology development. Rather than constituting a means to an end, it was almost as if pursuing "a quest for capital" became an end in itself. Capital was seen as a prerequisite for innovation: first you have to have money, then you can start working. I sometimes wonder whether the industrial members of MWR would be interested in collaborating with each other if they had to finance such activities entirely by themselves. I have asked people at MWR events about this and some said that they were unsure, while others said that it would never happen. But if collaboration is so crucial for innovation and economic growth, why do not firms invest more in it themselves? Are public organizations assuming a new type of role in supporting industrial activity more interactively than in the past, or are they simply being used as a new source of capital funding for things that the companies do not want to pay for themselves? An interesting question is whether MWR could keep up its activities were it not for public financial support? During MWR's annual meeting in 2004, a MWR member representative suggested that MWR "still requires public funding as a lubricant". A director of the board put it even more directly, suggesting that "public funding is necessary..., there is a friction in collaboration, and there is no company that is willing to pay for that". This is also interesting when considering the design of the

68 MWR first received funding from Nutek's cluster programme to develop a business plan for the initiative. This programme took over VISANU's role after the programme's completion at the end of 2005. Focus was predominantly on clusters, as innovation systems was seen as more affiliated with VINNOVA's programmes. Nutek's cluster programme focuses on business development in particular. MWR were later successful in this new programme and received continued support from Nutek to develop their initiative, particularly the business development side. See the Epilogue for further details.

innovation programmes; they are set up to run over 3 or 10 years to support the development of innovation systems and clusters. In other words, they are depletable sources of capital, and the innovation initiatives are expected to be self-funded once they have become properly established. And if MWR's members are not willing to "pay the cost of collaboration", this is probably going to be a decisive challenge of the future.

Making sense of the innovation scripts

In the MWR setting there were frequent discussion regarding what the innovation programmes and their rules and conditions meant for the initiative. This can be characterized as an ongoing sense-making process where the process leader and the directors tried to understand what the prescribed innovation scripts were about, how to enact them, as well as how well MWR actually fitted into the innovation programmes. Indeed, the collaboration ideal is nothing new to MWR; previous work at IVF reveals experiences from joint technology projects with several companies involved. Identifying and grouping "key" organizational actors was not seen as something problematic either. Nevertheless, how to actually carry out joint technology projects in such an arrangement was a topic of continuous debate, and there did not seem to be a single right way to purse this. And as we shall see, they had their ways of going about technology projects. However, the triple helix prescription seemed to be particularly difficult to accommodate. The MWR process leader even introduced this as a potential topic for discussion at the MWR member meeting in April 2004, concerning what to do with this unconditional requirement from the innovation programmes.

So how do people affiliated to MWR discuss the innovation scripts? An illustration of this is found at an informal meeting I had with one of the MWR directors over a cup of coffee. He described the VINNVÄXT and VISANU demands as lying at the periphery, only constituting an outer ring of that which is more important: the core of relations and trust, representing what he called "warmth" in MWR. VINNOVA and its demands, on the other hand, was referred to as "chillier", more rational and authoritarian, with its demands of for instance equality considerations, process researchers following the development, coupled with strict adherence to definitions of systems and triple helix. The demands that the director spoke

of exemplify the prescribed innovation scripts as perceived in MWR. However, Region West Götaland was discussed as much more lenient in its offer to support, with less strict demands.

Moreover, some people have even expressed that governmental policies on clusters and innovation systems are of little relevance for industry. I have heard from several persons, both at MWR meetings and VISANU workshops, that "clusters cannot be created from scratch; they cannot be organized top down." Irrespective of whether this is the case or not, since the governmental agencies provide funding to research projects and collaborative initiatives, those interested in this financial cake are more or less forced to follow its recipe. For example, the VISANU programme for clusters and innovation systems was referred to as the *70 million program* during its kick-off event. After the presentation I heard someone from the audience saying:

> 70 million is not a lot of money [when distributed to different initiatives], still it has completely changed the way people think…

This supports the idea that the innovation scripts have gradually become more and more institutionalized and taken for granted in the context of innovation systems and cluster initiatives. Such a description is quite fitting for the MWR initiative; even if MWR did not receive full funding from the innovation programmes, its innovation scripts have still been highly influential in guiding the initiative's activities. A similar argument was actually proposed by the VINNVÄXT Secretary, who suggested during an interview that even if only a few initiatives were successful in the competition, VINNOVA had managed to stimulate the mobilization of innovation systems initiatives and actors in a much wider sense than they had anticipated.

Another example of how the innovation programmes were discussed was the debate on whether MWR should focus on building a regional innovation system or focus more on being an arena for microwave technology interaction, more like an interest organization. This view was put to the test as the MWR board once came to the point of deciding whether to participate in the second VINNVÄXT competition or not. A director at the MWR board put it this way: "either we continue with Microwave Road as an industrial association, or focus more on regional

issues". The regional issues of course referred to building the regional innovation system, focusing on generating more jobs and economic growth, whilst the other option concerned focusing on developing a forum for microwave technology development. This led on to a discussion of whether MWR should have an advisory board or not, and if this should mirror a triple helix constellation or not. Again, triple helix emerges as script that MWR people found that they have to relate to. The problem with how to accommodate the third triple helix sphere of the public sector surfaced yet again. The directors knew that if they were to submit a second VINNVÄXT application, they had to deal with the triple helix issue more explicitly than the last time. But, as another MWR director warned, "there is a danger if we exist for political power-holders, rather than for our members". These types of considerations were common in MWR, where directors and member representatives tried to make sense of what MWR should do and how it should act in relation to the innovation scripts. And as the director suggested above, the triple helix imperative was perhaps not what the MWR microwave members desired. These issues were further actualized as VINNOVA's second VINNVÄXT competition was announced, as we shall see in the next section.

Joining forces for stronger constellations?

An issue that was closely paired with applying for capital was indeed that of building stronger constellations; the more powerful the constellation, the greater the chances of receiving funding. In the spring of 2004 a new VINNOVA VINNVÄXT competition was announced. This time around, the programme was interpreted as prescribing the necessity for increased collaboration between clusters; that is building systems of systems for greater synergies and increased growth potential. Karl and the board of directors did not wish to simply submit an improved version of the last MWR application that had been denied funding.

When consulting the VINNVÄXT 2004 announcement text, I found that the guidelines did emphasise that innovation initiatives must co-operate with relevant actors in the region. To be sure, the guidelines were even more direct this time around, prescribing which headings the application texts should follow and which issues to address. But nothing was explicitly written about collaboration between different innovation

systems and clusters. Nevertheless, this matters little since the process leader and the directors of MWR perceived the programmes in that way. Perhaps they had received other information during direct contacts with officials at VINNOVA.

In a board meeting in March 2004, Karl emphasised the new requirements in the VINNVÄXT 2004 competition: "we have an assignment to collaborate between clusters, but VINNVOVA thinks we are unfocused... [followed by demonstrative sighs from the MWR directors]". Another director picked up on this and said that they did not have to apply to VINNVÄXT; it was their choice. But the alluring potential of receiving VINNVÄXT funding was still regarded as interesting. She clarified this by saying that "either we go by VINNOVA's rules, or ignore them [and do our own thing]". She emphasised that if they were to compete again, they had to comply with the cluster cooperation instruction: "we're not applying to VINNVÄXT alone…." As a result, the conversation shifted towards discussing the possibility of using the same base as previously but tying it to other initiatives, where MWR was supposed to act as a regional umbrella. During the same board meeting in March 2004 it was decided that Karl was to investigate the possibilities of applying together with other cluster initiatives in the region. The rationale for this was to obtain a stronger constellation and increase the chances of winning, by "joining forces" as Karl called it. After discussions between representatives from MWR and other regional cluster initiatives, as well as with Region West Götaland, Business Region Göteborg and VINNOVA, a new constellation was formed. The result was called AutoCom Region, which aimed at furthering integration and collaboration between the telecom and automotive industries in western Sweden. The strategic idea was to coordinate synergies and to develop process leadership for collaboration between regional actors in the region.

> The vision is to consolidate and further strengthen the Gothenburg region and western Sweden's position as a globally leading region for the development of advanced automotive technology and automotive related communications technology (VINNOVA VINNVÄXT application – AutoCom Region, 2004).

This time around MWR was grouped together with three other clusters, which jointly formed what was referred to as a "four-cylinder cluster engine" (VINNOVA VINNVÄXT application – AutoCom Region, 2004). The four clusters included Telematics Valley, MWR, Lindholmen Science Park and Innovatum Trollhättan.[69] In this endeavour, the strategy was furthermore to ensure the support of what was referred to as "heavy names", something which MWR had refrained from in the past, even though they knew they were unsuccessful in the last VINNVÄXT round partly because of their weak triple helix constellation. But this time around they were going to present an impressive lineup. An industrial advisory board was formed, including senior managers at Ericsson Microwave Systems, Saab Ericsson Space, Volvo Aero, Volvo Car Corporation and Saab Automobile. A management group was also set up, constituted of senior regional politicians, university presidents as well as senior industrial managers, representing a triple helix constellation. Although this was described as a "strong constellation", one person who worked with putting the AutoCom Region application together said that it was "hard work" and a matter of "maximizing compromise". Nevertheless, a winner in the VINNVÄXT competition was said to receive as much as 2 million Euros per year during a total of 10 years, including 50% funding from for instance Region West Götaland, and the prospect of such rewards persuaded the MWR board of directors to give the competition another try.

However, the AutoCom Region application was unsuccessful, and once again MWR failed to get support from VINNOVA. A parallel but different proposal focusing on the Biotechnology industry in western Sweden was supported instead. During a board meeting after the rejection decision the members tried to make sense of why they had failed. Somebody suggested that Biotech is hyped up and that there might be political reasons why only one initiative in western Sweden received financial support. I later heard from somebody from VINNOVA who said that the reason for AutoCom's failure was that it was only a constellation of influential people and organizations, lacking a clear strategic idea of what it

69 Telematics Valley is an association of industrial organizations within the field of telematics. Lindholmen Science Park seeks to integrate high technology companies and research in a smaller geographic area of Gothenburg. Innovatum Trollhättan is an initiative for design and product development. All these are so-called innovation initiatives that are more or less supported by the public sector.

was that the initiative was supposed to do. In addition, General Motor's threat of closing SAAB Automobile's factories in Trollhättan had resulted in the so-called "SAAB package", a large governmental financial support programme for the automotive industry. According to the intended project leader for AutoCom Region, about 2 million Euros from this programme was to be directed to automotive telematics, which according to him was more or less identical to the AutoCom Region initiative. The MWR board seemed concerned however: to what extent would this benefit their members? Despite the unsuccessful application, the discussions in the board meeting shifted towards putting even more emphasis on strategies for how MWR could obtain a financial base, ensuring a security that would enable the association to concentrate on the primary objective of running technological projects. Again, this highlights the central feature of the quest for capital in MWR.

AutoCom Region was not the only attempt at joining forces for stronger constellations. Ever since the establishment of MWR there have been comparisons with the interest organization Telematics Valley (TMV) in western Sweden. This formation was purportedly more geared towards telematics services or telecom software for the automotive and transport industry, whilst MWR was described as more technology oriented and hardware focused. The overlap between TMV and MWR has often been stressed, and their technologies and services were often characterized as complementary, representing different stages in a value chain. The two associations' respective process leaders both had office spaces at Lindholmen Science Park at the time, where their paths often crossed. Gradually the two began talking about the overlap, and they eventually came to discuss more elaborate forms for collaboration, after the AutoCom Region initiative. These ideas were also particularly emphasised by the MWR initiative's two directors representing Mölndal municipality and Business Region Göteborg (BRG).

In October 2005, TMV's and MWR's directors met to discuss the issue further. They identified similarities but later came to the conclusion to work separately, at least in the immediate future. Instead, the linkage between the two remained, e.g. inviting each other's members to their respective seminars and theme days. However, in 2007 the BRG demanded that, in order continue receiving financial contributions for marketing activities, with which BRG had supported MWR since its establishment, MWR had to

collaborate more with Telematics Valley. Here, BRG poses extended requirements; not only should MWR focus on inter-organizational collaboration, it should also collaborate with another regional innovation initiative. And these prescriptions, or rather innovation scripts, are particularly important to adhere to, simply because performing the scripts might be rewarded by capital funding and not performing them might be punished by the cutting or removal of funding altogether. However, not all activities in MWR were concerned with raising capital. In the next section we will examine an activity that was more related to the idea of furthering collaborative technology development.

A competence inventory

The idea of competence is reappearing in MWR, particularly microwave technology competency. During a board meeting soon after the MWR kick-off, I listened in on a discussion regarding the need for a member competency inventory. Karl brought the issue to the table, saying that they actually did not know who the members were and that there was a need for charting the members' number of employees, their technology, education and competency. A manager for a small engineering firm commented that one cannot ask about what competences a company has; instead he suggested posing the question of "what they can offer in a sharp situation". Karl seemed to agree, and emphasised the importance of "being there…, visiting the companies and not simply asking questions, but examining what was behind the words" The rationale was to focus on their members now that the MWR idea had been developed. The board members were very much aware that a lot of their attention had so far been placed on building the network and now they had to focus more on their members, starting with mapping them in a register. However, the ever-recurring quest for capital was still lurking in the background.

At this point in time MWR had a project manager called David, who had built a database for inputting competency information. He explained to me that much of the information was in Karl's head and that little was formalized. This meant that MWR was heavily dependent on Karl, and because of this they perceived a need for systematizing the information so that others could benefit from it. David consequently developed a database where the members were supposed to input descriptive information

regarding their organizations, such as their address, number of employees, academic qualifications etcetera. The second type of information concerned the member organizations' products and services, as well as important clients and suppliers. Perhaps most importantly, the competence inventory ultimately aimed to map the members' unique competencies, grouped into basic and applied research, development, production, market and training, as well as into unique resources such as testing machines. This information was then to be put in a searchable database. This work primarily focused on member companies and research institutions. At one time, I asked about the involvement of MWR's public sector members in the inventory, receiving the answer that their participation was more to do with allowing them insight into MWR and that their role was still rather unclear. After all, MWR was really about furthering microwave technology development. Again, this exemplifies the ongoing struggle in MWR related to the triple helix script; the role of the public sector was rather ambiguous.

However, they soon found that the database did not work as well as they had hoped. Instead they prioritised visiting the members, meeting them in person. I shadowed, that is followed and observed, Karl and the project leader David during three of their member visits. The visits typically began with a guided tour around the member company's development and production sites, after which Karl and David sat down to talk with a few of member representatives. My understanding of these visits was generally that they filled a communal purpose; they discussed the role of MWR, industry experiences, acquaintances and former colleagues, technology and production processes, products and so on. It seemed like the parties were all initiated into microwave engineering, and they all acted as if they were part of a collective that was bound together by microwave technology. Storytelling seemed to be a central feature in these interactions, and I later learned from Karl that the purpose of the visits was not so much to chart competencies. Instead, they provided a setting for discussions about what the member companies had developed and produced in the past and what they wanted to get out of being a member in MWR. Soon after this David was offered another job and resigned from MWR, and the database was "put on ice" as it were. The idea of picking up the work with a database has resurfaced on several occasions, and after this study's completion I heard that they had put together some kind of database, albeit much simplified compared to the initial design.

Missing activities

The ongoing activities in MWR can be referred to as microwave management or MWR in practice. The activities encompass efforts to recruit and retain members as well as to promote the initiative, be it through presenting the initiative in brochures and models, building a website, sending emails, visiting members, or hosting meetings and technology seminars. Indeed, microwave management also largely entailed attempts to raise capital in order to develop microwave competency and technology. Related to this were the efforts to strengthen the MWR constellation, linking it to other innovation initiatives and developing structures for mapping its members' collective microwave competency.

Many of these activities thus concerned grouping microwave related organizations and their representatives in MWR, and getting them to interact. However, a recurring theme from my observations of MWR board meetings and generally from being in the field was the ambition to work with technical projects. There was often talk about developing technology in specific projects, suggesting that this was the real purpose of MWR and what was considered as useful by its members. Karl once put it this way: "we cannot just compete [referring to VINNVÄXT]; we have to get going with concrete [technical] projects". However, the central technology development activities seemed to be missing in MWR.

A similar discussion took place as early as during one of the initial board meetings in December 2003. One of the board members stressed the need to focus on MWR's members and the purpose of the initiative, keeping the external issues aside for the time being. They all concurred; some even suggested that "without members we will not survive", and that "the bottom line is the members' utility". The discussion then turned to what the purpose of MWR was and whether they should have a cluster or project focus, and Karl said, "we get money for the former but the members need the latter." They all seemed to agree that they have to "get on track and initiate technical projects". This kind of talk is particularly interesting as it concerns what type of activities MWR should pursue, and thus also influences how its identity is constructed. And the issue of technology projects was a pressing one. This had been a MWR selling point all along, explicitly stated in all their visions and brochures, as well as being expressed in MWR's other communications with their members and

financers. And now they had to shift from merely arranging microwave meetings, and get down to working with technology. The chairman of the MWR board emphasised that the initiative now needed a shift of gears: "the members get exchange from the network in itself, contacts exchange during the first year… the second year we have to have concrete projects". However, this was commented on by another director who pointed out that "there is a risk if we just go out with a project [too early]..., networking serves a purpose in itself." It follows that MWR's directors did express worries with regards to simply starting projects that none of the member's wanted. Despite such worries, they all concurred that it was important to get going with a collaborative technology project as soon as possible. But as one director emphasised, the projects had to have both technology and business development value. There was also a general agreement that MWR would get its "big headlines" in the press when it could display its first technological gadget: "we have to get something concrete!", as one director of the board put it.

Many of the subsequent activities in MWR were directed towards initiating technology projects. The next chapter will concentrate on two initiatives for developing technology, providing more detailed examples of how the innovation systems and cluster scripts, as well as the local ideas of strengthening the microwave technology industry, were put into practice.

Discussion – organizing Microwave Road or technology development?

In the previous chapter I described efforts at *arranging for microwave innovation*, pointing to how representatives from microwave technology related organizations were assembled under the umbrella of MWR so as to further joint innovation activities. In this chapter I have concentrated on MWR in practice and what happened when the innovation scripts were translated into ongoing activities. When studying the establishment and practice of MWR, we find that when the innovation scripts are enacted this certainly influences what is done in MWR, guiding actions towards organizing inter-organizational arrangements. Triple helix is perhaps the most vivid example of such an organizing script. It is less adaptable than innovation systems and cluster scripts, and thus has far reaching

implications for organizing, as it dictates what type of actors should interact in innovation initiatives such as MWR. When MWR was formally launched as a combined innovation systems and cluster initiative, the next step was to fill the form with activity contents.

These activities typically concerned arranging meetings where microwave engineers gathered to discuss how their industry could be strengthened and how they could engage in collaborative technology development. Indeed, microwave technology appeared to be what joined these people together. Certainly, the vast majority of the participants at the meetings work with microwave engineering related issues. It also appears as if the MWR process leader and the directors see microwave technology as being at the centre of things. In fact, they continuously sought to group people, companies, research organizations, supporting public organizations, as well as technology development ideas and capital around microwave engineering. And many of the activities in MWR have thus far concerned generating interest in the initiative. In a way, this also exemplifies efforts to revitalize an industry that is in need of regained confidence after the telecom crisis around the year 2000. But this is by no means a resuscitation attempt beyond hope; the MWR meetings were characterized by a profound belief in the potential of microwave technology and the future of telecommunications.

Participants at the MWR meetings often highlighted the strength of the region's microwave competence and the benefits of collaboration, suggesting that together they can become more competitive if they work together. In Chapters 4 and 5 we saw how this collaborative ideal runs through the innovation programmes, but it also appears to constitute something that the microwave engineers emphasised as important for their industry. The MWR managers and board of directors also placed considerable attention on trying to make sense of the scripts and prescriptions in the innovation programmes from which they sought to acquire capital funding. The issue of triple helix causes particular perplexity and is often widely debated, particularly since the representatives of MWR struggle with how to deal with the public sector helix.

In many ways, many of MWR's ongoing activities concern incessant efforts of grouping organizations, such as when attempting to receive support for the innovation programme applications, enlisting members, getting representatives to come to the microwave meetings, making sure that financers provide capital for the initiative and so on and so forth. Indeed, in organizing MWR, much focus was placed on attempting to assemble organizations in a structure that was aimed at facilitating collaborative microwave technology development.

I have found that many of these activities can be characterized as efforts at *striving for, and maintaining, cohesion*. The MWR's process leader and directors are well aware of the fact that the association is not self-sustaining, and because of this they continuously seek to get other actors to gather around the notion of microwaves and technology development. In other words, they strive for cohesion in assembling their group of microwave-related organizational representatives. And this also entails what I call efforts at *continuous recruiting*. Let me illustrate what I mean with this: just because the MWR initiative was formally established, this did not mean that organizational representatives, capital, microwave technology, membership fees, public financial support, and so on, were automatically recruited to the initiative. Instead, MWR's process leader and directors did what they could to recruit actors and allocate them with roles and relationships. So not only did they act to convince their members of the utility of MWR, they also sought to persuade others of its use and growth potential, such as the representatives for the funding programmes of innovation and Region West Götaland. Again, this can be explained by Callon's (1986) sociology of translations, which highlights how actors try to get others to comply with their interests, mobilizing them to join their programme of action. We will return to this issue in Chapter 9.

Since the funding bodies had requirements that had to be fulfilled in order to be eligible for such innovation support, much emphasis was placed on making sense of the innovation programmes and their scripts, particularly by the MWR board of directors and its process leader. This involved attempts at trying to organize a triple helix structure, as well as reassuring the funding organizations of the initiative's growth potential. This in turn is clearly reconstructed in texts and actions with regards to how MWR is portrayed, how its board of directors is comprised, and which organizations are recruited as members in the initiative.

The fieldwork material from the board meetings and other occasions shows how people affiliated with MWR attempted to make sense of the innovation scripts in translating them into meaningful actions, fitting their desires and beliefs. But why do they focus so much on organizing a microwave cohort? The reasons may of course be many, such as arranging meeting places for microwave engineers, but the explicitly stated rationale was to facilitate microwave technology development projects. And for this it was deemed central to group relevant organizations together. Indeed, an initiative such as MWR could be seen as having a centrifugal propensity or a tendency to fall apart, and therefore requires continuous efforts of (re)construction, or indeed recruiting. Actions such as technology seminars, annual meetings where engineers meet and discuss with one another, as well as distributing news emails, updating the website, visiting companies, collecting and distributing press clippings, etcetera, all have some form of a cohering effect. And, to some extent the idea of microwaves and microwave engineering practice also act to unify various actors, almost as if the microwaves were a sticky substance holding a wide host of parts together. And it does not seem too hard to convince microwave engineers of the importance of focusing on developing microwave competency and technology collaboratively, particularly as the idea is that the government agencies would fund such activities. One of the most central activities in MWR was indeed to stimulate the development of new microwave technology applications, which would also mean developing new microwave business opportunities. But was this organized in MWR?

In summary, as MWR was translated as a combined innovation system and cluster for strengthening the regional microwave technology industry, an inter-organizational network of companies with established microwave identities, and research institutes and public organizations was formed. The proclaimed ambition was indeed to use this network to further collaborative technology development. Indeed, this was how MWR translated the innovation programmes in practice, editing the innovation scripts by combining them with their past experiences from technology work and adjusting them to fit their technology development ambitions. However, once the structure was established, and the MWR network was in place, they struggled to find out what to do. It was almost as if they focused on organizing MWR rather than organizing technology development, and the initiative was thus missing central activities. So when they had

constructed the form, they were very keen to fill it with technology development contents. And technology project initiatives represented a way forward. The next chapter tells of two such initiatives: the Automotive Group and The Ceramics project. These initiatives are particularly interesting as they point to two different ways of organizing, where one was more successful than the other.

CHAPTER 8

Grouping vs. acting for technology development

Now that MWR was formally established as a combined innovation system and cluster initiative, focusing on microwave technology development, it really had to get down to action. As we know from the previous chapters, technology development was MWR's edited take on the innovation programmes and their scripts. So far the actions had focused on organizing MWR and their association, network, cluster, and systems structure, as opposed to technology development. The efforts so far had largely concerned assembling their version of an association, network, cluster, and system structure. And now that the "structure" was in place they struggled with coming to terms with what MWR should do. The purpose was indeed to develop technology, but this was easier said than done. The form was in place and now the initiative's process leader and directors tried to fill it with contents, that is, with activities. MWR's activities had largely centred on arranging meetings, applying for capital, making sense of the innovation programmes and scripts, constructing a yet stronger constellation, mapping competencies, and simply making sure that the initiative did not fall apart. The latter included making sure that its members and financers were happy. But the "missing activities" in terms of technology development were indeed nowhere to be found.

A frequent theme at the MWR board meetings was the search for possible technology projects. This particular issue was described as a "hard question", i.e. technology related, which in engineering work is often seen as more important than "soft questions" regarding for instance personnel or

organizational issues. Nevertheless, the MWR representatives often described the networking and meeting arenas as crucial for MWR, but the key emphasis was still to initiate collaborative technology projects. The latter was characterized as an important means for getting to "action". In other words, technology work is what validates as "real" action, which is why the people representing MWR strive so hard to facilitate this. Indeed, once the MWR organization and structure had been established, technology development became the most pressing issue. Statements such as: "we have a head, now we need a body" exemplify just this, suggesting that the likes of vision, strategy and structure were developed first, which then were supposed to lead on to operations and actual work. An alternative interpretation is that the head had done the thinking and now it was time for the body to act.

In this chapter I will pay attention to how two technology initiatives were organized, comparing similarities and differences regarding how the innovation scripts were performed in practice. The first initiative was referred to as the Automotive Group, which sought to bridge the regional telecom and automotive industries by assembling an organizational group for innovation. Although the initiative gathered much interest in MWR, it was eventually dissolved and was more or less regarded as a failure. The second initiative was called the Ceramics Project, were MWR members joined together on an internal problem regarding how to work with ceramics as a carrier material for electronic circuits in microwave engineering. This, on the other hand, was deemed a more successful attempt to produce technology development action.

The automotive group – attempting to bridge industries

The first effort towards developing technology in MWR became known as the *Automotive Group*. It was framed as an attempt at joining telecom and automotive technologies, something which bears close resemblance with the coinciding VINNVÄXT 2004 application AutoCom Region.[70] The

70 AutoCom Region was an innovation systems application that combined the four innovation initiatives Microwave Road, Innovatum, Telematics Valley and Lindholmen Science Park. It

Automotive group had its first official meeting in early spring 2004. However, the idea of linking microwave technology applications to the automotive industry was not entirely new. It had indeed turned up in various guises at previous MWR meetings and in past documents, presented as an area with great potential. The idea was to find new fields of technology application, such as using telecom technology in automotive products.[71] Again, the ambition was to strengthen industries' competitiveness and to generate economic growth. At a first glance this seemed to fit MWR's ambition of finding new applications for microwave technology, which indeed was a priority for MWR, as outlined in the previous chapter. Communications technology, radars and other sensors were seen as applications of microwave technology that could be developed for vehicles and infrastructure, possibly opening up a new market opportunity for microwave companies. And at this point in time the MWR process leader and the board of directors were pressed to commence some type of technology development activity; showing both financers and members that interesting things happen in the association. An opportunity to both initiate some type of member activity, as well as explore a potential way into the automotive industry "opened up", as one engineering manager in the MWR board of directors put it. This route went via the Swedish Road Administration (SRA) into the so-called Intelligent Vehicle Safety Systems programme (IVSS). But it was more than just an opening; it was also an alluring potential source of capital, considering the IVSS research and development budget of about 64 million Euro.[72] IVSS was thus considered as a highly interesting opportunity for pursuing technology development, as well as a solution to MWR's quest for capital.

The purpose of the IVSS programme was to fund projects that would improve tomorrow's road safety, hopefully leading to "smart technologies and IT systems which would help reduce the number of traffic-related fatalities and serious injuries" (IVSS Brochure 2005). The IVSS programme was a joint venture between SRA, VINNOVA, Invest in Sweden Agency,

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can be seen as an attempt to build a superstructure or group, a system of systems, a group of groups, or a structure of structures. See section 7.3.4 Joining forces for stronger constellations?

71 *Telecom* refers to telecommunication technology, where microwave technology is often used for sending and receiving digital information. *Automotive* denotes the automotive vehicle industry, encompassing cars, busses, trucks and other automotive machines.

72 IVSS was indeed considered as important for MWR and was jokingly referred to as a potential source of "the first millions" for their technology development ambitions.

VOLVO AB, VOLVO Car Corporation, SAAB Automobile AB, SCANIA AB and Scandinavian Automotive Suppliers AB.

When consulting the initial IVSS agreement (2003) between these public organizations and automotive companies, it becomes clear that the programme primarily aimed to meet commercial needs of the involved automotive companies, as well as the requirements of economic-political and transport-political goals. The automotive companies were said to define their commercial needs themselves. The public goals referred to reductions in traffic fatalities and injuries, as well as to increases in employment in the field, the number of companies and their profitability, and the ability to attract foreign direct investments. In terms of the programme funding distribution, IVSS contributes 370 million (about 37 million Euro) and the automotive companies SEK 270 million (about 27 million Euro). The programme encourages project suggestions that are supported by at least one of the participating automotive companies, and correspond to the outlined programme goals. Indeed, these requirements are explicitly stated in the IVSS information brochure, suggesting that all projects must meet the goals of the IVSS parties. It also stated that an idea had to be "sold" to one of the programme parties, suggesting that the automotive industry representatives and the public officials had to be mobilized for a project to even be viable for evaluation. Or as a MWR director put it: the automotive companies "call the shots". Some of the focus areas in the IVSS programme included communication platforms, safety systems and telematics, all of which were of potential interest for the MWR representatives.

Nevertheless, a manager from Ericsson Microwave Systems who had insight into the IVSS programme emphasised that they "should be careful with having an overly romanticised view of the programme". Ultimately it was the automotive companies' agendas that were prioritized, and "the millions would not simply fall into the microwave companies' laps". She added that 50% of the projects were allegedly "cut off at the ankles" straightaway, from an engineering perspective. So it was not only "politics" at large here, which they had criticized VINNOVA for doing; the proposals would be critically examined from a technology point of view by the automotive representatives. She also suggested that the world of telematics is difficult, that the business cases are clumsy and the stakeholders many: operators, telecom technology providers, automotive companies all want in.

Technology development had always been portrayed as necessary in MWR, and IVSS constituted a possibility for engaging in this. However, when this matter was discussed in a board meeting in December 2003, the research engineer at IVF who wrote the MWR VINNVÄXT application in 2002 stressed that technology is not what should be focused on per se. Business development should come first, not just microwave applications for the sake of it. His suggestion was that MWR should act as a catalyst for product development, not engaging in the actual development as such.[73] Technology is not regarded as the difficult part; instead it is developing the services and the business cases that is the tricky bit. Nevertheless, the research engineer concluded by proposing that the IVSS programme should be used as a starting point for MWR's business development aspirations. The board of directors agreed that an "automotive group" was to be formed, coordinating microwave technology cooperation in relation to the IVSS programme. It was also deemed important that it was collaborating microwave firms that should submit applications to IVSS, not MWR.

Grouping together and presenting technology

The Automotive Group became the working name for a series of meetings where MWR's members were invited to present ideas and proposals for how microwave technology applications could be used in the automotive industry. The following could be read in the Automotive Group invitation email in March 2004, again emphasising the need for concrete projects and technology platform development:

73 Two years later his argument was to be re-actualized. Focus had been on technology development up till then, but as financers and new MWR board members began stressing the imperative business development, a gradual shift in focus was put in motion. This change occurred after the main study of MWR and is addressed in the *Epilogue*. Nevertheless, throughout this study, the focus in MWR has first and foremost been on technology development.

> MWR - automotive: an advisory group is under formation for the IVSS project (Intelligent Vehicle Systems). The work field is ”external communications platforms”.
>
> The dialogue with the IVSS project begins for interested members the 23/3 at 3 pm on NAVET/Lindholmen in order to arrive at proposals for concrete projects. The group is already marketed internationally by ISA (Invest in Sweden) through brochures and visits. "Sweden has cutting edge microwave technology companies - crossroads of automotive and ICT".
>
> Observe! ALL INTERESTED MEMBERS ARE WELOCOME TO THIS MEETING! (For more info on IVSS, see www.pff.nu)
>
> (MWR members email, March 2004, my translation).

The email went out to all MWR member representatives as an open initiation and encouragement to come and discuss communications platforms for the automotive industry. The series of meetings began at the end of March 2004 and were held at IVSS's premises at Lindholmen Science Park in Gothenburg. In a telephone conversation, the process leader for MWR told me how he actively had phoned members: urging them to come to the first Automotive Group meeting. He explained how he at first thought that the IVSS secretariat were going to be more active than they had been, although he was quite pleased with the number of participants. 31 participants attended the first Automotive Group meeting; 17 of these represented various microwave technology companies. In addition to these, three people came from the IVSS organization and one from Volvo Technical Development Corporation (VTU). The representative from VTU and a manager at Ericsson AB were there to hold presentations on automotive and telecom technology. A table of the meeting participants and their organizational affiliations is found below:

Participants at the first Automotive Group meeting (Adapted from MWR Automotive meeting participant list, 2004)

Organization	Abbr.	Representatives
Microwave Road	MWR	1
Intelligent Vehicle Safety Systems – The Swedish Road Administration	IVSS/SRA	2
Volvo Cars Safety Centre - Volvo Technical Development Corporation	VTU	1
EMC Services	EMC	1
Chalmers		3
The Industrial Research and Development Institute	IVF	1
OMNISYS		1
KAPSCH TraffiCom		1
IMEGO		1
ACREO		1
Mölndal Municipality		1
Ericsson AB	EAB	3
Frontside Electronics		1
Kitron Development		1
MICOM		1
ARMEKA International		1
School of Business, Gothenburg University		1
MICROBIND		3
Swedish National Research and Testing Institute		2
Ranatec		1
TRIGTEK		1
Elmatica		1
NOTE Borås		1
Total number of participants		**31**

Apart from the co-hosting SRA and the IVSS programme, the majority of the people came to represent industry or research organizations. Interestingly, there were no explicit references whatsoever to the idea and concept of

triple helix, nor to innovation systems and clusters for that matter. Three of the organizational representatives were also MWR directors.

The plan for the meeting was to introduce the IVSS programme and the possibility of applying for project financing for technology development that would improve road safety. MWR was intended to act as an intermediary organization between MWR's members and the IVSS programme. The idea was moreover that MWR's member representatives should meet and discuss technology, investigating how telecom technologies and systems could be integrated and applied to those of the automotive industry. The rationale was to group together in producing joint technical specifications, bridging telecom with automotive and also suppliers and producers. Again, this provides an example of the collaborative ideal, which is commonly premiered in these types of innovation programmes. It also provides an example of how relevant actors, with set identities, are identified and grouped together under the MWR umbrella. The finished specifications were then to be presented for, and discussed with, the automotive industry, and ultimately used in applying to IVSS for funding collaborative R&D projects. In addition, representatives from microwave technology companies were encouraged to develop and discuss proposals for communication platforms, which the IVSS organization would then link to automotive manufacturers for further development.

At the first meeting, representatives from SRA began by introducing their programme for improving infrastructure by using IT and telematics, in order to reduce severe traffic accidents. The programme and the project classifications were discussed and debated by the MWR participants, for instance suggesting that boundaries around specific types of technologies cannot be too restricted. An example of this was found in a discussion on what "dependable systems" meant, where some microwave engineers were sceptical as to categorizing this as a separate core technology: "shouldn't all technologies be dependable". This was followed by an account of earlier investments in vehicle–to-vehicle–to-road communication, presented by an engineer from Volvo Technology Development Corporation. The type of desired technology development included systems for communication between vehicles, as well as between vehicles and the road infrastructure.

This first meeting paved the way for a series of five formal Automotive Group meetings in total. What happened during the subsequent

Automotive Group meetings was that representatives from MWR's members turned up to present their company, university department or research institute, as well as their ideas for how microwave technology could be used to improve road safety. These performances often ended with an open appeal, seeking interested partners willing to participate in developing the project idea further. Some also presented specific proposals for how various parties could collaborate to develop applications or products for the automotive industry. The proposals included automotive radars, optical sensors for slippery roads, intelligent road signs, combined communications and entertainment systems, traffic information systems that could warn of upcoming traffic jams or accidents, etcetera.

Even though the microwave engineers came to the meetings and presented their technology proposals, they often raised questions with regards to the IVSS secretariat's role in all this. Some expressed that the whole initiative was rather vague: should they just turn up and present their technology ideas, who was listening, who was supposed to do what? These concerns were rendered so important that they were discussed in a separate informal preparatory Automotive Group meeting between two representatives for MWR and one from the IVSS secretariat. Bengt from the IVSS stated that the secretariat was by no means a filter with regards to which projects that would be funded. Instead, the purpose of the group according to him was to identify ideas for potential projects. In effect, IVSS was supposed to facilitate interaction between the automotive and microwave industries, where MWR summoned representatives from the latter. However, it was the parties in the IVSS programme, i.e. the Swedish automotive industry and the SRA, that ultimately decided which project proposals to fund. The meeting exemplified how the parties attempted to make sense of the different roles in the Automotive Group and the IVSS programme. At the meeting, Bengt explained that "the automotive industry wants to cooperate with you but they don't know how". He therefore suggested that the microwave representatives met by themselves in the first few meetings, finding potential constellations first, to invite the automotive representatives at a later stage. Bengt added that it was important not to define areas of discussion too early, allowing for less controlling of the discussions. MWR was hence supposed to act as a catalyst for creating projects, something that the two MWR representatives concurred with,

although still being somewhat hesitant with regards to how this was to be done.

At the second meeting the audience had increased from 17 to around 30 people who primarily worked with microwave technology-related applications in one way or another. Only one automotive representative, from Volvo Car Corporation, was present throughout the entire meeting, a trend that continued at the following Automotive Group gatherings. Indeed, automotive representatives did occasionally turn up at the subsequent meetings to present glimpses of pressing issues in the automotive industry, only to leave shortly thereafter. As a result, there were primarily microwave engineers at the meetings, discussing among themselves how microwave technology could be applied in the automotive industry. There was hence little interaction between the two industries that were to be bridged. So the meetings were more characterized by one-way communication rather than interdisciplinary dialogue, where microwave engineers were supposed to do the work themselves, and then present their results to the automotive representatives. The automotive representatives would supposedly join later, when the projects become more concrete. Nevertheless, all project applications had to involve and be approved by one of the five automotive partners in the national automotive research programme. So irrespective of the fact that the automotive side seemed to be rather passive, they still had the upper hand with regards to which projects to fund. The expressed ambition, then, was that the microwave representatives should discuss and come up with project ideas and specifications that ultimately would be presented and further developed at a later "sharp" meeting with automotive representatives. This suggests that there was a rather asymmetrical power relationship between the automotive and microwave representatives, where the former was deciding the rules of engagement.

During a coffee break at the second meeting I noticed how three of the engineers started talking about a possible system. During their presentations, they had themselves pointed to similarities in their different suggestions. Lars, a researcher at IVF, went over to Ola at Omnisys Instruments to ask about the availability of hardware. Soon Jens from ACREO joined them. I hear Ola mentioning the importance of co-ordinating their roles, emphasising that they should avoid overlaps if they were to work together.

A month later, at the third Automotive Group meeting in May 2004, the presentations continued. This time around, however, Bengt and Karl suggested that participants were welcome to work separately with their ideas and did not have to sit through all the presentations. Instead they were encouraged to use other adjacent rooms for discussing their ideas. The three engineers that I overheard talking about complementary technology ideas a month earlier took this opportunity and left the room to discuss further. I was allowed to sit in and listen as they discussed how they could design an automotive communications system. The engineers knew each other from the last meeting, and I also got the feeling that they had talked with one another since then. Almost instantly, they began discussing what was interesting and what was not from a business point of view. A fourth engineer from a company testing electromagnetic interferences asked if he could join them and sat down. At first, they introduced their ideas, looking for complementarities. One of them said that the "interference" track was interesting but perhaps fitted better in one of the other themes; nevertheless, he stayed on and made his way into the discussions. They continued to talk about developing a demonstrator. One engineer explained that his company already had a generic platform that could be used, suggesting that it would be insane to develop something new. The issue was debated for some time as Ola appeared to be keen on developing a new platform himself. They discussed circuit cards, antennas, frequency layers, standards, suppliers, graphical interfaces, and so forth. Ola from Omnisys commented that they all had somewhat different interests and since IVSS was not co-ordinating them, he suggested that they formed a meta-project with sub-projects. They all agreed that the entire process with IVSS and the Automotive Group had been delayed, and they had to start now, before it was too late. Ola said: "we cannot simply continue to present ideas, we have to start working!" Lars concurred with this as he laughingly added: "yes, at the last meeting we were also supposed to work…" They continued to debate different views, which components to use, as well as pondering what the automotive industry and the IVSS might want. One of them posed the question of what the other's specific purpose was, and somebody jokingly suggested "I don't know, I'm just here for the money [followed by laughter]". In the end they all seemed to agree that they should try to do something together and began writing a specification, dividing roles, appointing a co-ordinator and allocating tasks and work packages.

Ultimately the engineers managed to produce a technical specification for a possible communications platform. They seemed quite content with the specification, which was to be presented to the automotive representatives in a forthcoming meeting. One of their chief concerns was that the proposal had to be specific with clear deliverables; it was by no means to be seen as science-fiction.

The automotive encounter

Two weeks later, the communication platform mentioned above, as well as other suggestions, were supposed to be presented to the automotive industry at the fourth Automotive Group meeting. This was the time when the automotive industry was to be represented to discuss the proposals. Nevertheless, when I arrived at the meeting I realized that very few of the representatives from the Automotive Companies were present. The meeting was opened and framed by Bengt, the representative from the IVSS programme, in the following manner:

> Bengt: The thought behind this day is to present the ideas that these [the previous Automotive Group meetings] have resulted in. /…/ This is about getting an indication on viewpoints as well as finding possibilities for interplay [or collaboration/cooperation] with interested parties…., who may find reasons to meet again for a continued concretization.

However, he was interrupted by Karl, the process leader of MWR, whose task had been to administrate the proposals:

> Karl: Firstly, I think it is necessary to clarify the different roles here, who is representing who, Volvo, the Road Authority, the Automotive Component Group…?
>
> Bengt: Yes…, we are missing Saab and Scania [automotive companies]... [followed by a rather long silence]

> Karl: I don't really think that one has succeeded with reaching all the parties, information on the proposals has arrived too late. I got the last one just the other day. Getting as many people together as we actually have here requires a lot of time and effort. I am not particularly happy with this constellation.

There was no explicit response to this somewhat critical comment; instead the room went rather quiet. With regards to the new proposals, Karl was displeased by the fact that a few completely new participants suddenly appeared during the meeting when the automotive representatives were supposed to be present. Indeed, the IVSS programme had been framed as a possible intermediary between the telecom and automotive industries. And the majority of the representatives had been regular participants in the previous meetings, presenting and discussing ideas. The new participants, on the other hand, had not participated before and this was something that the microwave representatives found quite curious. The past meetings had almost exclusively included MWR members, but now these boundaries had been extended.

The meeting had moreover been described as "sharp" and the time when it "really mattered"; it was the instance when the projects were to be presented and discussed with representatives from automotive companies. For some reason, however, there was a low automotive presence and the meeting did not unfold in the manner that I had anticipated myself. I asked Karl about this during the coffee break and he said a little irritably:

> Karl: [They] do not live up to their commitments, automotive aren't here! And those who in fact are here aren't decision makers, they're technicians. Perhaps the Microwave Road groups [those representing the technical proposals] have to act directly towards the automotive industry instead.…

As the meeting continued, a person from the Automotive Component Group made a similar observation and confirmed Karl's doubts, suggesting that "it might be better to pitch directly towards for example SAAB instead", a conclusion that others seemed to concur with. So, rather than constituting the arena when it really mattered, the meeting seemed quite general and was not as critical as it had been framed previously. At the end

of the meeting, Bengt from the IVSS programme commented on the absence of automotive representatives in a somewhat modified way, by saying that "they [automotive] will come when it [the technology project proposals] becomes more concrete." Perhaps he did not think that the specifications were up to standard yet, which potentially could explain the poor automotive turnout. But regardless of which, it reemphasised that the automotive companies were the ones in charge. The meeting closed earlier than scheduled and the planned lunch never took place, suggesting that it did not go as they had hoped for.

When I later asked about this event, I learned that some of the other microwave engineers were disappointed, if not to say angry, about this development, suggesting that they had wasted their time. They had spent time and effort to put the proposal together and in the end there was no automotive audience to present it for. Several people thought that IVSS had not fulfilled their coordination duties and stressed that they were not happy with the meeting's assemblage of participants. During a board meeting a couple of weeks later, I overheard a discussion between Karl and Ola, the engineering manager at Omnisys Instruments who was involved in the technical project proposals in the Automotive Group:

> Ola: We are thinking about shutting down [their technical project proposal work], it costs too much money.
>
> Karl: No, damn it…
>
> Ola: IVSS has not realised that this costs us money…

A few months later I learned that Ola and Omnisys withdrew from developing the proposal further, which came as no surprise. Having said that, Lars at IVF proceeded to work on the proposal and, as we shall see, it was to turn up in other automotive settings.

"It came to nothing…" and looking for alternative ways

The MWR board later decided to confront IVSS and see how the situation could be improved. After the summer of 2004, I asked Karl what had happened with the automotive group and he replied rather disappointedly "it came to nothing". He also said that it made him wonder about the role

that IVSS played in this, why they had not been able to bring the automotive industry to the table, as well as about the future possibilities for collaborating with the automotive industry.

In a later conversation with Karl, I learned that the very specification for the communication platform mentioned above had reappeared in another context. It became a part of a EU application, and according to Karl there were plans to develop the platform at a microwave technology lab in Uddevalla, Sweden. Later, Karl also told me that the contact with the IVSS administration has been picked up again, indicating that some form of interaction between the groups might continue. However, none of these intentions were put into practice.

Still, the idea of linking the telecom and automotive industries was not abandoned. A year later, in March 2005, an automotive radar day was arranged by the MWR members Kitron Development and the ACREO institute in Jönköping. This time around, reports suggested that the automotive representative turnout was greater. About 70 people were present, and there was allegedly a large interest in the potential for developing automotive radar systems. A similar initiative was arranged in early summer 2005. This time the event was attended by some 50 participants, and grouped under the wider topic Automotive Communication Technology. Again, the meeting was characterized by presentations that highlighted the potential of linking telecom with automotive. Clearly, automotive radar was seen as a promising application where high frequency microwave technology can be used. Even though it appears to generate much interest it seems to be hard to achieve in practice. Representatives from telecom and automotive nod their heads approvingly but seem to struggle with getting to work together on automotive communication. At the meeting, the Swedish Road Administration also presented its work on reducing the number of traffic fatalities and injuries. Ericsson opted for their third generation mobile technology for building a communications infrastructure, and Autoliv outlined their view of automotive safety and how telematics could be used in this. The communications platform from the IVSS setting also re-emerged, slightly more developed, in a presentation by one of its originators. This was however the last time I encountered the platform in the MWR setting, and I

later learned that it was never developed.[74] Some even suggested that the idea of linking automotive and telecom was already too late, and suggested that German firms such as Bosch had already won the race and that VOLVO already bought their products from such firms. Indeed, later that fall in 2005 the new Volvo S80 car came with an "anti-collision warning system" option which was based on radar technology. And this had little to do with microwave companies in western Sweden.

Overall, there certainly seems to be interest in connecting the automotive and telecom sides, but they struggle with finding ways for how to do this. The way in which they went about this was to organize a group of groups, attempting to link different types of companies from two different industries. Nevertheless, these attempts seem to have failed, and today MWR has given up the idea of combining the microwave and automotive industries. At one point, a representative from Ericsson also mentioned that the large Swedish telecom company had taken a strategic decision not to develop relationships with the automotive industry and to focus instead on what they did best in the telecom industry. Perhaps representatives from the two different industries do have different takes on technology and business, which makes it hard to marry them. This might have been the case due to asymmetrical power relations between the automotive and telecom companies, where the former "called the shots". A more plausible explanation, however, is that the Automotive Group was characterized by vague ideas and many different interests regarding how to work together and with what.

Reflecting on the automotive grouping for technology development

The Automotive Group provides an example of what is done in MWR and how a technology development initiative was organized. On the whole, these events provide an example of continuous attempts to link telecom and automotive technologies, as well as of striving to connect ideas and artefacts such as technology and capital, with people, projects organizations, and

74 About a year later I spoke with one of the engineers who partook in writing the communications platform specification. He explained that they never got the opportunity to develop the platform and that it was no longer relevant; as he saw it, you could buy those kinds of products off the shelf nowadays.

industries, etcetera. All this can be referred to as activities of grouping for innovation. Focus is primarily placed on identifying and assembling key organizations and their representatives, gathering a cohort where different and shared practices and views can meet in seeking to stimulate innovative technology development. In this respect, representatives for the IVSS programme and MWR were attempting to create an organizational group (as the name Automotive *Group* clearly implies). This speaks to the collaborative ideal that we have seen in both the innovation programmes VINNVÄXT and VISANU, which is also translated into how MWR and its activities are organized. This collaborative ideal, advocating organizational grouping or the assembly of innovation arrangements, is also enacted in the Automotive Group. However, there is a difference compared to the innovation scripts that were enacted in establishing MWR and its ongoing practice: the Automotive Group was not guided by the triple helix prescription. Moreover, in the Automotive Group the innovation scripts were also extended in that they sought to bridge two different industries as well as two different types of actors. In effect, the Automotive Group attempted to establish a group of different groups, as well as to link suppliers and producers in some kind of value creating relationship. The initiative thus sought to build a system of systems, or a network of networks as it were.[75]

In the Automotive Group, we have seen how representatives found the IVSS programme as an opening into the automotive industry, and as such both a way to find new applications for microwave and to solve the problem of getting to work in MWR. And as Chapter 7 concluded, getting into action and actually initiating technology projects was a chief concern for the MWR directors and process leader. They were also embarking on a quest for capital so to speak; as the reader might recall, "collaborative initiatives don't come for free", and the IVSS budget of over 60 million euro was alluring enough.

Nevertheless, the Automotive Group did not sell itself; the process leader for MWR had to urge member representatives to come to the Automotive Group meetings, and particularly the first one. This is indicative of what I referred to as *continuous recruiting* in the previous

75 This is indeed similar to the ambitions found in forming the AutoCom Region application to VINNVÄXT 2004 that sought to arrange a system of four clusters.

chapter, where the process leader and director went to great lengths to group organizations around their microwave initiative, as well as making sure they stayed members. Indeed, this is also manifested in the simple notion of *presence*, which emerges as a central feature at the start of most microwave meetings; they were asking questions about who was there and who was not, as exemplified in the case of the automotive representatives.

At the meetings we saw how microwave engineers and researchers presented ideas on the topic of automotive communication. The participants asked questions and discussed the proposals. They were typically encouraged by Karl from MWR and Bengt from IVSS to develop the ideas further, often commenting something along the lines "interesting, I suggest that you form a constellation and develop this further!" Again this accentuates a way of organizing collaboration, or rather grouping, which is akin to the innovation scripts that were enacted in constructing MWR. At the meetings, the discussions were lively, often including technical jargon, comparisons of experiences, sometimes expressing criticism of why things had been done in certain ways and so on and so forth. The microwave engineers and researchers seemed to speak the same technological language, and I often struggled to follow what they were talking about. To be sure, several of the engineers worked with different applications of telecom and might be engaged in somewhat variegated practices. However, to me it seemed as if they understood each other and they actually did appear to be more or less joined by their interest in microwaves, just as the MWR representatives claimed in the previous chapter.

Even though the Automotive representatives were seldom present at the Automotive meetings, they were the ones that the projects had to be "sold" to, and they were the ones ultimately deciding whether to fund them or not, which is perhaps not so strange considering that they had funded half of the programme budget of 60 million euro. However, since they were not present at the meetings, how were the microwave engineers supposed to know what the automotive ones wanted? Bridging two different industries is probably destined to be an uphill struggle if one or more of the parties are reluctant to interact. So even if the idea was good in principle, it seemed hard to realise in practice.

During a later informal meeting with Karl he retold a story from a meeting with representatives from Ericsson and Volvo that he had attended. He said that the people from Volvo did not understand what MWR was;

they kept asking "what the product was". Karl explained how he got support from someone from Ericsson in describing MWR. According to Karl, automobile companies are used to buying ready systems from for example the German technology company Bosch, which would suggest that automotive companies might not develop systems jointly with others. Whether this is true or false I leave unsaid; however, it reveals how Karl perceived the situation. He clarified this by saying:

> It is two completely different worlds, two different business concepts. /…/ It's only steel and rubber for those guys. /…/ They see the car as a box and simply want to plug in a communications modem [a telecom product], but they don't exist at the moment; they have to be developed!

Maybe there is something to this; perhaps people working in different industries frame their actions differently, seeing the world in separate ways, which might have consequences for their possibilities to understand one another, let alone work together.[76]

Indeed, the Automotive Group can be characterized as an attempt at creating new interfaces and reconstructing traditional boundaries. Crassly put, the solution for how to achieve this appears to concern identifying the necessary organizations, persuading their representatives to come to meetings, not least by pointing to a big bag of money, putting them in the same room, and in so doing, hoping that they might come up with creative ideas and form groups for collaborative technology development. However, the Automotive Group did not turn out the way Karl and the MWR board had hoped. Perhaps the telecom and automotive fields are different, separated by some form of boundaries around their respective practices. If this is the case, it is likely to be difficult to assemble a constellation where telecom and automotive organizations would simply start collaborating to develop new technology.

Moreover, little was said with regards to what it was that they should develop and the whole "bridging idea" was rather vague. Nevertheless, the representatives for MWR and IVSS tried to organize an interface between

76 The work of preparing the AutoCom application to the second VINNVÄXT 2004 programme tells a similar story. Here, the attempt to work together across different innovation initiatives was characterized as a "maximized compromise", in that different interests of the various participating organizations had to be reconciled.

the two industries by administering meetings and attempting to pull the different actors together. But apparently this was done without succeeding to bring the automotive representatives to the table. Again, this points to how actors try to get others to comply with their projects, defining problems and mobilizing actors to act in line with such problems. According to Callon's (1986) "sociology of translation", this can be seen as entailing actors' persuading others to take specific roles and interact in specific ways, as well as getting actors to speak for larger collectives. In the Automotive Group, actors can also be seen as seeking to draw attention to, and get others to buy into, their problem or interest. MWR's process leader and IVSS tried to point to the benefits of joining telecom and automotive technologies. This was followed by efforts to allocate roles to other actors and attempting to get them to interact in particular ways, as well as getting spokespersons to speak on behalf of larger groups. Indeed, it could be argued that the representatives for MWR and IVSS tried to identify the important actors and attempted to get them to act in certain ways, such as in writing specifications and presenting technology. However, they failed to get the automotive representatives to assume their roles as discussants at the meetings, and the initiative eventually lost credibility amongst the MWR members. This notion of getting actors to behave in particular ways is interesting for understanding this study. We find examples of this in innovation policy and programme development, as well as in the establishment and practice of MWR. I have chosen to refer to this as *processes of continuous recruiting*, something to which I will return later on.

The Automotive Group did not generate any technology development projects and was more or less considered as a failure. MWR was increasingly pressed for getting to technology development work; it had to show its members and financers that the initiative was worthwhile and actually pursued its aim. It follows that MWR had the knife-to the throat and had to solve the problem of actually developing technology. The next section will investigate a potential solution to the problem, studying the so-called Ceramics Project.

Acting on ceramics

In the beginning of 2004 and throughout the spring, I occasionally heard Karl and the directors talk about initiating a technical project on so-called ceramic substrates. This idea was further concretized at a MWR association meeting I attended towards the end of April 2004. During the meeting, an engineer from one of MWR's largest member organizations, Ericsson Microwave Systems, presented a suggestion for a new joint technological project on ceramic substrates. A ceramic substrate is a type of carrier material for microelectronic circuit boards, often used in higher frequency (above several GHz) microwave applications. The technology development project proposal came at a suitable time because the MWR process leader and directors were eager to get down to technology development action, especially now that the Automotive Group had not turned out as well as they had hoped. A ceramics project had the potential of providing the sought-after evidence of activity in MWR that both the financers and members requested.

Specification and debate – a balancing act

The Ceramics Project was presented as MWR's first technology project. This means that the previous Automotive Group initiative was not presented as a technology project; perhaps it was rather forgotten than anything else. When I first heard of the Ceramics Project, it had already been presented to Region West Götaland, which had granted financial support to pursue the R&D project, provided the participating members co-financed the budget with an equal amount in terms of their invested work-time in the project. The project was allegedly a result of careful considerations of all members' interests, having a common denominator, as all microwave companies need carrier materials for their electronic circuits.

The goals and expected long-term effects of the project were ambitious. In a project information sheet, posted on MWR's website, the following could be read:

Ceramics Project goals and expected effects (MWR Ceramics Project Information Sheet, 2004).

Overall Project Goals	Expected Long Term Effects
• To develop technologies for cost effective high performance ceramic substrates. • To enhance the regional infrastructure for ceramic substrate design and manufacturing	• A formation of an internationally competitive innovation cluster • A growth in the regional manufacturing sector • Strengthening of company cooperation and formation of a complete regional supply-chain

Ceramics had been referred to as relevant for a large portion of MWR's members. The project information sheet stated that "ceramic substrates is one of the dominating circuit board technologies that have characteristics suitable for high frequency applications and are commonly used in different high performance applications" (MWR Technology Project Information, 2004). As such, the project was regarded as something of interest for the whole of MWR. But it was not only technological aspects that were introduced as goals with the project — the regional issue was framed as important too. This is certainly related to the fact that Region West Götaland was the principal financer of the project. Its regional development unit has clear ambitions of making the western part of Sweden more competitive, with increased production, jobs and ultimately economic growth, which warrants the focus on substrate manufacture and building a complete regional supply chain for ceramics substrates.

Even though there had been talk of a ceramics project during spring 2004, parallel to the Automotive Group, it was only later in September that an invitation went out to MWR's members. This came at a time when MWR really had to show technology development action; by then the Automotive Group had been dissolved and a new project was seen as paramount.

An invitation to partake in a ceramics substrates project was sent to MWR's members shortly after the association meeting. The invitation was based on an already written project specification with defined work

packages. Representatives were encouraged to come to a first meeting to discuss the design of the project and its specified work packages. An excerpt from the invitation is found below.

micro wave road

VÄSTRA GÖTALANDSREGIONEN

Invitation to Microwave Road's members

VGR [Region West Götaland] has granted funds for the first technology project within Microwave Road.

The project will focus on Ceramic Substrates – commercial and technical aspects. Participation is free of charge for members but with requirements of own work effort as counter financing.

We have thereby the pleasure to invite all members to a meeting which has the goal to

- Further develop the definition and contents in the project's activities/work packages
- Form work groups for the different work packages

Ceramics Project Invitation (Adapted excerpt from MWR Ceramics Invitation document 2004.09.08, my translation)

The document indicates that the project has already received funding and appears to be pre-specified in that it focuses on ceramic substrates specifically. In addition, it also included suggestions for activities and so-called work packages in the project. In a sense, the invitation represents an effort to frame or guide the future course of action, while at the same time

leaving some room for discussion in further developing the packages. As we can see, the idea is still to form groups around the work packages, reintroducing the collaborative mantra that we have seen in the previous MWR activities. The work packages included:

- A market survey – inventory of the region's needs for ceramic circuits and substrates.
- An application study – which applications are possible and suitable for ceramic circuits and substrates.
- Inventory and realization study for manufacturing line – client base for prototype and series delivery and inventory of the region's competence and experience
- Summarizing guidelines – general construction guidelines for a regional manufacturing line.
- Material mechanics study – study of material mechanics, critical parameters, error modes. Theory and practical experiments.
- Process study, robustness and reliability – producing data as grounds for robustness and reliability analyses. Improvement of assembly processes, environmental protection, etc.
- Construction and verification methodology, mapping robustness – Develop methodology for ex. x-ray, leakage tests, etc.

Ceramics Substrate Work Packages (Adapted excerpt from MWR Ceramics Invitation document 2004.09.08)

During the first ceramics meeting, the project leader Henrik from Kitron Development, presented the project specification to an audience of about 15 microwave engineers from various MWR member firms and research institutes. An episode from the beginning of the meeting follows below.

> Henrik [Project leader]: OK, let's start, we are not all here but this will do. I think it is great, it is more than expected really. This is a very interesting field, but it is also a little slim, which has the implication that not all companies in this association are interested. There is nothing strange with that. But those of us that are here today are interested and it is going to be exciting to see what comes out of this. /…/ [Henrik invites Karl, MWR's process leader, to say something about the project].
>
> Karl: Well, I just thought that I would say briefly…, we have now got the first technical project with funding from the Region. And we have chosen a somewhat slim field, but it is in the end directed by needs. And we have chosen to proceed with applying for other technical projects. This isn't just "the one and only" [said in English], this is just the beginning of technical projects that we could get support from the region for. So, I hope that we will get "spin-offs" [said in English] from this project, which we can formulate and put together in new project applications. As mentioned, this time we have chosen a project leader appointed by the board… Henrik is from Kitron Development and he will run this project independently together with you and those interested. There will of course be more companies diving into this; I am convinced this will be the case, especially when it comes to suppliers…
>
> But Henrik will be contact person and he will ultimately report to me and present outcomes, economic project accounts, to Region Västra Götaland among others. But we will go through that later. I will not be seen much at these meetings. I don't think I'm going to say much more than that, I think it is fun that we have got started.

Both Henrik and Karl refer to the Ceramics Project as a slim field but also as an important one. Indeed, it appears as if both of them are engaged in constantly promoting the project and justifying it by referring to it as "needs oriented" and technologically "interesting". In Henrik's opening of the meeting it almost seemed as if he was trying to excuse himself for why they had chosen to focus on ceramics. Still he attempted to *frame* the meeting by suggesting that this was an important field and something that was of interest to many of MWR's members. Indeed, it was almost as if he was trying to "sell" the initiative to those present at the meeting. There were also examples of making promises about the future and the

possibilities for new projects later on. Similarly to The Automotive Group, this project constellation is also voluntary and the MWR representatives were dependent on getting members to join the initiative. Neither Karl nor Henrik can exert any hierarchical control or give orders to the participants.

There are no set contractual arrangements, no specified economic transactions or other exchanges involved from the start. In a sense, activities involving setting up the project, inviting participants, specifying work packages, attempting to manage deadlines and so on, are characterised by what has been referred to as *continuous recruiting* earlier, constantly promoting the specific project and the MWR initiative in general. Organizing in the Ceramics Project appears to involve incessant activities to make parties interested, keeping them in some form of constellation. Again, the meetings are paired with talks of *presence*, about the turnout and on who is there and who is not. All this is furthermore synonymous with what I have referred to as *striving for and maintaining cohesion*, in that the representatives for MWR, and the Ceramics Project in this case, seek to group representatives and create bonds between them and with the MWR initiative. Moreover, the excerpts from the meeting above point to how Karl and Henrik turn to standard organizational or project language, rationalizing the initiative. This might be interpreted as attempts to impose some form of structure on the events and actions relating to the Ceramics Project, something which can be referred to as efforts to construct a formal organization. After this, an engineering manager from Ericsson Microwave Systems (EMW) introduced the work packages in the project specification, upon which Henrik continued to outline the aims for the first ceramics meeting. However, at this point the participants began to question the specified work packages, indicating mixed interest and aspects of challenge and debate in the collaborative setting, as the following episode illustrates:

> Henrik: A goal today, would be to work through this here today and then go out before lunch and have everything set; so we have work packages defined, we have budget, we know who is working with what, and we have a contact person. I think this is a high ambition and we probably won't have time for all this today. And it requires room for thought in between when doing these things. We start this process today…, chewing on the work packages, seeing which parties are interested, what time one

is willing to put into these packages, what bought services one sees as needed in the different packages... We start this process today and we will need to set a goal for when this should be finished. We will do a, call it "bottom-up" budgeting, and set times for the project. Then we will see how that matches what we have from above, which the orderer has put on us [the financing Region West Götaland is referred to as the orderer or client]. Then we will also see when to meet next, perhaps in smaller work groups, and lock the project contents. We will then stop there and will be finished before lunch. Is there something else that is missing completely here?

Ola [Manager at Omnisys Instrument and a MWR director]: It is probably a question of discussing these work packages. If it is possible to imagine other work packages as well, broadened? Because, it is said that this is about ceramic substrates, which is a broad area, but the work packages aren't so broad. Is it possible to consider other packages than those listed?

Henrik: This is a tough balance act, which we have talked a lot about and…, it is probably crucial not to increase the project contents too much. At the same time one cannot be too rigid and say that there is no room for manoeuvre at all. So there is a certain opening, that's how it is. But the decision is made; it is decided on the specification that exists, so that one cannot diverge too much. [A silent pause]. Why don't we set up things that aren't [in the work packages] on the white board while we go through and then we can lift that further to someone who decides whether to take that direction in the project. But I don't think that we should hinder making an inventory of interesting aspects today.

Ola: No, because there is a contradiction in keeping a broad direction and then following the work packages, because there one has probably already chosen an LTCC[77] production line. And then it isn't broad ceramics. It is contradictory; one has already decided a direction. This is very narrow as I see it.

Karl: No, an LTCC line has not been chosen…, so it is still ceramic substrates.

77 LTCC stands for Low Temperature Co-fired Ceramics. This is a specific type of substrate with multiple layers of ceramics used for RF (radio frequency) applications.

The dialogue above can be understood in the light of a debate over technological direction. Ola represents a company that primarily works with satellite communication. This involves frequency spans that are substantially higher than the microwave technology that Ericsson Microwave Systems, for instance, are traditionally engaged in. It follows that an LTCC production line would produce so-called thick film substrates, which are not suitable for high frequencies and are hence not of interest to Ola. Moreover, it appears as if Henrik knows this and therefore acts in a moderating manner, mediating between different parties. On the one hand, the project has already been specified as a ceramic substrate project and has received funding for activities relating to this.

Indeed, the very first project specification in fact formed the basis for the initial project proposal, presented by the Ericsson Microwave Systems engineer at the MWR association meeting earlier in May that year. The specification included a suggestion of investigating the possibilities of establishing an LTCC production facility in western Sweden, which would not fit Ola's operations. On the other hand, Henrik is dependent on "getting participants on board" in order to run the project. Just as Henrik said himself, it is hence a "balancing act" with regards to the different interests. To please all the participants, he invited them to come up with more ideas, writing them down on the white-board, suggesting that if new directions come up, these would be lifted to the MWR board of directors, which ultimately had the last say. But Ola did not let Henrik off with this. He proceeded to say that the whole thing is contradictory, stating that ceramics was a wide field, and then having the project ready-made with set work packages. After this episode they continued to debate and negotiate the direction of the project, and I was curious to see what would come out of this collaboratively framed project.

As the meeting proceeded I learned that each of the project members were required to contribute with their own time in working on the project, adding up to a total of the ca. 130.000 Euro that Region West Götaland contributed. The discussion on the work packages continued throughout the rest of the meeting. Another engineer also suggested a shift from production to focusing on applications of ceramic substrates, something which later turned out to be central to the project.

The project boils down

During the second meeting, not nearly as many as 15 engineers were present. In fact, the participants had been reduced to representing two industrial firms, Saab Ericsson Space, (SES) and Ericsson Microwave Systems (EMW), and three research institutes, Acreo, IVF and the Swedish Ceramics Institute, as well as Chalmers University of Technology. The engineers presented their interests from the viewpoint of their organizations and discussed possible ways of carrying out the project. It became clear that the representatives for the industrial firms all expressed an interest in ceramic substrates, albeit with some variations in focus. Ola from Omnisys had decided not to continue with the Ceramics Project. When I spoke to him during a board meeting dinner, he called the project "Ericsson defined" and did not see how it could fit his business. However, during the third meeting Ola reappeared, and presented a third direction. I gathered from Karl, the MWR process leader, that he had convinced Ola to rejoin the project. As a result, the Ceramics Project was separated into four sub-projects — one market application and realization study, and three industrial sub-projects, run by Ericsson Microwave Systems, Saab Ericsson Space and Omnisys Instruments respectively. The first market study was initially intended to be run by the research institutes. However, the institutes gradually dropped out from the project, reportedly because their representatives found that the companies took too much space. MWR's own project leader Anders therefore finalized the market study in the end. What is more is that the new sub-projects had all boiled down to something different from the original specification and its work packages. For example, the manufacturing line had completely vanished, and the three projects appeared much more specified then the fairly general original work packages and were much more guided by company-specific interests. This is obvious in the new modified specification, which is found in Appendix 4.

The use of a specification was indeed a new prop in organizing MWR. I was curious about this and interviewed Henrik, the ceramics project leader, shortly afterwards. He told me that the original project specification had originated at Ericsson Microwave Systems. It was in fact developed jointly between the ceramics project leader Nils at Ericsson Microwave Systems and Ove at the IVF. Henrik explained that the members' interests

are most important, but sometimes it is necessary to have a specification to start from. He added that not everyone's interest can be accommodated; otherwise it is hard to reach an agreement on a specific direction. Henrik's main task was now to make sure that the projects would take off, as well as finding a way to exchange knowledge and experience among the three subprojects. He seemed a little concerned, as it now appeared as if MWR's first collaborative technical project had become three separate projects, although running parallel as part of the wider Ceramics Project. There have also been some issues raised concerning the selection process for technical projects at other MWR meetings. Some of the members were not entirely content with how the Ceramics Project was defined and selected, despite the fact that the board of directors had approved it. Nevertheless, the project proceeded as follows: each participating member organization did their (home)work at their respective companies, apart from the so-called *flip-chip* sub-project where representatives from Omnisys and Chalmers worked together (see Appendix 4). At the remaining seven Ceramic Project meetings they discussed their project designs, tests, results, problems, questions and so forth, engaging in what might be called technological storytelling.

Technological storytelling

At the subsequent Ceramics Project meetings there were often lively discussions around the sub-projects. The representatives from the projects met regularly to discuss their ceramics work and results, rotating meeting venues among the different project members' premises. The last aspect meant that all meetings also entailed study visits at the different participating organizations, which appeared to be appreciated by the project members. During the meetings there were also lengthy discussions concerning project organization, especially how to request public finances, possible property rights issues, as well as about the deadlines that were constantly being pushed forward in time.

At these meetings, the engineers talked technology at length; they asked one another if they have tried this and that, telling stories of previous experiences from other projects and dealings with suppliers. In these accounts, the engineers motivated why their focus was important, discussed technical details in a straightforward and sometimes critical way,

suggesting alternative approaches and so on. The discussions dealt with issues like migrating metals, for example when gold and silver "float" into one another, cracking substrates, as well as problems with suppliers, recommendations and warnings of technicians they had worked with, etcetera. On these occasions, the participants also presented power points, pictures, ceramics artefacts, diagrams on frequency losses, etcetera, to assist in their storytelling of ceramics endeavours.

Wrapping up the project

All in all there were nine Ceramics meetings, stretching between September 2004 and December 2005, out of which I observed eight. Two of the sub-projects were said to be finished according to plan. However, Saab Ericsson Space's project on evaluating a new LTCC structure and its composition was never completed. The reported reason was that the ceramics supplier failed to deliver the new type of desired materials. At one of the last meetings, representatives from Omnisys and Chalmers told the group that they had achieved promising results from their study of verifying parylene coating material for so-called flip-chips, encapsulating sensitive electronics. The results were to be published in a scientific journal and were presented as a poster at the European Microwave Week conference in Paris in October 2005. Ericsson Microwave Systems finished their study on thick-film substrates and had carried out electrical and process evaluations. According to the Ericsson engineer Petter, "this new type of constructing technique could potentially be used in their radar production" and was said to have generated important learning.

All the respective subprojects reports were also to be made available for MWR's members at the MWR website. Today the meeting protocols and progress reports can be found online for MWR's members, along with the sub-project reports. The project was finished in spring 2006 and the final report was completed soon after that.

A sharp project, or?

Results from the project were also to be presented in some way at a workshop arranged by the European Network of Excellence on Multi Material Micro Manufacture in November 2005, which was located at IVF's premises in Mölndal. I attended this event, finding that only one of the

ceramic substrates participants was there to present their results for the Ceramics Project. As we know, the project was delayed and not finished at that time, and no collective presentation was thus possible. In relation to this, I heard somebody mentioning, "It is lucky that this is not a real delivery project." This puzzled me and I thought to myself: what is this then, is it just a play-pretend project? Why did they consider the project as such? One explanation can of course be that since Region West Götaland financed the project and due to the fact that there were no customers at the receiving end, it was not seen as a real project. Perhaps the participants do not take these collaboration activities as seriously as when for instance developing and selling a system to a client? This calls for further exploration; let us go back to one of the prior meetings to investigate these collaborative aspects in more detail.

During the ceramics meetings, there were discussions regarding the expectations from the project "orderer" Region West Götaland, that is the regional administrative organization that funded both the project and large parts of MWR's process leading activities. The engineers talked about the importance of showing results and indicating how the resources have been used, as well as pointing to the upcoming activities. There was also a discussion concerning potential continuations of the project and about the possibilities of applying for more capital from Region West Götaland. One engineer from Ericsson Microwave Systems said that "[i]t would be a shame to lose momentum…" and the others seemed to agree, suggesting that they now have a good network on ceramics to continue with, and they were hoping that the Region would finance these too. This was followed by a dialogue regarding various types of project directions, focusing for example on soft substrates and three-dimensional construction techniques. Microwave construction techniques seemed to be a central issue in the technology talk in MWR. However, Petter, a participant from Ericsson Microwave Systems, commented on this at the final ceramics meeting:

> Petter: Have we explicitly said that we should work with construction techniques first and foremost? There are broader areas, now we have looked at substrates, but if you look at the microwave field, then there can be a whole range of interesting things to look at, both when it comes to construction techniques and… But perhaps it is construction techniques that we have aimed at, or…?

Henrik: Well, I cannot really explain why these types of projects are so common. It could be that construction techniques are neutral ground.

Nils: Yes it is neutral ground; I was just going to say that.... it is easy to be generous, talk about it in general terms, offering knowledge.

Anna: Yes I think so… Designing circuits and such things, hmm… then one might want to….

Nils: …then one is into that knowledge which makes one unique, seeing it from a competition perspective.

Henrik: Or maybe that is what one thinks… [Everyone laughs].

This is interesting as it touches on what type of issues are seen as appropriate for this take on collaborative technology development projects. Neutral ground appears to be seen as important. Circuit design is more sensitive and something some companies might want to keep to themselves. In the Ceramics Project, the availability of capital and a general interest in microwave engineering and ceramics seem to have contributed to the engagement in the partly joint activities that the Ceramics Project entailed. But the dialogue also speaks to the issue of what to relate to in technology initiatives like this. It appears as if it is necessary to have an idea, object or technique that everyone in the technical project can associate with and work around, in a useful way. This becomes even more evident in the following statement:

Petter: Perhaps one can agree on a number of areas that many feel… [are relevant] /…/ I don't think it will be interesting if there is nothing to talk about. It works now when we do things together. But we know that when we just meet, then no one says anything [small laughter]. Nobody offers anything for free, saying: look at what we have done…, it doesn't work like that. That's how it is. So there has to be something to work around. To make it interesting….

Anna: … then it has to be something concrete.

Petter: Yes, otherwise one can meet in other settings.

> Henrik: Yes... [laughing quietly], I'm laughing a little, not at all because… but it almost sounded like, if we were to sit here without anything to talk about, then we would each just sit in a corner and drink coffee, eating pastries… [Everyone laughs].... no, but I agree with you.
>
> Nils: But one has to have a goal with meeting. /…/

As the project was wrapped up I noticed that its value for MWR's members had become a topic for discussion, and some voices suggested that it was not an optimal project. It has also been suggested that the project was not "sharp" enough but more of a first joint technology project attempt, and that it would be different in the coming technical projects. Maybe it will be different in the future, maybe not. Nevertheless, the Ceramics Project provided the sought-after evidence of activity in MWR; now they could at least point to how they worked together on technology issues.

The results from the Ceramics Project were also used in a later project idea, proposed by one of the participating organizations in the previous project. This time around, so-called "soft substrates" were the focus, i.e. carrier substrates made in other materials. However, during the project presentation meeting the 10 or so engineering representatives from MWR member organizations seemed somewhat hesitant concerning the idea. And Region West Götaland was no longer ready to finance another technology project without complementary sources of funding. The project was consequently put on ice. In fact, to my knowledge, the Ceramics Project is actually the only technology development project to be undertaken in MWR to date.

Reflecting on ceramic action for technology development

The Ceramics Project started with somebody presenting an idea of what to do. At the time there was an urgent need to get down to work in MWR. The Automotive Group had not turned out as the MWR directors and its process leader had hoped, and they therefore found it necessary to show both members and financers that interesting things happened in MWR. Substrates was a topic that had been discussed ever since MWR's first VINNVÄXT application, and was often presented as something of

relevance to a majority of MWR's members. At this critical time for MWR, one of its directors from Ericsson Microwave Systems picked up on this and asked her colleagues to write a project specification for a ceramics substrate project. Ove, the industrial researcher at IVF, assisted in this work. The specification was presented to Region West Götaland, which agreed to fund the project with SEK 1,3 million (about 130.000 Euro); then the project was initiated.

With a specification ready and cash secured, MWR sent an invitation to all its members to meet and discuss the project specification and work packages. Everyone was welcome to join a collaborative project on ceramics, provided they funded their own working time. At the meeting the work packages were openly discussed, debated and even criticised; some thought it was a too narrow a field for a MWR project; others saw direct overlap with their work. Interestingly, one of the topics of discussions concerned to what extent the project had been pre-specified: was the specification fixed or did it allow for new directions? The newly elected project leader tried to accommodate all the different interests and desires and at the same time stick to the specification, suggesting that it was a *balancing act*.

Again, the MWR and the Ceramics Project representatives engaged in efforts to sell and promote the project, convincing the members that it was relevant for them. The issue of *presence*, who was there and who was not, re-emerged, and there are several similarities here with what has been referred to as activities of *continuous recruiting and striving for cohesion* in both MWR and the Automotive Group. The Ceramics Project leader tried to facilitate the members' participation, negotiating the different interests and getting as many people as possible on board. Ultimately the project boiled down to a market survey and three sub-projects, where company member representatives had translated the idea of ceramics into something that fit their own business.

At first there were proclamations of interest and intention, and then there were debates and negotiations with regards to what to do. The issue of setting up an LTCC production line was questioned directly, providing an example of how an actor, in this case the engineering manager from Omnisys, sought to get others to comply with his interests. In so doing, he also positioned himself and his company as an actor to count with. But there were many different inputs at the meetings, where several representatives

expressed their interests and desires on how the project should focus. And as we know, ultimately three sub-projects were formed, accommodating the interest of the most outspoken company representatives. This suggests that the actors could not agree on a specific aspect of substrates; instead they translated the projects in ways that would fit their interests. Nevertheless, ceramic substrates can be conceived of as a form of boundary object (Star and Griesemer, 1989). In other words, despite being from separate companies with different interests, albeit with a shared microwave practice, ceramics constituted something that all the organizational actors could relate to; it was something that acted as an object that could move across the boundaries of different companies. Ceramics was sufficiently concrete and yet flexible enough for the project to interest several actors, allowing them to join in some form of collective action around technology development.[78] As Star and Griesemer suggest, consensus is not necessary for cooperation, but some form of reconciliation of meaning is required. Despite the possibility that different actors perceive and translate ceramic substrates in different ways, it may act as a boundary object, which according to Star and Griesemer (ibid.), has a structure that is common enough to make it recognizable and plastic enough to be adjusted to local interests. This also makes ceramics an actor in organizing the project, that is, a technological artefact that actors from different settings could relate to, even the public financer Region West Götaland. The Automotive Group, on the other hand, did not have a clear boundary object to which all parties could relate, and collective action might have been hindered because of this. Moreover, the boundaries between the automotive and telecom industries were probably more difficult to traverse since their practices were completely different. Perhaps the later developments on "automotive radars" could have become a tentative boundary object. But as we now know, this never materialized in any collective work. What was even more problematic in the Automotive Group was that there were no ideas about what to do. In that respect the Ceramics Project differed from the Automotive Group. In the former, the object of ceramics was coupled with ideas or scripts concerning what to do. The specification enabled them to discuss what they agreed on and what

78 As a matter of fact, the word *substrate* coincidentally means a base on which an organism lives, or a substance to act upon, or an underlying support (Merriam-Webster Online Dictionary, 2007), and as such it resembles the idea of a boundary object.

they disagreed on, acting as a trigger to the subsequent rewriting of the specification and the formation of three sub-projects.

These findings from the Ceramics Project are in line with Hernes (2003) argument that boundaries, such as those around microwave technology and ceramic substrates, may constitute enabling mechanisms and not just constraining ones. The construction of MWR as an organization involves setting boundaries around microwave engineering. The Ceramic Project also provides an example of how boundary setting, coupled with an object that may cross company boundaries, enabled some form of technological work (irrespective of whether it will result in innovations and increased economic growth or not). Still, the Ceramics Project appears to be more characterized by coexistence rather than by collaboration. The representatives of the participating organizations are not exactly working jointly in the sub-projects; rather they take on separate tasks that are then made sense of collectively. And the extent to which the sub-projects' activities fit together and whether the results are of value has been debated in MWR. Nevertheless, focusing on ceramics did enable some form of collective action. Moreover, this project did not follow the innovation script of grouping actors together in attempting to further innovation, as the innovation programmes prescribe. Instead, the MWR representatives translated what I call the IVF heritage, in that they worked together on a shared technology problem in joint projects. In this case it concerned acting on ceramics.

Discussion – two different ways of organizing

The Automotive Group and the Ceramics Project are interesting to compare since they exemplify two different translations of innovation scripts. The Automotive Group on the one hand focused on grouping organizations, much like the innovation scripts in the earlier organizing of MWR. The Ceramics Project on the other hand was organized according to a different script that concerned acting on a problem rather than beginning with grouping organizations. Let us explore this further.

The Automotive Group initiative aimed at bridging telecom with automotive, searching for opportunities to develop new applications, as well as finding capital funding for this. Similarly to the scripts in the

government-funded programmes, the organizing logic is to identify the most important actors, convincing them of the utility of the Automotive Group, and grouping them together to discuss the possibilities of technology collaboration. The organizing scripts in Automotive Group hence result in the formation of organizational groups, thus creating an inter-organizational structure first and then investigating what to do. This focus on grouping together resembles the innovation scripts and prescriptions found in the VINNVÄXT and VISANU programmes. Indeed, the acts of *inviting representatives* and *attempting to form organizational groups* in the Automotive Group follow a similar logic to that which had characterized the organizing of MWR up till now. However, there was a difference compared to MWR in that two different industries were trying to be linked in the Automotive Group. Moreover, the latter was also characterized by efforts of linking suppliers and producers in the anticipation of generating new business relationships. Nevertheless, the idea was still to put people together at meeting arenas, to present, comment, discuss and propose technology, similarly to the innovation scripts. Actors were thus arguably regarded as placeholders with already established identities, rather than actors by virtue of acting.

In other words, the organizations are identified by referring to their representational identity rather than what it is they are thought to carry out. Such actors are then grouped together in an arrangement such as Automotive Group. For example, Ericsson knows telecom and should hence be present; Volvo produces cars and is thus a central actor; and so on and so forth. This time around, however, there were no prescriptions such as VINNOVA's triple helix that had to be adhered to. Instead, the microwave engineers were encouraged to develop ideas amongst themselves and to do it in whatever way they wanted, although preferably in collaboration with others. The representatives from MWR and IVSS were hoping that such an actor constellation in the Automotive Group would result in new contacts and the identification of synergies and overlapping interests, as well as in collaborative technology development. And technology presentations and discussions on automotive communication were hoped to trigger these actions, much like a brainstorming activity might do. In all fairness, it seems plausible to assume that good ideas can indeed emerge from such settings. However, the ideas were never translated into technology development actions, nor were they translated into business development actions.

Perhaps this was due to the fact that the MWR and IVSS representatives were not able to mobilize the automotive representatives to partake in the initiative. Or perhaps it was due to the fact that there was no clear idea of what to do in MWR, other than meeting and presenting ideas and hoping that this would lead on to innovation work.

Contrary to the Automotive Group, the Ceramics Project began with a specification for action, i.e. working on ceramic substrates, rather than grouping actors together first and then coming up with something to do. It could thus be argued that they enacted an action script rather than an organizational grouping script. Rather than identifying key players and grouping them together, the Ceramics Project began with identifying a topic to act on. An invitation went out to MWR's members to join a pre-specified and funded project on ceramic substrates. Indeed, MWR's process leader and directors certainly made use of the member register of MWR as the initiation was sent to a pre-specified group. However, the difference here was that the specification *framed* what the work was going to be about! It did not point to which actors should be grouped together; instead it focused on an action theme in steering the project towards work on ceramics. The project specification also included prescriptions in terms of the work packages. However, these prescriptions turned out to be rather negotiable and flexible, inviting the potential participants to make what they wanted of the project. And as we know, the Ceramics Project was eventually translated into three sub-projects as defined by the three participating companies.

Another key difference between the Automotive Group and the Ceramics Project was money. The Automotive Group was indeed a materialization of the quest for capital, which we have seen as a theme running through the construction of MWR. The Ceramics Project specification had been developed by a handful of people at Ericsson and IVF and was presented to Region West Götaland, which granted research and development funding for running the project. The Ceramics Project was thus funded before it was presented to the MWR group. This also meant that it was already decided that the project should focus on ceramic substrates. The following step was then to invite MWR's members to join the project. In that respect, the collaborative technology development script was still at large, similarly to the innovation programmes and the initial organizing of MWR. But there was a difference in that, rather than

assembling a group first and then deciding which actions to pursue, the logic had been reversed to first deciding what to do and then inviting the members to carry out the project. This resembles what can be referred to as the IVF heritage, alluding to the past experiences from the industrial research institute IVF where companies had been gathered to work on shared technological problems. Past experiences were thus edited into a new ceramics script. Nevertheless, as we have seen, the specification and the work packages were questioned and debated, even openly regarded as slim and criticised by some. Thus it appears as if the Ceramics Project was more concrete regarding which actions to pursue, in comparison to the rather abstract notions of what the Automotive Group was supposed to do, or the entire MWR initiative for that matter. The Ceramics Project on the other hand followed a familiar script, building on past experiences from joint technology work with which several of MWR's members were familiar. In addition, the Automotive Group was an experimental first attempt of getting to technology development. The Ceramics Project on the other hand was characterized by a sense of urgency, or a knife-to-the-throat situation, where MWR's process leader and directors could not afford to fail. The differences between the two technology development initiatives are summarized in the table below:

Differences between the Automotive Group and the Ceramics Project

The Automotive Group	The Ceramics Project
A first attempt at joint technology development – not critical	A knife-to-the throat situation – a sense of urgency
Grouping organizations first	Identifying problem first
A quest for capital	Budget secured before project start
Vague idea of what to do	Specific idea of what to do
"Third helix" SRA as active facilitator	"Third helix" Region West Götaland as passive financer
Absence of object of action	Ceramics as boundary object
Actors as placeholders	Actors as acting
Searching for ideas to translate into action	Translating ceramics into action
Attempting to bridge two different industries	Focusing on one industry
Attempting to link different types of companies: suppliers and producers	Attempting to link similar types of microwave companies
Two different engineering practices	A similar engineering practice
An experimental initiative – a new script	Building on past experiences – the IVF heritage of joint technology projects – a familiar script
Regarded as a failure	Regarded as a success (albeit debatable)

When comparing the scripts of the Automotive Group vis-à-vis the Ceramics Project, I have argued that there was more of an action focus in the latter. In addition, the idea of ceramics and the technology specification can be seen as a label or boundary object (Star and Griesemer, 1989). Ceramics was sufficiently general for several actors, many of whom were engaged in similar albeit separated practices, to relate to, and specific enough for translating it into some form of collective action. The boundary ceramics object was debated, negotiated and translated into sub-projects, accommodating the participating actors' interests. The sub-projects were then reported and made sense of collectively. So rather than starting with

assembling a group, the Ceramics Project started with an idea of what to do, then a group was assembled. Thus the innovation script of structuring and assembling groups was hence dropped, for the benefit of another organizing script that was more action oriented in defining what to do first, then translating this into action and grouping.

The notion of scripts and organizing is central to this story about organizing innovation in its entirety. In the final chapter I will specifically address how innovation scripts have been performed and edited in relation to the organizing of the MWR initiative.

CHAPTER 9

Performing and editing scripts

In this thesis I have told a story about how theories of innovation-producing arrangements are translated (Latour, 1986; Czarniawska and Joerges, 1996) into innovation policy, and how these theories and policies are translated into practice in the Microwave Road (MWR) initiative. The basis for this has been a study guided by three research questions. The first entailed answering how innovation theories and models were used in Swedish innovation policy and programmes. The second and third questions concerned exploring how the innovation initiative MWR was organized, and to study how the theories of innovation-producing arrangements and the innovation programmes were related to what was done in the initiative.

The story began with investigating how innovation is generally regarded as something paramount for the development of economic growth and thus seen as necessary for societal prosperity. However, the theories of innovation have shifted over time. Some have of course been around throughout, but the point is that the dominance of particular theories has changed. Initially, innovation was explained as something that exists out there in the economy, like an exogenous by-product that could be utilized. But later theories moved towards studying how innovation was produced. Individual entrepreneurs became understood as the actors who combined resources in ways that generated innovations and economic development (Schumpeter, 1911/1934). Later on the focus was shifted towards seeing innovation production as a process that takes place within firms (Nelson, 1988; Fagerberg, 2005), often following planned steps of idea generation, problem solving and implementation (Utterback, 1971). However, in the

1980s the linear inter-firm processes were regarded as too restricted (Kline and Rosenberg, 1986), suggesting that innovation processes are far more complex and dispersed. Theories of innovation systems (Freeman, 1988; Lundvall, 1988, 1992; Nelson, 1993), clusters (Porter, 1990) and more recently triple helix constellations (Etzkowitz and Leydesdorff, 2000) became increasingly commonplace in describing how innovation is produced. They highlight systems and network structures of interlinked firms and other organizations as the locus of innovation, which is why I have called them theories of innovation-producing arrangements. These theories are fashionable today, constituting an increasingly dominant paradigm of how innovation is understood. And the fact that these theories have formed the basis for contemporary international and Swedish innovation policy makes them particularly central for this story on organizing innovation.

The shifts in the supremacy of innovation theories point to how the views of innovation have been translated over time. But the theories have also been translated between different localities and entities. In fact, the theories of innovation-producing arrangements are inscribed, by academics and policymakers alike, into innovation policy, both internationally and in Sweden, in hopes of stimulating economic growth and thereby societal wellbeing. One might say that these theories and policies have become fashionable and constitute the latest trend on how innovation should be stimulated. One such trend began at the OECD, where recommendations and policies for developing innovation systems and clusters were formulated. Here economists worked in close collaboration with policymakers, contributing to moving innovation theories into policy practice. The Finnish and Swedish governments were early in following this new innovation policy trend, and developed their own national ways of furthering such innovation arrangements. The theories and policies were thus imitated and translated, and spread across the globe (in a way similar to that described by Czarniawska and Joerges, 1996 and Czarniawska and Sevón, 2005).

In Sweden, the increasingly popular theories on innovation systems, clusters and triple helix were inscribed into specific innovation policies, both in the Swedish agency for innovation systems (VINNOVA) and in two programmes for developing regional innovation systems and clusters (first VINNVÄXT and then VISANU). In other words, the theories of innovation-

producing arrangements were translated as local innovation scripts for how innovation should be furthered. These scripts, leaning on academic legitimacy of innovation economics, constitute guidelines or programmes-for-action regarding how to organize innovation initiatives. Such scripts are often materialized in written documents, and as Czarniawska and Sevón (1996) argued, one way for ideas to travel is indeed through their objectification into texts. However, scripts can also be institutionalized in practices; inscribed or not, they can constitute taken-for-granted "ways of doing things". Policymakers at the Swedish government agencies and their related programmes inscribe theories into policy and thus construct scripts for how innovation is supposed to be developed.[79]

The inscriptions are also a means to make sure that state funding is distributed and used appropriately and consistently. In fact, the scripts can be seen as carrying rules of action, directly or indirectly prescribing how innovation initiatives should be organized. Indeed, as March argued, "individuals and groups create rules consciously as instruments of control. They construct identities and conceptions of proper behaviour in order to control the actions of others as well as their own" (1994: 79). And just as rules are instruments of control, so are scripts. And, paired with financial incentives, the scripts affect how an innovation initiative is organized as they are translated into action.

The above account responds to the first research question on how theories of innovation-producing arrangements have been employed in Swedish innovation policy and programmes, translated as innovation scripts. In describing how MWR was established and organized, I have shown what happens when these innovation scripts meet practice in a local innovation initiative, thus answering the second and research questions. As microwave engineers, managers and researchers attempted to act on the scripts, hoping this would generate financial rewards, they engaged in efforts to build a collaborative microwave innovation initiative. In so doing they translated their version of an innovation-producing arrangement into practice. This process of translation also entailed activities of editing the innovation scripts to make them fit the purpose of the initiative, which of course was to develop new technology and microwave applications, thereby strengthening the regional microwave technology industry. At first

79 See Chapter 2 for an outline of different perspectives on scripts.

MWR's representatives, i.e. its process leader and directors, attempted to copy and implement, that is perform, the prescribed scripts. They described themselves in the light of a system and cluster with collaborating microwave-related organizations from the triple helix spheres of industry, research and the public sector. In other words they attempted to enact the scripts. In so doing they also built on past experiences of collaborative technology work between the local microwave technology industry and research institutes and universities.

It follows that in establishing the innovation initiative, the focus was primarily attempting to arrange an inter-organizational network structure, or rather an organizational group of microwave technology-related organizations. The purpose was to get microwave representatives to meet and interact in various ways. However, having created such a group, inertia assailed the initiative. The process leader and the directors struggled to come to terms with what the initiative actually should do once the "network" was in place, recalling MWR's purpose of developing technology. One solution for getting to work, in line with MWR's explicitly stated purpose, was to initiate joint technological projects, something with which they had experiences from past joint technology initiatives related to the industrial research institute IVF. At first this was done by attempting to link microwave and automotive engineers in the so-called Automotive Group, aimed at generating collaborative technology projects. This first initiative was more or less regarded as a failure, but the second attempt, the Ceramics Project, was more successful. The latter was closely linked to microwave engineering practice and focusing joint technology work on substrate materials. These two cases exemplify what was done in MWR and allow comparing different ways of organizing and how this relates to the innovation policy ideas and scripts outlined in this thesis.

In this chapter I will discuss the findings from the study further, paying particular attention to the innovation scripts and how they are related to local practice in MWR. This involves discussing how the scripts are performed in MWR and their relevance for technology development. This also entails discussing the consequences of what I call a *structural precedence* in organizing MWR. I will further explore how editing the scripts may allow for local collective action, as in the Ceramics Project. This facilitates a discussion of the relationship between scripts and organizing, pointing to different ways of performing and editing the scripts,

highlighting a structure logic on the one hand and an action logic on the other. These findings permit an exploration of how the innovation programmes and scripts are characterized by templates of modernity, offering some insight into why the actions unfolded the way they did in MWR. Finally I will show what the practical implications of these findings are for innovation policy.

Prescribing innovation scripts

I have pointed to how guidelines for furthering innovation have been institutionalized in policy practices and inscribed in innovation programme texts, policy documents and symbols. Interestingly, in the Swedish innovation programmes, these scripts were explicitly prescribed as normative instructions regarding how innovation initiatives should be organized, something which indeed has had implications for MWR.

Previous research has typically looked at inscriptions in technological devices and how this may or may not guide the actions of technology users (e.g. Woolgar, 1991; Akrich, 1992). Texts like theoretical publications on innovation-producing arrangements or innovation programme guidelines can also be seen as inscriptions in "literary technologies" (cf. Joerges and Czarniawska, 1998). There are numerous examples of such policy texts at the OECD and in Swedish innovation programmes. And just as the scripts can be symbolically represented as letters in a text, they can also be represented in pictures and diagrams. An example of this is the use of a model of the intertwined triple helix, mimicking a DNA spiral (albeit with three strands) in illustrating how organizational interaction in new constellations may generate innovations. Moreover, the scripts can also be enacted in storytelling, thereby legitimizing and strengthening textually inscribed scripts. Such stories on innovation are told by policymakers, ministers and other government officials, as well as by famous academics, consultants and business gurus, narrating how innovation is best furthered. They are also communicated in educational settings, as exemplified in the cluster or triple helix management workshops arranged by the likes of VINNOVA and Nutek. Indeed, scripts are furthermore enacted in policy practice, which is for example obvious in the way innovation agencies invite participants representing triple helix actors to innovation policy

workshops and meetings, or assemble appraisal boards to evaluate innovation initiative applications.

What is more, scripts take the form of normative instructions. The triple helix script exemplifies this very well as it is much more detailed than the other innovation scripts, prescribing that innovative constellations must entail interacting organizations from industry, research and the public sphere. Indeed, these innovation scripts largely concern the arrangement of innovation-producing arrangements. Interestingly, the word "in-struct" in itself may refer to the arranging of a definite pattern of organization, something which is central to the findings presented in what follows. And since the innovation programmes are organized as competitions with large sums of funding at stake, where only a few would come out as winners, adherence to the scripts becomes particularly acute, as the story of MWR has shown.

In conclusion, the innovation scripts are directed towards organizational formation, or more specifically, towards organizing arrangements of interacting organizations as a prerequisite for innovation. This means that the scripts can be characterized as guidelines with regards to what to do and when, i.e. how to organize innovation initiatives. This extends the scope of the previous research on scripts, which traditionally has focused on inscriptions in technological devices. What is more, the study of MWR shows that performing the innovation scripts influences what actions are undertaken and how they are interrelated. This means that when the innovation scripts are enacted they become *organizing scripts*, guiding how actions are linked and made understandable. However, even though scripts have an action-directive character, actors may choose not to perform the scripts, or to alter them to fit their own project, and then performing them. In what follows I will continue discussing the relationship between scripts and organizing. The next section describes how the innovation-producing arrangement scripts were performed and edited in the MWR setting.

Performing and editing the scripts

One of the most central themes in this thesis is how the innovation scripts are performed and edited in practice. And by practice I mean what is done and how in preparing local innovation scripts, as well as what is done in establishing and organizing MWR and its technology initiatives. In innovation policy practice, theories of innovation-producing arrangements are translated into policy and scripts for how to organize innovation initiatives. As I will show, this translation particularly involves editing, in combining and transforming innovation theories as scripts. Moreover, in construing MWR, the initiative's process leader and directors first sought to perform the scripts by arranging an innovation structure, and then they edited them into new scripts that were enacted in local practice, with varying outcomes. The notion of editing is useful for explaining how the theories of innovation-producing arrangements are put into practice, both at VINNOVA and in the regional programmes of innovation. And it is particularly helpful for exploring how the scripts were enacted in local practice in the MWR initiative.

Policy editing

In preparing the regional innovation programmes, agencies such as VINNOVA, Nutek and ISA acted as editors in imitating theories of innovation-producing arrangements and international innovation policies, translating them into local hybridized innovation scripts for how to organize innovation. Such editing is similar to Sahlin-Andersson's (1996) description of the OECD's earlier formulation of science park success stories, which were circulated as recipes to be implemented. In Sweden, policy editing concerned combining and blending theories of innovation systems and clusters, as well as the triple helix model, in formulating a hybridized local innovation script. What this suggests is that organizations such as the OECD and VINNOVA act as both editors (Sahlin-Andersson, 1996) and idea-carriers (Czarniawska and Joerges, 1996) in preparing and promoting innovation scripts.

The edited scripts were also presented as if they could be applied to any setting, similarly to Sahlin-Anderssson's (1996) notion of editing rule concerning context. The scripts are lacking context specificities, something

which makes them general recipes for how innovation can be stimulated, and thus easier to spread in time and place. In addition, Sahlin-Andersson's editing rules of formulation and logic provide further explanations for why such theories and policies can be circulated as success models, or rather as scripts. When paired with academic legitimacy, success stories such as Silicon Valley and labels like *innovation systems* and *clusters* attract attention, allowing them to be identified and spread. The Swedish agencies also used business gurus such as Michael Porter to legitimize their efforts, as well as to increase the scripts' attractiveness and ensure their circulation. Moreover, the innovation scripts also follow a formal rational logic with clear causes and effects. And as Sahlin-Andersson argued, a story following a rational logic takes "the form of a recipe which it is possible to transform into an implementation plan" (1996: 88). Such recipes often carry "a set of necessary ingredients" that is presented as if it can be copied in another locality. Obviously, this resembles what we have seen in the innovation programmes and their scripts very clearly indeed.

However, VINNOVA and VISANU not only edited scripts, they also prescribed them in seeking to guide how innovation initiatives were organized. Explicitly stated or not, the scripts had to be performed in order to receive funding! This introduces a form of enforcing control in the translation process, on top of the characteristics of social control, fashions and traditions that Sahlin-Andersson (1996) identified. And as the word *policy* implies, the innovation programmes thus "police" how innovation initiatives should be organized. The designers of the innovation programmes thus seek to establish norms for organizing innovation. The innovation programmes use rewards and punishments to stimulate desired behaviours; performing in line with the scripts may result in financial rewards and refraining to do so is punished indirectly by denying such rewards. The next section deals with what happened when these scripts were performed in local practice in the MWR initiative.

The scripts' implications for organizing Microwave Road

The innovation programmes and their related documentation carried scripts that innovation initiatives are supposed to follow; they contained "texts" that were supposed to be acted upon. The MWR process leader and board of directors initially attempted to copy and follow the scripts,

translating them into action by directing activities towards organizing an innovation-producing arrangement around microwave engineering. Building on their past experiences from joint technical work, as well as old and new contacts from past education and work placements, the MWR process leader and directors identified what they called "key players" in the regional microwave technology industry and tried to recruit them to endorse the initiative and become members. In other words, they tried to organize an innovation arrangement, identifying and grouping actors in order to further collaborative development of microwave technology. The board of directors was also put together as a triple helix constellation, with representatives from the microwave technology industry, a technology university, research institutes, and regional county and municipal organizations. It follows that in establishing MWR, its initiators attempted to copy the innovation scripts in performing what they interpreted as the necessary steps in developing a combined cluster and innovation systems initiative. They grouped together organizational representatives around a technological field, they elected a process leader and a triple helix board of directors, and proceeded to organize their inter-organizational network.

All these actions formed the MWR actors' translation of what constituted a combined innovation system and cluster. And enacting the innovation scripts, describing MWR as an innovation system and cluster, legitimized the initiative's very existence, towards both its financers and its members. It follows that by translating the innovation scripts, MWR's actors also edited them in Sahlin Andersson's (1996) sense, reformulating innovation systems/clusters in the light of a microwave collaboration initiative. Similarly to Sahlin-Andersson's editing rules, the innovation labels and form scripts were contextualized and filled with local contents, following a formal planned logic. However, in translating the scripts into action, MWR's process leader and directors still attempted to emulate the scripts as they were expressed in innovation policy documents, performing them in a step-by-step manner. Thus, in the early organizing of MWR the scripts were enacted without being markedly altered.

In fact, these innovation scripts were put into practice from the very beginning of the MWR initiative, directing how the 2002 VINNVÄXT application was written, as well as guiding who was invited to the initial start-up meetings. The MWR representatives' efforts to create such an organizational group began with enlisting people representing their

respective organizations and their fields, as well as recruiting them to attend meetings and speak for the initiative. This notion of recruiting has continued throughout the initiative's development, which is why I have chosen to call it continuous recruiting. And the question of "who is present" and actions concerning getting people to speak for the initiative and attend the meetings were ever present. This bears similarities with Callon's (1986) notion of a "sociology of translation", which refers to how actors attempt to get other actors to comply with their interests, regardless of whether those actors are humans, institutions or natural entities. Callon argued that actors attempt to make themselves indispensable through problematizing, i.e. describing and defining problems, to entice others to follow their projects. Having succeeded in this, actors next seek to lock others into roles that fit their problematizing by balancing power relations, something which he refers to as interessment. According to Callon, actors then proceed to enrol other actors by defining and interrelating their allocated roles. And in the final moment of translation, spokespersons for the relevant collectives of actors are mobilized. Indeed, this line of reasoning can help explain some aspects of what we have seen in this study of organizing innovation.

Take for example the inscription of scripts and programmes-for-action. VINNOVA and VISANU prescribe scripts that are supposed to be put into practice in innovation initiatives. In so doing they define why it is necessary to stimulate innovation (generating growth) and how this should to be done through developing innovation-producing arrangements. They also define which actors need to interact (ascribing roles, as Akrich (1992) would put it) as well as prescribe how representatives from triple helix spheres should be mobilized. This procedure was indeed enacted by the initiative takers for MWR, who translated it into practice by establishing MWR. Indeed, MWR's process leader and directors arguably sought to underscore the need for increasing collaboration between local microwave organizations, presenting MWR as a solution. The purpose was of course to stimulate microwave technology development benefiting a wide host of organizations, as well as to increase knowledge development and sharing, create new links between organizations, and so forth. In so doing the MWR representatives sought to engage the attention of other actors and lock them into roles and relationships in the initiative. As a matter of fact, the MWR representatives themselves spoke of "generating interest, achieving anchorage, and selling the idea". And this concerned getting microwave companies on board, the

microwave engineering collective and microwave technology in itself, as well as public organizations, research institutes and institutions, and not least funding agencies like VINNOVA and the VISANU programme. They also sought to get member representatives to speak for the initiative, creating a yet stronger anchorage, not least to the public organizations that funded a large part of the initiative. However, this was not a one-off activity. As I have argued, the MWR process leader and directors constantly engaged in continuous recruiting in seeking to enrol members and capital. Indeed, MWR's process leader and directors engaged in persistent attempts of striving for, and maintaining, the cohesion of their microwave grouping. Another way to look at this would be to suggest that the two different framings of the innovation programmes and MWR converged as the initiative was established. However, MWR's "quest for capital" was also a continuous process, where its process leader and director incessantly sought for sources of funding. In fact, the findings from MWR would suggest that a sociology of translation, as presented by Callon (1986), is an ongoing process.

Despite VINNOVA and VISANU's intentions to stimulate innovation, employment and growth, the results from the study of MWR shows that such scripts are of little relevance with regards to MWR's purpose of developing technology. What happened was that actors, such as the researcher at IVF who authored the first VINNVÄXT application and MWR's process leader, attempted to follow the scripts to the best of their ability in their efforts to bring organizational representatives together. However, once the organizational network structure was set and the member enlistment included representatives from all the three helices, they struggled with coming to terms about what to do. The original innovation scripts were of little relevance to the purpose of furthering joint technology development. In other words, the focus on arranging a structure was followed by inertia, i.e. an indisposition to move, with regards to developing microwave technology products and applications. In a sense, MWR got "stuck" on structure, focusing on developing a network organization rather than technology platforms and products. This is strikingly illustrated by the MWR representatives' sudden, but not surprising, exclamations that they had to get going with technology, and not just organizing their network. Of course, identifying and recruiting organizations to a microwave group constitutes some form of action, but

the purpose was to develop technology and business, and the inter-organizational structure in itself provided no opportunities for this.

In other words, the scripts trigger organizing of inter-organizational arrangements, but this does not mean that they result in producing innovation. Is it plausible to assume that simply assembling a group of organizations is enough for producing innovations? Indeed, the most categorical of the scripts, the triple helix prescription, draws attention to such assembling in particular. It constitutes an unconditional prescription that an innovation initiative's structure must incorporate organizations from the three spheres of industry, academia and the public sector, otherwise funding will not be granted. Interaction between the three spheres is deemed necessary, and in effect, the triple helix script not only prescribes how an innovation initiative should be organized but also ascribes roles and interaction patterns. And there is little room for negotiating whether such a script is relevant in a local setting or not. This is indeed very curious, particularly as it is questionable whether it is sound to take the assumptions behind the theories of innovation-producing arrangements for granted. In fact, MWR representatives often talked about the historically close relationship between the local microwave industry and Chalmers University of Technology, but they did not know what to make of the third public helix. Instead, it seems as if the triple helix script functions to legitimate the initiative towards its financers, rather than contributing to innovation work. In addition, the evidence that triple helix constellations are successful recipes for innovation production, and that this script is universally applicable, is indeed limited (see Chapter 3).

Nevertheless, the scripts did allow for collective sense-making with regards to the microwave industry, its technology and possible future development. Performing the scripts enabled the formalization of meetings for a microwave engineering community, where engineers could meet and discuss issues that they found relevant. But this did not afford the collaborative technology development work that was described as the proper activities that the initiative should further.

Given these uncertainties regarding the relevance of the innovation scripts, it is intriguing to see that they have such a dominant influence on the first stages of organizing MWR. The theories of innovation-producing arrangements are presented as packaged truths, taking the shape of scripts ready to be performed. The process of writing applications to the

VINNVÄXT and VISANU programmes contributed to the early shaping of the initiative along the innovation scripts. The MWR process leader and directors were simply trying to follow the rules of the game in seeking to become a winning (that is, funded) initiative. They tried to perform the scripts in attempting to construct their own take on a combined innovation system and cluster. What this suggests is that, as requisites for innovation systems, clusters and triple helix become part of innovation scripts that are enacted, they contribute to constructing such phenomena (cf. Callon, 1986; Latour, 1986). Similar findings have been reported by Callon (1998), who pointed to how the science of economics actually produces the economy.[80] The results of this study on organizing innovation are indicative of a tight coupling between scripts and action, where the scripts are aimed at closely guiding behaviour in the MWR setting, an issue to which I will return in the next section.

It is interesting to note that even though the scripts are rather categorical, dictating the necessity of specific actor structures, they are still quite abstract and general. They prescribe the construction of a generic form that is supposed to be filled with local content. But such a standard form and homogenous scripts are not necessarily appropriate for all settings, and it is not given that they are relevant for technology development or innovation work. In fact, in the MWR case, the scripts had to be edited to fit the local setting and allow for local action.

Editing the scripts in local practice

The initial activities in MWR were focused on setting up an initiative that grouped different microwave related organizations together. But once the structure was in place, frustration arose within MWR as the initiative's process leader and directors struggled with moving on to action. In so

80 The famous economist Keynes (1936: 383) was also clear on the influence of economic theory, stating, "…The ideas of economists and political philosophers, both when they are right and when they are wrong, are more powerful than is commonly understood. Indeed the world is ruled by little else. Practical men, who believe themselves to be quite exempt from any intellectual influences, are usually the slaves of some defunct economist. Madmen in authority, who hear voices in the air, are distilling their frenzy from some academic scribbler of a few years back." This is certainly quite a strong statement; all economists are of course not defunct. Nevertheless, it illustrates how economists and economics contribute to producing, and not simply mirroring, the economy. Ironically Keynes' own theories grew to have a significant influence on organizing the economy, for better or for worse.

doing, they searched for a work approach that would fit their purpose of developing technology. The subsequent Automotive Group and Ceramics Project exemplify two initiatives following somewhat different organizing scripts in getting down to collaborative technology development. What is interesting with these projects is that they illustrate different ways in which the innovation scripts were *edited* and adapted to local interests and practices. This section will deal such editing in particular, pointing to adaptations and combinations of scripts, or deletions of parts of them, as the scripts meet practice in two MWR settings.

We know that Sahlin-Andersson (1996) argued that the imitation and circulation of organizational success models is characterized by an editing process, where "successes" are reformulated in local settings. She suggested that that which is imitated are rationalizations or success stories. Such stories were indeed present in MWR, as exemplified in the occasional references to for instance Silicon Valley. However, the representatives for MWR do not so much tell stories of other successful innovation settings; instead they often turn inwards and backwards in time in describing past microwave successes, such as when the fighter jet JAS 39 Gripen was constructed, or when Ericsson's communication devices called mini-link were developed, or how Bluetooth came about. Nevertheless, the innovation scripts arguably form rationalizations of success stories of how innovation is best produced, and these rationalizations are imitated as they are translated into local MWR practice.

As the innovation scripts were first performed and then edited in MWR, theories of innovation-producing arrangements and success stories of innovation were reformulated in the light of the new microwave innovation initiative, similarly to Sahlin-Andersson's findings. And when enacting the scripts in MWR, past experiences and practices were edited in a process of translation, so to fit local desires to develop the microwave industry. A loosely connected group of microwave engineers and the companies they represented were thus presented as a cluster and system in which innovation activities take place. In the process of performing and reformulating the scripts, they were edited in conformity with local interests of developing microwave technology and competence in ways that would benefit all of MWR's members. Organizing a microwave community was their initial way of doing this.

Combining scripts in the Automotive Group

In the Automotive Group the focus was, as the name suggests, yet again placed on forming a group of organizational representatives at the outset in order to further collaborative technology development. At first it seems as if such an organizing script is similar to those found in the innovation programmes and in the arranging of MWR, despite the fact that it was not directly linked to any of VINNOVA's or VISANU's regional innovation programmes. However, in the Automotive Group two different innovation scripts were in fact combined, reformulated as a new script.

The innovation-producing arrangement scripts, prevalent in the construction of MWR, were edited in the Automotive Group by being combined with a script directing organizations from different industries, with different supplying and producing roles, to collaborate in developing new applications based on existing technology. The idea of linking different technologies and practices was new to the MWR scene and quite different from the cluster and systems perspectives that often focus on specific industries. Perhaps one explanation for this is that the MWR actors attempted to get closer to a business relationship with potential customers, linking suppliers and producers in their efforts to promote technology development and innovations. What is more, the role of the triple helix was also edited. Public representatives such as the Swedish Road Administration and other funding agencies were (re)considered more as facilitators for bring the industries together, as well being financial sponsors, rather than as active participants as the triple helix script prescribes.

Nevertheless, the edited script was yet again characterized by proposing arranging an organizational structure first and then considering what to do. As the script was enacted, representatives from automotive and telecom firms were invited to join the new grouping in seeking collaboration potentials, but they were also to some extent pushed into roles. Similarly to the establishment of MWR, attention was placed on identifying key actors and inviting them to meetings. However, the Automotive Group script was not familiar to the microwave engineers. They were not used to working in such a setting, where they were to present ideas to a passive customer, with no idea of what the customer wanted. As one engineer put it, it was not "sharp" as a normal microwave company–customer firm relationship is. Again, actors are grouped together

and are ascribed roles in ways that are thought to generate innovation. However, such an organizing script does not seem to afford such results, at least not in the ways anticipated. Irrespective of whether the script was relevant or not, MWR's members acted on it, whilst the automotive representatives did not - they did not turn up at the meetings and the initiative was soon dissolved as a result.

Constructing a new script in the ceramics project

After the Automotive Group was dissolved, MWR returned to the inertia that previously characterized the initiative. A "knife-to-the-throat" situation arose where getting to work was deemed as absolutely vital. The Ceramics Project was proposed as a solution. This project is particularly interesting as it points to extensive editing of the innovation scripts, building on past experiences and practices of collaborative technology development. Here, the MWR process leader and directors (re)constructed a new locally adapted script by turning to previous technology work experiences. They proceeded by identifying the technological field of ceramic carrier materials as something of interest to a majority of its members, and thus turned inwards in constructing a local problem to solve. Building on experiences from past projects at the IVF institute, where different firms allegedly worked jointly to solve technology problems with great success, engineers at one of the largest member companies were asked to develop a technology specification that would form a basis for collaborative work.

Thus, MWR actors edited the innovation scripts by taking them apart, incorporating local interests and past experiences, and constructed a new script that fit their desires and beliefs more appropriately than had the original innovation scripts. Akrich's (1992) analysis vocabulary can assist our understanding of this: the users of the scripts, that is MWR's process leader and directors, de-scribed them. According to Akrich, de-scription concerns "mechanisms of adjustment (or failure to adjust) between the user, as intended by the designer, and the real user" (1992: 209). In MWR and the Ceramics Project, this entailed dismantling the innovation scripts, adjusting them, and then constructing a new script more appropriate to their local setting. In effect, MWR's spokespersons translated their experiences of joint technology projects into organizing the Ceramics Project. The collaborative ideal was still present, but this time around actions did not follow the innovation scripts and prescriptions dogmatically; actors in MWR were

much freer to act as they saw fit. The project was not financially dependent on programmes such as VINNVÄXT and VISANU. Instead, the finances came from the Region West Götaland organization, which accepted a looser link to the innovation scripts. Rather than focusing on deciding which actors should participate in the initiative from the start, the Ceramics Project was characterized by a script where the focus was primarily placed on what to do. They turned inwards and identified ceramics as something meaningful to work with — something that related to their own practice and experiences. What is more, in editing the innovation scripts, the triple helix script was deleted altogether. In fact, public MWR member organizations were not invited to the project. Region West Götaland acted as a passive financer, allegedly reasoning that MWR knew microwave innovation best and thus letting representatives for the initiative organize the project as they saw fit. Still, the regional organization expected that the project would generate new jobs and economic growth, which the specification suggested as a possible outcome. However, it is important to note that the new Ceramics Project was introduced as an innovation activity in MWR, which was still framed as an innovative cluster. So the new script was still associated with the theories and scripts of innovation-producing arrangements. Moreover, as I illustrated in Chapter 8, the Ceramics Project and its organizing script were continuously edited as the project proceeded over time, being translated into different sub-projects and actions.

Differences in editing space

The above discussion points to variations in how the scripts were edited. One of these differences concerns the closeness of the couplings between the innovation scripts and action. That which is done can either be tightly or loosely coupled to the theories of innovation-producing arrangements and the related innovation scripts. I call this variance in couplings *editing space*. Scripts with narrow editing space can only be performed in limited ways; they cannot be freely edited and adapted in action. Scripts with wider editing space, on the other hand, do allow for editing and locally adapted action.

For example, the initial activities in MWR illustrated a perceived necessity of performing the prescribed innovation scripts in organizing a combined cluster and innovation systems initiative. This determinacy between scripts and action can be characterized as tight couplings; the

process leader and directors of MWR copied the scripts as something that have to be performed and thus attempted to put them into practice, i.e. translating the scripts into action. On the one hand, tight couplings can be characterized by rationalized procedures and principles where emphasis is placed on, for example, structural features, efficient coordination, or bureaucratic rules in organizations (see Weick, 1976). And as Weick argued, these preoccupations may in fact blind us to the "attractive and unexpected properties of less rationalized and tightly related clusters of events" (Weick, 1976: 3), i.e. looser couplings. However, to say that entities (such as scripts and actions) are loosely coupled means that they are responsively linked (i.e. interdependent) and subject to spontaneous change, while at the same time they preserve their own identity and separateness (Weick, 1976; Orton and Weick, 1990).

At the outset, MWR was arguably characterized by tight couplings between the scripts and what was done. As I have argued, this resulted in focusing on formal organizational structure, which corresponds well with Weick's (1976) account of tight couplings as characterized by rational determinacy, leaving little room for equivocating and editing. This was partly due to the fact that the innovation system and cluster scripts were strongly enforced by the innovation programmes; they were indeed prescribed. However, this type of script enforcement was less evident in both the Automotive Group and the Ceramics Project. Here the scripts, to a varying extent, allowed for editing and adaptation to local settings. But this does not mean that the innovation scripts were entirely decoupled from action (cf. Meyer and Rowan 1977); these two technology development initiatives were still framed as taking place in the innovation system and cluster initiative MWR, which meant that they were still related to the innovation scripts. In other words, they were not decoupled, but loosely coupled to the innovation scripts. And since the scripts were no longer enforced by the likes of VINNOVA, they could thus be edited. There was hence what I have chosen to refer to as a wider *editing space* in the Automotive Group and the Ceramics Project. This space denotes the manoeuvrability between scripts and actions, representing degrees-of-freedom of editing and performing scripts. Some scripts may of course be institutionalized, guiding our actions without our noticing. However, when innovation scripts receive prescriptive qualities, the editing space can help

to explain why some scripts are easier to translate into local actions than others.

My suggestion is that a wider editing space afforded the combinations of scripts in the Automotive Group and the reconstructing of a new script in the Ceramics Project. Of course, the latter example was characterized by greater looseness and fewer externally enforced constraints, and hence had a wider editing space. Perhaps these differences are a result of fewer prescriptions from the funding agencies in the Automotive Group and particularly the Ceramics Project. Nevertheless, this is not to say that the Ceramics Project was decoupled from the innovation scripts; the project was still very much presented as being a part of the MWR agreement, which in turn was organized as an innovation-producing arrangement. The difference was that the scripts became less like prescriptions and more like mouldable labels that could be filled and shaped by local content.

Labels as providing wider editing spaces

When more generally adhered to, as in the Ceramics Project, terms such as *innovation systems* and *clusters* can actually act as labels or objects that may be translatable into meaningful action, or block it.[81] Labels can certainly be directive, but they do not prescribe action to the same extent as a fully developed script. According to Weick (1985), labels that are agreed upon can contribute to the reduction of ambiguity and instead generate some kind of stabilization. Such labels may, as Weick suggested, "serve to focus attention and shrink the number of possibilities as to what might be occurring" (1985:128). The innovation scripts in the Swedish innovation programmes are of course more instructive in terms directing action towards focusing the arrangement of inter-organizational structures. But when allowed a more general and loosely coupled relationship to actions, as in the Ceramics Project, these scripts may become endowed with more label-like characteristics. The innovation scripts constitute temporarily stabled materializations, which could be said to form minute structures, which were translated and edited into actions. Problems arise when the scripts are coerced to foster specific actions in a step-by-step manner. But when scripts are allowed editing and can be translated into local practice, they may enable actions adapted to the local setting. And as the innovation

81 A label can also be considered as a boundary object (Star and Griesemer, 1989), as described in analysing the Ceramics Project in Chapter 8.

scripts are endowed with directive and yet mouldable characteristics, it is plausible that they can contribute to both the stabilization of a general direction of action, as well as to generating an editing space that allows for local adaptation.

In sum, the notion of editing space between scripts and action can help us understand how innovation policy is translated into practice in different ways, both when the scripts are performed and when they are reconstructed. Such differences affect how organizing occurs in MWR and its technology initiatives. The next section turns to exploring the characteristics of two dominant organizing logics in the scripts that appear in the MWR setting, as well as to investigating the outcomes of enacting them.

Two organizing scripts in practice

In describing MWR practice, I have shown how the arrangement of MWR, the automotive grouping, and acting on ceramics, all involve actions of trying to perform and also edit the innovation scripts. In this section I will point to the organizing logics characterizing the enactment of these scripts, as well as consider the outcomes of these undertakings. When generalizing from the early organizing of MWR and Automotive Group on the one hand and the Ceramic Subject project on the other, we can distinguish two different organizing scripts: one focusing on structure building and another on action. I refer to these as the *structural precedence script* and the *action script*. What I mean here is that in their original form, the scripts frame, legitimize and allow for some actions, while constraining others. Indeed, both the design and enactment of the scripts contribute to constructing organizing outcomes. But these outcomes cannot be determined *a priori*; there is no exclusive set of consequences. This is indeed why a performative organizing perspective has been necessary for studying the innovation programmes and MWR, exploring how efforts at organizing innovation unfold.

Structure before action – the structural precedence script

When the people affiliated with MWR enacted the innovation scripts in the innovation programmes, the consequence was that arranging inter-organizational structure was prioritized over action. I have chosen to call this the *structural precedence* script, where organizational form is placed before and above contents, in terms of both time and significance. By precedence I mean that which *precedes*, following the logic of "first you build a structure and then you act". In other words, emphasis is placed on constructing the form first and thereafter filling it with contents. Precedence also concerns a *prioritization*, such as when suggesting that "a structure is necessary for directing otherwise random action". This can be understood in the light of what March (1994) called a "logic of consequence" where decision making action is considered as rational choice. In consequential decision making, action alternatives and their expected consequences are evaluated on the basis of preferences. Now, the Swedish innovation policies aimed at increasing innovation activity, which in turn was deemed necessary for economic growth. Building on theories of innovation, the alternative considered as serving these preferences was to initiate the establishment and development of inter-organizational arrangements with actors from industry, academia and the public sector.

Thus the arrangement of such structures was seen as the first necessary action, after which the innovation production could begin. This follows March's argument that a logic of consequentiality "depends on anticipations of the future effects of current actions" (1994:2). This means that actions are geared towards capturing a future and imposing it on the present, for instance through devising plans and contracts (March, 1994), or as in this case, through inscribing and prescribing innovation scripts. Such rational ideas are commonplace in modern thinking, March argues, not least in plans, which he suggests "are developed on the basis of expectations of the future, then are implemented in such a way as to enact the future they anticipate" (1994: 79). Thus, rational action largely concerns time, something which is evident in the structural precedence script, where a structure is supposed to be created *before* acting.[82]

82 Of course structur*ing* can also be seen as action, i.e. to build a structure.

Indeed, the efforts with planning and arranging the structure of MWR preceded technology development action: the enacted organizing script was to group different organizations first and then to decide what to do. I would argue that this comes as a result of performing the innovation scripts and translating them into action. These innovations scripts are based on the theories of innovation-producing arrangements, describing successful innovation settings as being comprised by collectives of particular types of interacting organizations, often geographically grouped. One problem with the innovation theories is that they often portray actors as occupying a given place in a network or system, rather than showing what they do. Some theoretical perspectives, such as the triple helix model, suggest that the structures of industry, academia and public sector are not supposed to be static. But when enacting such scripts, both in innovation policy and MWR, the centre of attention is still identifying and grouping actors, rather than engaging in technology development work. In that respect, actors became what Latour (2005) would call placeholders instead of actors that act (or are acted upon). What this means is that an actor has to do things and make a difference to be regarded as an actor; one cannot simply occupy a place in a given structure. The innovation scripts arguably prescribe a structural precedence, and thus actors as placeholders. And when these scripts were enacted in MWR they influenced how organizing unfolded in the initiative. Performing the structural precedence script shaped the possible content of MWR and how it was filled, just as the form of a baking dish would shape the content of the filling poured into it. My point here is that the structural precedence is built-in, or inscribed, in the innovation scripts. These inscriptions and outcomes emerge as a consequence of both the design and the performance of the scripts in their original form. This is indeed knotty, as the structural precedence in MWR was followed by inertia; once the structure was in place they struggle to get into action.

Why was this the case? One explanation could be that actors' roles become static when performing the structural precedence script. It seems more plausible that actors' roles are shaped by action, emerging as a result of what the actor does or what is done to it. Here, however, the roles seemed to be set from the beginning; microwave companies, academic institutions and public organizations were all presented as vital for the initiative, but what were they supposed to do once they were part of the structure? Organizational representatives were rounded up or grouped

together, but there were few ideas in terms of what actions they should pursue, let alone how they should interact. Nevertheless, it is important to note that despite the fact that the early organizing of MWR and the Automotive Group did not bring forth collaborative technology work, both initiatives enabled microwave engineers to meet and interact. Participants in the initiatives told stories of past experiences, talked about technology and its possibilities, searched for new ways to initiate collaborative technology projects and so on — all things that were presented by a wide array of participants as being of value for the industry and its development.

It follows that formal structure and rational principles and procedures are widespread and commonly used in organizations in general (March, 1994, Meyer and Rowan 1977). But how can we understand the origin of the structural precedence script and its organizing logic?

Echoes of modernity

When considering the results of this study, one might ask why the theories and policies for innovation-producing arrangements, and their related scripts, are prescribed in such an assertive fashion. Why was there such a strong belief that innovation occurs in particular types of arrangements, such as in clusters, innovation systems and triple helix constellations? In this section I will make a case that one plausible answer is that economics as a field of science is guided by modernistic ideals and constructions of the social world, affecting the assembly of the innovation scripts, and hence also the organizing in MWR as the scripts are preformed. The innovation programmes and scripts were indeed interpreted as prescriptions that need to be acted upon in the MWR initiative. This is, at least in part, a result of the innovation programmes' focus on formal and functionalist structure, or the use of lists, tables and recipes ascribing roles. All this, together with the reliance on scientific expertise as expressed in the theories of innovation-producing arrangements, and their rationalistic assumptions and principles of certainty, can be understood in the light of a modern project of creating social stability.[83] So could the structural precedence be an echo of modernity?

The economist McCloskey (1983: 484) argued that the methodology of the science of economics is modernist, suggesting that most of its principles

83 Latour (1993) argued that we have in fact never been modern, despite countless efforts of striving for something that can be called modernity.

are obsolete. So what does this mean? Writing on the rhetoric of economics, McCloskey argued that modern precepts of economics include the ideas that prediction and control are the goals of science, that only observable implications matter to the truth of a theory, and that these observations are reproducible in objective experiments. Other principles entail the belief that such observations should be possible to express in numbers; if not they are meagre and unsatisfactory. In addition, rigorous methodology is seen as necessary for distinguishing that which is scientific from the non-scientific, as well as detaching science from values about morality and art. According to McCloskey, modern economic theories also assume that events can be seen as being governed by laws. Interestingly, McCloskey added that few philosophers nowadays believe all or even any of these modern principles, but most economists still do.

The universality and abstractedness of economic principles are indicative of beliefs that its theories are independent of context. But as this study has shown, economics of innovation need to be re-contextualized. It is only in practice that we know how and in which ways the theories influence what is done. And as the findings from this study of organizing innovation suggest, enacting an innovation script (translated from economic innovation theories of innovation-producing arrangements) in MWR led to structural precedence and inertia. Thus, even if economic theories of innovation may have good arguments and seem plausible, they should not be enforced too assertively as general recipes for innovation. Otherwise problems such as the ones highlighted in this story might arise. Similarly to McCloskey's argument, I see the innovation theories and programmes that we have encountered in this story as following a modern framework in their efforts to form structures for innovation. The word *policy* can in itself be traced to the social "order", which indeed is what the innovation programmes seek to engender (the link between police as ordering and policy is hard to ignore). But in the light of the results presented here, perhaps there is need for scrutinizing the assertions found in the innovation programmes and their scripts, assuming a more pragmatic stance towards innovation and economic growth.

But where do these modernistic ideals come from? Toulmin (1990) discussed the origin of modernity in his book *Cosmopolis*, arguing that it be traced to the rise of a philosophy of certainty during the 17th century. According to Toulmin, the quest for certainty gained foothold in a time

when Europe had suffered great hardship during the 30-year war. The Renaissance and its ambiguous ideals, which had been characterized by humanistic open-mindedness, sceptical tolerance and theoretical modesty, were blamed for the adversity of the war and the difficult times. Ambiguity was no longer accepted, and focus was increasingly placed on abstract and universal theory, arrived at through rational methods, which would limit uncertainty. Descartes was at the forefront of this movement, presenting his ideas of rational methodology in a philosophy of certainty and a demand for proven knowledge. Later, the astronomer Galileo and the physicist Newton developed what can be referred to as modern science, with its mathematical principles of inquiry (Toulmin, 1990).

All this coincided with the institution of the sovereignty of nation states and formed the setting in which scientific enlightenment was expected to prosper, gradually replacing rhetoric with science and formal logic as the basis of reason. Ideals of modernity were cherished, with its preference for abstract theoretical principles rather than practical reasoning. As Toulmin so eloquently showed, this also included shifts to prioritizing the universal rather than the particular, the written rather than the oral, the general instead of the local, and the timeless rather than the timely. This was also an era when economics began to be developed as a field of theoretical investigation, since the wealth of nations was an increasingly large concern for regimes. In this endeavour, economic theories gradually became more and more influential. And these principles of science also proved influential in the Industrial Revolution that began in the mid 18th century (see Parker and Smith, 1978 and particularly Toulmin, 1990). Indeed, we often come across similar ideals of modernity throughout society, and time and again in institutionalized economic and management theories and practices (c.f. Meyer and Rowan, 1977). We also encounter them in education, government policy and legislation, in mass media reports, and so on. Perhaps the structural precedence actually represents a structural prevalence in the social world?

Of course, the innovation programmes in Sweden are not enforced dictatorially. Still, statements like "innovation systems promote national growth" are almost axiomatic, and the belief that this relationship is strengthened by the development of innovation initiatives, following scripts derived from theories of innovation-producing arrangements, is promoted strongly. Perhaps the assertiveness of these theories and scripts needs to be

reconsidered. According to Toulmin (1990), much can be gained by reclaiming some of the ideals of the humanistic renaissance and accepting the uncertainty of human life that comes from the evidence of diversity and disagreements. He also goes on to argue that in the long run we are forced to be pragmatic. And it is the pragmatic view that I want to emphasise in this thesis. Being commonly affiliated with a philosophy of pragmatism, Rorty (1979; 1982) also emphasised that we can never have true knowledge of things as they are. But this does not stop us from having hope in our attempts to strive for happiness, using knowledge as a means for this rather than as an end in itself (Rorty, 1999/2003).

There is of course nothing wrong with policymaking attempts to increase our well being. But there is a problem when policies such as those expressed in the innovation programmes enforce, or are interpreted as enforcing, deterministic theories and scripts on how innovation-producing arrangements should be organized. This is indeed especially so when they are not seen as appropriate for the local setting. The poor fit of the triple helix script in MWR exemplifies this point clearly. Nevertheless, the agencies work for a government that has been democratically elected, and their task is in part to use taxes to fund research and development. And presumably they need to have some idea of how to distribute this money, which is where the innovation theories come to the rescue.

However, based on the results of this study, instead of coercing truths of how innovation is believed to be produced, the innovation programmes, with their labels and scripts, must be allowed editing in local practice. Then it is possible that they may serve as means for framing and guiding actions, albeit indirectly. In this thesis we have seen how the innovation programmes and their scripts may indeed stimulate joint technology work, as in the Ceramics Project, as long as they are treated pragmatically and are edited to fit the local context.

Action before structure – the action-oriented script

The Ceramics Project followed a different organizing script, focusing on what to do rather than organizational structure. As I showed in the previous section, this was a result of editing the innovation scripts and combining them with local interests and past experiences, constructing a new script. Once the project specification was written, accepted and funded,

MWR's members were invited to work on ceramics substrate development and applications. Focus was placed on work within the field of ceramics, thus introducing an action-oriented script. And as I discussed in the previous section, this was possible due to a wider editing space of the innovation scripts in the Ceramics Project. What followed was that potential participants or actors in the project negotiated what to do in the project, engaging in efforts to mobilize and enrol others in line with their own interests or programmes-for-action. The Ceramics Project script thus followed an action script rather than a structural precedence script. We can only speculate why this was the case, but one plausible answer is that the MWR representatives turned inwards and, with the help of the member representatives, identified an action-theme in ceramics; something that allegedly was of interest for a larger group of microwave organizations. In this respect, content was prioritized over form, contrary to the previous activities in MWR. It can thus be argued that the microwave engineers followed what March (1994) called a logic of appropriateness, matching their actions to their practice and past experiences of joint technology projects, editing the innovation scripts to fit their own context. This is indeed different from the consequential logic (March, 1994) that we saw when the innovation-producing arrangement scripts were performed in organizing MWR, and helps us understand why the Ceramics Project afforded some kind of joint technological work.

I have proposed that the Ceramics Project began with focusing on what to do before arranging a structure. Nevertheless, the project was of course reliant on the microwave representatives who were assembled in MWR; they formed the group to which the project invitation was sent out. However, these representatives were not given roles prior to the project's formation. That is, the actors in the project were not ascribed roles as placeholders; rather, they shaped and performed their roles through acting within the project. The Ceramics Project was more dynamic than the Automotive Group, and its structure unfolded as a result of the ceramics actions undertaken. In other words, its structure emerged through action. Interestingly, the sub-project structure then acted back on the subsequent actions, allocating work to three separate organizations. Some have suggested that this sub-project structure was a compromise, but the project was nevertheless presented as a success. Indeed, it did afford meetings where the uses of ceramics in microwave engineering were discussed, and

an academic paper was published based on the project's results. Allegedly, it also enabled a better business proposal on behalf of one of the member companies who claimed to have become more competitive in a bid towards the European Space Agency.

On scripts and organizing

In this study I have shown how the innovation scripts, as materializations of fashionable ideas and theories that are inscribed in texts, presentations and models, and carried in stories or embedded in practices, become organizing scripts as they are enacted. But this is not the same as saying that a new script is implemented in a linear fashion, with specific effects on organizing. Instead, as the scripts were translated into practice in MWR they were re-written or edited in various ways. At first they were performed in establishing MWR, reproducing a structural precedence that resulted in inertia, and later they were treated as mouldable labels and scripts that were combined and edited into a new script, allowing for some kind of collective technology work.

These findings question rational ideas of the linear relationship between plans, implementation and results. This might seem obvious, but as Suchman (1987) suggested, there is still an overrated belief in western society that plans should be devised first and then put into practice, often in a step-by-step fashion. But Suchman argued that the relationship between plans and action is much more complicated, and characterized by mutual construction. The theories of innovation-producing arrangements and scripts can indeed be seen in the light of plans-for-action, and the results in this study have illustrated a similar relationship where scripts are recursively linked to action via processes of editing. And this has been possible to show because of the methodological approach taken: studying processes of organizing and how they unfold over time.

In many ways, these findings concern the relationship between structure and action. This issue is by no means a new idea; it has been widely debated within sociology and organization theory for the last century. My story's contribution to this is certainly modest, yet the idea of organizing scripts as focusing structure and/or action is still interesting to explore further. As I pointed out in Chapter 2, Czarniawska (2002) argued

that if we are interested in organizations we should not study them as ready-made structures; instead we should examine processes of organizing. This notion builds on, among others, Weick's (1969/1979) conceptualization of organizing, which according to Czarniawska (2002) follows Allport's (1962) suggestion that all collectives are results of individual actions. Groups do not just exist, they have to be formed. And organizations should hence be seen as sets of action rather than as given collectives (Czarniawska, 2002). This idea was developed by Giddens (1979), who similarly argued that structures do not exist "out there". Instead he proposed that the concept of structure should be replaced with what he referred to as *structuration*. Giddens suggested that structures are temporarily produced and reproduced through human action. In other words, structure and action are two sides of the same coin. This suggests that actions produce temporary structures, and that these structures act back on action in a recursive relationship. Indeed, the inscriptions of innovation theories into innovation programmes materialized as innovation scripts, or minute structures in the shape of action-patterns, which influenced how MWR was organized when enacted. However, as they were edited, new scripts were produced.

Nevertheless, in the world of organizations, formal structure is still regarded as a high-priority issue - forming an institution that is imitated across organizations, bringing legitimacy (see for example Meyer and Rowan, 1977; Mintzberg, 1979; and DiMaggio and Powell, 1983/1991). This is evident in the corporate and public jungle of organizational charts and depictions of hierarchical structures and networked organizational relationships, as well as in MWR where organizations are enlisted into a microwave constellation. This may not be so surprising; anthropologists have shown that contemporary western societies are preoccupied with a *logic of writing*, which prioritizes the making of tables, lists, and recipes, as well as ascribing roles (Goody, 1986). This is reminiscent of the innovation scripts we have seen in this story, where the identification and interrelating of key actors are emphasised, which indeed is very similar to a view of actors as placeholders (Latour, 2005), as opposed to seeing actors as discovering their role through doing things. In MWR, microwave companies, research institutes and institutions, and public organizations are identified as actors. And it is these actors that are, following the innovation scripts, grouped together. But the problem with this placeholder script is

that it does not provide the desired action. In MWR it was followed by inertia, which is quite paradoxical as the innovation programmes seek to stimulate innovation activities. Thus, it seems that it is not enough to simply enrol place-holding actors; they have to act (or be acted upon) according to some programme-for-action to be actors.

Nevertheless, editable scripts and labels can actually result in organizing action, not simply obstructing it. Bakken and Hernes (2006) have indeed presented a similar argument in suggesting that organizing should be seen as both a noun and a verb. They suggested that the shifting to organizing perspectives in organization theory has been necessary for understanding processes and the unfolding of events (cf. Weick, 1979) not confined to formal organizational structures. Such perspectives take organizing as a verb. However, as much as this move was central for organizational analysis, Bakken and Hernes argue that it is important not to forget the importance of nouns in shaping organizing. Building on the process philosopher Whitehead (1929), they point out that nouns such as *labels* and *scripts* contribute to shaping of verbs like organizing, just as such verbs contribute to the shaping of nouns. I agree with their point; this study has indeed attempted to follow a similar logic in analysing how scripts and organizing are interrelated. And the results of the study of organizing innovation point to how theories of innovation-producing arrangements, innovation policies and programmes, and the organizing of MWR were closely intertwined. Indeed, this suggests that both nouns and verbs were at large in the initiative.

Practical implications – the policy challenge

On the basis of the results of this thesis, what can we say about the programmes for creating innovation systems and clusters where innovation emerges and generates growth? Well, firstly this is a very ambitious project, and it also points to the importance attributed to innovation, as well as towards the influence of economic theories. But can innovation processes be stimulated and controlled by grouping representatives from what are deemed as key organizations? As I have shown in this thesis, such scripts are of little relevance for technology development in the MWR case; they seem to stimulate the assembly of organizational arrangements rather than

joint technology work. And what is paradoxical about the innovation programmes and their placeholder scripts is that its originators seem to reward one thing while they hope for another; they reward organizational structuring while hoping for innovation and growth (cf. Kerr's 1975 argument on the folly of rewarding A while hoping for B). Perhaps this comes as a result of the competition design of the innovation programmes, where only those representing the scripts and showing highest growth potential are rewarded as winners. Indeed, this might also provide an explanation for the "Swedish paradox" — why substantial investments in research and development purportedly do not seem to result in innovation and growth; perhaps it is because innovation structure is prioritized over innovation action?

However, when edited to fit local practice, previous experiences, and interests, the scripts did allow for some kind of technology development in MWR. It is hence my belief that innovation policy can be improved by examining, and learning from, studies of processes and stories of innovation in the making. There is also reason to suggest that the policies and programmes should be more suggestive than directive in supporting innovation; every industry, field of research, consumer, and public organization have their own local context that must be taken into account.

Much emphasis is placed on innovation-producing arrangements, where research and development are key features. Indeed, when seeing innovation as the capitalization of novelty it is not surprising that research and development are centrally placed. But what about activities of production, marketing, distribution, and sales, are they not important for the generation of incomes? I do not wish to suggest that innovation follows such sequential steps; however, it seems safe to assume that it involves more than simply R&D activities. As Landau and Rosenberg (1986) suggested, innovation processes are seldom linear; instead they follow iterative processes with multiple feedback loops, where innovations commonly follow winding paths. Others, such as Akrich, Callon and Latour (1988/2002ab) have highlighted that innovation is often seen as neat flows from research and development to markets when understood retrospectively. But this is too simple a view. Conversely, they argue that innovation is by definition "created by instability, by unpredictability, which no method, however refined, will manage to master entirely (1988/2002a: 195). Together with the results of this study, this suggests that

any policy attempts to control innovation arrangements are rather futile, if not doomed from the start.

The results of this study on organizing innovation are based on rich material concerning how innovation policy is put into practice, and with what consequences, in the MWR initiative in particular. Consequently, I have no intention of generalizing the findings or suggesting that they characterize all innovation initiatives related to the innovation programmes.[84] Nevertheless, the results provide a rich description of what happens as policy is put into practice. The findings from this study also point to the importance of looking at action and practice in innovation initiatives such as MWR, and not just focusing on structural features, as in enlisting organizational members and arranging organizational networks. As I have shown in this thesis, performing the scripts in MWR led to a structural precedence, causing inertia. There is hence a risk that the innovation scripts might inhibit action if they focus too much on rational planning and structuring. But if the scripts allow editing in local practice, they can engender what is perceived as relevant collaborative technology projects. Thus, structural precepts must not overshadow action. And perhaps such scripts need to be more heterogeneous, allowing for wider applicability in various settings.

Indeed, scripts, strategies and other instructions may generate legitimacy as well as preparedness for action. And it is probably better that the innovation programmes seek to group organizations to form innovative constellations, rather than attempting to control the actual innovation processes. Still, form and content are not mutually exclusive; they influence each other, and both need to be considered simultaneously. In the light of the results from the Ceramics Project, it seems as if action, as opposed to structure, is the right place to start. Taking these findings into account, the innovation programmes thus need to loosen their modernistic ideals and

84 However, a follow-up study departing from the results of this study commenced in the beginning of 2008. That study, undertaken by Fredrik Lavén, Björn Remneland and Torbjörn Stjernberg, is funded by VINNOVA and aims to compare the relationship between policy and practice across different innovation initiatives that applied for funding to the first VINNVÄXT competition in 2002. The present study of the relationship between the innovation scripts and VINNOVA on the one hand, and MWR on the other, points to the centrality of textual exchanges. Perhaps other innovation initiatives that received funding from the VINNVÄXT programme had a different kind of relationship to VINNOVA and the innovation scripts, and were organized differently? Hopefully, such a study can further reveal the dynamics between scripts and practice.

principles. My overall recommendation is that innovation policies and scripts should act to frame behaviour; they should not be enforced deterministically. It appears as if policy and scripts must be adaptable and sensitive to the specificity of unique situations; they must allow local editing. This means that the scripts need to accommodate the expedient and extempore, being pragmatic rather than guided by principle. Otherwise there is a risk that they will lead to undesired consequences of stressing administration rather than innovation production. Policy-making might also benefit from reframing the axiomatic assumptions of the causal relationship between innovations and national economic growth. Otherwise the innovation programmes could run the risk of being perceived as overly optimistic and ambitious, as they might not be able to live up to their promises.

The intention of the VINNVÄXT and VISANU programmes was probably not to impose innovation structures on the innovation initiatives. But, as this study has shown, this matters little if the scripts are interpreted as such in practice. This suggests that future innovation programmes need to beware of what it is that they communicate and how. Moreover, it is possible that the way in which the programmes are designed creates the structural precedence. Asking initiatives to join refereed competitions, such as VINNVÄXT, pressures the contestants to play along the rules of the game as they interpret them; the process of evaluation affects that which is evaluated. And as in all competitions, the winners are those who succeed within the rules, possibly bending them, but not breaking them.

Conclusions

So what can we learn about the relationship between scripts and organizing on the basis of the findings from this study of efforts to organize innovation? Well, one thing that seems evident is that scripts must not be to canonically imposed top-down. Instead, it seems important that scripts are both mouldable and at the same time amenable to local translations. Certainly, a script's function is to direct action. But scripts have to be editable and allow for loose couplings with local settings and practices in order to function as both facilitating and guiding relevant action. In other words, editable scripts may provide a frame within which local action can

take place. In that case scripts can act as ordering devices (Suchman, 2007) that provide assistance in the plurality of action possibilities. The conclusions from the study can be summarized as follows:

- Theories of innovation-producing arrangements, such as innovation systems, clusters and triple helix, are inscribed by academics and policymakers into innovation policy and programmes, allowing them to travel in time and space. Innovation theories are thus combined and edited, that is rearranged and rewritten, and inscribed as hybridized innovation scripts for how innovation initiatives should be organized.

- The innovation scripts are prescribed to innovation initiatives such as MWR and produce a power relationship as they have to be performed (or are so interpreted) in attempts to receive funding from the innovation programmes. Following the innovation theories, the scripts prescribe the necessity for organizing inter-organizational arrangements, including actors from industry, academia and the public sector.

- As the scripts were performed in practice in the innovation initiative MWR, they were translated into actions of identifying and grouping organizations related to the microwave technology industry in western Sweden. The purpose was to facilitate collaborative technology development, thus strengthening the local microwave industry and contributing to economic growth. However, performing the scripts and translating them into a microwave innovation-producing arrangement led to a structural precedence and inertia with regards to developing technology; the focus was on form rather than on what to do.

- When scripts are more loosely coupled to actions, they afford an editing space that allows for writing more appropriate and locally adapted organizing scripts that can be translated into relevant action. Interpreting the scripts as labels rather than specific organizing instructions allows for a wider editing space and thus both guidance and wider action possibilities.

- This illustrates how the innovation theories and scripts are performative in constructing innovation policy and an innovation initiative like MWR. The practical implication is that innovation policy and scripts must not enforce the organizing of particular organizational arrangements canonically, for then there is a risk of structural precedence and inertia. Instead, innovation scripts and labels should provide guidance and allow for editing so they can be locally adapted and translated into relevant action.

This study has shown how enacting innovation scripts primarily resulted in focusing on structural features in MWR. However, when edited they facilitated relevant action. Nevertheless the innovation scripts and labels did constitute something to "dance around". After all, the VINNVÄXT competition and the VISANU programme, as well as their innovation labels, scripts and capital, triggered the formation of MWR. And the MWR initiative still exists and receives enough funds to undertake its microwave activities, at least for the time being. What is going to happen with the initiative in the future, and whether it is going to be regarded as a success or failure, remains to be seen.

EPILOGUE

A new script arrives

At the first MWR board meeting in 2003, it was decided that the process leader should put together a business plan[85] for the initiative. Later that year, it became clear that this had not been done. Karl explained that this type of organization is different from for example companies, and that it is therefore difficult to formulate such a plan for MWR. Three years later, the board picked up the idea again, this time around as a necessary preparation for an application to the new Nutek cluster programme. The latter took over the role that VISANU had until its closure in 2006, albeit focusing on clusters development exclusively. This new programme emphasised business rather than technology development, and the focus was on cluster development exclusively, which made it somewhat different from the previous VINNVÄXT and VISANU programmes. Applications to the new Nutek cluster programmes were instructed to submit a business plan. In effect, a new script was introduced through the new cluster programme, focusing on business development in clusters. In fact, Nutek actually funded two consultants to work with a business orientation on behalf of MWR, mapping what was called "microwave business" in the autumn 2005. The idea was to prepare MWR for a new cluster application. However, representatives from MWR's board of directors soon took over this task. They claimed with pride that they knew the microwave industry better than the consultants. This was a decision that freed up some desperately needed financial resources to fund MWR's daily operations.

85 The Swedish word for business plan is *verksamhetsplan*, which highlights operations more than business.

The business plan was a continuous topic of discussion and was brought up at MWR's strategic planning meetings in spring 2006, appearing to be a big concern for the MWR directors. During fall 2005, MWR's members also elected a new board of directors, which meant that, among others, a new member from Ericsson AB took a seat in the board. He also accentuated the need for concentrating on business, contributing to a shift from focusing on technology to business development in MWR. Moreover, this engineering manager from Ericsson proved to have quite an influence on the direction of discussions during the MWR board meetings, and in so doing he reinforced the new business development script that arrived via the new Nutek cluster programme. So yet again, the question of producing a business plan, and distributing it to MWR's members, was re-actualized as crucial for the organization. Interestingly, this points to how both innovation scripts and microwave business practices were edited into a new script for MWR yet again. The following updated version of MWR's vision provides some evidence with regards to the influence on this business development focus as opposed to the previous emphasis on technology development.

> Our vision is that **Microwave Road shall be Europe's strongest hub for technology and market development based on microwave technology**.
>
> The business idea is to increase the members' opportunities to create **more and better businesses** through Microwave Road's active support for technology, business and market development.
>
> The association turns to companies and institutions in the **global microwave industry**. Microwave Road is the **neutral playing field** that connects unique competences and resources inside and outside the cluster.
>
> Microwave Road is a cluster network for national and international collaboration around microwave technology with some forty companies, public actors, as well as colleges and universities as members.
>
> We welcome more members!
>
> (www.microwaveroad.se, 2007, bold in original)

As we can see, there is little mention of technology platform development *per se*, and the scope appears to have widened in its focus on business development. Interestingly, the notion of cluster networks is emphasised, and as I have highlighted previously, clusters had been identified as being a "Nutek concept" (see Chapter 4), suggesting that MWR adjusted its focus to the new programme. In fact, over time, there were fewer and fewer references to innovation systems in the MWR setting, and throughout this study it has been clear that the representatives of MWR seemed to prefer the notion of cluster over innovation systems. Nevertheless, the initiative is also described as acting on international grounds, and thus leaves the regional aspect of clusters somewhat in the rear. What the future translations of these scripts will be, and what consequences they will have for organizing, remains to be seen.

When I reported my findings on organizing scripts, structural precedence and editing to MWR's board of directors in December 2006, they all seemed to agree on the influence of the innovation programmes. Karl, MWR's process leader put it this way: "The VINNVÄXT competition made us into a tanker that just sailed on and on and on in a certain direction…" He then added, being quick to pick up on the notion of scripts, that "Nutek has provided us with a new script, developing a business plan and focusing on business!" Another director from Region West Götaland came up to me afterwards and talked about how VINNOVA had actually been criticized for going out so strenuously with innovation systems, especially since it only funded so few initiatives. Indeed, a person working for VINNOVA once told me that the VINNVÄXT programme was a big experiment, and that people at VINNOVA knew this very well indeed.

Whether the newfound business development scripts will change MWR or not remains to be seen. The issue of funding the management of the initiative is still a matter of concern, and I have received recent reports that the initiative might not receive as much funding from the public organizations in the future as they had hoped for. There are, however, indications of a change with regards to a business script, and one of the chief reasons for this is the prospect of venture capitalist funding, as opposed to public funding.

What is next: microwave venture?

Related to the work on the business plan, Karl, the process leader for MWR, coincidentally came into contact with a financial consultant currently working for IHM Business School in Gothenburg. He assisted MWR in the process of writing a business plan, and together with another venture capitalist he proposed setting up a large investment fund with venture capital. This was aimed at funding promising microwave technology projects with business potential, i.e. had the potential of generating large capital gains. In a sense this development seems to follow the, by now familiar, tracks of MWR's quest for capital. However, there is a vast difference in scale this time around. The two financial consultants' ambition was to start an investment fund with between 250-400 million SEK (about 25-40 million Euro). As the financial consultant put it during MWR's association meeting in 2006: "250 million, my experience is that it will be like a jar of honey on a warm summer day, the bees will come!" (Financial consultant, 2006.10.24). Several people seemed to agree, suggesting that the consequences of such a development would be striking: it was said to have the potential of revolutionizing MWR and the efforts to stimulate microwave technology development. The focus on economic growth still remained, albeit with little focus on Sweden in particular; this was about making money! However, during the coffee break at that same meeting, a few participants told me that this development was not "anchored" amongst the members, and they were not sure whether they liked it or not.

Nevertheless, MWR's board agreed to initiate an attempt with the investment fund, which became known as *Microwave Venture*. The task on behalf of MWR's process leader was now to reinitiate the mapping all the different technologies and competences in the microwave cluster, serving as a base for selecting potentially lucrative technology projects, an ambition which we recognize from the association's early activities. However, Microwave Venture never managed to raise the amount of capital they had envisioned. One engineering manager, who was also an MWR director, explained to me that the reason for this was that they had failed to attract a "lead investor". Nevertheless, the fund was launched anyway, albeit on a more local and smaller scale. This time around MWR's members were encouraged to invest capital themselves. However, recent reports suggest that the fund has not really taken off yet, allegedly because of the lack of a

local lead investor. Today, there is no telling where the next course of events and actions will take MWR, and who knows: with the new business scripts, maybe the winds of change are at large?

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APPENDIX

1. List of acronyms, abbreviations and concepts

ACREO	The Institute for Contract R&D in electronics, optics and communications technology
BRG	Business Region Göteborg
CI	Swedish Ceramics Institute
EMW	Ericsson Microwave Systems
EAB	Ericsson AB
IMEGO	The Institute for micro and nano technology in Gothenburg
IVF	The industrial research and development corporation
IVSS	The Intelligent Vehicle Safety Systems
LSP	Lindholmen Science Park
MWR	Microwave Road
Nutek	The Swedish Agency for Economic and Regional Growth
SES	Saab Ericsson Space
SRA	The Swedish Road Administration
TMV	Telematics Valley
VGR	Region West Götaland
VINNOVA	The Swedish Agency for Innovation Systems
VINNVÄXT	VINNOVA's regional innovation systems programme
VISANU	The national programme for clusters and innovation systems

2. List of personal names and affiliations*

Ove	Industrial Researcher at IVF, one of the initiative takers of MWR
Karl	Process leader for Microwave Road
David	Project leader for Microwave Road 2003-2004
Anders	Project leader for Microwave Road 2004-2007
Bengt	IVSS Programme official
Ola	Manager at a satellite communications company

Lennart	Researcher at the IMEGO Institute
Lars	Researcher at IVF
Henrik	Ceramic Substrate Project manager, from Kitron Development
Nils	Ceramic Substrate sub-project leader, from EMW
Petter	Process engineer, EMW
Anna	Industrial researcher Omnisys Instruments/Chalmers

*The names are pseudonyms to protect the anonymity of the interlocutors.

3. Fieldwork activities between 2003 and 2008

TIME	FIELDWORK	No of activities	Participants	Place
2003				
January	VISANU Kick-off	1	100+ participants, including one of MWR's originator Ove from IVF	Arlanda, Stockholm
March	VISANU Workshop	1	100+ participants, mainly from municipalities and regional government bodies. MWR's process leader discussed attending but never turned up in the end.	Conference centre, Sigtuna
May	MWR's first association meeting	1	30+ potential MWR members	IVF Mölndal
Oct	Interview with MWR Process leader (MD)	2	n.a.	School of Business, Göteborg

Nov	OLN research project meeting with case representatives	1	MWR process leader, representatives from VGR, and the Offertkraft project	West Swedish Chamber of commerce
Dec	MWR Kick-off	1	100+ Microwave engineers and managers	Ericsson Microwave Systems, Mölndal
2004				
Jan	Comdex fair and the MWR exhibition space	1	MWR process leader, project leader, chairman of board, representative from BRG	Gothenburg
February	Interview with MWR project leader	1	n.a.	VGR office
March	Interview with MWR director – Industrial researcher and initiative-taker to MWR	1	n.a.	IVF, Mölndal
March – Dec	Four board meetings	4	MWR Board of directors	Rotating between members
April	MWR association meeting	1	MWR members	
March	Planning meeting before second Automotive Group meeting – shadowing process	1	MWR process leader, MWR member	SP, Borås

	leader		representative, representative from IVSS	
March-June	Five Automotive Group meetings	5	Automotive Group participants	Lindholmen Science Park, Gothenburg
May	VINNVÄXT 2004 Planning meeting	1	MWR process leader, MWR board member, two representatives from VGR	VGR, Gothenburg
May	MWR member visits – shadowing process leader	3	MWR process leader, project leader, and member representatives	SES, Gothenburg; Sivers IMA, Lysekil; Microbind, Uddevalla
Sept	Four informal meetings with MWR representatives	4	For example with MWR process leader, project leader	SP, Borås
Sept – Nov	Four Ceramic substrates project meetings	4	Ceramic Project participants	Rotating between EMW, SES, Omnisys, CI, IVF etc., Gotehenburg and
October	MWR yearly meeting and reflection seminar	1	MWR member representatives	Chalmers, Gothenburg

Nov	Interview with Ceramic substrates project leader	1	Project leader	Kitron Dev. Gothenburg
Nov	Project planning meeting with MWR and VGR	1	MWR and VGR representatives	VGR, Göteborg
2005				
Jan-Nov	Six Ceramic substrates project meetings	6	X CS project member representativs	Rotating betw. member organizations
Feb-Dec	Seven MWR Board meetings	7	MWR Board of directors	Rotating between member organizations
April	Interview with MWR Process leader and project leader	1	MWR process leader and project leader	LSP, Gothenburg
June	Theme day - Automotive radar	1	MWR members	Microbind, Uddevalla
Sept	MWR yearly meeting	1	MWR members	SES, Gothenburg
Nov	Theme day - Microwaves for Growth	1	50+ MWR members and others	SES, Gothenburg
Nov	Ceramics conference arranged by EU network 4M	1	EU network and MWR members	IVF, Mölndal
Dec	Technology project proposal meeting – Soft substrates	1	Members of MWR	Omnisys, Gothenburg
2006				
Jan	Strategic planning days	2	MWR board of directors	Conference centre,

				Uddevalla
March	MWR board meeting	1	MWR board of directors	SES, Gothenburg
Oct	MWR yearly meeting	1	MWR members	EAB, Gothenburg
Dec	MWR board meeting – presentation of research results	1	MWR board of directors	Mölndal City Municipality, Mölndal
2008				
Jan	Interview at VINNOVA	1	The author of the VINNVÄXT programme	VINNOVA, Stockholm
Jan	Meeting with VINNOVA on results and follow-up study on innovation policy and practice	1	VINNVÄXT programme director, secretary, etc.	VINNOVA, Stockholm
Feb	Presentation and discussion of the study's results at VINNOVA	1	Entire VINNOVA organization, particularly the Actor department (designers of VINNVÄXT) and the department of Worklife	VINNOVA, Stockholm
Total number fieldwork activities 2003-2008		**63**		

4. The Ceramic Substrate Project Specification

VÄSTRA GÖTALANDSREGIONEN

micro wave road

Dokumentnamn/Document name	Infoklass/ Classification
Project specification	()

Godkänd/Approved by		Lagringsdata/File	Reg nr/Reg No	
		Project Specification	10425_00017	
Utfärdare (Tj-st-bet, namn)/Issued by	Telephone	Datum/Date	Utgåva/Issue	Sida/Page
		2004-11-10	P1A	

Sub-project goals / Work Packages

Market, Application and realization study

Sub-project goal:

- To understand the market needs in the region, application possibilities as well as realization possibilities for a production line for ceramic substrates

60 GHz FlipChip Thin-film ceramics

Design and realization of 60 GHz MMIC FlipChip carrier substrates in the form of a thin-film circuit on Alumina and/or quarts. Primarily run by Omnisys/CTH.

Sub-project goal:

- Show that there is knowledge in the region to design, manufacture and verify a 60 GHz design.
- Develop and obtain a benchmark of Chalmers/IVF flipchip bumping and assembly process on ceramic substrates

Flexible ceramic building techniques

Developing flexible ceramic building techniques with focus on TK and high frequency performance respectively. Primarily run by EMW

Sub-project goal:

- To understand what is possible and what limitations the different technologies have concerning performance and TK
- Design considerations concerning reliability and assembly processes for mixed systems for example LTCC and Au/Ag thick-film.
- Design considerations concerning high frequency performance for mixed systems for example LTCC and Au/Ag thick-film.

LTCC Benchmark

Benchmark of LTCC system DuPont 943. Primarily run by SE Space.

Sub-project goals:

- To understand the benefits and drawbacks and possible limitations in reliability, high frequency performance and assembly processes.

The ceramics sub-projects (excerpt from the updated Project specification since the original specification had been negotiated and altered, 2004).

5. Study timeline