



# Analyseinstitut for Forskning

## Organization and Management of Research Environments

Evanthia Kalpazidou Schmidt



**Organization and Management  
of Research Environments**

**Evanthia Kalpazidou Schmidt**

December 2002



# CONTENTS

<b>Abstract .....</b>	<b>5</b>
<b>Introduction.....</b>	<b>7</b>
<b>1. Research on research: Important theories .....</b>	<b>10</b>
1.2. Dimensions of theory and practice.....	14
1.2.1. A Model for Studies of Research Environments .....	14
<b>2. Main Findings.....</b>	<b>17</b>
2.1. A Scandinavian study – Research Environments in a Nordic Perspective. A Comparative study in ecology and scientific productivity .....	17
2.2. Dynamism and Innovation at Danish Universities and Public Sector Research Institutes. An analysis of the factors that characterize dynamic and innovative research environments .....	18
2.2.1. Factors that characterize dynamic and innovative research environments.....	19
2.2.2. Organization of research in innovative and dynamic research environments ..	22
2.2.3. Leadership and management of dynamic and innovative research environments .....	22
<b>3. Analysis .....</b>	<b>24</b>
3.1. Research influence, control and innovation in research environments.....	24
3.2. Urban and rural research cultures.....	26
<b>4. Research environments and context – frame factors .....</b>	<b>33</b>
4.1. Internalism versus externalism.....	36
<b>5. Concluding remarks .....</b>	<b>38</b>
<b>References .....</b>	<b>39</b>



## **Abstract**

*Research, innovation and research environments are keywords in the current socio-economic context. Research environments are faced with the challenge to enhance and nurture innovation and become more dynamic in order to contribute to development of research and the establishment of the knowledge-based society. In such context the exploration of the factors, both internal and external to the research environments is crucial.*

*The theme for this article is elements that constitute research environments as well as elements that characterize innovative research environments. The article focuses on the relationship between organization, management and control of research, research processes and environmental conditions on the one hand and research quality and outcome on the other. It points to some common features identified in the organization and management of dynamic and innovative research units, as well as in the prevailing research cultures, and discusses interaction between the internal and external factors influencing research processes in a theoretical context.*

*The results presented here and the analysis that follows could serve as a reference for researchers and other research agents aiming to promote innovation and dynamism in environments. The analysis of the elements that constitute research environments and that of influence and control mechanisms of innovative research environments might be important tools for management and organization of research units and for policy makers attempting to create innovative, dynamic and well-functioning research frameworks.*



## ***INTRODUCTION***

The globalisation of markets and the significance of research in the knowledge-based society in combination with constantly growing demands on human and financial resources have led to focusing on concepts such as research environments, management and organization of research and research environments, productivity and efficiency.

These are concepts that dominate current debate on science being it within research communities or among policy makers and other agents. The European Union concluded at its Barcelona Summit in March 2002 that there must be a significant boost of the overall R&D and innovation effort, with emphasis on frontier technologies. The EU decided that the overall spending on R&D and innovation should be increased to 3% of GDP by 2010. Two-thirds of the new investments should come from the private sector. The EU is now working on an integrated strategy for education and research, a European Knowledge Area, which will include actions to develop transparent environments for education, research and innovation and establish networks and centres of excellence in research, linking the private and the public sector research.

The question of which research units, teams and environments that are dynamic and innovative, and how these became so, how factors that influence research and innovation processes can be explored, are hence of significance for research agents, universities, public and private research institutions and policy makers.

The central theme for this article is factors that constitute research environments. The main question is how do we find out which research environments are dynamic and innovative and how these became so. Another central issue is how research is organized, controlled and influenced by internal and external factors and how such factors become frameworks for innovative initiatives, alternatively restrain research processes and dynamism.

The current debate on research often overlooks the link between research environments, conditions for research activities, research processes and the outcome of research. Demography and social aspects of research communities, academic and research cultures, management and leadership, specializations, communication patterns and networks that influence the outcome of research, and the interaction between these factors, have rarely been subject to a detailed analysis. In the literature focus has mainly been on criteria for good research. Neither has the question of why some researchers, teams and organizations demonstrate an outcome better than others been studied extensively. However in investigations where those issues have been touched upon most studies have tried to identify “determinants of performance” using mainly quantitative measures of performance



(Gulbrandsen 2000). The present article aims to fill, partly at least, the gap by exploring research environments by use of quantitative and qualitative methods.

This article is based on the results of two empirical studies. The first study is the doctoral thesis: *Research Environments in a Nordic Perspective. A Comparative Study in Ecology and Scientific Productivity* (Kalpazidou Schmidt 1996). The thesis is a comparative study of three psychological research environments in Scandinavia. The objective of this survey was to identify and analyse factors that constitute research environments and which generate or impede the necessary conditions for effective production of knowledge. The analysis was made at all levels of conduct i.e. the micro-, meso- and macro-level (studying input as well as structures, processes and outcome and setting these in a context e.g. external to the environments frameworks). The objective of this approach was to map out as many of the elements that interact within the research environments as possible, and to identify elements interacting with the wider society (external factors that facilitate internal processes or cause internal dysfunctions) and influencing research activities and outcomes. Emphasis was consequently on exploring and understanding variation and similarities between the Scandinavian cases.

The second point of departure for the article is a study prepared for The Danish Council for Research and Research Policy by The Danish Institute for Studies in Research and Research Policy. The objective of the study: *Dynamism and Innovation at Danish Universities and Public Sector Research Institutes: An analysis of the factors that characterize dynamic and innovative research environments* (Graversen, Kalpazidou Schmidt, Langberg & Lauridsen 2002), was to look into the characteristics of dynamic and innovative research environments, in order to utilise such environments as best practice. 15 dynamic and innovative research environments in Denmark were selected, representing all faculties, for the study and upon consultation with The Danish State Research Councils (for a detailed description of The Danish State Research Council system see Foss Hansen 1996, Benner & Sandström 2000 and Bertilsson 2001).

The study aim was to explore factors that constituted innovative and dynamic research environments and furthermore explore how factors within research environments as well as factors in the broader environment, such as the Danish research policy, influenced organizational structures, research activities, processes and outcome. The study looked at multiple elements within the research environments, among others organization structures, funding, physical and social environment, research processes and communication patterns and networks in relation to external influence.

The findings of the two studies are described below. The two studies have the same theoretical point of departure and the same methodological approach.

The first part of this article outlines the theoretical context for research on research by focusing on different theoretical approaches as well as the model used in connection with the empirical studies. The theoretical model combines two main perspectives. In part 2 findings of the studies are presented and discussed. In part 3 attention is given to the development of the concepts used for the analysis of research influence and control. Finally in part 4 focus is on the interaction between elements in research environments and the elements at macro-level.

## **1. RESEARCH ON RESEARCH: IMPORTANT THEORIES**

Research on research as a scientific field focuses on conditions that have an impact on research activities and processes, and the factors that influence the development of research. Research on research is consequently exploring how research is organized, controlled and influenced.

In the literature two main distinct perspectives have developed on how research is influenced and controlled. On the one hand the **internalist perspective**, which outlines the development of research as determined mainly by structures and processes within the scientific community. On the other hand the **externalist perspective**, which perceives the development of research as influenced first and foremost by structures and processes in society as a whole. Within these two perspectives a variation of different theories exists, depending on which mechanisms of control they focus on. A brief presentation of some important theories follows below.

Theories within the **internalist perspective** differ with respect to the mechanisms of control and influence that they consider important. Some theories emphasize **bureaucracy**, others **market**, others again **democracy** or **autonomy**, **norms** or **dialogue** and even **communication** as the main mechanisms influencing research processes, development and innovation.

Theories that emphasize **bureaucracy** as mechanism of control exercised from the hierarchy of authority, the elite structure and through the reward and resource distribution system are based on the classical control concept (Cole & Cole 1973, Broad & Wade 1982).

Other theories consider the scientific community as a **market**. Within this market the scientists "exchange" their results for credit, recognition and grants. Different kind of markets that researchers deal with is the publication market, the professional market, the academic market for credits and recognition and the market for grants (Hagstrom 1965, Bourdieu 1975, Latour & Woolgar 1979).

Theories within internalism that focus on **democracy** as a mechanism of control and influence basically perceive the most important mechanisms to be the internal democratic structure of research institutions, the autonomy of institutions and the traditions for research autonomy. Theories refer to a bottom-up influence structure (see Polanyi 1962, Price 1963).

Theories that focus on **norms** as mechanisms of control see development of research in relation to fundamental norms within the research society: universalism, communality, disinterestedness, organized scepticism, emotional neutrality, originality, rationality, objectivity and generalization; as well as **counter-norms** that have been formulated as a reaction to norms described by Merton and others. Mitroff has the view that science contains norms and counter-norms. Norms are the ideology of science. Counter-norms such as particularism, interestedness, solitariness, organized dogmatism and emotional commitment are equally valid, although these norms don't function - as the Mertonian norms don't either - in every situation (see Barber 1952, Merton 1952 & 1968, Storer 1966, Mitroff 1974, Mulkay 1977). According to Mitroff research is influenced by the personalities that carry the activities. Furthermore gives Mitroff a more differentiated picture of the norms and counter-norms function e.g. as depended on the discipline, field and problem: "Whereas the conventional norms of science are dominant for well-structured problems, the counter-norms proposed here appear to be dominant for ill structured problems".

Other theories within the internalist perspective consider **dialogue, networks and communication** among researchers the most important mechanism of influence on research (Law 1973, Barnes & Edge 1982).

In addition there are theories in the analysis of research activities that have the research groups and individual researchers as their point of departure, i.e. they focus on the micro-level.

The internalist perspective in general has first and foremost been criticized for focusing on factors internal to the research community. External frame factors influencing research are not subject to analysis in this approach, meaning that internalism points out only some of the dimensions of research organization and processes.

The **externalist perspective** is more open and complex than internalism, and hereby more equivocal. Within this perspective different theories exist which as a common feature has the development of research within a context. Externalism focuses on the relationship of research to society as a whole and vice versa. The most significant theories within this perspective are briefly presented below.

In the externalists perspective **Galtung's theory** on the relation between research and society sees research as a reflection of society. Galtung's theory perceives the academic society as a society based on a structure of hierarchy where the scientific elite controls the development of research (Galtung 1977).

**The theory of finalization** on the other hand is based on Kuhn's theory on the development of science. The theory was developed at Max Planck Institute in Starnberg and has a more differentiated approach to the external influence on research, compared to Galtung's theory. The theory of finalization perceives disciplines as developed through norms and dialogue in three phases: a) an exploratory phase characterized by disagreement about theory, b) a paradigmatic phase characterized by internal theory development and c) a post-paradigmatic phase characterized by finalization and application of theory. According to this theory research is more sensitive and less resistant to external control in the exploratory phase, especially in the post-paradigmatic phase. In the later phase new networks and communities are needed and created in partnership with scientists, politicians and citizens, while in the paradigmatic phase the most appropriate organizational setting is autonomous self-administration of institutions (see Pfetsch 1979).

Other theories within the externalist perspective have quite different viewpoints. **Knorr-Cetina's theory on transepistemic connection of research** regards research development as depending on a combination of processes of dialogue within networks and, though to a minor extent, on market mechanisms. Processes are complex and indirect, and researchers are not always conscious of the background for these. Transepistemic interactions often remain implicit and unclear (Knorr-Cetina 1981, 1983).

**Whitley's differentiated externalism** perceives disciplines as organized differently and in several ways influenced by society. The degree of external influence is different as well. The influence depends on the one hand to the degree of interdependency between the researchers in a discipline or field, and on the other hand to the extent that the task is clear and readily definable when choosing research objects and methods. There are disciplines and fields where the external influence is of major significance for development and others where it is not (Whitley 1984).

Theories different than the above but still within the externalist perspective, take more descriptive starting points. These perceive research units as institutional organizations that can be changed with organizational means. Others again stress the importance of introducing "management science" and "dynamic planning" to research units as in any other institutional organization (MacCorkle & Archibald 1982).

The above-presented theories within externalism can be divided in two main categories namely social externalism and cognitive externalism. According to social externalism the influence of external factors is limited to not cognitive processes while cognitive externalism (The theory of finalization, Knorr-Cetina's theory) perceives influence of external factors as

reaching so long as to the core of knowledge and as a consequence influencing not only research production and outcome, but even the process of choosing research field. According to cognitive externalism knowledge is therefore a relative factor.

### **The research policy perspective within externalism**

Relationship between science and society has changed significantly during the last decades and science policy paradigms have changed accordingly. This development has been thoroughly addressed in a number of contributions to the field of science policy studies (Gustavsson 1971, Elzinga & Jamison 1994, Gibbons et al. 1994, Ziman 1994, Guston 2000). The literature illustrates that organization and functioning of research systems as well as design and managing of science policies are still changing rapidly, and that demands put on the research systems are increasing in most countries<sup>1</sup>.

The research policy perspective considers research units as political organizations and influence and control of research as determined by contextual factors i.e. policy-making. The external influence depends on the degree of bureaucracy that policy-making bodies practice on research institutions.

The arguments on this issue are divided: on the one side the argument prevails that high degree of autonomy and freedom is the basis for development and innovation, and that policy-making should have this as a point of departure. On the other side the prevailing argument is that research must be planned, organized and controlled by political means.

In the literature some more profound arguments can be found, however these represent a more differentiated view of how research policies can be designed and implemented (see Cheng & McKinley 1983, Foss Hansen 1988). They point to the beneficial effects of a differentiated policy depending on the discipline, the research field and how clear and well definable the subjects in question are. According to these perceptions research could (in some phases and within some fields) with major benefit be subject to external influence. The point of view is that the policy challenge is to create conditions for diversity and moreover to give room for basic and innovative science.

---

<sup>1</sup> For a more explicit presentation of the latest development in the field of science policy at European level see Science Policy, Setting the Agenda for Research, STRATA Accompanying Measures, Managing with Uncertainty in Science Policy, Proceedings from MUSCIPOLI Workshop One. The Danish Institute for Studies in Research and Research Policy 2001/8.

## **1.2. DIMENSIONS OF THEORY AND PRACTICE**

Research environments and research activities are different. Simple models, internalist or externalist, have difficulties giving a complete description of the influence of different factors on research. A combination of elements from both perspectives, e.g. the analysis of internal as well as external factors influencing research, could give a better understanding of the complex activity of research (see Scott 1981, Dahllöf 1982 & 1985, Scharioth & Gizycki 1986, Andersen & Foss Hansen 1985-86, Foss Hansen 1987).

In brief the starting point for the studies that this article builds on is a theoretical approach that combines two perspectives (internalism and externalism) in an analysis of factors that interact in research environments and between the environments and the surrounding society. A Model for Studies of Research Environments was developed for this purpose. This model was developed and tested in connection with the comparative study of research environments in Scandinavia (Kalpazidou Schmidt 1996). The Model for Studies of Research Environments has moreover been modified later on to fulfil the needs of the study of dynamic and innovative research environments in Denmark (Graversen et al 2002).

### **1.2.1. A Model for Studies of Research Environments**

The Model for Studies of Research Environments (MSRE) focuses on capacity, organization and research activities and processes taking place within research environments, as well as on environmental conditions outside the institutions that influence organization and research processes (figure 1). Conditions that are found outside the units (different societal and economic factors, research policies and the academic market) could have a direct or more indirect, although significant, influence on research activities and outcome (Dahllöf 1982 & 1985, Foss Hansen 1987, Kalpazidou Schmidt 1996).

The MSRE opens up for analysis of elements of input, structure, process and outcome. The study becomes more complex but also more significant. The reliability of the study also becomes greater than when using classical input-output models, where the "black box" of conditions for research activities and processes - and the interaction between internal and external factors - is left out of focus.

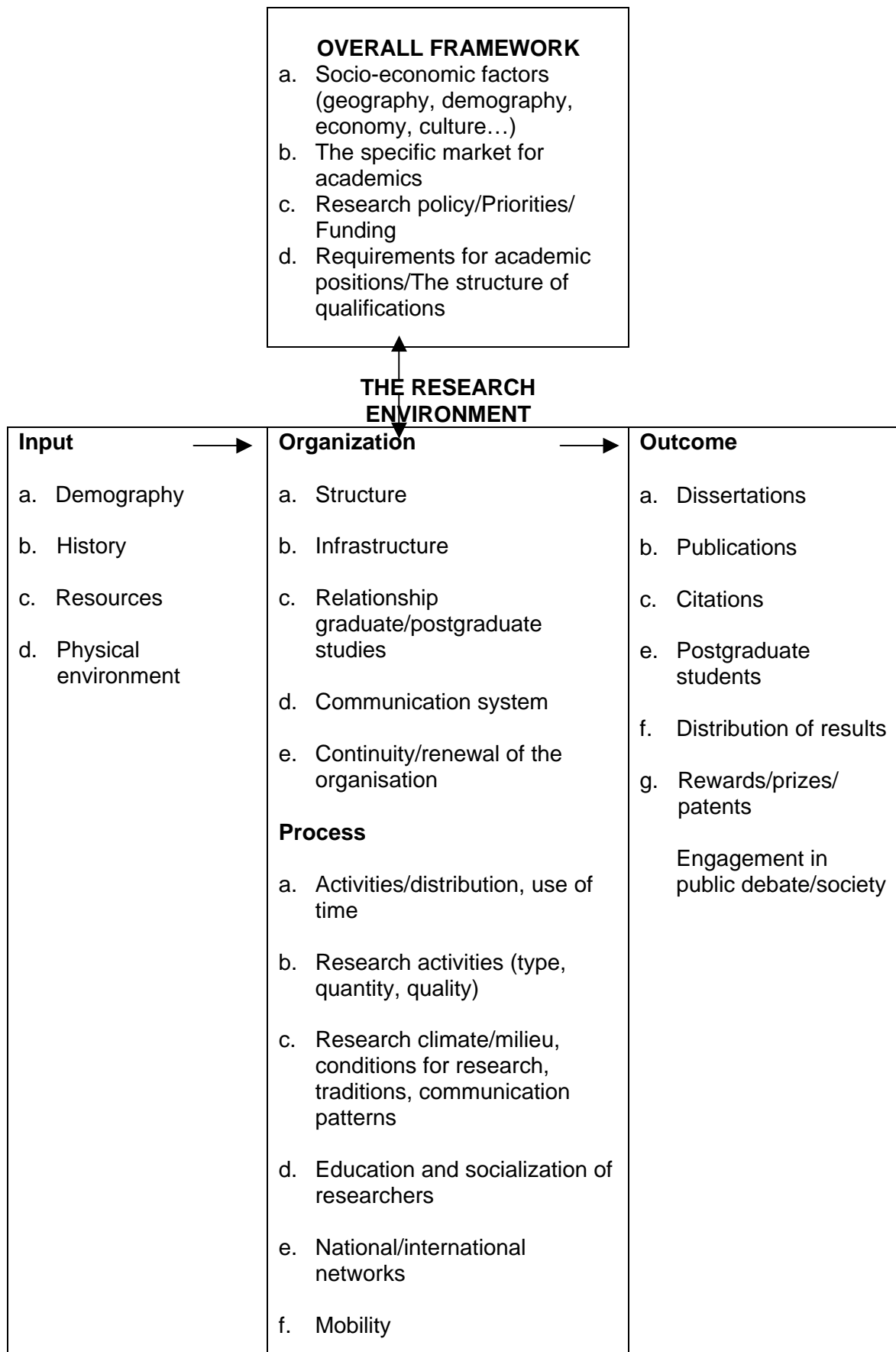
According to MSRE a research organization transforms an input (grants, qualification of research, competences) through a process to an outcome (dissertations, publications, postgraduate students, patents, rewards etc.). Research is determined by different processes in the environment such as research activities, communication patterns, conditions for research, working climate, recruiting systems, reward systems, education and socialization of researchers. These processes are however influenced by internal and

external structures such as the infrastructure of an environment, the organization, management and structures on the meta-organizational level as the networks as well as other external factors i.e. relations to the surrounding society.

Elements of structure and elements of process interact. The preconditions of research process and production are defined by the structure of an organization, but in a longer perspective structures can be influenced and changed by processes within a research environment as well as by other external factors.

The model moreover focuses on the relationship between science and society and emphasizes the societal factors influence on research factors, such as policy making. According to the MSRE external factors constitute a framework for research activities. This relationship is interactive, meaning that changes in conditions external to scientific activities, in the society as a whole, have an impact on the organizational level as well as on research processes and activities, and vice versa. The following analysis is consequently based on a dynamic approach.





**Figure 1. A Model for Studies of Research Environments (MSRE)**

## **2. MAIN FINDINGS**

This presentation summarizes the findings of the two empirical studies, the comparative study of research environments in Scandinavia and the study of innovative and dynamic research environments in Denmark. Moreover it analyses the results that were achieved in the two studies and puts it in a theoretical context. The aim of this approach is to discuss factors that constitute research environments and additionally those that characterize innovative research environments.

### ***2.1. A Scandinavian study – Research Environments in a Nordic Perspective. A Comparative study in ecology and scientific productivity***

The reason behind the comparative study was a wish to explore factors that constitute research environments on one hand and to shed light on the question why some research environments are more productive, effective and dynamic than others. The survey consequently focused on factors internal to the research environments of three Scandinavian University Departments in Psychology (in Denmark, Norway and Sweden) as well as external factors in the broader environment, the society outside the academic world, in an effort to find explanations for how the interaction between the different elements, internal and external, influenced the research outcome.

From a comparative point of view the Scandinavian countries are interesting to study due to their closely linked history, their similarities in geography, demography and economic development. Also the research environments had the same background and origin (philosophy) and the same roots, the German experimental psychological research. Besides cultural, social and demographical similarities, the studied environments showed important differences with respect to education and research organization and research traditions. It was therefore interesting to observe how these “cases” developed within different frameworks. A combination of qualitative and quantitative methods was used. Qualitative interviews proved to be a good instrument and gave useful information on research processes, management issues and organizational characteristics. Interviews captured the working climate and tacit concepts in the environments and statements reflected whether the environments were seen as evocative or as a barrier to the process and outcome (For an extensive description on methodology issues see Kalpazidou Schmidt 1996).

The results of the comparative approach showed major differences with respect to dissertation rates as well as outcome in general, organization, research processes, traditions and cultures and the degree of internalisation of the studied environments (and of the publications accessibility depending on the language used). That is to say differences even

with respect to the significance of the publications for the development of the discipline in general.

The results showed that dissertation rates in the Swedish research environment were ten times higher than these of the Danish and Norwegian. Moreover the average rates of the international oriented publications (publications in other languages than Scandinavian) per researcher during the studied period were higher at the Swedish research environment, namely more than double the rates of the Danish and Norwegian counterparts.

The question of why the development of these research environments has been so different (despite the fact that they have had the same background, origin and similar input) and how these differences can be explained was identified as being factors internal to the environments and the interaction between internal and external to research environments factors.

Internal to research environments factors were the organizational structure of the environments, the organization (or lack of organization) of research activities, the input and demography of the departments as well as the processes in the environments. The processes comprised research traditions and profiles, specializations, communication patterns, community life and socialization, rewards and stimulation, networking and external dialogue, working climate and mobility, autonomy and freedom of the researchers to choose research fields, theories and methods and attitudes to what was worth publishing and where (An elaboration on these factors influence on the environments follows in section 3 in connection with a discussion of different research cultures.)

Factors external to the research environments had a significant influence on them, and put strains on what was possible to implement in these environments. External factors at the macro level of conduct are described more extensive and elaborated in a following section.

## ***2.2. Dynamism and Innovation at Danish Universities and Public Sector Research Institutes. An analysis of the factors that characterize dynamic and innovative research environments***

The study of 15 research environments showed the complexity of research activities and pointed out the differentiation that characterizes research. The study highlights the common features and the similarities within organization and management of research environments, communication patterns, recruiting and personnel policy, working environment, conditions for research, financing and other factors.

The empirical study was based on surveys carried out among researchers and research managers. A combination of qualitative and quantitative methods was used. The analysis was based on in-depth semi-structured interviews with the leaderships of the research environments. Furthermore questionnaires were sent to the researchers and data were assembled from university and research institutions. Moreover the study had as point of departure the history and demography of the research environments. These types of information were included in order to detect the origin and roots of the dominant research cultures, the leadership and the management traditions and the way different personalities; leaders and management styles had shaped each research environment.

The studied research environments represented all the faculties covering basic and applied research. Some environments were small, others large. Some comprised whole institutes, others departments, while some were centres and others networks. Obviously the selected research environments comprised only a part of the dynamic and innovative environments in Denmark. Furthermore it is the assessment of this article that the findings of this study are not a specific feature limited only to Denmark. As the studied environments interacted lively with other research environments internationally and many were highly inspired from environments abroad it is likely that the findings correspond to the way research environments function in other countries.

### ***2.2.1. Factors that characterize dynamic and innovative research environments***

The study reveal that features characterizing dynamic and innovative research environments comprises the following:

- Clearly formulated research strategies and research objectives. It was primarily the leadership that formulated goals and strategies.
- Distinct research profiles. Researchers in these environments worked predominantly in research areas that were unique to Denmark.
- The management focused on research activities and processes, quality, innovation and competence development.
- The management focused on organizational efficiency and productivity.
- Research strategies encompassed planning and coordination of activities, formulation of target areas, and prioritisation among research areas and research projects.

- Dynamic and innovative research environments had active leaderships based on modern personnel management styles. Research leaders were active within the environment, in relation to the political system and took part in the development of society as a whole.
- Dynamic environments often were shaped against the backdrop of inspiration from abroad. Typically managers were inspired by experiences that they have gained in foreign environments through research assignments outside Denmark. As to management styles inspiration concerned in particular physical planning and organization of research activities. In many instances inspiration from abroad also influenced the cognitive processes. That is to say it influenced the choice of research fields and subjects.
- Interaction with international research environments was of high priority and of outmost importance for dynamic and innovative environments. Not surprisingly most of the studied environments were also internationally well known and internationally recognized. Building on international networks was a decisive factor for these environments. Knowledge transfer was considered a precondition for innovation.
- Dynamic environments had excellent research frameworks and attracted adequate financial support. The selected environments could draw on substantial external resources, significantly contributing to the environments' innovatory dynamism. External resources from the private or public sector further stimulated teamwork and cooperation with other environments in Denmark and abroad. External funding reinforced interdisciplinary initiatives and facilitated the process of recruitment of new researchers. An interesting observation was that most of the environments chosen relied substantially on external funding. Existing levels of research activity evidently could not be maintained without such external funding.
- Dynamic environments were based on flexible research organization where internal cooperation based on specialized teams had high priority.
- Dynamic environments were based on well-defined, transparent staff policies that encouraged, supported and assisted the process of creating professional contacts, especially to international networks. These initiatives set the framework for researchers' professional development. Staff policies were based on the principal of research autonomy. The degree of "academic freedom" was in general higher during research processes and limited when choosing research subjects. The reason behind this was that the studied environments were characterized by distinctive research profiles and in many cases activities unique to the country. Consequently prioritisation and focusing on

particularly these activities was a common feature. This factor however restrained the possibilities of working within a wider range of research areas.

- Dynamic environments were boosting the scientific elite. The elite ensured the overall quality of work and assisted young researchers – in the socialization process and in relation to the different markets surrounding them, such as the publicity market and the resource market. This setting further rewarded well-performed research by use of different incentives and reward mechanisms. Management aimed to make environments equally attractive to Danish and foreign researchers as well.
- Dynamic and innovative research environments had a clear and transparent recruitment policy with a solid core of senior competences and young researchers. Leaderships focused on recruiting energetic, enthusiastic and committed researchers. Interaction between several generations of researchers under the same roof was clearly promoting innovation. Recruitment policy was a significant factor in promoting innovation in research environments.
- Environments were furthermore characterized by a good working climate. The organizations had internalised norms with explicit research traditions and cultures. At the same time a pluralistic approach prevailed. This approach contributed to openness towards new ideas and research traditions. Furthermore an ongoing dialogue on research tasks, research theories and research methods was found to be a characteristic of these environments. Dialogue and openness to new ideas clearly promoted innovation.
- Research environments featured in the study had an organization that was flexible in relation to external factors. The organizations were characterized by ability to adapt to external factors and sensibility towards changes in the society. Dynamic environments promoted the research groups' interest in society. The majority of institutions maintained a good and close connection to the private sector and the political establishment. It has to be underlined though that this does not unequivocally imply that all research environments in the study had established a close cooperation with the private sector. In some of the environments researchers were working on issues that were not of relevance to the private sector.

### **2.2.2. Organization of research in innovative and dynamic research environments**

Focusing on the organization of research, the following features became apparent:

- Dynamic and innovative research environments in Denmark were organizations without clearly defined boundaries. These environments were open, somewhat “fluid”, and usually non-conformist. They comprised a core group of researchers, and a group of not so closely connected researchers. The units consequently did not emphasize their outer boundaries. Instead they focused on defining internal elements and relations such as cooperation and quality. The organization influenced the research activities and the overall development of the units.
- Activities of the studied units usually had as their starting point demands and needs originating in the surroundings. Researchers combined these demands and needs with their professional interests. This evidently increased the potential for obtaining external funding from a variety of sources.
- The informal structure of dynamic and innovative research environments studied in this survey – namely factors such as dialogue and communication, network building, internalised norms, values and traditions influence research content, quality, international visibility and productivity demography (different personalities interacting within a given framework) - had a significant influence on the organization of research, on leadership styles and on research processes in the environments.
- The organizations emphasized and facilitated interaction with international research and network building. Reference groups and potential networks were found internationally due to the fact of high degree of research specialization.

### **2.2.3. Leadership and management of dynamic and innovative research environments**

Furthermore the competencies, the personalities, the significance and effects of management of research units as well as perceptions of leadership styles and their influence on research environments and processes were in focus. The results of this part of the study of leadership of dynamic and innovative research environments show that:

- Managers of dynamic environments were active and respected researchers themselves, with adequate leadership qualities, and this had a considerable impact on their relation to colleagues. Additionally it was found that the majority of managers had been instrumental in creating and shaping the environments from the very beginning. Managers of innovative environments were found to have a significant power to influence and change

environments within the existing organizational frameworks. This influence was partly a consequence of the manager's additional professional activities, such as memberships of committees and councils.

- Managers considered it essential to have clearly formulated research strategies and well-defined research goals.
- Managers shaped usually the research environment. They were responsible for securing the resources, prioritised the tasks, formulated the target areas, encouraged cooperation and teamwork, utilized different incentives and remuneration systems and attempted to stimulate and develop competencies by offering researchers professional challenges on a regular basis.
- Managers considered it important to formulate clear and transparent personnel and recruitment policies. They usually encouraged a non-authoritarian leadership style enshrined in the principle "freedom based on responsibility". In short they promoted dialogue, communication and openness to new ideas and traditions and tried to create a well-functioning social environment. With respect to recruiting, research managers emphasized features such as professional qualifications, interest in the research area and social skills. Several managers also pursued the task of recruiting foreign researchers – i.e. at international conferences.
- Managers focused on quality of research, quality assurance and cooperation with international environments. They regarded this as particularly important, especially in relation to young researchers' professional development.
- Managers presented and emphasized the significance of the research work of their environments internationally as well as in relation to the private sector and the society as a whole. These issues were considered particularly important for the environments' dynamism and development, not simply because of their impact on funding, but also as these factors have to do with promotion of innovation in a competitive international context.
- The study also points out that managers had the opportunity of influencing research policy through their research work, as their research activities were unique to the country. In addition, managers of dynamic environments were well represented in the research policy-making system as well.



### **3. ANALYSIS**

#### **3.1. Research influence, control and innovation in research environments**

The results of the above presented surveys reveal that the main research influence and control mechanisms - discussed previously in relation to the theoretical point of departure - are to be found at all levels of analysis, e.g. at the macro-level (mechanisms such as *external dialogue and communication, market control*) and at the meso- and micro-level (mechanisms such as *democracy and bureaucracy, traditions, norms and values*). The combination of these mechanisms and the degree of influence of these in the environments vary. Moreover the interaction pattern between the control mechanisms varies. Consequently the combination of these mechanisms and the interaction between them give different types of research environments.

Control mechanisms influencing the research environments such as *bureaucracy* build on hierarchies and formal authority e.g. a closed rational organizational structure. The *wider concept of control mechanisms* on the other side builds on dialogue, communication, networking, democracy and institutional autonomy as well as on market control. This conceptualisation of control mechanisms is more complex than the close structure of bureaucracy. It is in addition based on a more open and flexible organizational perception than hierarchies (see also Foss Hansen 1988).

The wider concept of control mechanisms based on a higher degree of autonomy is though not uncomplicated. It has been concluded from the surveys that organization and management of research in dynamic and innovative research environments give scope for a *high degree of freedom and autonomy* during the research process. This is the case despite differences between the studied environments with respect to research fields, research cultures, strategies and goals. Freedom to choose research field and object is though more restricted in these environments (especially for younger researchers) due to high specialization of teams in the units (teamwork demands often close cooperation on a specific theme) and distinct profiling of the environments. However, high specialization is not the case only for well-organised research environments. High specialization in loosely organized units is also very common. In cases where the individualist's research culture prevails there is more room for autonomy and freedom throughout the whole process of research, from the choosing of the research object to the publication of results. This obviously gives more room for new research initiatives and exploration of new fields and problems.

*Meritocracy* defined as the legitimate disciplinary authority is highly present in the studied environments. Meritocracy incorporates the internalised rules that the authority builds on. In

every day life though researchers rarely understand these rules as concepts of control. In meritocracy the *academic elite* is the most significant actor in a structural perspective with regard to quality assurance and control of reward systems, as well as in relation to other markets that researchers operate within (such as the publication market). Academic elites, particularly in innovative research environments, have developed mechanisms that facilitate younger researchers' socialization process and help them manage relationships to the different markets surrounding them (i.e. the funding market, different government agencies, different interest groups and elites as well as the publication market by offering them possibilities to publish together with more established academics).

The above-mentioned mechanisms in combination with *the working and social climate* in an environment building on *traditions, norms and values*, define moreover the networks of actors and the patterns of influence that characterize research environments. The academic elite particularly in innovative and dynamic environments, functioning as the leadership of research environments, focuses on processes and uses the organizational structure as a management tool in an effort to further develop the environments.

The elite is obviously aware of the significance of other main actors in the research process - such as government agencies, university and institutional agencies and other interest groups, such as the private sector. The elite consequently seeks to become an integral part of the research policy system and to establish and maintain a good relationship with the entrepreneurial sector. Participation in the research policy system guaranties research environments a certain influence in terms of policy regime and gives an immediate access to current policy instruments, to information on policy changing and increases the possibilities to adjust activities in accordance to the changing market. This implies though prospects of more socio-economic relevant research but also high concentration on applied oriented research and therefore even the risk of neglecting basic research.

Even changes in external economical and political conditions e.g. in the framework and overall ecology of research environments affect processes in the environments (Kalpazidou Schmidt 1996). The extensive network that the majority of the studied innovative environment have established, also in relation to the surrounding society, and the openness these show with respect to adapting to external conditions, is one remarkable element of dynamic and innovative research units.

### **3.2. Urban and rural research cultures**

The study of factors internal to the research environments show that these represent different types of environments - with regards to organization, structure, demography, research processes, research traditions and conditions for research activities, research specializations, communication patterns and community life. To separate the different aspects of research environments would be artificial and would not contribute to the understanding of research environments. That is why the analysis of the interaction between the different dimensions of research environments in the two studies this article is based on adapted a more open approach e.g. the research culture concept. This concept summarizes the elements that constitute research environments.

In the analysis of various types of environments a distinction between an "urban" and a "rural" setting was adopted to describe the different research cultures. Becher (1989) initially introduced among others the urban and rural setting in order to describe discipline cultures in a study of academic cultures in twelve disciplines in UK and USA.

The distinction between *urban and rural research environments* was introduced and further developed by Kalpazidou Schmidt (1996) in the study of research environments in Scandinavia. The distinction between urban and rural research cultures is consequently based on the analysis of the elements that constitute research environments at a specific stage in their development and has been proved pertinent in describing the complexity of the research culture.

The urban-rural cultural setting used in the present context is meant as a **continuum** (with urban and rural environments at the two opposing ends, see figure 2) where the research environments can be placed alongside each other depending on their characteristics. To characterize an environment as either urban or rural implies that there is a *predominance* of one of these research cultures in the environment. Research environments after all represent *heterogeneous cultures* that include characteristics of both urban and rural cultures. Furthermore research environments are dynamic organizations, which means that they are *changeable* organizations over time.

This has to be pointed out particularly with respect to the results that the Scandinavian study show. This study was completed during the first half of the 1990s. The overall framework for research activities has changed dramatically since then in all the three countries focusing in the study, evidently they became more homogeneous. It is more than likely that the changes in the overall framework have had a significant impact on the research environments as well.



**Figure 2. An illustration of the urban – rural continuum (where A...D are the research environments positions on the continuum depending on their characteristics)**

The first point to establish, in order to understand the difference between the two research cultures, is to identify the elements that characterize each one and answer the questions: What is it that characterizes an urban respectively a rural research environment? In which respect are dynamic and innovative research environments mainly urban in character? In which respect are these different from rural environments?

The answers to the raised questions are to be found in the research data derived from the two studies described earlier in this paper. Thus, two further points need to be considered before giving answer to these questions. First, the fact that emphasis and focus in the *Danish study of dynamic and innovative research environments* was on the *urban research culture* (as these showed mainly characteristics of a such culture). The characteristics of *the rural research culture* on the other hand were identified and described more in detail first and foremost in the *Scandinavian comparative study*.

Secondly it is necessary to pay attention to *the difference in time* between the two studies. As previously mentioned the comparative study of three Scandinavian environments took place in the 1990s at a time when Swedish State interventionism in higher education and research was already established as a tradition. In Sweden profound higher education reforms and research policies (described in the following section) was introduced long before Denmark and Norway. In the cases of Denmark and Norway such reforms were not introduced until the second half of the 1980s and during the 1990s. It was therefore too early to detect the effects of reforms in Denmark and Norway at the time of the study and in connection with its collection of data.

The study of innovative and dynamic research environments in Denmark in 2001, approximately a decade later, is consequently studying a different research ecology. This however doesn't make the comparison of the two ecologies less relevant. On the contrary a comparison between the two ecologies gives the possibility to detect the changes and follow the development of the ecology of research in Denmark and the influence of these changes on the research environments.

Keeping in mind these considerations the author shall answer the questions raised above in order to highlight the difference between urban and rural cultures by describing the most essential dimensions of the urban-rural dichotomy (see Figure 3).

**The first** element that differentiates the urban from the rural research environment concerns the organizational level e.g. the degree of organization of research activities. Urban cultures show a high degree of research organization and consequently emphasize *leadership and management* as the prime force formulating and drafting the framework for research innovation and dynamics. For the urban culture *cooperation and teamwork*, where several researchers are involved in common projects, is the key word. Other studies point to the same feature, namely that performance is highest under conditions that might seem contradictory, e.g. high levels of autonomy can be found together with high degree of interdependency in research units (Pelz & Andrews 1976). Studies moreover show that groups with high autonomy but with little external pressure perform poorly, while groups with an equivalent level of autonomy and external pressure or with strong internalized norms of innovation and change perform well (Kim & Lee 1995).

In rural cultures research activities are based on the principle of “*every man, his own project*”, so *individualism* and *separatism* are concepts dominating in rural cultures. Urban cultures on the other hand build on close cooperation in every step of the research process working as an orchestra under the direction of a conductor, the research manager. Teamwork seeks to minimize competition among researchers in the unit, although competition – in particular among research groups about funding - usually occurs. Rural cultures seek to limit or control competition by means of separatism, specialization and individualism.

Urban cultures build on a hierarchical structure of organization namely *the academic elite*, which provides the framework for activities i.e. the resources, the networking, the recruiting and socialization of researchers. Hierarchies are accepted and elites are respected for their authority in urban cultures. At the same time urban cultures give room and freedom during research processes. Research autonomy is more limited though when choosing research field and subject due to pronounced, well-defined and in many cases distinct profiles, research strategies and priorities. This, as mentioned before, may in the long run restrain original initiatives.

Research environments dominated by a rural research culture have traditionally been organized individually. The formal structure does not directly influence the choice and planning of activities. In these environments the autonomy of researchers is significant.

Specialization of individual researchers on fields that are different from each other is another common feature. The high degree of specialization limits the opportunities for collaboration among researchers within the research unit. In general internal communication is limited in rural cultures.

Lack of interaction, challenge and stimulation can restrain innovation and may have a negative effect on quality of research especially with regard to younger researchers. Other studies also show that interaction with challenging colleagues in the same environment and with other relevant actors influence the quality of the performance. On the other side a high degree of organization and demands for high efficiency (essential elements of the urban culture) may have a negative effect on the originality of the outcome. Researchers often talk about the need for the right blend of challenge and support in the environment (see also Gulbrandsen 2000). The organization can be a source of challenge and stimulation, especially for younger researchers, and maybe even a source of creativity (Amabile 1988).

**The second** element that differentiates the two research cultures are concepts such as *strategies for research activities, priorities and focused research, planning and coordination* that dominate urban cultures and is vague or even totally absent in rural cultures. Research traditions and research profiles in urban cultures are predominantly characterized by well-defined research fields and objects, as well as target oriented research with many elements of a positivistic oriented research approach. Researchers typically concentrate their efforts in narrower areas and on well-defined objects, containing separable problems, tackling them therefore relatively quickly within the research group where necessary support can be found. Rapid publication (usually in form of articles in journals) dominates the production of the urban culture. This may have an impact on the image of urban researchers. These may get a reputation as working harder than others. However, the results of the dynamic and innovative research environments show that this is not the case. The average time spend on research is similar for urban scientists as well as other researchers (Graversen, E. K. et al. 2002).

Consequently the focus on research activities, interaction and a strong sense of unity among researchers are of importance for the promotion of innovation. The size of the units on the other hand seems not to be a significant element for innovation and dynamism.

Urban researchers use external funding more frequently and systematically than rural researchers. This implies that urban researchers must produce results “on time” in order to achieve continued funding.

Rural researchers on the other hand have no common research strategies, no common planning and coordination - and therefore enjoy more autonomy in their activity - and are usually involved in *wider research fields* often working with theory development and research objects that are not clearly defined as well as with problems not sharply delineated. The research process might so be prolonged and the production over the years limited. This is due to the fact that rural researchers prefer monographs as their publication form. Rural environments may thus give more room for critical research, for original and basic research. Rural environments cover a broader territory and give more freedom to choose research field than urban environments.

**The third** element that differentiates urban from rural culture is *the communication and dialogue pattern*, the internal as well as the external. In urban environments communication - both formal and informal - is intensive. Internal exchange of ideas usually takes place in an open and trustfully atmosphere and as an integral part of the process of teamwork. Researchers discuss research issues and problems systematically; they give feedback and are involved in every step of the research process. Urban researchers often have reference groups where research issues are subjects to debate. Informal channels for communication facilitate exchange of knowledge and save time and resources. There is a high intensity and a high pace in urban activities as well as a rapid information network, a wide international network and a high degree of internationalisation. A busier and more intense pace of internal life generally characterizes this culture together with a more open attitude to society's needs and demands. This may have implications on research activities, as focused research is common in urban culture. Again, the risk of neglecting basic research is eminent.

Rural researchers working in such highly individualistic environments experience little or no support regarding epistemological and funding issues and they often feel "alone" in their own environment.

The two research cultures have different ways of communicating with the surrounding society. Urban cultures focus on *networking* and regard networks as a significant tool in their efforts to become dynamic. The two cultures are furthermore different as to the frequency of contacts to other research environments and to issues concerning publication of research. Urban researchers have a range of activities related to their research (visiting other environments, attending conferences, hosting conferences and seminars, accepting visiting professors etc.). They have an extended national and international network that promotes innovation and is significant for the renewal of the research environment. Here leaderships use opportunities to present the urban units to other researchers, institutions and other agents. High visibility in combination with a usually high productivity and inflow of

researchers also creates an image of urban researchers as harder working than others. The survey of dynamic and innovative research environments however show that this is not the case. As mentioned earlier, urban and rural researchers on average spend the same time on research. Misconceptions as the one described here can be the case even concerning the issue of research quality. Despite the fact that the scientific outcome of rural cultures - with respect to quality - can be superior to urban cultures the perception of urban environments in general is more positive in this respect too.

Elements such as the above may have a considerable impact even on the perception of research environments with regard to assignments, external funding and not least in relation to policy-making. An urban culture based on well-organized teams, research groups and a leadership that is actively involved in almost all steps of the research process is highly effective in promoting the image and interests of the research group. Urban environments can easier get a higher status. Compared to rural environments these have a general reputation for high productivity and are usually favoured with regard to external funding. This is often the case in urban cultures due to researchers ability to obtain external grants based on the strength of being member of a specialized team. Teams are usually under the leadership of a full professor, who is very often a well-known appreciated researcher. The professor takes care of the interests of the urban research group. This usually has an impact on the status, the image and the esteem of urban researchers. In the rural culture the researcher is often left alone to deal with the various problems that he/she is confronted with during the research process. Even policy-makers, research councils, funding agents, the private sector and other agents may perceive urban environments as more dynamic and innovative in comparison to rural. The consequence again is higher external funding, which obviously gives a better framework for activities.

**The forth** element that differentiates rural and urban research culture is the *flexibility* in relations to *external conditions*. Urban cultures are flexible and compliant with regard to external influences. Urban researchers do not live in “ivory towers” and respond more often to external stimuli. Urban cultures show also a higher ability to adjust to external circumstances. The implications of this could be a more pragmatic attitude, even a tendency to change research field or favour specialisms that are popular or have an applied orientation.

In addition elites in urban cultures are more *engaged in research policy and policy-making*. This gives access to information on policy issues and opportunities to influence research policies and strategies, and to promote the interests of their environments. Engagement in other *societal issues* such as taking part in public debates, informing the society on research



issues and results, and publishing articles in non-scientific journals, are other characteristics of the urban culture.

<b>OVERALL FRAMEWORK</b>		
a. Socio-economic factors (geography, demography, economy, culture...)		
b. The market for academics and researchers		
c. Research policy		
d. Academia, staff structure and requirements on research merits/capabilities		
<b>RESEARCH ENVIRONMENTS</b>		
	<b>RURAL CULTURE</b>	<b>URBAN CULTURE</b>
<b>INPUT</b>		
Demography	Little or large research environment	Little or large research environment
External resources	Limited	Large amount
<b>ORGANIZATION</b>		
Structure	Loose structure, egalitarian culture	Hierarchical structure
Degree of research organization	Loose organization of research	High (Strategies, priorities, coordination)
<b>PROCESS</b>		
Research activities	Individualist, separatist	Teamwork, orchestra
Research profiles	Wide range, critical and theoretical research	Distinct profile, well-defined subjects, narrower range, positivistic orientation
Autonomy and freedom	Very high degree	High during the research process, limited when choosing research subject
Internal dialogue	Limited/ltd. competition	Intensive, ltd. competition
External communication (international)	Limited/limited visibility	Networking/high visibility
Mobility	Limited	High
Flexibility in relation to external conditions	Limited	High
<b>OUTCOME</b>		
Number of postgraduate students	Limited	High
Doctoral dissertations	Few, monographs	Many, articles
International oriented publications	Limited	The majority
Type of publication	Monographs	Articles
Production per researcher	Low	High

**Figure 3. An illustration of the ecology of different research cultures**

#### **4. RESEARCH ENVIRONMENTS AND CONTEXT – FRAME FACTORS<sup>2</sup>**

The multiple factors that have been analysed above in relation to the different research cultures appeared within the research environments e.g. at meso- and micro-level. These factors influenced researchers and their motivation as well as innovation, production and quality of research.

Important questions to put at this point in time are the following: *Under which political, economical, social and educational conditions, e.g. within which overall framework, the two research cultures have developed and why? And furthermore, how can the interaction between internal and external factors be described?*

To answer such essential questions a change of level of analysis must be made, hereby moving from the individual/group-perspective and the organizational-perspective to the *macro-perspective* focusing on the relationship between research and society and therefore focusing on the context for research.

The results of the two studies that this article is based on reveal that external factors, usually decided at governmental and structural level, influenced the input, the process and the outcome of the studied research environments (and promoted or limited innovation). In order to identify the external factors and their interaction with internal elements a comparative approach was adopted. This approach evidently captured the differences between the different frameworks of research. The following is so an illustration of the comparison of the overall framework for research activities in the studied countries during the time period 1960s to the 1990s (for a more detailed description see Kalpazidou Schmidt 1996).

In the perspective of the urban-rural distinction and keeping in mind that this was a historical study, it was concluded that the **urban pattern** (characterizing the studied Swedish research environment at a specific time) **appeared in combination with the following external factors:**

a) A high demand for new doctors and other qualified researchers on the academic and educational market. This again was a consequence of the expansion of education in general, and of higher education and research in particular. Research institutions within this framework responded to increased societal demands for higher academic degrees. At the same time as the system developed it became more formal. Political-administrative

---

<sup>2</sup> The rationale for this analysis is based first and foremost on the results revealed from the Scandinavian comparative study where the function of research environments in three different contexts was in focus.

processes embedded in formal structures and based on formal positions replaced the informal settings where a homogeneous elite of actors knew one another personally. The emerging networks of actors also became more politicised.

b) A government policy that actively engaged in the sector by formulating educational and research policies and by implementing educational and research reforms in an effort to organize more systematically the higher education and the doctoral programmes and define research strategies and priorities. A model responding to the increasing demands for doctors in society introduced a new and shorter postgraduate programme leading to an increase in numbers of postgraduate students in Sweden. A labour market for PhDs was developed that became considerably broader than the few professorships available at universities. The role of the Swedish welfare state has - to a much greater extent than in other Scandinavian countries - traditionally been interventionist with a strong presence in both higher education and research. This process also contributed to the integration of higher education and research policies in the welfare state and the labour market policies.

c) Introduction in Sweden of some basic rules regulating the competence of professors and other tenured positions at universities and colleges at a time when demands in society, in terms of explicit needs for PhDs, were high. Such intervention by the Swedish government had an indirect – however rather strong – influence on the higher education institutions and on other parts of the educational system.

d) Strong competition among a great number of highly competent researchers led to an intensification of efforts to improve research merits. This implies that the universities had the possibility of selecting the professors from a wide pool of competent applicants. The positive consequences for the quality of research are more than likely.

The "**rural**" pattern on the other hand – basically characterizing the Danish and the Norwegian research environments at that specific time on their development - appeared in combination with the following **external factors** (as mentioned before, these factors have changed since the 1990s as the framework for research changed in both countries):

a) Stagnation on the higher educational and scientific market during the 1980s and the beginning of 1990s. The scientific community as well as the rest of the society had difficulties absorbing new researchers. This had implications for the mobility of researchers and the diversity of the environments. In smaller academic environments like the Scandinavian such a tendency, if no measures were taken, could prove unfortunate for the dynamics and innovation of the institutions and the development of the disciplines.

b) Lack of research policies, research strategies and priorities on governmental as well as on institutional level led to an individualist, separatist research culture. The synergy effect, a result of coordinated research activities, could not be accomplished in the studied research units during this specific period. Policy shifts during the last two decades however led to changes in the organizational structures and the policy instruments. Higher education and research are nowadays an integral part of macro economic planning and active labour market policies in the Scandinavian countries.

c) An organizational structure based on a limited number of tenured positions at the universities and colleges, which in combination with a general stagnation on the market for academic researchers was neither a benefit to advancement and promotion nor to mobility. Lack of incentives, of attract/reward mechanisms and of access to direct and indirect remuneration systems restricted the dynamism of the institutions.

d) Lack of rules regulating the competence of new professors during the studied period, that didn't encourage productivity. For a long time a PhD was not required for obtaining a position as assistant or associate professor. This is in part the explanation to the low research productivity, at least at the doctoral level. In addition the majority of the academic staff in Denmark and Norway was appointed during the late 1960s and 1970s primarily for teaching, not for research.

e) The impact of the 1968 student revolt on the universities led to a deep and long crisis for the Scandinavian higher education systems, especially in Denmark and Norway. This happened at a time when an enormous expansion of the universities as educational institutions took place. Organization of higher education, not research, was in focus during the following decade.

In conclusion, it can be said that factors at the macro-level influenced the units and the implementation of reforms in the research environments. The interaction between external factors and the internal characteristics of the environments promoted or impeded research activities and the outcome of these activities.

The ecology of research has changed significantly during the last decades in Scandinavia, and especially in Denmark, where governments reformed the higher education and the research system introducing different research policy initiatives.

As previously concluded research environments are heterogeneous cultures, containing urban and rural elements. Classification of an environment as either urban or rural was

made on the basis of the elements that predominate the environments. There are though several arguments in the literature on science and research for a differentiation of policy-making, based on the discipline, the field and the research subject in focus. This view is shared by the majority of the research leaders that participated in the study of innovative and dynamic research environments. According to these views the degree of “urbanization” or “ruralization” of research environments in a similar overall socio-economic context is depending first and foremost on the research field and the tasks. Not all urban or rural qualities and elements are applicable or required for all disciplines, fields and research problems. Consequently the ecology of research (subject for policy-making) must adjust to the research activities in focus.

Differentiation is the core characteristic of research. Policy-making as a strategy for promotion of innovative research environments has to pay attention to the differentiated nature of research, create conditions for research diversity and ensure that there is room for basic research as well.

#### **4.1. INTERNALISM VERSUS EXTERNALISM?**

The results of the studies presented above show that elements that influence research activities and processes are found amongst factors internal to the research environments as well as external factors, i.e. in the surrounding society.

The two perspectives, internalist and externalist, which also have been discussed in the beginning of this article, emphasize the different aspects of how research is controlled, influenced and developed. This being said, it is clear that the theoretical point of departure for each perspective illuminates only some of the relevant factors, either the internal or the external, in an analysis of research activities and knowledge production. Triangulation of perspectives in the studies presented here has been a useful instrument in the attempt to highlight the complexity of research environments.

It is obvious that either the internalist or the externalist perspective in its own can explore the numerous elements of the organization of research and the research process, the preconditions for research activities and the outcome of these. The two perspectives must be seen as complementary rather than excluding each other. The complementary function means that the two perspectives could be applicable for the analysis of elements that constitute different research environments, as well as the analysis of these elements in a research environment during different periods.

Some researchers within this field have argued for the need to incorporate several frameworks and perspectives in order to give a more complete picture of complex organizations as research environments. Here again it must be emphasized that each perspective gives a coherent, but still insufficient, illustration of organizations and processes.

## **5. CONCLUDING REMARKS**

The article points out that from a theoretical as well as from a methodological point of view it is of significance to analyse all the elements, internal and external, to the research environments and to focus on the interrelation between these elements in order to analyse the environments, and to explore research and processes at all levels.

The two analyses presented here - the analysis of the Scandinavian environments as well as this of the dynamic and innovative research environments in Denmark - have focused on the following:

- Factors that characterize research environments and research cultures.
- The elements that are of significance to the development of innovative and dynamic research environments.

The studies have in addition illustrated the fact that what actually characterizes research environments is diversity. Research has different requirements, is carried out under different conditions and within different frameworks. The differentiation depends on factors internal to the unit such as the organization and structure of the institutions, the research cultures, the research traditions, networks and community life.

The differentiation moreover depends on context-related socially determined factors that are external to the units, such as historical-economical national priorities and research policies. External factors often work indirectly, but nonetheless have a significant influence on the dynamics of research environments.

Research environments are complex organizations. Simple input-output models are not appropriate when studying research ecology and research processes. Research activities have different requirements and take place within different context. Studies of research environments require more complex models as well as triangulation of different methods. Knowledge gained by use of such studies could be the point of departure for the development of a comprehensive dynamic and innovative research ecology.

## **REFERENCES**

- Andersen, R. & Foss Hansen, H. (1985-86), Research Evaluation and Research Policy. *Økonomi & Politik*, 59, Nr. 3. Copenhagen.
- Barber, B. (1952), *Science and the Social Order*. New York: The Free Press.
- Barnes, B. & Edge, D. Eds. (1982), *Science in Context. Readings in the Sociology of Science*. Stony Stratford: Open University Press.
- Becher, T. (1989), *Academic Tribes and Territories. Intellectually enquiry and the cultures of disciplines*. Open University press. Stony Stratford.
- Benner, M. & Sandström, U. (2000), Inertia and change in Scandinavian public sector research systems: the case of biotechnology. *Science and Public Policy*, vol. 27, Nr 6, pp. 443-454.
- Bertilsson, M. (2001), From Honoratiorees to Bureaucrats: Research Counselling in transition. In Science Policy. Setting the Agenda for Research. Strata Accompanying Measures. Managing with Uncertainty in Science Policy. Proceedings from MUSCIPOLI Workshop One. *The Danish Institute for Studies in Research and Research Policy 2001/8*.
- Bourdieu, P. (1975), The Specificity of the Scientific Field and the Social Conditions of the Progress of Reason. *Social Science Information* 14, pp 19-47.
- Broad, W. & Wade, N. (1982), *Betrayers of the Truth*. New York: Simon & Schuster.
- Cheng, J. & McKinley, W. (1983), Towards an Integration of Organization Research and Practice: A Contingency Study of Bureaucratic Control and Performance in Scientific Settings. *Administrative Science Quarterly*, 28, pp. 85-100.
- Clark, B. R. (1987), *The Academic Life*. Princeton, Princeton University Press.
- Cole, S. & Cole, J. (1973), *Social Stratification in Science*. Chicago & London: The University of Chicago Press.
- Dahllöf, U. (1982), Faculty profiles in a long-term and comparative perspective. Belanger, Ch. E. (Ed.), *The universities in a changing world. Adaptation or guidance. Proceedings Fourth European AIR Forum, Uppsala University 25-27 August 1982*.



Dahllöf, U. et al. (1991), Towards a new model for the evaluation of teaching; an interactive process-centred approach. *Dimensions of Evaluation in Higher Education*. Higher Education Policy Series 13. London: Jessica Kingsley.

Elzinga, A. & Jamison, A. (1995), Changing policy agendas in science. *Handbook of science and technology studies* (eds Jasanoff, s. et al.). London, Sage.

Foss Hansen, H. (1987), Effective Research – A Project Concerning the Development of Evaluation Methodology, with special reference to the humanities and the social sciences. *Evaluation of Research. Nordic Experiences. Proceedings of a Nordic Workshop in Saltsjöbaden, Sweden, 3-5 September 1986*.

Foss Hansen, H. (1988), Organisation and control of research. An introduction to research on research. *Politik og administration*. Copenhagen: Nyt fra Samfundsvidenskaberne.

Foss Hansen, H. (1996) Research administration and research policy. *Økonomi & Politik*, Nr 4, pp. 18-29.

Galtung, J. (1977), *Methodology and Ideology*. Copenhagen: Ejlers Forlag.

Gibbons, M. et al. (1994), *The New Production of Knowledge – Dynamics of Science and Research in Contemporary Societies*. London, Sage.

Graversen, E. K.; Kalpazidou Schmidt, E.; Langberg K.; Lauridsen P. S., (2002), Dynamics and Innovation in Universities and Public Research Institutes in Denmark – An analysis of the characteristics of dynamic and innovative research environments. *The Danish Institute for Studies in Research and Research Policy 2002/1*.

Gulbrandsen, J. M. (2000), *Research quality and organizational factors: An investigation of the relationship*. NTNU, Trondheim.

Gulbrandsen, J. M. (2000), Between Scylla and Charybdis – and enjoying it? Organisational tensions and Research Work. *Science Studies 2/2000*.

Gustavsson, S. (1971), *Debatten om forskningen och samhället*. Uppsala: Almqvist & Wiksell.

Guston, D. (2000), *Between Politics and Science*. Cambridge University Press.

Hagstrom, W. O. (1965), *The Scientific Community*. New York. Basic Books.

Jacobsen B., Madsen M. B. & Vincent C. (2001), *Danish Research Environments*. Hans Reitzels Forlag

Jørgensen T. B., Foss Hansen H., Antonsen M. & Melander P. (1998), Public organizations, multiple constituencies, and governance. *Public Administration*, vol. 76, autumn, pp. 499-518.

Kalpazidou Schmidt, E. (1996), *Research Environments in a Nordic Perspective. A Comparative Study in Ecology and Scientific Productivity*. Acta Universitatis Upsaliensis. Uppsala Studies in Education 67, Uppsala.

Kalpazidou Schmidt, E.; Graversen E. K.; Langberg K. (2002), Innovation and Dynamics in Public Research Environments in Denmark – A Research Policy Perspective. *The Danish Institute for Studies in Research and Research Policy*. Working papers 2002/10.

Kim, Y. & Lee, B. (1995), R & D Project team Climate and Team Performance in Korea: A Multidimensional Approach. *R & D Management*, nr 25, pp. 179-196.

Knorr-Cetina, K. (1981), *The Manufacture of Knowledge*. Oxford: Pergamon Press.

Knorr-Cetina, K. (1983), The Ethnographic Study of Scientific Work: Towards a Constructivist Interpretation of Science. Knorr-Cetina, K. & Mulkay, M. (eds), *Science Observed. Perspectives on the Social Study of Science*. London. Sage.

Latour, B. & Woolgar, S. (1979), *Laboratory Life: The Social Construction of Scientific Facts*. London: Sage Publications.

Law, J. (1973), The Development of Specialities in Science: The Case of X-ray Protein Crystallography. *Science Studies*, nr 3, pp. 275-303.

MacCorcle, C. & Archibald, O. S. (1982), *Management and leadership in higher education*. San Francisco: Jossey- Bass Publishers.

Merton, R. K. (1957), Priorities in Scientific Discovery: A chapter in the sociology of science. *American Sociological Review*, vol. 22, nr 6, pp 635-659.

Merton, R. K. (1957), *Social Theory and Social Structure*. New York: The Free Press.

Mitroff, I. (1974), Norms and Counter-norms in a Select Group of the Apollo Moon Scientists: A case study of the Ambivalence of Scientist. *American Sociological Review*, vol. 39.

Mulkay, M. (1977), The Sociology of the Scientific Research Community. Spiegel-Rösing, I. & Price, D. (eds): *Science, Technology and Society*. London, Sage.

Pelz, D. C. & Andrews F. M. eds (1976), *Scientists in Organizations. Productive Climates for Research and development*. Revised edition. Ann Arbor, MI: Institute for Social Research, University of Michigan.

Pfetsch, F. R. (1979), The Finalization Debate in Germany: Some Comments and Explanations. *Social Studies in Science*, nr 9, pp. 115-124.

Polanyi, M. (1962), The Republic of Science. *Minerva*, nr 1, pp 54-73.

Price, D. (1963), *Big Science, Little Science*. New York: Columbia University Press.

Scharioth, J. & Gizycki, R. (1986), Voraussetzungen und Möglichkeiten von Wissenschaft und Forschung (im universitären und ausseruniversitären Bereich) für die Entstehung hochentwickelter Industrietechnologien in der Bundesrepublik Deutschland und für eine Intensivierung der Kooperationen mit Wirtschaft und Industrie. *TI, transferinformation, Wissenschaft, Vermittlung, Praxis, Gessellschaft ur Förderung des Wissenxchaftstransfers e. V. Frankfurt am Main, Heft 1/86, jan/feb*.

Scott, W. R. (1981), *Organizations: Rational, Natural and Open Systems*. Englewood Cliffs, New Jersey, Prentice-Hall Inc.

Science Policy. Setting the Agenda for Research. Strata Accompanying Measures. Managing with Uncertainty in Science Policy. Proceedings from MUSCIPOLI Workshop One. *The Danish Institute for Studies in Research and Research Policy 2001/8*.

Scott, W. R. (1981), *Organizations: Rational, Natural and Open Systems*. Englewood Cliffs, New Jersey, Prentice-Hall Inc.

Storer, N. W. (1966), *The Social System of Science*. New York: HOH, Rinehart & Winston.

Ziman, J. (1985), *Criteria for National Priorities in Research*. London: Imperial College, Department of Social and Economic Studies.

Whitley, R. (1994), *Prometheus bound – science in a dynamic steady state*. Cambridge University Press.