

The Coming of Age of the Danish Research Manager

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Abstract

Research management is a relatively new academic discipline. This paper takes stock of the developments leading to increased focus on the management of research seen from primarily a Danish perspective. It also discusses conditions for research management in a Danish context. Particular emphasis is placed on management in Danish universities as universities are the institutions in which all researchers have been trained and socialised and furthermore home to many of the norms and standards traditionally associated with the scientific community. In conclusion an attempt is made to develop an approach to research management. It is argued that this approach should not exclusively be built on the basis of existing, general (business) management theories. An independent approach must be developed which takes into account the diversity of the scientific community, of the research work and of the management process itself.

1. Introduction. Research management as a discipline

Research is a highly costly activity with great socio-economic impact. Research also employs a large number of people. It is therefore striking that there exists only relatively little literature about the management of research. Some literature in the area of industrial technology management and innovation and some literature in the field of project management can be found. However, it is a characteristic of a large part of the existing literature that it is neither underpinned by much theory nor by empirical data. Generally speaking, the area of research management is thus sparsely covered. Especially the field of public sector research management has not been devoted much attention by management scholars. And next to none by Danish management scholars.

Recent years however, has seen a marked increase in the international interest in research management and today research management has become an academic discipline with its own journals and associations etc¹. The development of research management as a discipline took speed in the US around the 1940's and was originally focusing on the management of industrial and military R&D projects. Only relatively late did the field

¹ The largest European associations are "European Industrial Research Management Association" (EIRMA) and "European Association of Research Managers and Administrators" (EARMA). The world's largest association is probably the US "Industrial Research Institute" (IRI) which also publishes one of the leading journals "Research-Technology-Management". Other journals in this or related fields are e.g. "International Journal of Technology Management", "Research Policy" and "Higher Education Management".

expand to include the management of public sector research. Indeed, some would argue that as far as some fields of Danish public sector research is concerned the management issue is either ignored or at best only beginning to be addressed in many Danish public research institutes - particularly university departments². Although there may be some truth in this, it is also true that both political, industrial and academic awareness of research management has increased considerably in Denmark in the last decade. It is possible to identify a number of reasons for this development, some of which are primarily national and some of which are parts of a general international evolution³. Taking the national perspective first, three major issues/ developments in particular spring to mind:

1. The effect of the Danish University Administration Act⁴ ("Styrelsesloven") which was in force from 1970 - 1993, when it was replaced by the more streamlined University Act (Universitetsloven). This is dealt with below.
2. The formation of an independent Danish Ministry of Research in 1993 separated from the Ministry of Education. An independent research ministry has created greater focus on national research policy and the management of research institutions.
3. The increase in Danish expenditure on research and the increase in the number of people working within Danish research. From 1985 to 1995 Danish expenditure on research and development rose from 1.24% of GDP to 1.91% of GDP and the number of R&D full-time equivalents went up from a little less than 20,000 to a little more than 30,000 people⁵. Increased spending leads to increased demand for accountability leading in turn to more focus on management as a consequence of this demand.

However, the prime reason for the increasing interest in research management in Denmark (and internationally) should probably be found within world-wide societal and scientific developments. It seems likely that the rise in the 1980's of "New Public Management"⁶ has been influential in changing research policies and bringing research management on the agenda as far as public research is concerned. Broadly speaking, New Public Management initiated a shift in the discourse on the public sector from central planning and administration to modernisation, market forces and social accountability. For the public research system the increasing demand for greater social accountability has resulted in a stronger emphasis on the link between academic research and national

² See e.g. Nørskov, 1997.

³ This raises the question of causality. It may be argued that it is not possible to separate the national from the international; were national initiatives not taken in response to international trends? The answer is probably yes. It is, however, beyond the scope of this paper to engage in a detailed discussion of this matter and the distinction between national and international has been made purely for reasons of clarification.

⁴ The University Administration Act was originally adopted in 1970 as "Universitetsstyrelsesloven" and changed its name following an amendment in 1973 to "Lov om styrelse af de højere uddannelsesinstitutioner". A number of small amendments to the act were made during its period in force.

⁵ Forskningsministeriet [Danish Ministry of Research and Information Technology], (1997:13).

⁶ Then one might ask what caused the rise of New Public Management? As this is beyond the scope of this paper - and to avoid a situation of infinite regress - that question will not be dealt with here.

economic and industrial needs. It may be argued that a utilitarian, political discourse on research has gained dominance in the field of research policy; a discourse which emphasises an instrumental role for research in promoting industrial competitiveness and quality of life for citizens. On a European scale this demand is e.g. reflected in the title of a Commission working paper on the 5th Framework Programme of Research: "Inventing tomorrow - Europe's research at the service of its people". The conclusion in the introduction of that working paper is even more explicit: "The aim now is to make research more efficient and increasingly directed towards meeting basic social and economic needs by bringing about the changes which each individual citizen desires" (Commission of the European Communities, 1996:2). On an international scale, the OECD has through its reports and policy recommendations to governments been very centrally placed in the development of this new, socially accountable approach to research policy. The OECD has itself described the consequences of this approach in the following way: "as government funding for academic university research is increasingly of a mission-oriented, contract-based nature and linked to performance criteria, universities increasingly engage in short-term and market-oriented research" OECD (1998a:24). An increased emphasis on research management seems a natural corollary of an increased emphasis on such concepts as "market orientation"; "efficiency" and "performance criteria" as it is by means of improved management that the new "mission-oriented" goals for research must be reached.

Gibbons et al.'s (1994) well-known book "The new production of knowledge" is doubtless linked to this general development in international research policy. Gibbons et al. have pointed to the rise of a new mode of knowledge production in contemporary society. A new mode which also seems to connect with the growing focus on research management. Gibbons et al. talk about a development from the dominant "traditional" mode of knowledge production, which they term Mode 1, to a new, much more complex and heterogeneous mode of knowledge production which they term Mode 2.

These modes are not exactly clear-cut and indisputable analytical constructs; in fact they may be accused of being a-historical, too simplistic, not sufficiently documented and not sufficiently precise⁷. Regardless of these well-documented flaws the modes are still referred to extensively in the science studies literature, probably because they - despite their obvious shortcomings - provide a very useful framework for conceptualising some important overall trends in international research.

In Mode 1, knowledge is said to be created and communicated largely within academic institutions and within the boundaries of highly specialised scientific disciplines. Mode 1 entails *centralised* knowledge production and is broadly speaking identical with the disciplinary structure of science and technology traditionally found in universities. Mode 1 emphasises individual creativity and quality control is ensured through peers acting as gate-keepers. It could be argued that in Mode 1 there are a number of "invisible", established structures such as the peer-review system, journals, the existence of an

⁷ See e.g. Fuller 1995, Agassi 1997 and Godin 1998 for critical reviews.

identifiable international elite of researchers, long-standing paradigms, scientific socialisation, etc. which govern (or manage) how much of the research is carried out.

From the basis of Mode 1, a new mode is said to have emerged, Mode 2, which is seen as supplementing, not supplanting Mode 1. Mode 2 has come about largely as a consequence of the massification of education and research. The places where competent research can be carried out and the number of people capable of doing it have multiplied in recent years⁸. Mode 2 therefore entails a *decentralised* production of knowledge. In addition, scientific work is increasingly taking place across existing institutional and academic boundaries. Mode 2 may also be seen as a response to the more and more complex problems of modern society, which it has become increasingly difficult to address within traditional disciplinary boundaries. Thus Mode 2 is affected by market forces/demand outside the traditional internal scientific “market” of Mode 1. Mode 2 is therefore transdisciplinary and takes place in a global scientific field with many players, where the universities constitute only one player (although certainly still a major one). Mode 2 emphasises group creativity, takes place in a flexible, socially distributed setting and quality control is much less clear. In Mode 2, quality is not only measured in terms of intellectual interest but also in terms of social, political and economic “usefulness”.

With the growth in Mode 2, many of the above “invisible” governing structures of Mode 1 are thus becoming less influential in the world of research and it is not yet clear what is going to replace them. The gate-keeping procedure has e.g. been challenged making it harder to judge what is good science. Without going into a discussion of whether this is good or bad for science⁹ the emergence of Mode 2 knowledge production must now be considered a fact of life¹⁰. This is e.g. also reflected in the ongoing political and scientific debate on the role of the universities in modern society, where most developed countries are currently witnessing a transition from the classical Humboldtian university to a new, more open and market-oriented model¹¹. In this new model universities are expected to concentrate research efforts, take a more active role in the national innovation system and

⁸ The growth of science is, however, by no means a new phenomenon. In the 1960’s Derek de Solla Price (1961, 1963) addressed this development and he e.g. showed how the number of scientific journals has grown by a factor of 10 every 50 years; from the publication of the first journal in 1665 to 1961, where Price estimates that there are around 100,000 scientific journals.

⁹ On this point Gibbons et al. argue that “it does appear that they [Mode 2 characteristics] occur most frequently in those areas which currently define the frontier and among those who are regarded as leaders in their various fields” (1997:1).

¹⁰ It is questionable whether Mode 2 has not actually been a “fact of life” for much longer than it is argued by Gibbons et al. They trace the birth of Mode 2 to the end of World War II, but as has been pointed out by Godin (1998) the research world before the second World War was not as “introvert”, monodisciplinary and homogeneous as the concept of Mode 1 may lead one to believe. Thus the line between Mode 1 and 2 might not be as straight as Gibbons et al. contend and as it might seem from the discussion here. For that reason it should be noted that one should see the Modes as useful ideal types representing the extremes in a continuum and not as two sharply separated entities, as observed by Andersen (1999). The Modes first and foremost summarize and operationalise a trend which seems to be growing stronger *pari passu* with changes in research policy (cf. above), the massification of higher education and the rapid growth of the number of researchers in public and private employment. As pointed out above, it is through their encapsulation and operationalisation of this growing trend that the Modes have earned their prominent place in the science studies literature - despite their lack of conceptual precision (Godin, 1998).

¹¹ The OECD report “University Research in Transition” (1998b) gives a very qualified exposition of this development.

compete for funds internationally. It is not clear to which extent this transition and the debates connected to it have impacted on the attitudes of the individual Danish university researcher.

As compared to Mode 1 knowledge production, Mode 2 knowledge production has increased the size and complexity of the research community and of the research process itself. It may be argued that this growing complexity gives rise to *internal* calls for more effective management within the research community. Not only in the corporate research world but also in the public: The Danish Medical Research Council has e.g. issued a report calling for a strengthening of clinical research management (1999) and the Danish central union for academics ("Akademikernes Centralorganisation") which organises university researchers has e.g. called in public for management improvements in Danish universities both at the level of departments and at institutional level¹². However, the public debate has shown that a great many Danish university researchers do not agree to these views and the extent to which there are calls for management improvements among the rank and file researchers inside the public research community is not clear. But it is indisputable that knowledge production is increasingly being regarded by politicians (as also argued above) and business people alike as the most important strategic comparative advantage in the global marketplace. This development has resulted in increased *external* political and industrial demands for effective and efficient research management and, accordingly, an increased interest in research management as an academic field. Not just in Denmark but throughout the world. No matter whether one believes that a growing focus on management is good for science or not demands for "effective" management of research are not likely to go away in the near future. Even when such demands can be seen as running counter to some of the long-established practices - some would say the very nature - of the scientific community.

The actual existence of growing demands for effective management of research is taken as the point of departure for the discussion here. An aim of this paper is therefore - from the perspective of the individual researcher - to try to contribute to the development of an approach to research management which is capable of balancing some of the inherently conflicting demands of research management. These conflicting demands are discussed below.

1.1. The levels of research management

Research management is not an unequivocal concept and it may be exercised on different levels. When discussing research management one should therefore make clear from the outset what level of management is being addressed. Broadly speaking it is possible to divide research management into (at least) the following levels:

¹² Mandag Morgen no. 36, 19 October 1998.

- Macro level: Research policy as laid down by Research Councils and Parliament/Government in legal, financial and administrative frameworks for institutions etc.
- Meso level: Institutional/departmental/corporate strategies for long-term goals
- Micro level: management of individual/group research projects, management of the research staff (personnel management).

Clark's (1995) distinction between types of conditions within national systems of higher education is useful to describe the differences between these three levels (although Clark is using his distinction with a different purpose, i.e. to address the relationship between research and teaching). Borrowing his terms, it may be said that the macro level is supposed to "*enable*" research in the sense of providing broad national conditions that are conducive to the administration of research at the meso level and to the actual production of research which takes place at the micro level. As far as everyday life at the meso and micro level is concerned, the macro level is thus an exogenous level of research management¹³.

At the meso level conditions can be described as "*formative*". Conditions are here closer to the production and may indirectly, and in some instances directly, shape and influence the way research is carried out. But the meso level is in a sense still external to the actual research work, which takes place in the small units of the micro level. It is thus at the micro level that research is "*enacted*". It is in the basic research units that we find the conditions that directly influence and shape behaviour and research performance. Subsequently, the micro level is the 'truly' endogenous level of research management and it is the activities going on at this level which the supportive efforts at the macro and meso levels are aimed at.

The purpose of this paper is to look into conditions for everyday management of people and processes in R&D organisations. It is not an objective to examine the overall framework in which this management takes place. Therefore the focus is on the "*formative*" and "*enacting*" meso and micro levels that will be viewed primarily from an internalistic perspective as research management on these levels is primarily carried out by researchers themselves. That does not mean to say, however, that external actors do not influence what happens on the meso and micro levels. On the contrary, the "*enabling*" conditions of e.g. legislation and finance may be of great importance to management conditions on the meso and micro levels. Thus where appropriate such factors are included but they are not dealt with in their own right but in terms of their impact on the micro and meso perspective.

¹³ On the face of it, this division into three levels depicts a top-down system where the level above without consultation provides the conditions for the level below. In reality, though, there is feedback from one level to the other thus making it possible from one level to affect the levels above and thereby indirectly affect the conditions at one's own level. Consequently, taking a very overall view, it can also be argued that the three levels may be regarded as one, endogenous system. From the perspective of the individual researcher's daily working life (micro level), however, it seems likely to assume, that the macro level is primarily viewed as an exogenous level of research management whereas the meso level may be viewed as both an exogenous and an endogenous level.

Additionally, when discussing the management of research it is important to be conscious of differences between scientific disciplines and between institutional actors in both the public and the private sector. This is a factor that much of the existing literature tends to neglect in an attempt to develop an all-encompassing theory for the scientific community. Differences between disciplines and institutional actors is dealt with in section 3.

2. Is it at all desirable to manage research and researchers?

Regardless of the growing interest in research management it is by no means regarded as a matter of course that research both should and can be managed. It has been pointed out that the researcher is often regarded as an independent, solitary figure - a kind of artist¹⁴ - whose work should take place as autonomously as at all possible and therefore without the "interference" of management. Hammond e.g. notes that the history of science has many references to discoveries as "aesthetic experiences" (1964:3)¹⁵ and Balck (1994:2-5) says that an "artistic mentality" is dominating research and development. Also Isaksen (1997) describes the view of the researcher as a solitary figure or artist. Writing on the dynamics of creativity, Bennis & Biederman (1997:2) claim that "we cling to the myth of the Lone Ranger, the romantic idea that great things are usually accomplished by a larger-than-life individual working alone". This impression of the great solitary figure is more or less consciously linked to some of the most famous names within science such as Galilei, Newton, Einstein and Bohr. In the image of these heroes of science, researchers are seen as involved in a highly elitist and unpredictable activity which by its very definition neither can nor should be subjected to management by any external party. "Research work cannot be planned; if it can be planned it is not research" as Miller (1986:36) has observed in a description of R&D characteristics as seen by insiders¹⁶. This view is often called the "serendipity model"; important discoveries are made almost by accident. Along these lines, Maslow (1966:134) has written about the scientific originator as "a first explorer of an unknown wilderness" with no clear idea of where he is heading. The explorer/scientist has neither a map nor a guide to lead the way: "Every step he takes is a hypothesis, as likely to be a mistake as not". Thus one may ask the question, how and if such a venture into the unknown can be managed? Furthermore the concept of research management is by some seen as the antithesis of academic freedom - a notion which has traditionally been held in high esteem in the research world, particularly in university departments.

¹⁴ I am here using the term 'artist' to refer to the popular conception of an artist as someone who works completely autonomously and whose works of art are the results of highly individual and unpredictable processes. This popular impression of the artist may very well be a myth; artists too may work methodically and according to 'rules' learnt in e.g. art school. Suffice it to say, however, that the use of the term 'artist' in its popular or even 'mythical' sense here serves the purpose of highlighting some fundamental differences in the conception of what it means to be a researcher.

¹⁵ The full quote reads: "Some scientists would insist that it is not possible to give formal instruction in how to do research, and the history of science is full of the physicist's or mathematician's reference to his discoveries as 'aesthetic experiences' presumably because he indeed finds his creative researches difficult to describe. Hammond, however, also goes on to say that in spite of this research processes can "at some other level....be understood or at least described as very human activities".

¹⁶ Miller does not himself subscribe to this view but uses it as an example of researchers' self-image.

Notwithstanding that there may be elements of truth in these statements it should be noted that this, elitist and autonomous view of research pays little attention to a number of important developments¹⁷ in the research world and outside of it. Developments that can *inter alia* be linked to Gibbons et al.'s concept of Mode 2 knowledge production. First of all, research is no longer merely a matter for a small, select academic elite. The number of researchers has increased rapidly and it is believed that around 80% of all researchers throughout history are alive today (Kragh, 1999¹⁸). Olesen Larsen (1999) even claims that the figure is close to 90%. Additionally, research is increasingly becoming a question of expensive equipment, teamwork and critical mass. It is therefore not very likely that we are going to see single, great individualists such as the above once again dominating "their" fields of science. The way these great personalities worked reflected a time in history, which there is no turning back to. The evolution of science both in terms of what kind of knowledge is produced and how it is produced does not take place in an intellectual vacuum. Thus, although research has not become a downright mass occupation either the romanticised picture sometimes seen e.g. in the media of the researcher as a lonely "hero" struggling in splendid isolation towards a great breakthrough is certainly outdated (if it were ever valid). Nor is every researcher a potential Nobel laureate. Many work within the framework of more or less set subjects and most do a kind of "average" or standard research; more or less in accordance with Kuhn's concept of puzzle solving within normal science (1962). Additionally, most researchers do have some kind of impression of the goal and outcome of their research. In any case they are forced to give consideration to these issues when they are confronted with the accountability demands of those funding their research no matter whether it is government or privately funded.

It is tempting to use the term "desacralisation" to describe this development. The term should in this connection not so much be understood in the academic sense in which it is sometimes used by anthropologists and others but rather in its more mundane sense: From once being a relatively closed, highly special activity for the "chosen few" research is increasingly becoming a "worldly", professional line of work alongside other demanding professional lines of work. Fuller (1997) even talks of a "secularization of science"; having practically replaced religion and become "society's most esteemed institution", science is now experiencing that its position is challenged and science is itself being "secularized", according to Fuller.

One may regret this development or not but it seems to be an inevitable consequence of the massification in research and the increase in Mode 2 production of knowledge. This development can also be seen in the light of the discussion about the "finalisation" of (natural) science. Even though this way of interpreting science is widely disputed (and rightly so) the fact that a number of disciplines see themselves as effectively in the stage of

¹⁷ As argued by Godin (1998:469) the historic reality of scientific autonomy may also be questioned: "autonomy is first and foremost a historically based rhetoric – some would call it an ideology".

¹⁸ Kragh uses the term "scientists". In his book he is also specifically referring to the (natural) sciences and thus not the social sciences and the humanities which are probably not included in the figure he gives. Olesen Larsen refers to "researchers" which I take to include also the social sciences and the humanities.

finalisation¹⁹ may affect the way research in general is organised and managed. Finalised sciences are sciences with very few blank pages; most breakthroughs are believed to have taken place already making it possible to set up very specific research programmes with very specific objectives operating within the framework of generally accepted, certified theories. Under such conditions the researcher does not need much of an artistic temperament; instead he becomes more like an artisan who masters a certain craft, i.e. knows certain theories and knows how to apply certain methods of analysis.

Another factor, which is not taken into account in the individualist view of researchers, is the fact that a researcher is also an employee. Since the Hawthorne studies²⁰ were carried out in the late 1920's it has been widely acknowledged that if employees are highly motivated productivity and quality will be optimum. Yet in the individualist view, the motivation of researchers is not recognised as a problem nor as a management responsibility. It is assumed that researchers are different from other people in that they can continuously motivate themselves and need neither social nor professional supervision. It is also assumed that researchers do not attach much importance to the working climate they are in. A sense of belonging to a group, having good relations to colleagues, pursuing common goals etc. is regarded as being of minor importance. At the end of the day, the only thing that really counts is the individual research work, which is its own reward. When research was an activity for the select few this view may have had some relevance. In an age where there is talk about the "research industry" it does not seem to make much sense to argue that proven management principles found to be conducive in the management of all other kinds of professional personnel are not also relevant for researchers. An inspiring and dynamic research environment does not come by itself. It has to be actively created. This requires management. It requires the setting of joint, organisational goals that are commensurate with the individual goals of researchers.

On the basis of the above discussion it is possible to deduce two competing perspectives on research work. In figure 1 I have attempted to highlight some of the underlying assumptions and implications of these two perspectives. For lack of better words I have called the two perspectives "the individualist perspective" and "the employee perspective". It is important to note the following: the two perspectives should be seen as contrasting ideal types, not empirically distinct entities; the dichotomy does not discriminate between myth or reality - images may still be important even if they are founded on rhetoric rather than reality; the elements of this dichotomy are not necessarily each other's antitheses - they do not exclude each other and they may and do exist alongside each other. Quite a few researchers probably see themselves and their work as a mix of the two perspectives²¹.

¹⁹ Ziman, 1994 e.g. mentions fluid dynamics, plant genetics and even economics as examples of supposedly finalized sciences.

²⁰ See e.g. Schein, 1990 (1988) pp. 63-68 for a lucid interpretation of the Hawthorne studies.

²¹ A possible assumption is that researchers working in "little science" such as the humanities and parts of social science might subscribe to more elements from the individualist perspective than researchers from "big science" such as the technical and natural sciences who are more used to working collectively in large teams.

Despite these caveats the dichotomy may still be useful for researchers and research managers as analytical constructions which may help to describe the self-schema of individual researchers, researchers in a given field, institution etc. It should also be stressed that the employee perspective certainly does not rule out e.g. individual ambition, dedication, excellence, creativity, improvisation etc. and many of the other positive adjectives often associated with being an individualist. In other words, the employee metaphor is not intended to imply any qualitative devaluation as compared to the individualist metaphor.

Figure 1: Images of the nature of research and researchers

The individualist perspective	The employee perspective
<ul style="list-style-type: none"> • Research is unpredictable and therefore unmanageable; the serendipity model; a researcher can be described as a kind of artist • The researcher is a “self-employed” person who motivates him or herself • The research work carries its own reward and surroundings are of minor importance • The researcher must be autonomous and free to set his or her own agenda for research: free thinking • Research is a personal calling for the few; it is a highly elitist and unique activity • Researchers are individualists and loners 	<ul style="list-style-type: none"> • Management is possible as most researchers do standard research and work with set methods (“puzzle solving”); a researcher can be described as a kind of artisan • The researcher is an employee who sometimes needs to be motivated • The research work is important but so are colleagues, culture etc. of the place of work • The researcher must integrate his research agenda with the desires of stakeholders: free and institutional thinking • Research is a professional calling; it is a craft which can be taught - hence the term “research students” • Researchers are individualists and team players

2.1 Creating a good research environment

To create a good research environment is quite a feat. Autonomy and individualism has been inbred in many researchers creating an inclination to resist integrating their work with others²². Paradoxically, Jacobsen (1990:68) found in a survey of 18 Danish university departments (within both the humanities and the social and natural sciences) that when researchers were asked to comment on what it would take to make their research environment really good, the most common answer was: improvement of social and professional communication and interaction. It could seem that researchers are torn between on the one hand an intrinsic individualism and on the other a desire to engage in more social and professional interaction. Bridging that gap is, however, not impossible. Autonomy/individualism and co-operation/interaction are not necessarily each other’s opposite numbers. It is possible to remain autonomous while co-operating and interacting with others in networks or projects.

²² See e.g. Smith and Tuttle (1988) or Rosenbaum (1991).

So far it has been assumed a priori that there is a positive relationship between the research environment in the immediate surroundings (department etc.) of a researcher and his or her research productivity, quality and creativity. But the question may be asked whether a research environment with good social and professional relations is necessarily conducive to scientific production? Could it not be that good social and professional relations rather lead to nothing much being done but having a good time doing it? Furthermore, are personal characteristics in actual fact not the decisive factor and couldn't it also be that it is not so much the immediate surroundings that matter, but rather the so-called "invisible colleges" or research networks to which the individual researcher belongs: a researcher often has colleagues in other countries and institutions that may be more important to him or her than the colleagues next door.

As to the latter questions, invisible colleges and personal characteristics are doubtless important in research and their significance should not be neglected. The training, motivation, skills, etc. of the individual researcher naturally affect productivity. But, as observed by Bland and Ruffin (1992:385), several studies indicate that the most powerful predictors of research productivity are environmental characteristics. What is more, it is also the environmental characteristics rather than the personal that can most easily be changed making it most effective to focus on the research environment. As to the importance of invisible colleges, their significance may even be increasing, given the growth in Mode 2 knowledge production and the rapid development within computer technology and telecommunications. In spite of this, it still seems reasonable to assume that the actual, physical place of work in which a researcher spends most of his or her time continues to be of great significance. It is in the immediate environment that the researcher has most of his or her face-to-face, work-related social and professional contacts and it is thus the immediate environment that is likely to give most positive or negative stimuli.

Concerning whether good social and professional relations are conducive to scientific productivity, Jacobsen (1990:70) has concluded that a productive research environment presupposes a good working climate. But on the other hand he also finds that a good working climate does not presuppose a productive research environment. Thus, even though a good working climate may not in itself warrant a productive research environment, creating a good working climate is a necessary starting point. It is certainly also important when it comes to recruiting new employees.

Bland and Ruffin (1992) have conducted a very useful and comprehensive literature review of the characteristics of the productive research environment, defined both in quantitative and in qualitative terms²³. They have studied literature comprising both medicine, the humanities, the natural, the technical and the social sciences. Furthermore, their material stems from both public and private research institutions. From this vast

²³ Most common outcome measures were number of published articles and number of citations. But other common measures were e.g. reputation and morale of the research group (1992:387). As to the methodology of the review, literature found in the literature search was abstracted and rated by the authors and only ratings of good or excellent were synthesised.

body of literature they have synthesised twelve organisational characteristics which were invariably found in productive research environments:

1. **Clear goals that serve a co-ordinating function** [*compatible organisational and individual goals*]
2. **Research emphasis** [*priority on research compared to other missions, e.g. education*]
3. **Culture** [*distinctive organisational culture, shared values and identity; often maintained by tales or rituals*]
4. **Group climate** [*good personal relations, mutual respect, stimulation and encouragement from colleagues, esprit de corps in the research group*]
5. **Assertive participative governance** [*participatory leadership, group decision making, frequent interpersonal relations between researchers and heads*]
6. **Decentralised organisation** [*flat organisational structure with good feedback systems to and from leaders*]
7. **Communication** [*regular and frequent discussions with peers*]
8. **Resources** [*number of colleagues, support staff, research facilities, libraries, amount of time and funding*]
9. **Size, age and diversity** [*performance increases as group size and diversity increases; productivity increases when a group has been together for a while but goes down when the group has been together for more than seven years*]
10. **Rewards** [*Although salary and promotions are important more important rewards are e.g. challenging work, stimulating colleagues and being valued by colleagues*]
11. **Recruitment and selection** [*concentration on hiring talent and socialising new recruits into the organisational culture*]
12. **Leadership** [*The power of a leader should be based on mutual confidence and competence; he or she must be perceived as a highly skilled scientist and demonstrate personal qualities associated with the above characteristics such as participative governance style, good communication skills, ability to support, etc.*]

Most of these characteristics overlap and it is difficult to say which is more important. But there is one unifying factor: leadership. Leadership has an impact on the creation, maintenance and reinforcement of all the other organisational characteristics. Either in terms of the more general management of the personnel or in terms of the management of the scientific work. Leadership is required to create a research environment that is both productive (measured in qualitative and quantitative terms) and pleasant to be in. More often than not, productivity and a pleasant research environment are likely to go hand in hand. This observation is not different from what has been found in numerous studies within business management. Yet it is far from automatically accepted in the research community which has a long tradition for resisting management attempts leading e.g. Smith and Tuttle (1988) to talk about a tradition of “anti-management”.

3. The plurality of the research sector

Traditionally, the division of work in the Danish research system has been along the following lines: universities produce graduates and disseminate knowledge to wider society; government research institutes produce and disseminate knowledge with a view to policy formulation and political decision making; private research departments and institutions use (and produce) knowledge to create innovative products and/or processes. This model is related to the classical distinction between basic, strategic and applied research/technological development. It has been argued that these types of R&D differ so much that they demand different management approaches. However, the distinction between the different types of research is by no means a clear one, nor is it particularly meaningful. It is actually possible to imagine more or less the same kind of research being

classified as both basic, strategic and applied. What matters is the context in which the research is carried out and the purpose of it. Although the classic distinction between research types is waning (cf. also Gibbons et al. above) there are still some fundamental differences in conditions for and purpose of research in the main institutions in the Danish research system. Differences that may impact on management conditions. In figure 2, I have attempted to illustrate some basic differences in research conditions in the Danish R&D system.

Figure 2: Some basic differences between institutions in the Danish R&D system

Conditions	Private R&D	Government Research Institutes ("Sektorforskning")	Universities
<u>Prime research purposes</u>			
Commercial	Yes	No	No
Providing basis for policy formulation	No	Yes	No
Education	No	No	Yes
Enhancing scientific knowledge	No	Yes	Yes
Technological innovation	Yes	Yes/No	Yes
<u>Clear impression of customer</u>			
	Yes	Yes	No
<u>Funding</u>			
Private	Yes	No	No
Public (primarily)	No	Yes	Yes
<u>Importance of publishing</u>			
Major	No	Yes	Yes
Minor	Yes	No	No
<u>Management</u>			
"Permanent" and professional (hired)	Yes	Yes	No
Elected for fixed period	No	No	Yes
<u>Salary structure/ Terms of appointment</u>			
Individual	Yes	No	No
Group contract basis	No	Yes	Yes ²⁴
<u>Most important reward</u>			
Financial	Yes	No	No
Peer recognition	No (Yes)	Yes	Yes

²⁴ Group contract basis does not rule out individual differences. As of 1 January 1998 publicly employed researchers in Danish universities and government research institutes have the choice between 2 salary systems: 1) the "old" system where salaries follow a fixed scale according to seniority and position (individual bonuses are relatively minor under this system) and 2) the "new" system with fewer scales of fixed pay and the possibility of obtaining individual, performance related bonus. Individual bonuses must in each case be negotiated between the management, the employee and the shop steward at the institution. The new system was introduced as a zero-sum-game (no extra money for salaries was granted to institutions) meaning that in the short term an institution must cut down activities in other areas or reduce the salaries of other employees if it wishes to give an employee a bonus in excess of the salary in the "old" system. The new system was also designed in such a way that it will primarily appeal to new recruits or young researchers and it may therefore take a number of years before the full impact of the new system will be felt. Subsequently, it is too early to say what the consequences of the introduction of the new system may be in the long run. Also, it is not yet clear how the new system is administered in practice in the institutions. However, it seems reasonable to assume that the "old" system (which still exists) where everybody gets a fixed salary is likely to be the most common system for some years.

This table takes a general institutional perspective and does therefore not allow for individual variations. Some Danish government research institutes e.g. have more in common with university departments than with the bulk of other government research institutes²⁵. It is also possible that some privately employed researchers feel that enhancing scientific knowledge is a prime part of the purpose of their research and that some, e.g. in large companies, are employed on a group contract basis. Furthermore, there are also differences between scientific disciplines not taken into account in table 1, e.g. as to the importance of publishing and the prime research purpose. A university researcher within the humanities or social sciences would probably not see technological innovation as a prime research purpose; on the other hand he or she might see him or herself as contributing to policy formulation instead.

It should also be mentioned here that there are traditional differences in the organisation of disciplines that impact on conditions for management. The social sciences and the humanities e.g. have a tradition for researchers to work individually and with differentiated projects. For the natural, technical and medical sciences on the other hand working in more closely knit research groups with relatively coherent projects has been the formula for success at least since the time of the Manhattan Project. As observed by Foss Hansen (1988:38 [my translation]), “closely coupled co-operative networks are found in disciplines producing ‘hard knowledge’ while loosely coupled networks are found in disciplines producing ‘soft knowledge’”. Likely causes of this difference could *inter alia* be the need to share expensive equipment within the “hard sciences” and the fact that when conducting experiments scientists often work side by side in laboratories. These phenomena are less common in the “soft” sciences although it is no doubt possible to find examples of group-based social or humanities research, which also demand expensive equipment, e.g. within language research and statistics.

3.1. Managing private sector research

Scientific relevance and quality in private research is commonly held to be measured by the notion of ‘science to dollars’. The purpose of corporate research is to create the basis for future profits and the research department is but one of the departments in the company; if it is not integrated into other departments, cf. below. This means that researchers must consider marketability and customer relevance before they consider scientific quality. The corollary of that is that academic freedom is low and taking risks is difficult as the pressure to produce usable - preferably patentable - results is big. Industrial research is not taking place for the sake of the advancement of science but for the sake of the expansion and the survival of the company, i.e. profit. Therefore, most private R&D is devoted to incremental improvements to existing technology. Also, research may be organised somewhat differently from the traditional disciplinary department structure known from most publicly funded research institutions. The way research is organised in

²⁵ E.g. Copenhagen Peace Research Institute and Centre for Language Technology.

the company is likely to influence the management of the researchers and of their work. Bamfield (1996: 54-60) suggests four possible ways of organising industrial R&D:

1. The functional organisation
2. The strategic business unit
3. The R&D contractor
4. The matrix

In the functional organisation there is a centralised research department existing alongside other centralised departments such as purchasing, sales, finance etc. in the company. This allows the R&D department some independence from day to day commercial pressure. It is also in the functional R&D organisation that we find the conditions that resemble most those of university departments or government laboratories. In the strategic business unit, however, the research function is integrated completely into specific, self-managing business units. Every unit then has the responsibility for managing all the necessary elements connected with their product, i.e. sales, personnel, production, research etc. In such an organisational structure research gets very close to the immediate needs of the market and research therefore becomes more focused on development and small improvements to existing processes and products. Long-term strategic research, however, becomes very difficult to carry out because of short-term pressures and the research carried out may turn into repetitive research because of lack of resources to continuously improve on methods.

A way to preserve R&D as an independent function and at the same time keep it close to the market is to let the R&D department operate as a contractor to the strategic business units in the company. This entails that the business units place specific orders with the R&D department on a needs-basis and the R&D department then carries out the research on behalf of the "client"; the strategic business unit. In this organisational structure the research department is allowed some freedom of manoeuvre but the risk is of course that the short-term interests of the business units will prevail in the company thus reducing the possibilities for carrying out more risky but potentially also more rewarding speculative research.

The industrial research function may also make widespread and permanent use of the matrix organisation. This entails the existence of one or more central research departments and a large number of market-oriented projects involving also people from marketing, production and possibly other departments. A matrix approach may of course also be used for projects internally in an R&D department but then it is not so much a way of organising the research function but rather a project management tool.

The framework for research management may thus vary quite a lot in industrial R&D depending on the way research is organised in the company. However, regardless of organisational structure most corporate research is organised with a traditional hierarchy with professional research managers with the authority to give orders to the rank and file researchers. This highlights a basic difference between researchers in industry/government research institutions on the one hand and universities on the other; the fact that there exists in industry and in government research institutions a dual career

system open to scientists who can seek to specialise as either professional managers or scientists. Another difference lies in the fact that the mission of corporate researchers is to excel in the *application* of research which involves close contact to market needs and therefore less regard for disciplinary borders and theory. In comparison academic researchers are more focused on the advancement of their disciplines and the theory underpinning these disciplines. In line with this, Betz (1987:192) concludes that the more market-oriented approach of the industrial researcher leads him or her to prefer a more targeted management style than the academic researcher who in general favours a “less planned, less tightly supervised style”.

These differences may also be understood in the light of the concepts of Modes 1 and 2. Research taking place in the context of application and research which involves a transdisciplinary and/or transinstitutional approach thus seems likely to be in need of closer supervision and monitoring than research which takes place within a more established paradigm/discipline. It is therefore interesting to speculate as to what will happen to management practices over time if Mode 2 continues to increase in size and importance. Will this e.g. lead to a convergence between private and academic research in preferred management styles?

However that may be in future, the existence of the current differences may lead us to believe that managing private researchers is completely different from managing publicly employed researchers. This is not so. The similarities are probably just as great or perhaps greater than the differences: the research process can be described in much the same terms, and, what is more, privately employed researchers have undergone university training where they were socialised into both a scientific culture and a specific scientific discipline. Researchers, be they privately or publicly employed, are all highly skilled employees with special values, expectations and needs. All have a strong professional or disciplinary identity and a desire to act out that identity. A Danish union journal for researchers has e.g. described how an increasing number of private companies create artificial “playgrounds” for their researchers. In these playgrounds the researchers can work with their own ideas that are not necessarily commercially exploitable alongside working on company projects²⁶. Additionally, Bamfield (1996:35) has observed that peer recognition is also a strong motivation for private researchers and he therefore advises research managers to be on the lookout for awards made by associations, government bodies etc. However, it should be noted that peer recognition is harder to obtain for industrial researchers since the ability to publish results is restricted due the need to retain trade secrets and keep knowledge confidential for commercial exploitation²⁷.

²⁶ Forskerforum [magazine for Danish publicly employed researchers], June 1998.

²⁷ In an interview with the author, a Danish research manager in a bio-technology company provided an interesting example of how peer recognition may be obtained for industrial researchers in spite of the need for confidentiality. The research manager’s bio-tech company was involved in a project with a number of academic partners, a good deal of which were very big names in their field. A major contribution of the company to the project was to provide big samples of bio-technological material of very high quality on which to make experiments and conduct research. To receive this material all external research partners were asked to sign a “Material Transfer Agreement” in which it was *inter alia* stipulated that all publications made on the basis of research on the material provided by the company must include an acknowledgement of the researcher at the private company who had been in charge of the production of the

Nevertheless, the desires for “playgrounds” and peer recognition are examples of the fact that considerable overlap between the conditions for the management of private and public researchers can be found.

3.2. Managing research in government research institutions

Danish government research institutions operate under conditions that to some extent can be characterised as a mix between the conditions of a private company and that of a university. There is a relatively clear customer-owner relation since the original purpose of government research institutes is to contribute to the formulation of policies and decision making within the sphere of the ministry to which the research institution belongs. This means that in many government research institutions the research agenda must be aligned with the needs of the owner-ministry with which research contracts may be entered. It also means that institutions must be capable of delivering research results within a set time limit and within a set budget. On the other hand most government research institutes also have a good deal of freedom to formulate their own research plan and e.g. enter into research contracts with external parties on a commercial basis. Like universities, they are primarily publicly funded and staff is employed on a group contract basis. Since 1997 the structure of academic positions has been modelled on that of the university system with positions as Researcher (corresponding to Assistant Professor/Lecturer), Senior Researcher (corresponding to Associate Professor/Senior Lecturer) and Research Professor. Furthermore, as in universities, a review panel is entrusted with the task of nominating qualified candidates for vacant positions²⁸. Most institutions also make use of the functional organisation with departments specialising in different fields. But unlike universities government research institutions have a professional management structure (cf. above) and are headed by a (managing) director. This renders it possible to create a managerial hierarchy as we find it in private R&D departments. The director generally has a dual responsibility as head of research and administration and contrary to what may be expected it is not necessarily the directors of the large institutions that have the largest administrative workload. This work may be delegated to an administrative manager or shared by more people in the management (Kallehauge et al., 1998). Most institutions have 2 or 3 management levels depending on the size of the institution.

Also the research undertaken at government research institutions may be seen as a kind of mix between corporate and university research. Most government research institutions carry out a mixture of short-term, highly focused application-oriented projects and long-term projects that are less focused on application but e.g. more on theory and methodology development, etc. A survey of Danish government research institutions

bio-technological material samples. This has meant that the researcher in question now has the pleasure of seeing himself not only being mentioned but also thanked in articles etc. made by some big names within his particular bio-technological field.

²⁸ Forskningsministeriets Bekendtgørelse nr. 664 af 19. august 1997 om ansættelse af videnskabelige medarbejdere ved sektorforskningsinstitutioner og Bekendtgørelse nr. 650 af 31. august 1998 om ansættelse af lærere og videnskabelige medarbejdere ved universiteter m.fl. under Forskningsministeriet [Ministerial Order no. 664, 19 August 1997 on the Employment of Academic Staff at Government Research Institutions and Ministerial Order no 650, 31 August 1998 on the Employment of Academic Staff at Universities (my translation) Ministry of Research and Information Technology].

showed that on average 50% of scientific full-time equivalents are devoted to long-term research projects²⁹. When it comes to the dissemination of results government research institutions are often obliged to publish their findings in a form which is directly usable for practitioners and sometimes results must be published within relatively rigid time limits. For that reason publishing in international, peer reviewed journals is not the only important form of publication. On the other hand the institutions still believe that peer recognition within their fields of specialisation is important (Kjerkegaard 1991) and publication in peer reviewed journals may be listed as a parameter in evaluations, accounts and management contracts between the government research institutions and their owner ministry (Kallehauge et al. 1998).

Micro level research management is usually the responsibility of the Department Head or Research Manager ["afdelingsleder", "forskningschef"]. In large institutions a Deputy Head and/or a number of Programme Managers may assist him or her. On the face of it, this structure should help make it possible for Department Heads to remain active in research and bring research management close to the individual researcher. A survey of researchers in Danish government research institutions³⁰ has shown that employees are generally satisfied with their immediate superior and that there is a positive attitude towards the introduction of goals as a management instrument for both the institutions and the individual employee. The survey also showed that young employees are generally more positive than older employees towards setting goals for individual employees (Kallehauge et al., 1998).

3.3. Managing university research³¹

Out of the three main actors in the Danish R&D system it is the management of university research which will be devoted most attention. There are at least two reasons for this. First of all, as mentioned above, all researchers have received university training and have thus been influenced by the disciplinary, scientific and management culture found in universities. Hence, it is the university system that is home to many of the norms which researchers generally live by - also outside the universities. Therefore universities constitute the most important object of study if one is to understand conditions for research management not just in a Danish context but most likely also in general. Subsequently, it is in the university sector that management developments will have the

²⁹ Kjerkegaard, 1991:161. The survey also showed that there are considerable differences between the scientific fields. The figure for the technical and natural sciences is thus 65% , veterinarian and agricultural sciences 26%, medicine 50% and the social sciences/humanities 21%.

³⁰ The survey comprised 20 government research institutions ranging from less than twenty to more than 1,000 employees. A couple of other interesting results revealed by the survey were that on average Danish government researchers spend 53% of their time on research (the rest is spent on administration, advising ministries etc.) and the average working week is 42 hours a week. This may be compared to a survey of 300 Danish university researchers conducted by Jacobsen (1990) which showed that most university researchers spend around 40% of their time on research and practically no university researchers have a working week of less than 40 hours. More than half the university respondents stated that their working week was in excess of 50 hours.

³¹ The vast majority of Danish university researchers have two main job tasks: research and higher education. These tasks are interlinked and rely on each other. In terms of management, the educational element of the researcher job is therefore given no special consideration in this paper.

largest impact, as such developments are likely to spill over to the other sectors in the Danish R&D system. Secondly, there is also ample reason to study the universities in their own right, as they make up the largest sector within the Danish public research system, representing almost 60% of Danish public research expenditure³².

Mintzberg (1983) characterises universities as “professional bureaucracies”. A professional bureaucracy is decentralised, the professionals control their own activities, are independent³³ of colleagues and administrative decisions are taken on a collegiate basis. Mintzberg’s notion of professional bureaucracies shares many of the characteristics of Weber’s concept of direct democratic management (1922 [1982]). Weber’s concept presupposes that all members of the group are in principle equally qualified to deal with common matters and problems. Another characteristic is that direct democratic management inherently tries to reduce the extent of authority to a minimum. Although Weber argues that these two characteristics are not necessarily linked it seems that a reason for trying to reduce management to a minimum is the fact that all, at least in principle, are equals in this system. This may create a situation where the person officially in charge may in actual fact be, and feel him or herself to be, the servant of the people he or she is officially in charge of. Danish universities can be understood in terms of both Mintzberg’s and Weber’s concepts. The egalitarian democratic structure of the universities may sometimes also result in a display of some of the characteristics of a “politicking anarchy” as observed by Rasmussen (1994). Although using the term to describe universities as such would certainly be a distortion, as also mentioned by Rasmussen, the term does draw attention to an in-built organisational or cultural preference or tradition for continuous questioning of decisions, problems and authority.

The formal framework for the management of Danish universities is given in the University Act of 1993. It was, inter alia, the intention of the act to strengthen management and planning of research through granting increased authority to the three management levels: the vice-chancellor, deans and department heads. Particularly the department heads were granted more authority which was also signalled in the name change from “Institutbestyrer” - which has connotations of “administrator” - to “Institutleder” which simply means “department leader”. An “Institutleder” must now also be appointed amongst professors and associate professors where previously he or she only needed to be a full time employee and not necessarily a researcher. Until 1993, the “Institutbestyrer” could in principle be a secretary³⁴. Furthermore, until 1993, the “Institutbestyrer” operated in the shadow of the so-called “Institutråd” [department council], which simply consisted of all permanently employed employees + a number of student representatives. The “Institutbestyrer” was appointed by the department council, which he did not necessarily

³² Forskningsministeriet [Danish Ministry of Research and Information Technology] (1997:16).

³³ It may be argued that in the job structure at Danish universities only professors and associate professors are truly independent since PhD-students and assistant professors are only temporarily employed and supervised by the group of professors and associate professors.

³⁴ E.g. Copenhagen Business School’s “Department of Organisation and Industrial Sociology” has had a secretary as “Institutbestyrer” (Agersnap 1997).

chair³⁵. Only when the council consisted of 40 people or more was it necessary to elect a department board.

With the new University Act of 1993, the department council was abolished, but the principle of direct, democratic management is still in place. Consequently, university research managers are elected by students³⁶ and colleagues and their activities are “shadowed” by collegiate boards and committees whose agreement must be solicited. The department heads that are the immediate superiors of researchers and therefore particularly interesting in this context are e.g. elected for a period of 3 years. The department heads chair the department boards, which consist of 3 other members. According to the University Act department heads have the authority to “direct employees to solve certain tasks while respecting their free choice of scientific methods” (section 7, subsection 3 [my translation]). The former act stipulated that “the department council [and no mention of the head] cannot decide on the individual researcher’s choice of research task (section 13, subsection 2 [my translation]). Thus, at least nominally, the department head now has increased authority.

But the fact that a department head is elected by his colleagues and only has a short period in office renders it difficult to make decisions that seriously affect the interests of the electorate. Consensus and compromise must constantly be sought with the danger of it leading to stalemate or the choice of second best solutions. Additionally, most elected managers have neither management education nor necessarily any management experience when they are elected. And as to the taking on of new research colleagues, the department head has no official authority. Until the present ministerial order was issued in the autumn of 1998³⁷ the selection of a candidate for a research job was even entirely the task of an independent review committee which recommended to the vice-chancellor a single candidate for the job (in practice the authority to employ university researchers is generally delegated to the deans). Formally, the department board and department head’s sole influence was then in the formulation of the job description. As such, this is still the case. What has changed is that the review committee no longer recommends a single candidate for the job. Instead it draws up a short list of qualified candidates which it then submits to the management of the university³⁸. It is then the dean (and/or vice-chancellor) who decides which person to offer the job to. The board and department head can of

³⁵ Once again Copenhagen Business School’s “Department of Organisation and Industrial Sociology” provides an example. For a long period the positions of “Institutbestyrer” and chair of the department council were held by two different people (Agersnap 1997).

³⁶ Students are entitled to vote in the elections of the vice-chancellor and deans. Votes, however, are weighted in favour of researchers [“videnskabelige medarbejdere”] whose share of the votes must always constitute at least 50%. Students, however, are not entitled to vote in the election of the department head. Here only researchers and technical-administrative staff can vote. Also in a department head election must the researchers’ share of the votes always constitute at least 50%.

³⁷ The order was met with much disquiet amongst university researchers some of whom organised a petition calling for the withdrawal of the order.

³⁸ If asked to do so by the management the review committee can draw up a prioritised list as a guide for the management.

course try to influence the choice of the dean (and/or vice-chancellor) and their opinion is likely to be asked.

But what is more, the department head is operating in an environment with a centuries old tradition of individual autonomy producing an inherent tension between individual and collective goals. Nowotny (1990) e.g. speaks of “three hundred years of solitude” with reference to the development of the natural sciences, and Sapienza has observed that “scientists are essentially trained to be solo contributors” (1995:VI). Furthermore, although the new University Act is now in place, a department head is still operating in the shadow of the ideology of the old University Administration Act, which was strongly influenced by the paradigms of equality, individual autonomy and academic freedom. Larsen (1997) e.g. characterises the University Administration Act as a “grand ideological experiment” [my translation] stemming from the youth rebellion in the late 1960’s. He pleads that it created a management vacuum of more than 20 years in Danish universities. Much along the same lines Hylleberg (1997:84) has commented that

“to many with knowledge of life in a [Danish] university department research management in such a place seems as remote as the moon”It is also a fact that the chain of command is very unclear if not blurred. Elected managers have only limited, formal direct influence on research carried out in the departments and the actual direct influence is in most cases even smaller” [my translation].

Yet Hylleberg goes on to argue that research management in Danish universities is in fact possible and does exist although perhaps in a very indirect manner. It seems reasonable to believe that research management does exist just as it seems reasonable to believe that there may be great variations from one department to another - even within the same disciplines. Variations will be great because in a situation where the formal framework does not provide the department head with much of an official power base then his or her clout will largely be decided by idiosyncratic concepts such as personal charisma, communicative and scientific competence, etc. In their time-honoured study, French and Raven (1959) identified five major types of power:

1. Reward power [the ability to reward others]
2. Coercive power [the ability to punish others]
3. Legitimate power [the ability to legitimise and make decisions within a certain domain - based on formal authority]
4. Referent power [the ability to persuade or dominate others based on personal charisma]
5. Expert power [the ability to give expert advice based on personal knowledge]

If we analyse the power base of the Danish department head he or she will more or less fall short of the first three types. In practice, it requires the acceptance of the department board to exercise power in connection with these factors. But also the department board’s formal powers are relatively limited. As to *rewarding*³⁹, the board may, on application and provided sufficient funds and staff are available, reduce a researcher’s teaching obligation (i.e. give more research time) and grant money for travel, equipment and research

³⁹ As to the possibility of giving monetary rewards see above note on the salary system.

assistance. The nature of these 'rewards' may, however, be questioned. Are they truly rewards in the sense of giving something extra or would some of them be more accurately described as removing obstacles to optimum job performance (which it is in the interest of every employer to do)? Another reward option open to the board is attempting to earmark a job for a certain person when formulating the job description, e.g. when an assistant professor is seeking a position as an associate professor. As to *punishing*, the options can broadly be described as "negative rewarding", i.e. withholding the above rewards⁴⁰. Consequently, as to *legitimising* based on formal authority this is difficult for a department head given the relative weakness of formal authority vested in the position.

Thus, if there are strong managers in Danish university departments, then their strength is rooted more in their personal characteristics (French and Raven's power types nos. 4 and 5) than in their formal position.

4. Conclusions. Research management as the art of managing the unpredictable

The research community is a diverse entity. Important variations exist and should be taken into account when trying to develop an approach to research management. This does not mean, however, that it is not possible to develop a general approach to research management. What it means is that such an approach should be open, non-bureaucratic, and flexible. It should not be too detailed nor should it neglect researchers' desire, need and tradition for a large degree of autonomy. There is a strong correlation between job satisfaction and influence on tasks amongst researchers, as e.g. found by Kallehauge et al. (1998:126).

For some, the very term research management smacks of an instrumental Weberian bureaucracy; a hierarchy where decisions are made only at the top and carried out at the bottom of the organisation. Such a hierarchy would be anathema to researchers and is certainly not to be recommended. It would doubtless lower research quality and demotivate researchers. Researchers are skilled, independent-minded individualists that in the majority of cases both can and must carry most of the responsibility for their own work. On the other hand, it should also be realised that researchers are social beings and that serendipity is no longer sufficient in a world where research is growing both in terms of employees and in terms of societal and economic importance. Furthermore, in the (post)modern world the complexity of research questions is increasing and more and more research takes place in the context of application adding to the complexity of the research process (cf. the discussion on Mode 2 production of knowledge).

The corollary of all of this is that research management is necessary but it should not be taken too far. An approach to research management should steer a course between the

⁴⁰ It is only in rather extreme cases that a researcher will be sacked, and that power cannot be exercised by the department head nor by the board but only by the dean or the vice-chancellor. In practice, the board will of course have an important say, if only indirectly.

extremes of tight control and laissez-faire. Such a course could benefit from acknowledging from the outset that research management has a dual purpose:

1. Personnel management
2. The management of the research work

This is no different from the management of any other kind of work making it therefore a rather mundane observation. Yet the distinction is seldom made in much research management literature which has a tendency to view research management as a unitary concept, not only in terms of the settings and disciplines in which it may be applied (as mentioned previously) but also in terms of its purposes. This is unfortunate because in spite of the obvious interconnections the two management purposes are also different and require different approaches.

As far as personnel management in a research setting is concerned the nature and importance of this does not seem to differ substantially from personnel management in most other settings. Thus, as argued in section 2, it does not make much sense to claim that proven management principles found to be conducive in the management of all other kinds of professional personnel are not also relevant for researchers. It is a management task to create a research environment that is productive (qualitatively and quantitatively) and pleasant to be in. As far as personnel management is concerned, the only major differences between research management and management in other areas probably are: 1) for reasons of ideology and tradition personnel management has been neglected in many research environments (concepts such as “teambuilding”, “management by coaching” and “management by walking around”, etc. are in practice thus rare if not unknown in many Danish research settings) and 2) a research manager should generally be respected for his scientific achievements before he or she assumes managerial responsibility.

Management of the research work on the other hand is indeed “the art of managing the unpredictable” since it has to do with managing processes towards end-products which cannot be described in detail beforehand and the nature and surroundings of which may be in constant flux. In other words, management of research work has to do with balancing the opposing notions of creativity/task uncertainty and control. One should therefore be careful if trying to apply theories from the otherwise vast body of general (business-oriented) management literature. Such an application should be balanced by an understanding of the special nature of the research process. A much praised management concept such as Total Quality Management would e.g. not seem appropriate due to the inherent difficulties in predicting and measuring quality in scientific work.

Nevertheless, some general approaches to management may be relevant in connection with research work; e.g. the *contingency approach*. This approach was developed to address complex management conditions and calls for a flexible manager capable of performing different roles in the management process. In short it holds that every situation is unique and organisational structure and management should consequently be adapted in each case. Sometimes it is e.g. more effective to focus on the task and sometimes it is more

effective to focus on the people. Also the concept of *risk management* may have something to offer with regard to planning R&D. The basic idea is rather simple: continuous monitoring of known and imagined circumstances that may impact negatively on the work at hand. These risks should be identified and rated for their likelihood and effect. Plans should be made for how (if at all) the likelihood can be minimised and for what to do in the event that a risk comes true. In other words, risk management entails an attempt to manage threats in the surroundings of the researcher and of the research project, which is of course only possible to a limited extent. Though perhaps only of limited value risk management may still be of use in many research projects, leading us to the theories of *project management*. Although much of the traditional literature is rather technical, bordering on mathematical in nature⁴¹ and therefore not very suited for research purposes most projects in fact share many of the characteristics of the research process; projects are generally unique, complex, surrounded by a good deal of uncertainty and dealt with by temporary teams. Some of the more recent project management literature takes this into account and tries to develop a more flexible and dynamic approach to the management of projects⁴². An approach, which seems suited to research.

It also seems that lessons could be learnt from the field of strategic management. As argued by Johnston (1990), strategic research makes it possible to direct research in a general way by defining broad national or economic objectives while leaving the choice of the particular direction of research or of a particular project to the social control mechanisms of the research system. Johnston's focus is thus the macro level of research management, i.e. science policy. I would argue, however, that strategic management with benefit could be used also on the meso and micro levels of research management. This observation is relevant to all research organisations but probably more so to public research institutes since it may be expected that private companies to a larger extent apply a strategic management approach more or less per se given their inherent clearer impression of mission. To Mintzberg (1978:935) "strategy in general, and realized strategy in particular, will be defined as a pattern in a stream of decisions". Creating such a pattern would render visible the purpose and goals of the research and prepare the basis for a synergetic environment where researchers work towards the same kinds of objectives, where they communicate and share information. It is, however, vital to the motivation and job satisfaction of researchers that they are involved in the setting of the overall goals with which individual goals should be integrated. Once overall goals have been set a way of ensuring that they are adhered to in practice could be to let each individual researcher develop his or her own research plan which on an annual basis is presented to, discussed with and approved by the management. The importance of employee identification with and acknowledgement of the goals and values of their place of work has also been emphasised by the literature on *value-based management*. Hence at the strategic level this approach to management also seems relevant in connection with the management of research.

⁴¹ See e.g. Gido, 1985.

⁴² E.g. Christensen and Kreiner, 1991, have broken with the technical tradition and developed some very useful theories for project management in an "imperfect" world.

If a department etc. has developed jointly acknowledged overall goals with which individual goals are integrated this also facilitates *self-management*. In an “autopoietic”⁴³ system such as the research world this is to a large extent what management is about. In most cases, research management is probably more about the management of the *context* of research than it is about the management of the *content* of research. Therefore, researchers should generally be coached rather than managed. (There may of course be variations to this rule of thumb. E.g. it seems likely that a PhD-student or post doc. may welcome and benefit from a larger degree of direction than say an associate professor or senior researcher). For the research manager (or “coach”) this entails functioning as a supportive critic who listens, gives advice, asks questions and serves as a source of facts and ideas, i.e. as a kind of consultant to his or her colleagues. The manager thus has the task of helping employees to constantly improve and reach higher goals. In the term of Kirkeby (1997), the manager should possess the Greek virtue of “maieutics” (the art of “spiritual” midwifing), i.e. the ability to set employees free, inspire them to create and make them seek inside themselves for the reason for their actions. Thus when employees decide to follow the leader they do so of their own free will.

On a somewhat more prosaic note, the manager should also deliberately encourage cooperation and communication within his or her unit. To enable this kind of research management the organisational structure should be lateral and the unit size should be relatively small. If the research unit is too big it is likely to become too difficult for one person to perform these tasks. A solution to this problem could be to delegate or share management responsibility, as is for example done in some Danish government research institutions (Kjerkegaard, 1991). One person, e.g. the department head, would have overall responsibility but would primarily be focusing on personnel management and general strategy for all of the department whereas a number of research leaders or programme managers, on a peer-to-peer basis, would be responsible for supporting creative thinking in smaller, subject-oriented units. In a Danish university setting this could e.g. be introduced through the establishment of a new position as research leader, or perhaps research professor with managerial obligations.

However, optimum research management is not just a question of managers and organisational structure. Much management in everyday life is informal and is not carried out by people formally appointed as managers. If it is believed that the research world would benefit from a greater awareness of management and management techniques then the real challenge lies in reshaping the traditional anti-management culture of the scientific world.

⁴³ Originally a biological concept, the term is here used in Niklas Luhmann’s sense of the word as interpreted by Larsen (1996), i.e. as a relatively closed system which itself produces and reproduces the elements of which it is made.

Research management can only be successful if individual researchers acknowledge that management will create a situation where the end result will be larger and better than the sum of the individual contributions. Only when there is a shared rationale between those who manage and those who are “managed” can management make a positive difference. For many research institutions this requires embarking on a process of organisational learning. This is increasingly being debated in a Danish context⁴⁴. Thus, although the Danish research manager is in many cases still a juvenile he or she is showing signs of coming of age.

⁴⁴ Research management was e.g. devoted a good deal of attention in the 1997 annual report by the independent Danish Council for Research Policy (1998). In 1997 the Danish Academy of Technical Sciences (ATV) published a book entirely on research management (sponsored by the Ministry of Research and Information Technology). Furthermore, the Danish Minister of Research has stated in public that he wishes to strengthen the management in universities (Berlingske Tidende, 28 May 1998) and the central union for academics “Akademikernes Centralorganisation” which organises university researchers has called in public for management improvements in the universities both at the level of departments and at institutional level (Mandag Morgen no. 36, 19 October 1998). Early 1999 The Danish Council for Research Policy put forward some rather radical proposals suggesting that the now elected top management at universities be replaced by professional managers; under this scheme the vice-chancellor would be employed by the Senate which would have a majority of members from outside the university. Deans would be hired by the vice-chancellor upon advice from the Faculty Council (Forskerforum no. 122, March 1999).

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