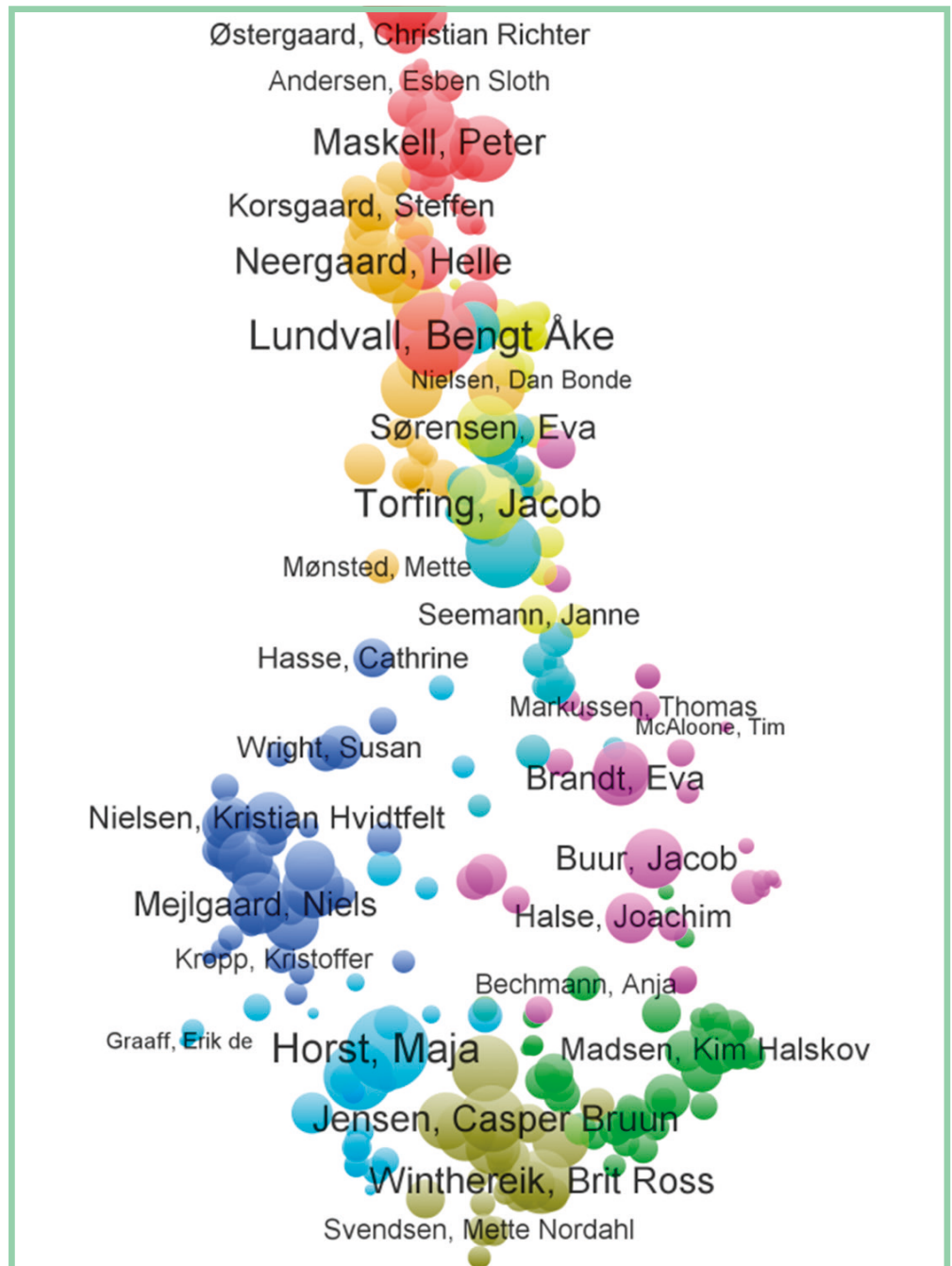


Mapping Danish Research on Research and Innovation

Research and Innovation: Analysis and Evaluation 2/2015



Ministry of Higher Education
and Science

Danish Agency for Science,
Technology and Innovation

Mapping of Danish Research on Research and Innovation

Prepared for:

Styrelsen for Forskning og Innovation
Bredgade 40
1260 København K
E-mail: fi@fi.dk
www.ufm.dk

By:

Centre for Studies in Research and Research Policy (CFA)
Lise Degn, Niels Mejlgaard and Jesper W. Schneider

Department of Political Science and Government
Aarhus University
Bartholins Allé 7
DK-8000 Aarhus C

Publication can be downloaded at ufm.dk/publikationer

ISBN: 978-87-93151-45-1

ISBN (electronic publication): 978-87-93151-40-6

ISSN: 2246-6762



Preface

This report presents the results of a study aimed at mapping Danish research on research and innovation (RI-research). The study was conducted by the Danish Centre for Studies in Research and Research Policy, Aarhus University, from December 2013 to September 2014, for the Danish Agency for Science, Technology and Innovation, under the Ministry of Higher Education and Science.

The report contains results and analyses based on five interconnected parts of the study: (1) desk research providing an initial overview of a diverse field and a working definition of RI-research; (2) a survey among department heads addressing the resources and organization of RI-research; (3) a co-nomination study among researchers in the field mapping the cognitive networks and cooperation patterns; (4) qualitative interviews with key researchers in the field; and (5) bibliometric analyses of the impact of Danish RI-research. The study was carried out by Niels Mejlgaard, Jesper W. Schneider and Lise Degn at the Danish Centre for Studies in Research and Research Policy at Aarhus University.

Contents

Preface	1
Contents	2
Executive summary	3
1. Introduction	5
2. Initial delimitation and working definition of RI-research	7
3. Methods and design	9
3.1 Data collection.....	9
3.2 Design.....	11
4. The scope and funding of public RI-research	13
4.1 Human resources in RI-research.....	13
4.2 Funding of RI-research.....	14
4.3 Assessment of the field by department heads.....	14
4.4 Key findings.....	15
5. Identifying cognitive and cooperation RI-research clusters	16
5.1 Mapping cognitive networks and key researchers.....	16
5.2 Mapping cooperation networks.....	21
6. Thematic orientations	26
6.1 Linking facets to cognitive clusters.....	26
6.2. Analysis of journal cross-citation activities.....	28
6.3 Key findings.....	31
7. Impact analysis	32
7.1 Core journals and impact.....	32
7.2 Interpreting results.....	33
7.3 Key findings.....	35
8. Key conclusions and points of discussion	36
8.1 Key findings.....	36
References	39
Appendices	40
Appendix A: Methodical considerations.....	41
Appendix B: Department head survey and distribution list.....	42
Department head survey.....	42
Distribution list for department head survey.....	42
Appendix C: Co-nomination survey.....	45
Co-nomination survey.....	45
Appendix D: Interview guide.....	47
Interview guide (Danish).....	47
Appendix E: Clustered journals and Danish publications.....	48
Appendix F: Introduction to Vosviewer.....	50
Appendix G: Additional figures and tables.....	51

Executive summary

There is growing academic attention and research activities related to understanding the dynamics of research and innovation, and their place in society. Research in research and innovation (RI-research) is, however, not a coherent, well-established, and easily defined field. It is rather a collection of subfields with some interaction that share the interest in examining research and innovation. Any attempt to delineate and map RI-research should therefore be explorative in nature and sensitive to the heterogeneity of the field.

The study presented here aims at providing a tentative mapping of RI-research in Denmark. It was tailored to capture complexity, combining various qualitative and quantitative approaches, including specifically desk research, a co-nomination procedure among researchers in the field, a survey administered to department heads, interviewing of key scholars, and bibliometric impact analyses. The results of the study can be summarized in the following main points:

Scope, distribution, and funding of RI-research

- RI-research is widely distributed across institutional sites. A survey among heads of departments identified at least 34 departments with RI-research activities.
- Several department heads prioritize capacity building within this area. Existing environments are, however, characterized by low volume, often in the shape of small groups or individual researchers.
- Typically RI-research is not performed in separate, dedicated units, but run parallel with or embedded in research activities outside the targeted RI-research domain.
- While the funding base for current RI-research is diversified, uncertainty about national funding opportunities is perceived as a barrier for further capacity building within this interdisciplinary field.

Identification of cognitive and cooperation RI-research clusters

- The collegial co-nomination procedure reveals a number of distinct cognitive networks among Danish RI-researchers. A number of the cognitive networks are fairly isolated from the remaining field, while others are more strongly interlinked. Specifically, the proximity of networks focused on various aspects of innovation research tend to be higher.
- These cognitive networks tend to cross institutional borders, in the sense that RI-researchers are intellectually influenced by other RI-researchers outside their own institutions.
- In several cases, the cognitive networks revolve around one or a few key scholars.
- While the cognitive networks transcend institutional location, the actual cooperation networks are, to a larger extent, confined. RI-researchers often cooperate within their own institution, and – the qualitative interviews suggest – beyond national borders, but less so with peers from other Danish institutions.
- In some cases, however, there is an almost perfect overlap between the cognitive and cooperative networks, which indicate that within these particular subfields, the potential cooperation possibilities are being exploited, i.e. researchers are actually working with the persons that they feel are relevant and influential in their own field.

Drivers of and barriers to cooperation

- Formalized networks like DRUID in innovation studies and DASTS in Science and Technology Studies are highlighted as important drivers for national research integration. Specifically the former has been instrumental in stimulating interaction among the cognitive networks that relate in different ways to innovation research.
- Lack of such formalized sites for interaction is emphasized in qualitative interviews as part of the explanation for weak cooperation patterns in other areas of the RI-research map.
- While RI-researchers have well-developed international cooperation with academic environments, the national potentials for cooperation (highlighted by the limited overlap of cognitive and cooperation networks) could be further exploited.
- Qualitative interviews with key RI-researchers emphasize the lack of actual cooperation between researchers and policy partners in the field. There is a perceived unfulfilled potential for mutual knowledge exchange between researchers and decision makers in research and innovation policy.

Thematic orientations in RI-research

- Based on keyword and facet analysis, a number of thematic orientations in Danish RI-research can be identified. The facet analysis in general points to a “tripartition” of the field into thematic orientations around “innovation”, “science, technology and society”, and “research and university policy”. The picture is, however, not clear cut, as the cognitive clusters often relate to several thematic facets.
- Using journal cross-citation analysis based on a universe of journals nominated by RI-researchers, a core set of journals capturing RI-research can be identified. The analysis identifies eight journal clusters, which are, to varying degrees, core to the RI-research field and interrelated through cross-citation activity. Three journal clusters were excluded due to low cross-citation with the other journal clusters and expectedly very low proportions RI-research papers. These three clusters correspond to “Economics”, “International relations” and “Natural sciences”.

Citation impact of Danish RI-research

- Danish RI-researchers have considerable publication activity and impact. Across the board, RI-research performs above world field average, measured by citations. In some areas, the proportion of highly cited papers is exceptionally high, while other areas are closer to the average of the field.

1. Introduction

Research and innovation policies have become increasingly important. Across Europe and beyond, significant efforts are devoted to building research and innovation capacity and to aligning research and innovation efforts to societal demands and challenges. Traditional separation of public research and private sector innovation has deteriorated, and cooperation between academia and business has been incentivized. Structural and organizational reforms have been implemented across countries, significantly altering management, funding, and prioritization in research and innovation. The role and responsibilities of research and innovation towards broader economic and social objectives are continuously debated, but continue to be based on a collective understanding that research and innovation performance is of vital importance to national prosperity and competitiveness (cf. European Commission 2005; OECD 2009).

Against the backdrop of these policy developments, academic interest in research and innovation as a field of research has also increased. Research on research and innovation (RI-research) is however not easily delimited and defined. It is not a cohesive field, but could more accurately be described as a range of interdisciplinary research areas, each under rapid development. The boundaries and main concepts are continually debated, and while a number of contributions have attempted to describe the evolution and delimitation of individual research areas (e.g. Martin 2012; Martin et al. 2012; Fagerberg & Verspagen 2009; Busenitz et al. 2003), it remains difficult to position the sub-fields, or indeed to draw a line around the broader field of RI-research.

An initial low-resolution panorama of RI-research in Denmark would emphasize its fragmentation. Very few environments are specifically dedicated to this area of research. Rather, RI-research appears to be nested in environments where the overall bulk of research is in other areas, but where individual researchers may be active and have an impact in the RI-research field. There is however no high-resolution portrait of Danish RI-research, and no systematic knowledge of its intensity, thematic orientation, funding, impact, or institutional landscape.

The report at hand presents a mapping of the Danish field of RI-research. It attempts to identify the active environments and individual researchers in RI-research, the scope and organization of the field, the thematic orientations, and the cognitive and practical cooperation patterns of the Danish field. The study has had five interconnected components: (1) desk research aimed at providing an initial overview of the RI-research field and specifically a working definition of RI-research to be used in the succeeding parts of the study; (2) a survey among department heads, mainly in the social sciences, addressing the resources and organization of RI-research in Denmark; (3) a co-nomination study among researchers in the field, mapping the cognitive networks and actual cooperation patterns in order to gain a rich understanding of the composition and organization of the field; (4) qualitative interviews with key researchers in the field, aimed at understanding the thematic hot-spots, the potentials and the challenges as perceived by the research leaders in the field; and (5) bibliometric analyses addressing the actual research performance and its impact on the broader RI-research field.

The initial working definition of RI-research is presented in chapter 2, and in chapter 3 the methodology of the study is described. Chapter 4 analyses the data from the Head of Department survey, and in chapter 5 the co-nomination data is presented, analysed and nuanced with findings from the qualitative interviews; particularly focusing on mapping the

cognitive and cooperative relations of the field. Chapter 6 focuses on the thematic orientations, drawing on bibliometric analyses of the co-nomination data, whereas chapter 7 presents an impact analysis of the Danish RI-field, based on both data from the co-nomination survey as well as data from international bibliometric databases. Chapter 8 discusses and draws out conclusions. Supporting material is appended.

2. Initial delimitation and working definition of RI-research

RI-research is an emerging and complex field. It transcends disciplinary boundaries and the low degree of institutionalization makes it difficult to capture in simple definitions. While consolidated research disciplines could be characterized *a priori* with some certainty (e.g. by designated journals and departments), a more explorative approach is needed in relation to RI-research. The aim of this study is to allow the field to define itself, and the co-nomination procedure, that we will specify later on, is instrumental towards this aim.

It is, however, necessary to identify a starting point, or working definition, for RI-research, which will inform our initial selection of respondents for the co-nomination procedure. It is important to note that this delineation is not intended as an *a priori* definition of the field, but is simply constructed to provide a starting point for an iterative process, by which the field will be mapped. The starting point – specifically the research subfields discussed below – is continually re-evaluated during and after the co-nomination process in light of the incoming nominations, and the method thus remains sensitive to the inclusion of alternative subfields, that the respondents themselves deem important and relevant to the overall RI-research field.

The Frascati and Oslo manuals, which are often used to delimit research and development (R&D) and innovation, define research and experimental development as “creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications” (OECD 2002) and innovation as “the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organisation or external relations” (OECD 2005).

Encompassing both these definitions, we initially understand RI-research as research which deals with the production of knowledge and the implementation, consumption and application of knowledge, which creates/facilitates improvements in businesses, society, and policy.

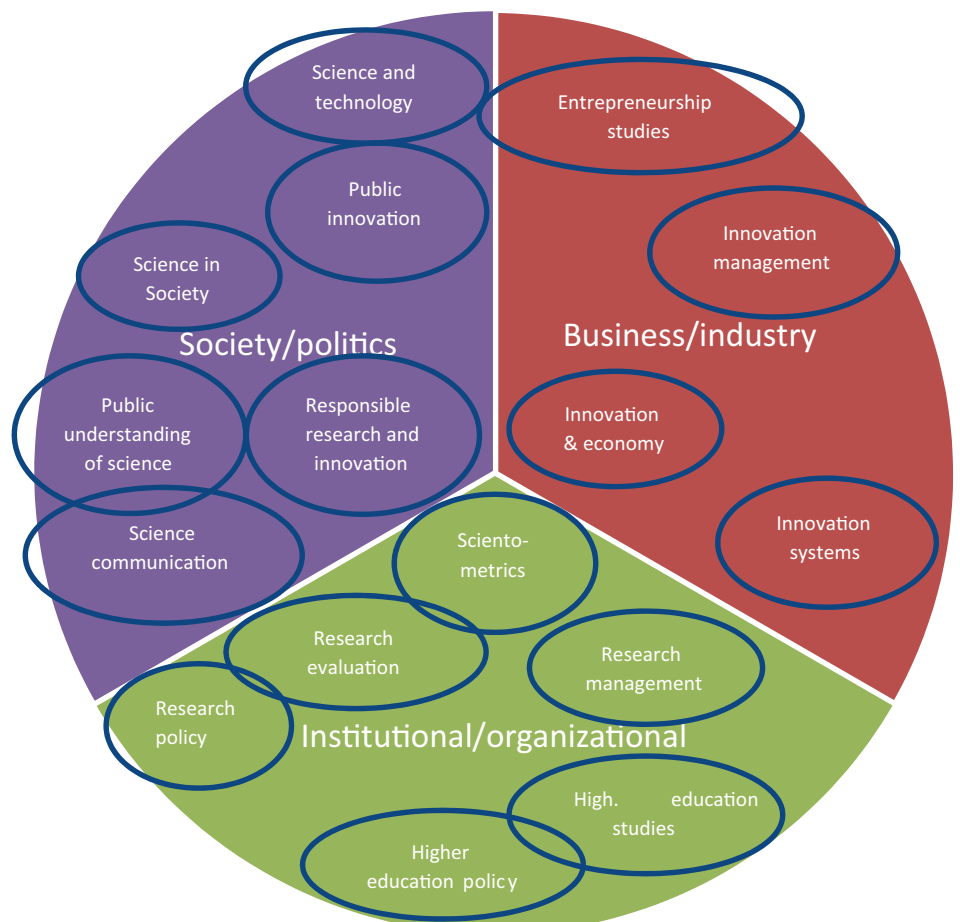
This preliminary working definition thereby does not include research on the appropriation of knowledge (pedagogical research and research on learning and teaching), research into the philosophy or the nature of knowledge (sociology/philosophy of science), and it is also distinct from “actual application” (e.g. the actual use of knowledge in industry or business). To qualify this working definition further, it is operationalized into a number of thematically distinct research sub-fields, based on an initial desk research review of the field. This is naturally not an exclusive list of sub-fields, but provides a starting point for the iterative mapping process.

The broad working definition allows for categorizations, which may be instrumental in providing an outline of a complex field and qualify the results of the co-nomination exercise. Broadly speaking, three categories of RI-research emerge from the working definition and the literature; one which is primarily focused on the business community or industry and the issues and themes related to this; one which is focused on societal issues and problems; and one which deals primarily with institutional or organizational issues and

themes related to research (cf. Fagerberg et al. 2012; Clausen et al. 2012). There are overlaps between the different orientations of these three categories, but the argument here is that each of the broad categories has a primary orientation in terms of research interest, questions and methods, which can be captured via the categorization. The subfields listed in the figure below thus all deal with the production of knowledge and the implementation, consumption and application of knowledge, which creates/facilitates improvements in businesses, society, and policy in one way or the other, but within a context of the broader orientations.

The advantage of such a preliminary categorization is that it enables access to the field, without delimiting the field. It has been applied in the present mapping as a basis for the iterative process, i.e. as a way of selecting the initial respondents for the co-nomination survey, but as the following chapters will demonstrate, that process has refined the initial understanding of the field. Figure 2.1 below illustrates the initial broad panorama of the RI-research field.

Figure 2.1. Initial field visualization



3. Methods and design

Since RI-research, as mentioned, is characterized by a high degree of interdisciplinarity and thematic differentiation, it is not easily delimited or captured by any single methodical approach.

A strictly quantitative approach might favour an a priori delimitation of the field, e.g. based on a number of journals that are considered central to the field (see e.g. Damvad 2013). Such an approach would enable, e.g., bibliometric analyses of the research output of the pre-defined field, but would also run the risk of excluding entire areas of research not captured by the pre-definition. In cases like the present, where the field is complex and crosses disciplinary boundaries, a priori definitions seem less useful.

At the other end of the scale, purely qualitative studies are useful in opening up a field and exploring in depth particular corners of it, but might be less useful in capturing the patterns of production and cooperation across an entire field such as RI-research. The present study is therefore designed as a mixed methods study, where both quantitative, qualitative and bibliometric methods are applied and mixed, in order to avoid some of the problems mentioned above and to enhance the use of the individual methods.

This mixed methods design enables a comprehensive analysis of the dynamics of the Danish RI-research fields, as the various methods inform each other both in the design phase, the data collection phase and in the analysis (Bloch et al. 2014). The different methods and their central purposes are described individually below and their interaction is discussed and visualized in Figure 3.1.

3.1 Data collection

The study is based on the initial construction of a very broad working definition of RI-research and subsequent qualification of this definition by the actors in the field themselves. Such an approach can e.g. be seen in Lenk (1983), Giusti and Georghiuo (1988), Georghiuo (1997) and Nedeva et al. (1996), where it is termed co-nomination analysis. Co-nomination analysis represents the backbone of the present study, but it is complemented by survey-, interview-, and bibliometric analyses.

The co-nomination process is based on an initial selection of central researchers, who collectively represent the breadth of the working definition of RI-research¹. These respondents are then asked, via an electronically distributed survey², to nominate the individuals and environments that they perceive to be relevant to their own research area (within the RI-research field). The co-nomination survey distribution process is then repeated (several times) among the nominated, which in the end provides us with a comprehensive picture of the scope and configurations of the RI-research field in Denmark.

1 Two to three respondents from each of the subfields listed in figure 2.1 were identified and comprised the "first round respondents" of the co-nomination process.

2 See the co-nomination survey in appendix C.

Table 3.1. Summary table of respondents and response rates in the co-nomination survey. Reminders were administered twice per respondent after approximately 2 and 4 weeks.

Survey distribution round	Number of recipients	Number of respondents	Response rate
1	36	26	72 %
2	86	72	84 %
3	132	85	64 %
4	119	82	69 %
5	172	102	59 %
English	76	38	50 %
Total	621	405	65 % (68% for Danish version, 50 % English version)

To analyse the co-nomination and cooperation data, symmetric matrices were obtained for each pair of nominated individuals, i.e. two individuals nominated together, and a frequency distribution analysis was conducted to calculate the strength of the co-nomination. A minimum threshold of at least two independent co-nominations was used as a threshold to filter out potential periphery or idiosyncratic nominations. Results were then imported into Vosviewer (van Eck & Waltman 2009), which was used to perform cluster analysis and visualize the network³.

Simultaneously a survey among the total population of department heads in social science departments in Danish universities was administered. This survey was designed to assess the formal organization of RI-research (e.g. in terms of funding, types of activity etc.)⁴, but also to reveal blind spots in the mapping of active RI-research environments (thus supplementing the co-nomination survey). The survey was distributed to relevant department heads in a two-step procedure. Initially, the sample included all department heads at social science departments across all universities and subsequently, invitations were sent also to the heads of non-social science departments that were identified as actively involved in RI-research via the co-nomination survey. The procedure was tailored towards achieving a sufficient coverage of the field, without overburdening heads of department where RI-research was unlikely to appear (e.g. in Health science and Technical science)⁵.

3 See appendix F for introduction to Vosviewer where all visualizations in the report may be studied more closely.

4 See appendix B for department head survey.

5 See distribution list and copy of survey in appendix B.

Table 3.2. Summary table of respondents and response rates in the Head of Department survey. Reminders were distributed 1-2 times, approximately 2 weeks after the survey was administered.

Survey distribution round	Number of recipients	Number of respondents	Response rate
1	44 (HoD social science departments)	31	70 %
2	28 (identified indirectly – on the basis of the co-nomination procedure, i.e. from departments beyond the social sciences, in which individual researchers were nominated as active RI-researchers)	16	57 %
Total	72	47	65 %

Finally a series of 10 qualitative semi-structured interviews were conducted with key researchers in the RI-research field. The aim of the interviews was to gain more in-depth information on the strengths, perceptions and challenges of the Danish RI-research fields, and the goal was therefore to identify key researchers in the field for interviews. The informants were selected on the basis of the results from the co-nomination process, i.e. the 10 selected informants all had a high number of direct nominations, and they also represented different branches of research (cf. the working definition) as well as differing institutional affiliations.

The interviews were conducted over the phone and lasted from 30 to 60 min. The interviews were semi-structured with room to digress and elaborate on themes that were perceived to be relevant by the informants, but the common themes were the current thematic orientation of the informants' RI-research, their relations to other environments and cooperation practices, external relations and policy partners, and the structural conditions of RI-research in general in Denmark⁶. The qualitative interviews were transcribed verbatim and coded via Nvivo, a qualitative data analysis software program, to which the transcripts were uploaded.

3.2 Design

As a main feature of the co-nomination survey, respondents were asked to indicate key persons and environments deemed important and relevant to their own field of RI-research. Respondents were also asked to indicate the individuals and environments, with whom they cooperate around RI-research in order to gain insight into the possible divergences between the cognitive networks (the individuals that researchers perceive to be relevant to their field of research) and the practical cooperation networks (the people, that researchers actually work with). The results of this part of the co-nomination are reported and discussed primarily in chapter 5, where the links between the cognitive and cooperation perspectives are analysed, with an eye for the possibilities of cooperation that divergence indicates. Findings from the interview material are also used throughout this section to substantiate and nuance the findings of the other analyses.

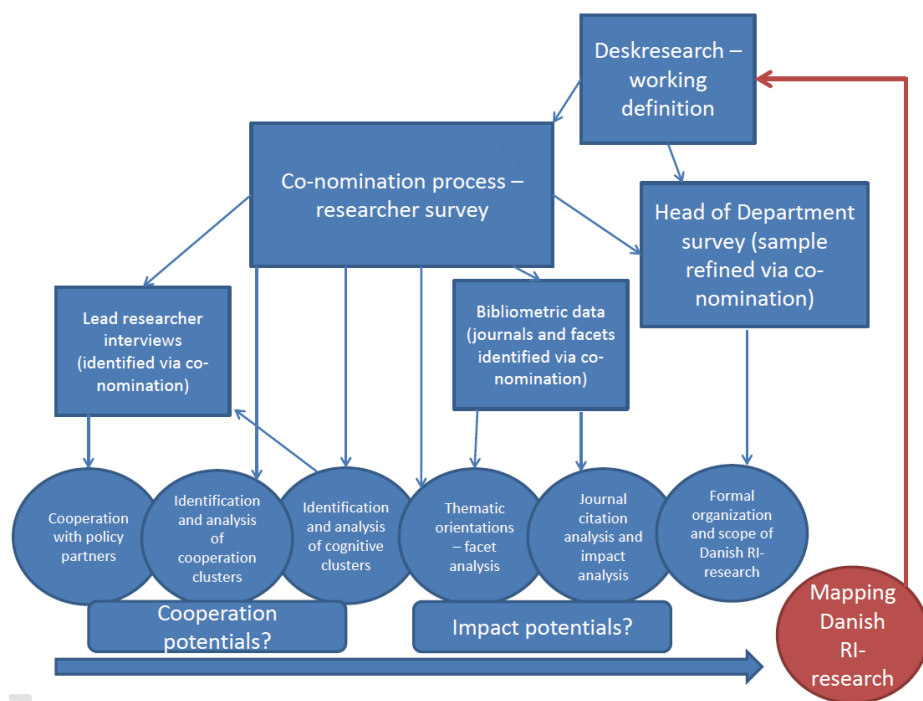
To support the bibliometric analyses, respondents were also asked to indicate up to 10 journals that were considered relevant to their particular field of RI-research, and to provide keywords or terms that describe their particular field of research. The RI-research

⁶ See appendix D for interview guide.

keywords were used to develop “facets”; more generalized categories which represent thematic orientations. These facets were constructed via a triple coding process, where the authors of this report each coded all keywords into more generalized categories, and subsequently discussed overlaps and differentiations. From the approximately 1400 keywords provided by respondents, 16 facets were developed and subsequently attributed to the respondents (who had provided keywords) via a dual coding process. These facets are used both in the analysis of the cognitive and cooperation network, to illuminate the thematic orientations within the field, and as a component for bibliometric studies reported in chapters 6 and 7⁷.

In Figure 3.1 below the research design and the interrelation between the various methods and analyses are summarized.

Figure 3.1. Research design



7 See appendix C for the co-nomination survey.

4. The scope and funding of public RI-research

This section presents results from the Head of Department survey on RI-research within Danish Universities.

4.1 Human resources in RI-research

Figures 4.1 and 4.2 below demonstrate the scope of reported human resources dedicated to the field of RI-research. It is important to note that it may be – and indeed was – difficult for the department heads to estimate the exact number of personnel and full-time equivalents dedicated to this type of research, both due to difficulties in delimiting the field and in accounting exactly for the research efforts of individual staff at the departments. As, e.g., the head of the Department of Education (DPU) at Aarhus University rightly notes, a very broad understanding of the RI-research field; one which would include social innovation in educational- and learning systems, didactics, pedagogy, reforms and management of educational institutions (at all levels of education, including primary and secondary) etc., would logically embrace almost all activities at DPU. A more narrow understanding would change the figures that she reported significantly. Other comments indicated similar reflections on the side of the respondents, but on the whole, most department heads opted for a narrower definition of the field, more in line with the initial intention of the survey.

Figures 4.1 and 4.2 below give an impression of the human resources (head count and full positions respectively) in RI-research across departments.

Figure 4.1. Personnel (head count) in RI-research at department level

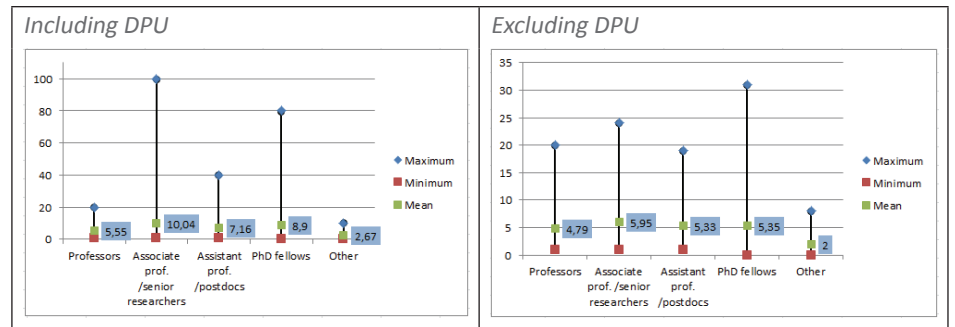
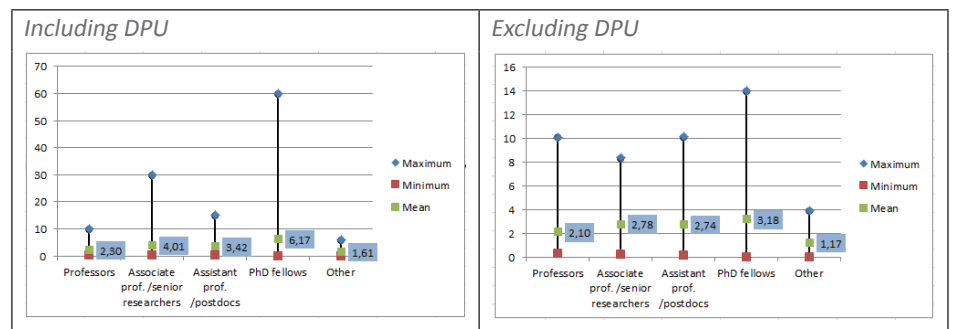


Figure 4.2. FTE (full time equivalents/full positions) in RI-research at department level



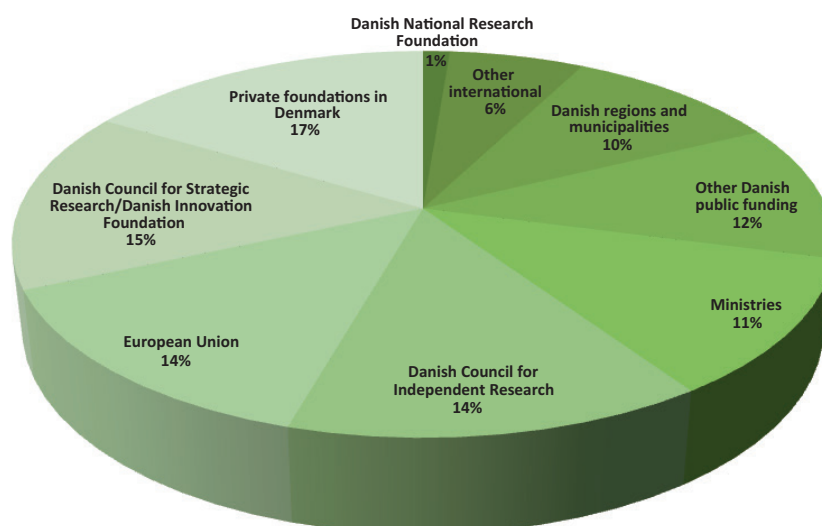
The graphics give the minimum, maximum, and mean reported personnel and FTE across employee categories, with and without DPU (for which numbers are reported based on a broad definition of the field thus skewing the results considerably). The figures illustrate significant variation, but also show that on average the local RI-research environments are fairly small, counting only a few full positions at each level. While only tentative conclusions can be made on the basis of the survey, the results support an overall impression that RI-research is dispersed across several institutions (at least 34 departments) but carried out in small groups or by individual researchers.

4.2 Funding of RI-research

Department heads were asked to indicate the degree of external funding related to RI-research in their department and again diversity seems to be the general picture. Department heads report everything from 0 to 90 percent external funding of RI-research, with an average of around 43 percent. The external funding sources also seem quite diverse. The research councils (for independent and for strategic research), private foundations, and the European framework programmes for research and innovation constitute the main sources of external RI-research funding.

Figure 4.3 below presents the sources according to the department heads.

Figure 4.3. Sources of external funding of Danish RI-research



This finding is supported by the qualitative interviews with RI-researchers, who describe a very diversified funding base for RI-research. Several informants mention the difficulties linked to obtaining funding for interdisciplinary research, such as RI-research, and the ensuing need to “piece things together” with smaller grants from several sources.

There also seems to be very large variations across subfields, as to which funding sources are seen as relevant and “possible” sources. National research councils seem to be perceived as more relevant and “obtainable” funding sources for innovation research, while private foundations and other smaller grants are perceived to be more relevant to e.g. STS-research (“the green part” of figure 2.1.).

4.3 Assessment of the field by department heads

Lastly the department heads were asked to assess the RI-research of their department in terms of challenges, strengths and thematic orientations, and the results supports the initial picture of an emerging and differentiated field of research.

The information that emerges from the open question is scarce, but several department heads do however highlight capacity-building within this area, and mention that they are building a group within the field or that it is an area which is coupled with or integrated in other, more consolidated fields of research. It would appear that RI-research is an area of interest across several departments, but that dedicated research efforts are yet to be mobilized. Some department heads emphasize strength in innovation and entrepreneurship studies, while other point to specializations in higher education studies and science communication.

This finding is again supported by the qualitative interviews, where several informants highlight that their university or department is very supportive of their research or in the establishment of a research environment, both in terms of financial support (e.g. seed money) or organizational support.

The interdisciplinary character of RI-research appears to be its strength, in so far as it captures an international agenda where challenge-oriented, interdisciplinary research is in demand, but also its weakness, in the sense that its development carries institutional challenges and that national funding opportunities are not obvious.

4.4 Key findings

In general the analysis of the department head survey demonstrates that Danish RI-research is quite widespread and is carried out in a number of units, but mainly by individuals or in small groups. Heads of departments mention that the research area is subject of institutional interest, but specific initiatives to strengthen the area are so far hard to identify. Funding seems to come from a variety of sources, but there also seems to be great differences across the RI-research field in terms of the perceptions of “possible” and relevant funding sources.

5. Identifying cognitive and cooperation RI-research clusters

In the present section, key findings from the co-nomination process are presented and discussed with the aim of providing a nuanced view of both the cognitive network of the RI-field (section 5.1), as well as the practical cooperation networks (section 5.2). By comparing these networks, the section also provides a discussion of the potentials for future cooperation, as well as the barriers that are perceived to such cooperation.

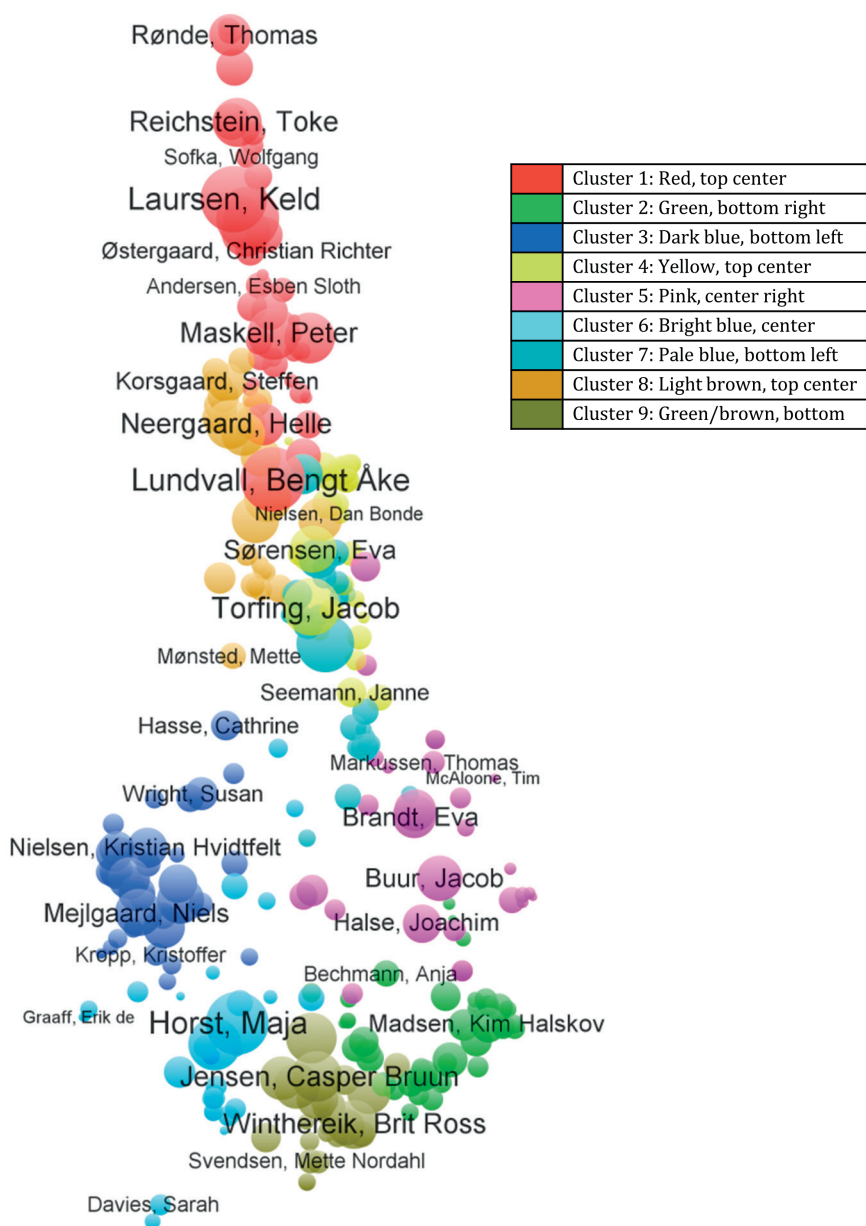
5.1 Mapping cognitive networks and key researchers

The term cognitive network means to emphasize that the map below (figure 5.1) illustrates the RI-research field as it is perceived by the researchers in it and it thereby represents the perceived importance of certain individuals and their relations with others.

The co-nominations are transformed to “distances” between the researchers, so that shorter distances in the map mean closer similarity between researchers, i.e. more frequent co-nominations. The maps are global projections of all these interrelated “distances” between the researchers. The challenging part in such a mapping exercise is to construct a meaningful map in two-dimensions based on a reduction of high-dimensional “distance” data; all the relations between the researchers.

The dynamics of such maps are usually that objects (researchers) with a broad profile, i.e. researchers co-nominated with several different authors will tend to move to the centre of the map. The periphery of the map, seen from the centre, will show objects that tend to be co-nominated with a more restricted set of other researchers, i.e., those in their academic neighbourhood. Essentially, the map can be seen as a network, where clusters are such neighbourhoods and the location of the clusters tells us something about how connected the cluster and its members are to the other researchers in the map. If they are closer to centre, they have a broader profile connecting with more clusters; are they on the periphery, they tend to be more isolated with fewer links to others.

Figure 5.1. General map of cognitive network. The visualization unfortunately does not support a complete view of all the top-nominees, but a guide to a more functional viewing is available in appendix F.



From the co-nomination data a total of 10 cognitive clusters were identified⁸. It is clear that the largest cluster (cluster 1 (red) with 48 individuals) is closely related to three other clusters (brown (8), yellow (4) and bright blue (6)), and more distantly related to the pink cluster (5). These four (five) clusters are all associated with innovation studies, more particularly innovation policy and funding, innovation systems, networks, clusters etc. (1), public innovation and innovation management (4), user driven innovation, design and creativity (6), and entrepreneurship (8) (see section 6.1).

⁸ In Figure 5.1 one cluster has been omitted. It comprises what might be described as the outskirts of the RI-field, as it consists of individuals occupied with research on biosynthesis and plant biology. This cluster relates to the field by association with the light blue cluster, centred around Maja Horst. Leaving out this cluster, however, provides a clearer image of the “core” of the RI-field and the remaining 9 clusters.

5.1.1. Cluster analysis

The red innovation cluster is clearly dominated by a number of prominent individuals who have achieved a high number of co-nominations (illustrated by the size of the label). Interestingly these individuals have different organizational affiliations (mainly Copenhagen Business School (CBS) and Aalborg University (AAU)), indicating that the innovation research field extends beyond single environments, but that innovation research however appears to be particularly strong in these two institutions.

This interpretation is supported by the results from the qualitative interviews. There is clearly a perception among the informants, that the environments at CBS and AAU are strong and influential players in this research field, not only nationally, but also in an international perspective.

What's known as "search", that is: how we search for external knowledge outside the borders of the business, and how they apply that knowledge within the business to make it more innovation-prepared and skilled, that's an area where they have been very successful with Keld Laursen at INO. And you can also say, because we have had really solid registry data, Michael Dahl has succeeded in starting up some good entrepreneurship research. (Interview with leading RI-researcher no. 7).

Another tendency noted in the interviews was that innovation research in Denmark is perceived to be fairly consolidated and widespread, seen in relation to the size of the country:

.. Danish innovation research is significantly larger than the size of the country indicates. There might be different structural explanations to this, but I don't think there is any doubt that it is the case. (Interview with leading RI-researcher no. 1)

This perception is supported by the findings of the co-nomination analysis, where the innovation clusters tend to dominate the map in terms of size and number⁹.

The bright blue cluster (6) also seems to have a clear "centre"-individual and associated individuals at Roskilde University (RUC), and extends to both University of Southern Denmark (SDU) as well as CBS. The facet-analysis (see section 6.1) reveals that this cluster tends to be diverse in terms of thematic orientation, as design, creativity and user driven innovation, innovation management, and systems, networks and clusters are associated with this cluster. The qualitative interviews indicate that this diversity might be explained by a focus on "service innovation" – a theme which cuts across some of the facets in the analysis. This research area is perceived to be something of a "niche-area", but one where Danish researchers are also influential on the international scene.

9 The five "innovation clusters" in the cognitive map comprise 163 individuals (307 in the total cognitive network).

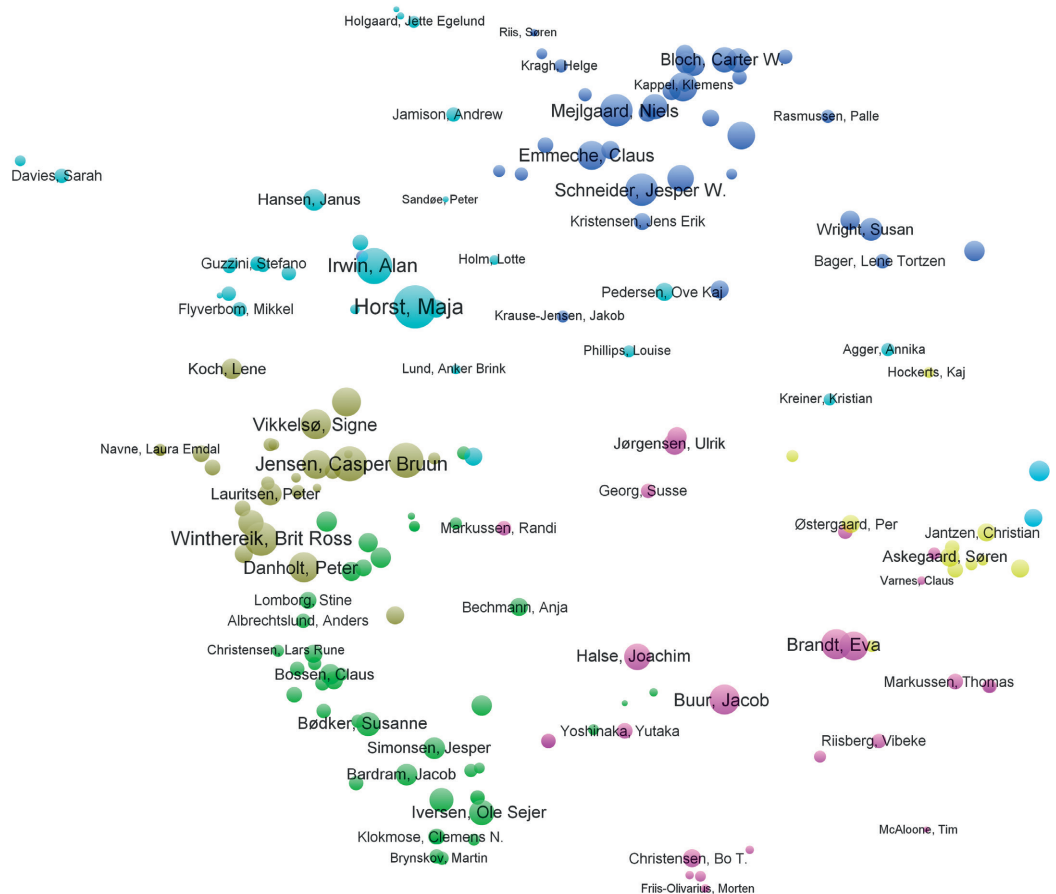
So you might say that it is a bit of a niche, which has had its own premises. There is not a lot of this in the general branch. But we are very strong within that niche. Internationally, we are also very strong in our little niche. (Interview with leading RI-researcher no. 4).

The brown cluster (8) comprises individuals both from Aarhus University (AU), SDU and CBS and the yellow (4) consists primarily of individuals from RUC and SDU, and the two clusters seem to be more dispersed than the previously mentioned ones. There are clearly prominent individuals who have achieved a high number of co-nominations, but the clusters are not centered around these individuals to the same extent as we see in other clusters, meaning that the key individuals are not necessarily mentioned by all nominators and that they are not co-nominated with the others in the cluster as consistently as is the case in the more cohesive clusters. Thematically, however, the facets that are associated with these two clusters are quite uniform: entrepreneurship in the brown cluster and public innovation in the yellow.

The pink cluster, which is related to these innovation clusters without being as intertwined as the rest, comprises individuals from e.g. SDU and the Design Academies. The research foci of these individuals are to a large extent focused on design in and as innovation, user driven innovation etc.

In the bottom section of the map (see figure 5.2 below) we find four clusters which are adjacent, but not as interconnected as the “innovation clusters”. The green cluster and the brown/green cluster are clearly linked, but the two blue clusters at the (top) left of the map are quite distinct.

Figure 5.2. General map of cognitive network – selection



The green cluster (2) comprises individuals from several universities (AU, IT University (ITU), RUC etc.) and again we see that there does not seem to be a clear “centre of gravity” in the form of a single or a few individuals as we saw earlier, indicating a more dispersed, and perhaps less consolidated, research area. Thematically this cluster is focused on design, participatory design, as well as technology and society issues. We see the same thematic orientation in the brown/green cluster (9) at the very bottomleft of the map, which, unlike cluster 2, centres around a few key persons located at ITU, AAU and AU. More specifically research in this cluster focuses on technology and society and a more general concern with responsible research.

These research areas are, by informants in the interviews, perceived to be relatively fragmented both due to the “nature of the research field”, i.e. that it is concerned with a wide range of issues and areas relating to science, technology and society, but also to the structural conditions that surround it:

It is a very pragmatic field in the sense that because there haven't been any specific programs where one could apply for funding, one needs to be opportunistic. (...) I think that this is something the field is very good at: moving in tune with what is going on in society. (Interview with leading RI-researcher no. 8).

Adjacent, we find the light blue cluster, which has a very clear individual centre of gravity at University of Copenhagen (KU), and a network of associated individuals located at primarily CBS and AAU, indicating a relatively consolidated field of research, which focuses on issues of science communication, public engagement and generally Science and Technology Studies.

The qualitative data support this finding, but as one informant highlights structural conditions, and in particular funding issues, play a vital role for the shaping of the research landscape in this area.

It is not like we have “environments”, because the country is not big enough for that. Or more specifically, there have not been grants that were big enough. So it is more characterized by single individuals who establish themselves in certain areas and become important there. (Interview with leading RI-researcher no. 5).

The ninth and final cluster, the dark blue (bottom left in Figure 5.1) is centred around a number of researchers from AU and KU. The cluster appears fairly cohesive, but distinct from surrounding clusters, which indicates that researchers in this cluster are commonly nominated together, but have few links to other, adjacent clusters. In this cluster we find thematic orientations on university policy and funding, research evaluation, as well as governance and management in higher education systems.

5.1.2. Key findings

In general, the cluster analysis of the cognitive network demonstrates that RI-research is widely dispersed among the Danish research institutions, and that it seems that the initial perception of the field as relatively fragmented and characterized by a limited number of salient individuals and a larger number of individuals that are more peripheral to the RI-field seems to be accurate. We see that some of the clusters have a “core-person” – or in the case of the innovation clusters on the right hand side, a few “core-persons”, which are

seen as highly relevant to the field, but a number of clusters also seem to be more “centre-less” or dispersed.

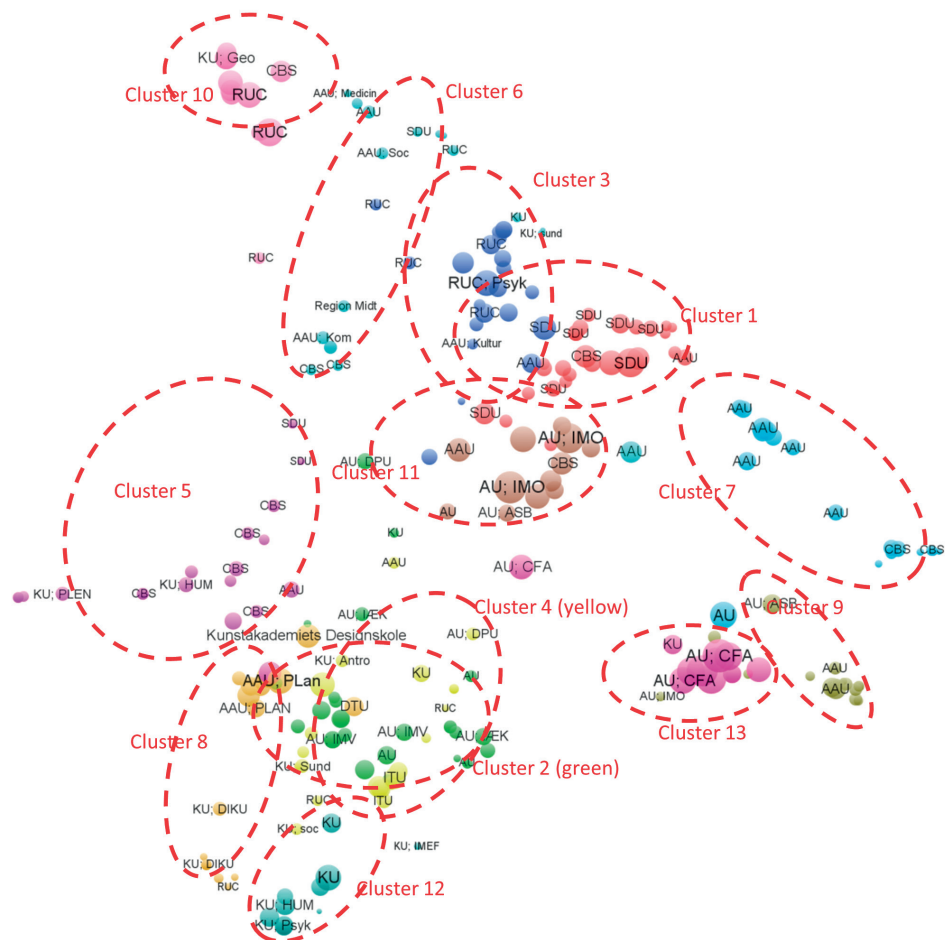
A general trend however seems to be that individuals in both the “centred” and “non-centred” clusters seems widely distributed across the universities, and it thus becomes relevant to look more closely at the actual cooperation patterns of the field, as they were reported in the co-nomination survey. In combining the cluster analysis of the cognitive network with a cluster analysis of the cooperation patterns, we should obtain a clearer image of the extent to which RI-researchers indeed cooperate with the individuals and environments that they see as relevant to their field, or where there are unfulfilled potentials for cooperation.

5.2 Mapping cooperation networks

In this section, data from the co-nomination survey are presented and analysed with particular focus on the reported cooperation patterns. Qualitative data from the interviews and results from the facet analysis are used to nuance the cooperation pattern analysis with regard to the thematic orientation of the cooperation clusters.

Looking at the cluster analysis and visualization of the cooperation patterns of the Danish RI-research field, we see a landscape which is much more closely linked to the institutional patterns and thus to a large extent (although by no means exclusively) reflect the institutional environments to which the individuals belong. In Figure 5.3 below, we see e.g. cluster 1 (the red cluster, centre right) which primarily comprises individuals from SDU, occupied with innovation studies. In the same way cluster 2 (the bright green, bottom left) consists primarily of AU employees, from different departments, but with a common focus on Science and Technology studies.

Figure 5.3. Cooperation network clusters, institutional affiliation labels



Along the same lines some clusters clearly represent distinct environments, as it is the case with cluster 13 (the pink cluster, bottom right) which consists almost solely of researchers from the Danish Centre for Studies in Research and Research Policy at AU. Also cluster 12 (blue cluster, bottom centre) comprises almost exclusively researchers working on the “Humanomics-project” at KU. 10

5.2.1. Comparing cooperation cluster and cognitive clusters

When attempting to compare the cooperation networks with the cognitive networks described and discussed earlier in this section, we see a somewhat varied picture, illustrated by Table 5.1 below.

Table 5.1. Degree of overlap between cooperative cluster and cognitive clusters. Note that the degree of overlap is an approximation.

Cooperative cluster	Cognitive cluster(s)	Comment
4	9	Approx. 100 % overlap with main cognitive cluster
7	1	Approx. 100 % overlap with main cognitive cluster
10	4	Approx. 100 % overlap with main cognitive cluster
11	8	Approx. 100 % overlap with main cognitive cluster
13	3	Approx. 100 % overlap with main cognitive cluster
3	6 & 8	Approx. 90 % overlap with main cognitive cluster
5	7 & 9	Approx. 83 % overlap with main cognitive cluster
12	3 & 8	Approx. 75 % overlap with main cognitive cluster
2	2, 5, 8, & 9	Approx. 66 % overlap with main cognitive cluster
9	1 & 7	Approx. 66 % overlap with main cognitive cluster
8	2 & 5	Approx. 50 % overlap with main cognitive cluster
6	2, 4, 7 & 8	Approx. 43 % overlap with main cognitive cluster
1	1, 4, 5, 6 & 8	Approx. 33 % overlap with main cognitive cluster

Some cooperation clusters closely resemble their “cognitive sibling”, as is the case with cluster 3 (the dark blue cluster, top centre), which has significant overlap with cluster 6 in the cognitive network (the yellow cluster in map 5.1). The same can be said for cluster 11 (brown cluster at the centre) which overlaps almost completely with cognitive cluster 8 (the brown cluster in the cognitive map), indicating that within these particular subfields, the potential cooperation possibilities are being exploited, i.e. the researchers are actually working with the persons that they feel are relevant and influential in their own field. These clusters are, as mentioned in section 5, thematically focused on entrepreneurship (cluster 11) and public innovation (cluster 3).

Cluster 7 (the light blue cluster at the far right) overlaps almost completely with cognitive cluster 1 (the red innovation cluster in the cognitive map), but this cognitive cluster however also overlaps with cluster 9 (green brown, bottom right) and cluster 1 (red cluster, centre right). The cognitive cluster was associated with themes such as innovation policy and funding, innovation systems, networks clusters etc., and comprised the largest cluster in the cognitive network, and it is therefore perhaps not surprising that we see it overlap with several cooperation clusters. However the result does perhaps indicate that within

10 See appendix G for similar illustration with “individual researcher” labels

this sub-field, the potential for cooperation might not be fully exploited or pursued. Another possible interpretation could be that because this field of research is perceived to be a “hot spot” in Danish innovation research, many researchers and research environments are attracted to the field.

Other cooperation clusters have no significant overlap with a single cognitive cluster, but rather comprises individuals associated with a variety of cognitive clusters. This is the case e.g. for cluster 6 (bright blue at the top), which overlaps with clusters 2, 4, 7 and 8 (green, yellow, light blue and brown) in the cognitive map, or cluster 1 (red cluster, centre right), which overlaps with clusters 1, 4, 5, 6 and 8 (red, yellow, pink, blue and brown) in the cognitive map.

This tendency could be interpreted as caused by lack of cooperative relevance, i.e. that the individuals who are perceived to be relevant to one’s own field, might not be relevant in terms of cooperation, e.g. due to highly specialized research foci, but it might also be due to structural or other barriers to cooperation within the particular subfield.

5.2.2. Cooperation challenges

The qualitative interviews may help us understand these potential barriers to cooperation. In general, according to the informants, cooperation patterns in Danish RI-research are to a large extent driven by personal relationships. These personal relations are in some cases supported through formalized networks etc., which is e.g. the case with the DRUID¹¹ network in the innovation clusters and the DASTS¹² network in the science, society and technology clusters. These two networks are highlighted as important cooperation drivers in their respective fields. Particularly the DRUID network, which was initially established via a grant from the Danish Research Council, is mentioned as a vital network both nationally and internationally:

The DRUID network has been a melting pot (...). It has been, and still is a giant network for innovation, which also connects to the rest of the world, and it is an institution beyond compare in Denmark within this field. (Interview with leading RI-researcher no. 7).

Emphasizing the importance of supporting cooperation through formalized networks, we see that in the thematic field of university policy and funding, research evaluation, governance and management in higher education systems, captured in cluster 3 in the cognitive network, the informants describe an unfulfilled potential for cooperation between the environments and individuals occupied with this type of research (captured in clusters 12 and 13), which is also visible in the visualization of the cooperative network, where the two clusters are completely separate and fairly distinct from their surrounding clusters and each other, even though they have significant “cognitive overlap”.

And as one informant points out, one potential way of strengthening the cooperation across institutional borders could be through network building:

11 DRUID: Danish Research Unit on Industrial Dynamics

12 DASTS: Danish Association for Science and Technology Studies

I think what is missing is maybe a forum or an annual workshop or some other type of platform, where these things could be discussed nationally. The community would certainly benefit from that. I think that there is a strong tendency that everything becomes very internationalized, so the colleagues you discuss your research with are often colleagues from abroad. And it often happens that you meet people from your "neighbour"-university on the other side of the globe, and discuss your research there instead of in Denmark. (Interview with leading RI-researcher no. 6).

Another tendency highlighted by the informants is the fragmented nature of the field; a circumstance which seems particularly present for the clusters in "the bottom half" of the cooperation network, e.g. clusters 2, 4, 5, 8, 9, 12 and 13. Informants from these clusters mention that for many, RI-related research is "simply" a minor part of their research, as e.g. within the Science and Technology studies field:

.. It is fragmented. (...). I mean, in reality there are a lot of people who do things that are relevant to the field. And if they were better integrated, it would be easier to obtain more visibility. (Interview with leading RI-researcher no. 5).

One informant mentions a possible explanation to this, namely the institutional barriers and disciplinary forces that may sometimes constrict cross-disciplinary subjects, such as parts of the RI-field:

We do research on things that you also find internationally, but we don't have the resources to "fill the field" in the same way that you find in other countries. It becomes a bit fragmented, because it also depends on the other things that people do, and which cooperation partners and resources that just happens to be available. (...) There are a lot of people with an interest in our field, and they are "tied" to some very monodisciplinary department patterns, which mean that they find it difficult to specialize in this field, because they are also pulled into other projects in their disciplinary fields. (Interview with leading RI-researcher no. 2).

5.2.3 Cooperation with external (policy) partners

A particular element, which was not covered in the cooperation network described and discussed above, is the degree and characteristics of cooperation with external partners, particularly at the policy level.

The general picture emerging from the qualitative interviews is that cooperation with external, not least international, (non-policy) partners is well established and mutually rewarding.

Cooperation and knowledge exchange with the policy level however is seen, across the board, as being very limited. Several possible explanations to this are mentioned by informants, e.g. the lacking Danish tradition for integrating science in policy development, the lack of formalized "feedback-mechanisms" between the research environments and the policy level, a more general, thematic, re-orientation in the research environment away from national policy issues to more international themes or biases among policy makers in the choice of "experts".

The perception among the informants is generally that there is an unfulfilled potential for mutual knowledge exchange, and often informants refer to other parts of the world where RI-research is a more integrated part of the policy development level, e.g. in Norway and the Netherlands.

5.2.4. Key findings

The analysis of the cooperation network in the Danish RI-research field indicates that cooperation to a large extent is linked to the institutional affiliations of the researchers. There however seems to be a number of areas, where the potential for cooperation is “under-exploited”, as illustrated by Table 5.1 where it is evident that some of the cognitive clusters overlaps with several cooperation clusters. The analysis has pointed particularly to the importance of supporting formalized networks, when attempting to strengthen cooperation within a certain area, but also institutional barriers and the fragmented “nature of the field” is mentioned as barriers to cooperation.

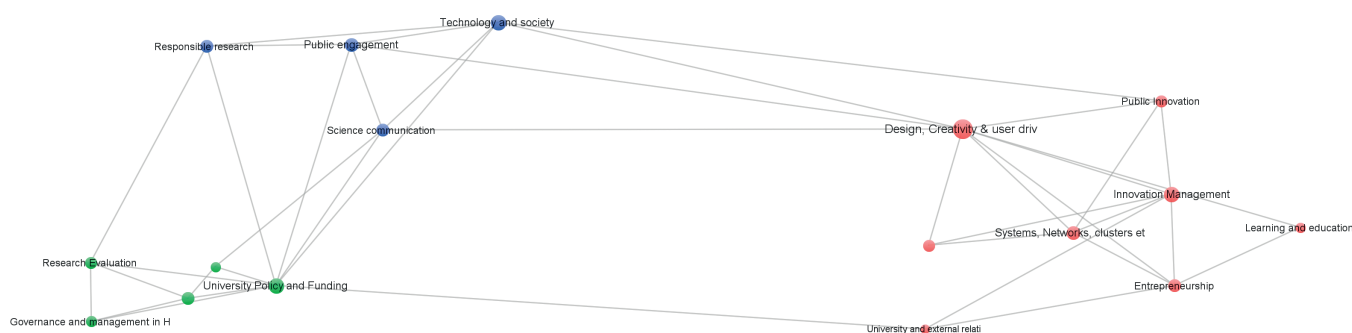
6. Thematic orientations

In the following chapter, the thematic orientations of the RI-research field in Denmark are presented and discussed. The thematic orientations are mapped by way of the co-nomination survey, where respondents were asked to provide keywords describing their primary research interests in the RI-field. To nuance this, the chapter also presents a cross-citation analysis of relevant journals also indicated in the co-nomination survey, which will be used to identify the “core-journals” of the Danish RI-field.

On the basis of the keywords that were provided by (some of) the respondents in the co-nomination survey a number of “facets” were developed, which represent generalized categories used to outline the thematic orientations of the network. The facets were assigned to respondents based on their provided keywords, and it is important to note that a respondent can have more than one facet assigned to her or him; a few has as many as five facets assigned.

Figure 6.1 shows how the facets are co-nominated between the respondents, i.e. which facets relate to each other and how. The map illustrates how innovation facets cluster together, same as facets relating to science, technology and society, and in the green cluster issues relating to research, universities and university policy. Interestingly there seems to be links between the “innovation” cluster and the “science and technology” cluster, and onwards between the “science and technology” cluster and the “research and university” cluster, whereas there are hardly any links between the “innovation cluster” and the “research and university” cluster.

Figure 6.1. Co-nominated facet map



6.1 Linking facets to cognitive clusters

In Figure 6.2 we have identified the most prominent facets linked to the respondents if they appear in the cognitive network as nominees. As we are interested in the theme(s) of the clusters and not the individuals we present the most prominent facets for each cluster. Prominent facets are the most frequent ones and frequency is illustrated in the map by the size of the facet labels.

The map illustrates that the clusters in the bottom right section of the map are particularly focused on issues relating to design, creativity and user driven innovation, and thereby in the clusters which seem to be somewhat “centre-less” and cross-institutional. This perhaps also describes the “outer perimeter” of the RI-field, as it extends to institu-

tions such as the Design Schools and Academies, but at the same time indicates that this particular area is one, which receives scholarly attention from many different individuals.

The top section of the map is “innovation heavy” in general and this thereby supports the finding, mentioned in section 5.1.1, that innovation research in Denmark is fairly widespread and consolidated in distinct research environments. The “science, technology and society” facets link to the clusters at the bottom of the map, and particularly cluster 7 (bright blue) and cluster 9 (brown/green). The “research and university” facets almost exclusively link to cluster 3 at the left side of the map, which indicates that research on these topics is narrowly linked to a limited number of individuals.

Figure 6.2. Cognitive network and associated facets. The size of the labels varies according to the frequency of facets and only the most frequent ones relating to each cluster is shown in the map. A full description of the facets is presented in table 6.1.



The orientations of the cognitive clusters can also be seen in the table below, where the distribution of facets in each of the cognitive clusters is described. E.g. we see that entrepreneurship is mentioned almost solely by respondents which belong to cluster 8, whereas e.g. design, creativity and user driven innovation or technology and society are more dispersed among the clusters¹³.

13 An important point in this is that this analysis is limited, as we only have data about the nominated individuals who have themselves responded to the survey, and have indicated keywords.

The table also helps illustrate the connections indicated in figure 6.1. by pointing out e.g. how cluster 3, despite the explicit relation to facets like academia and academic profession, governance and management in HE, research evaluation, research organization, and university policy and funding, also have links to science and technology facets – which in figure 6.1 was indicated by the lines between the clusters. The facet analysis should thereby provide us with a clearer image of the fields thematic orientations and the inter-linkages between them.

Table 6.1. Distribution of facets assigned to the 9 core clusters in the cognitive network (colour of number corresponds to cluster colour in Figure 6.2). Facets are derived from the keywords nominated by the respondents and for this analysis facets are assigned to clusters if the cognitive cluster contains the respondent. Notice, respondents can have more than one facet assigned to them. The main theme(s) for a particular cluster is simply the most frequent facets indicated with bold numbers.

	Cognitive cluster								
	1	2	3	4	5	6	7	8	9
Academia and academic profession			4				2		
Design, Creativity & user driven innovation	3	11	2	1	10	6	1	3	1
Entrepreneurship	3		1	1		2		13	
Governance and management in HE			5						1
Innovation Management	4			7	2	4	1	2	
Innovation Policy And Funding	6			1		3	1		1
Learning and education			2		1		1	5	
Public engagement			1	1			5		2
Public Innovation	1			14				1	
Research Evaluation			8						
Research organization		1	8				1		1
Responsible research		1	3			1	2		8
Science communication		1	2				4		
Systems, Networks, clusters etc.	10		1	4	1	5		1	
Technology and society	1	4	2	3	2		5		5
University and external relations	5		2					1	
University Policy and Funding		1	8				1		
Total	33	19	49	32	16	21	24	26	19

6.2. Analysis of journal cross-citation activities

To supplement the thematic analyses above and in order to perform focused impact analyses, we also delineate the Danish RI-research domain according to nominated journals. In order to be independent of the co-nominations and any potential skewedness of the data, we construct the network and derive the research specialties based on the recent mutual cross-citation activity in the Web of Science database between the nominated journals. The purpose of creating a journal citing network is to identify potential research domains based on citing practices between international journals. If the articles in two journals have

many cross-citations between them (they cite articles from each other), these journals are assumed to have common overall subject affinities.

It is well known from the scientometric literature that research fields and domains at different levels can be delimited using cross-citation traffic between articles or journals. Hence, by examining a matrix of journals' mutual cross-citations, nominated by the respondents, we are able to cluster and delimit domains of RI-research. It is important to keep in mind that such an analysis is restricted to international journal publication and more specifically the nominated international journals, but we would argue that this set of journals is sufficient to identify the main RI-research domains. The resulting domains are subsequently used to measure the general Danish research impact in these areas from 2005-2011 (see chapter 7).

Initially, the respondents nominated 569 individual outlets, and a threshold of minimum two independent nominations was enforced as a requirement for the journal to be included in the analysis. Eventually 149 journals were eligible for the analysis, i.e., they had at least two nominations and were indexed in the citation database Web of Science. The latter is required in order to perform the cross-citation exercise. An asymmetric matrix of cross-citations was created and the citing side of the matrix (the rows) was subjected to Vosviewer for similarity and cluster analyses.

Figure 6.3 below shows the journals' mutual citing relations, and the proximity of the journals thereby indicates that the articles in them cross-cite each other. The analysis in Vosviewer produced 11 clusters (color-coded on the map).

Figure 6.3. Citing relations of journals related to RI-research

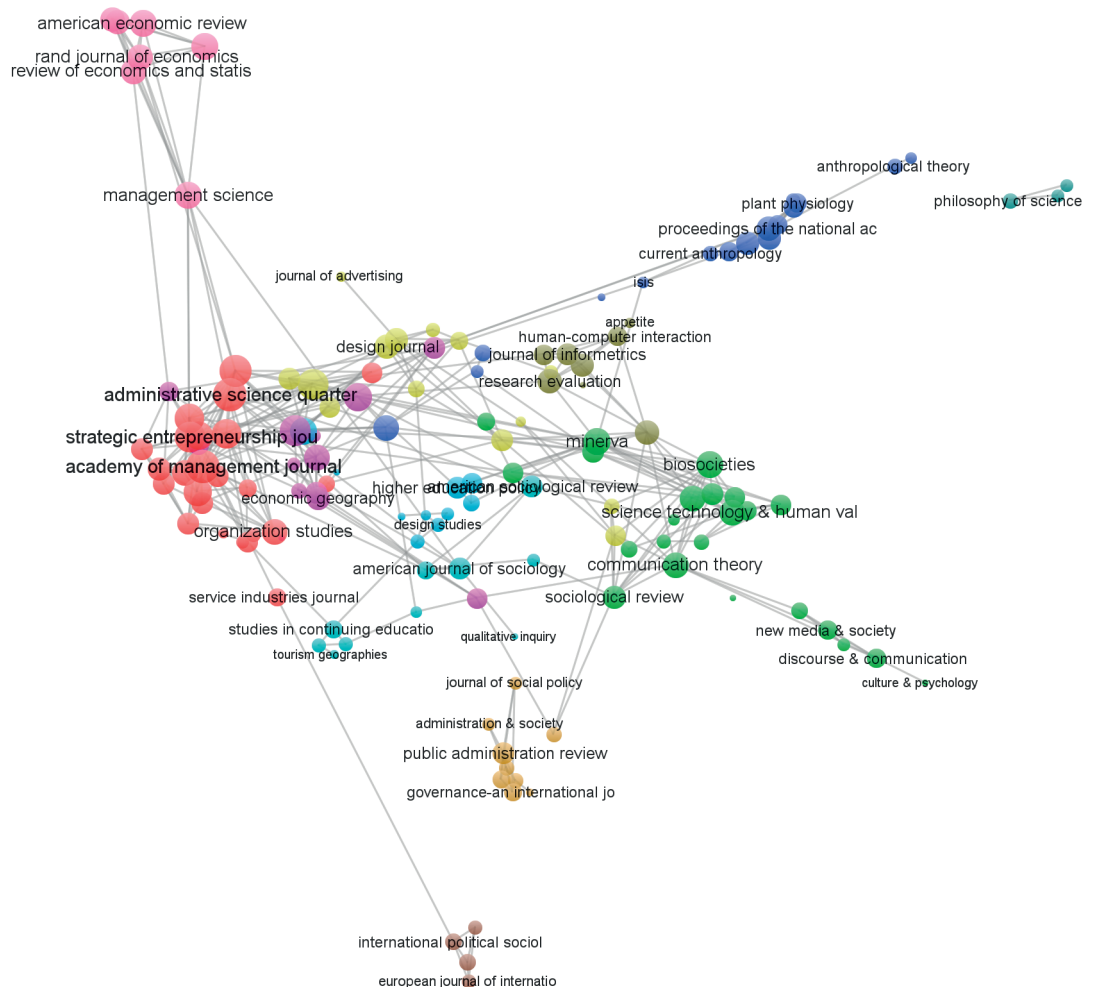
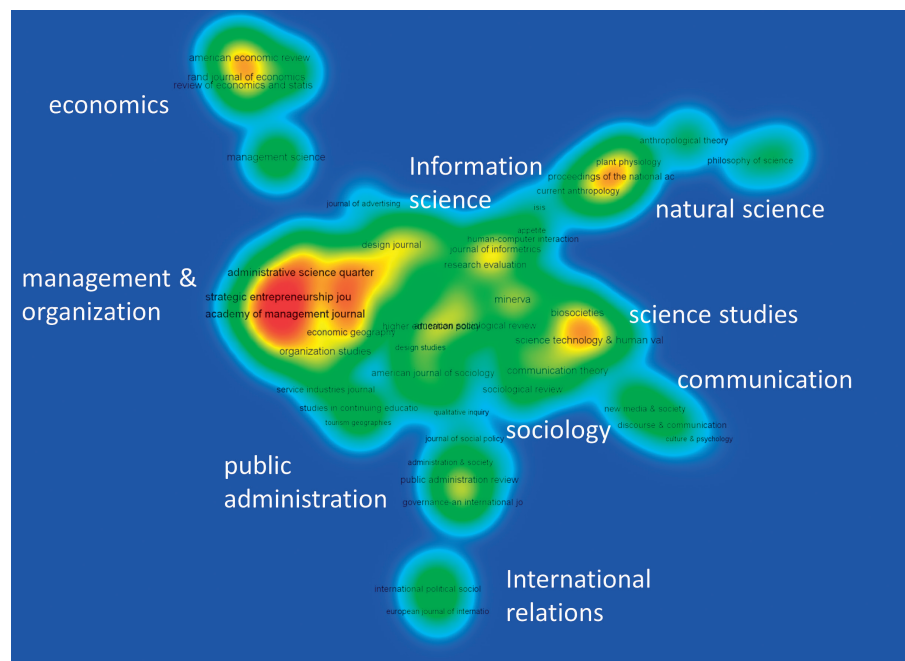


Figure 6.4 below shows a so-called “heat map” of the results. The colour code is from light blue, to green, to yellow to red, indicating increasing citing activity. It is obvious from the map that the large mainstream journals in established fields such as management and organization have dense citing activity between them. The map also demonstrates the thematic fields that the journals and clusters seem to cover, and it is clear that these fields vary considerably in scope and level, from “natural science” to “information science”. This is naturally due to dispersion in the reasons for nominating journals, i.e. some are nominated as “actual” publication outlets for Danish RI-researchers, and others as “inspirational journals”, which are read by Danish RI-researchers. This explains why large mainstream journals are nominated even though they rarely publish RI-research.

Figure 6.4. Citing relations of journals related to RI-research – density view



6.2.1. Identifying “core” RI-journals

An important empirical phenomenon in bibliometrics is the core-scatter phenomenon. A large proportion of articles on a topic tend to cluster in few core journals and the rest of the articles on the topic scatter among a large number of other journals. This is known as “Bradford’s Law of Scattering” and the phenomenon is extremely common across all fields of science. When mapping knowledge domains by use of cross-citation activity we are able to visually depict the core and scatter for a specific data set, in this case nominated journals, which may or may not publish RI-research. Core-journals, those assumed to contain a significantly larger proportion of the RI-research articles, will tend to move towards the centre of the map, usually creating an inner circle, whereas scatter journals are usually located on the fringes of the map, likewise in some kind of circle. Figure 5.5 roughly depicts the core set of journals.

on the well-known core-scatter phenomenon which in this case is very explicit (see section 6.2.1). Figure 7.1 below depicts where the clusters are located on the map and also tries to indicate what clusters are on the fringes of the core set; in this case “management and organization” (cluster 2), public administration (cluster 7), and the “communication” part of cluster 1. In these clusters we should expect that a considerable number of the Danish articles published in the assigned journals are on topics vaguely or not related to RI-research. Particularly cluster 1 is a “mixed-bag” of highly relevant journals, those located towards the centre of the map, and journals on the fringe, for example the “communication” part of the cluster. Indeed, cluster 1 is the most heterogenic of the clusters.

Table 7.1. Standard citation indicators calculated for Danish articles published in journals assigned to the included clusters (see appendix E) in the period 2005-2011. Indicators are based on CWTS’ CI-Web of Science database and comparable to the ones used in the Leiden Ranking (<http://www.leidenranking.com/>).

Publications (P)	% of total P	Mean Normalized Citation Score (MNCS)	Proportion of highly cited articles (PPtop10%)	Normalized proportion of highly cited articles (NPPtop10%)	Cluster no.	Subject areas***
170	23%	1.44	13.4%	1.34	1*	Science studies, sociology and communication
159	22%	2.07	24.7%	2.47	2**	Management and organization
87	12%	1.64	17.2%	1.72	3	Planning and development
56	8%	1.33	14.6%	1.46	5	Consumption, behaviour and management
35	5%	1.97	10.2%	1.02	6	Higher education
62	8%	1.28	12.4%	1.24	7**	Public administration
86	12%	1.62	18.9%	1.89	8	Information science
76	10%	1.32	15.3%	1.53	10	Research policy, technology and innovation
731						

* The cluster composition is mixed; there are highly relevant specific RI-journals but also journals which can be considered marginally relevant.

** Clusters on the fringe of the core; here we should expect that the majority of the Danish articles are not on RI-topics.

*** Subject areas are based on the journal subject categories in the Web of Science; notice individual researchers and particular clusters, as depicted in the cognitive map in Figure 6.2, may publish in different journals belonging to two or more subject areas. In the present analysis we have not identified the portfolio of journal articles linked to the different clusters in Figure 6.2 and subsequently mapped these articles to the subject areas outlined in the present table with indicators.

7.2 Interpreting results

Clusters 1 and 2 together constitute almost half of all publications in the period, i.e., 45% of the total. Given the composition of these clusters, described above, this is not surprising. We cannot infer that the bulk of Danish RI-research activity in international journals is within these two clusters since a considerable number of these articles no doubt are on other topics. The publication activities in the remaining clusters are more evenly distributed.

Two standard bibliometric indicators included in the Leiden Ranking are used: PP-top10% and MNCS. Both indicators are field normalized so that publications across fields with different publication and citation practices can be compared. Likewise, self-citations

are removed when calculating both indicators. PPTop10% is an indicator for a unit's proportion of highly cited articles, where highly cited in this case is the 90th percentile or above in the global citation distribution. MNCS is an indicator for the unit's mean normalized citation score.

The two indicators are most often correlated, but they are also complementary. Citation distributions are heavily skewed, as a small number of publications (10%) receive most of the citations (60%). Highly cited publications are therefore considered influential and the assumption is that a unit's proportion of publications at this level says something about the impact of this unit when it comes to influencing the scientific community.

Mean-based citation indicators have a natural reference value of 1 which corresponds to the average citation activity in the database. Thus, if a unit has an MNCS of 1.5 it means that the citing activity for the unit's articles in general is 50% higher than the average article in the database. Notice that due to the skewed distribution of citations, mean-based citation indicators are vulnerable when it comes to one or two very highly cited articles, i.e. they can influence the mean score considerably. It is therefore important to show both the MNCS and the PPTop10% indicators; the latter is more robust and it can indicate whether the MNCS is influenced by a few very highly cited articles.

Finally, like the reference value of 1 for the MNCS, the PPTop10% has a statistical expectation of 10 %, i.e. it is expected that the unit will have 10 % of its articles among the 10 % most cited in the database. While somewhat arbitrary, this threshold enables a calculation of the ratio of observed to expected articles among the most highly cited, indicated in Table 8.1 as NPPtop10%. The interpretation of NPPtop10% is similar to the MNCS: an NPPtop10% of 1.5 means that the unit has 50 % more than expected of its articles among the most highly cited.

In terms of general performance, all clusters can be considered to perform above the international standards in the database; however, performance in clusters 2 (management and organization), 3 (Planning and development), and 8 (Information science) is very good, in fact exceptional for cluster 2. Clusters 5 (Consumption, behaviour and management) and 10 (Research policy, technology and innovation) also have good performances according to the robust NPPtop10% indicator.

A considerably larger proportion than expected of Danish research articles in these clusters end up as highly cited, as indicated by the NPPtop10%. An important observation here is the discrepancy between the MNCS (1.97) and NPPtop10% (1.02) for cluster 6 (Higher education). Cluster 6 has high performance according to MNCS, but only an expected performance according to NPPtop10%. In this cluster there are two very highly cited articles (relative to their field) and their citation rates influence the calculation of the mean-based indicator considerably. However, these two articles seem to stand out in this cluster, since the NPPtop10% is only around the expected 10 %. This means that for the whole cluster "only" 10.2 % of the articles belong to the most highly cited articles in their respective domains, which is contrary to the other clusters where the observed number of highly cited articles is larger than expected, indicating a performance above average.

Table E2 in appendix E shows the publication activity among the nominated authors in the different clusters (only the most frequent nominated authors are shown). The purpose of examining this was to verify the field clusters and to examine the correspondence between nominations and the derived fields as well as to examine if Danish researchers are actually publishing within these areas from 2005 to 2011. The results are quite satisfying and indeed there seems to be good publication activity in all fields by the nominated authors. The latter is a confirmation of both the nominations and the actual clusters.

7.3 Key findings

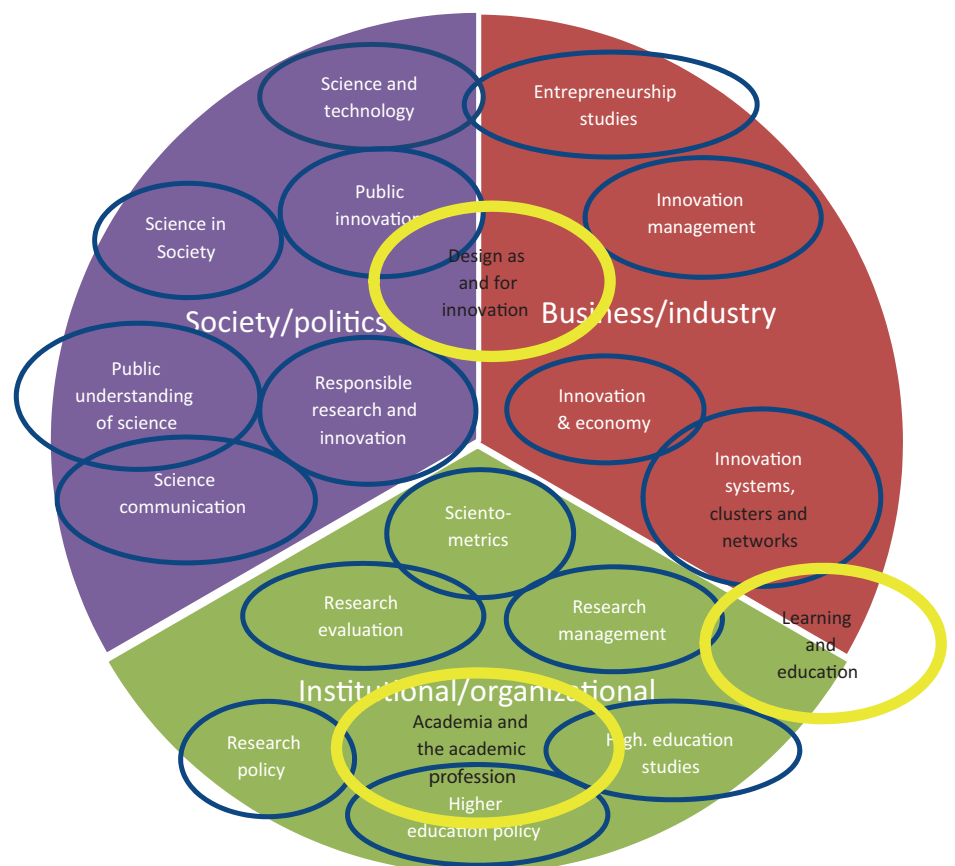
The impact analysis has demonstrated that Danish RI-research seems to be doing well in terms of publication activity and impact in the journals that Danish RI-researchers deem relevant to their field. More than expected Danish research articles end up as highly cited in the analysed journals, which indicates an above average impact of the RI-research field.

8. Key conclusions and points of discussion

In this report we have attempted to provide a comprehensive picture of the extent, scope and organization of Danish RI-research as well as the thematic orientations and cooperation patterns within the field. In the present section we will highlight key findings and discuss themes of relevance that these findings have shed light on.

8.1 Key findings

Looking at the results from the co-nomination process in relation to the initial working definition of RI-research, we see that the process has certainly helped enlighten the definition. We argue that we have covered all the subfields that were initially thought to be part of the RI-research network, but also that we have “discovered” a series of additional subfields, or at least refined the initially constructed ones. In Figure 9.1 below these refinements are visualized.



When looking at the characteristics of the field, it is clear that the initial conception of the RI-research area as a somewhat fragmented field holds true, but also that this is particularly so within the societal/organization/institutional branches. Both the co-nomination and cooperation analyses as well as the qualitative interviews indicate that the innovation field seems relatively cohesive – perhaps with the exceptions of the “niche” fields, such as cognitive cluster 6 (closely related to cooperation cluster 3).

This area of the RI-research field also appears to be the largest and is, in terms of organization, well consolidated, with formalized networks, well established cooperation patterns (albeit with potential cooperation opportunities across clusters) and with a strong international impact. This finding is supported by the impact analyses where it is seen that the clusters assumed to relate to innovation research (clusters 2,3 and 10 in chapter 7) have well above average performance, albeit with the reservation that cluster 2 is on the fringe of the field. This strong impact may be one of the explanations to the more consolidated nature of this part of the field, in that new researchers are naturally attracted to “hot” fields of research.

For other subfields in the RI-research field, the picture however looks somewhat different. The “green” and “red” areas of Figure 9.1 above, in general, seem to be smaller in size and more fragmented in organization and thematic orientation, with fewer formalized networks (particularly for the “green” area), more loose cooperation patterns, but with good impact and performance. In these research fields we see cognitive clusters both with strong centre individuals, but also more “centre-less” clusters which seem to be more disjointed than their counterparts in the innovation fields. Possible explanations to this cognitive fragmentation could be specialized research foci, i.e. that fewer individuals “cover” a research field which is thematically as broad, if not broader, than e.g. the innovation field, and structural conditions, e.g. more challenging funding opportunities.

In terms of cooperation patterns these sub-fields display a similar picture, with some clusters that seem relatively cohesive, but very distinct from other clusters (e.g. clusters 12 and 13), and some clusters which are closely intertwined but with limited “strength” and internal cohesion, e.g. clusters 2, 4 and 8. Possible explanations to this could be the lack of formalized networks or highly specialized research foci with a subsequent lack of cooperative relevance.

In general, across sub-fields, there seems to be potentials for improving the cooperation, except perhaps for the fields of entrepreneurship and public innovation, where there is a strong overlap between the cognitive pattern and the cooperation pattern, which indicates that researchers actually cooperate with the people that they find most relevant to their field.

However, in several areas we do not find this overlap, indicating that the potential cooperation opportunities are perhaps not being exploited. Examples of such a “lack” of overlap can be seen in cooperation cluster 1 and 6, which overlap with several cognitive clusters. This may be due to very specialized research foci within the cooperation clusters, but it may also be a sign of the under-exploitation of possible cooperation opportunities.

Another level of cooperation was also explored in the study, namely the level and nature of cooperation with policy level partners. The results indicate that regardless of subfield, this cooperation relation is underdeveloped. The interviews suggest that the relation to the policy development level is very weak, particularly in terms of the use of research based knowledge in the policy development process, but also in terms of dialogue with the policy level on field specific issues. Many different possible explanations to the weak nature of this relation is mentioned, e.g. the lacking Danish tradition for integrating science in policy development, the lack of formalized “feedback-mechanisms” between the research environments and the policy level, a more general, thematic, re-orientation in the research environment away from national policy issues to more international themes or biases among policy makers in the choice of “experts”.

A final focus area of the present study was the impact and performance of the RI-research field in Denmark. In general the findings suggest that the field as a whole performs well, in the sense that Danish articles in journals within the RI-research field have an above average impact and there seems to be good publication activity in all fields by the nominated authors. The impact and bibliometric analyses have however also contributed to the general picture of a very diverse field, which is difficult to delineate and capture via a priori definitions. The co-nomination survey however helped provide a more nuanced “universe” of journals, which constitute the basis of the bibliometric studies.

References

- Bloch, C., Sørensen, M. P., Graversen, E. K., Schneider, J. W., Schmidt, E. K., Aagaard, K., & Mejlgaard, N. (2014). Developing a methodology to assess the impact of research grant funding: A mixed methods approach. *Evaluation and program planning*, 43, 105-117.
- Busenitz, L. W., West, G. P., Shepherd, D., Nelson, T., Chandler, G. N., & Zacharakis, A. (2003). Entrepreneurship research in emergence: Past trends and future directions. *Journal of management*, 29(3), 285-308.
- Clausen, T., Fagerberg, J., & Gulbrandsen, M. (2012). Mobilizing for change: a study of research units in emerging scientific fields. *Research Policy*, 41(7), 1249-1261.
- Damvad (2013). Forskning om forskning og innovasjon. Kartlegging for Forskningsrådet. Available at: <http://www.forskningsradet.no/servlet/Satellite?blobcol=urldata&blobheader=application%2Fpdf&blobheadername1=Content-Disposition%3A&blobheadervalue1=+attachment%3B+filename%3DRapportDamvadForskningomFol2013%282%29.pdf&blobkey=id&blobtable=MungoBlobs&blobwhere=1274504176911&ssbinary=true>
- European Commission (2005). *Mobilising the brainpower of Europe: enabling universities to make their full contribution to the Lisbon Strategy*. COM 152, Brussels.
- Fagerberg, J., & Verspagen, B. (2009). Innovation studies—The emerging structure of a new scientific field. *Research policy*, 38(2), 218-233.
- Fagerberg, J., Fosaas, M., & Sapprasert, K. (2012). Innovation: Exploring the knowledge base. *Research policy*, 41(7), 1132-1153.
- Georghiou, L. (1996). The UK technology foresight programme. *Futures*, 28(4), 359-377.
- Giusti, W. L., & Georghiou, L. (1988). The use of co-nomination analysis in real-time evaluation of an R&D programme. *Scientometrics*, 14(3), 265-281.
- Lenk, P. (1983). Mappings of fields based on nominations. *Journal of the American Society for Information Science*, 34(2), 115-122.
- Martin, B. R. (2012). The evolution of science policy and innovation studies. *Research Policy*, 41(7), 1219-1239.
- Martin, B. R. (2012). The evolution of science policy and innovation studies. *Research Policy*, 41(7), 1219-1239.
- Martin, B. R., Nightingale, P., & Yegros-Yegros, A. (2012). Science and technology studies: Exploring the knowledge base. *Research Policy*, 41(7), 1182-1204.
- Nedeva, M., Georghiou, L., Loveridge, D., & Cameron, H. (1996). The use of co-nomination to identify expert participants for Technology Foresight. *R&D Management*, 26(2), 155-168.
- OECD (2002). *Frascati Manual 2002: Proposed Standard Practice for Surveys on Research and Experimental Development*. Paris: Organization for Economic Cooperation and Development.
- OECD (2005). *The measurement of scientific and technological activities. Proposed Guidelines for Collecting and Interpreting Technological Innovation Data. European Commission and Eurostat*. (Oslo Manual). Paris: Organization for Economic Cooperation and Development.
- OECD (2009). *Higher Education to 2030, Volume 2. Globalisation*, Paris: Organization for Economic Cooperation and Development.
- van Eck & Waltman (2009). VOSviewer Manual. Available at: http://www.vosviewer.com/documentation/Manual_VOSviewer_1.1.0.pdf

Appendices

Appendix A: Methodical considerations

As mentioned in the report, the method approach taken in the mapping exercise is to allow the network to define and delimit itself through the co-nomination process. This of course leaves a number of methodical concerns that we feel it is important to address.

First and foremost, the question of whether we have covered the field with this method seems worthy of discussion. With regard to representativeness, the response rate achieved, of approximately 60 percent, however, is deemed satisfactory and indeed surpasses the (satisfactory) response rates of other co-nomination exercises (e.g. Nedeva et al. (1996) report a response rate of 40 % as satisfactory). Combined with other indicators, e.g. the degree of redundancy in the nominations over time/distribution rounds, and the results from the qualitative interviews and bibliometric studies, we argue that this approach has demonstrated its potential in terms of mapping a diverse and fragmented field of research.

However, there are weaknesses of the co-nomination method, particularly related to the autonomy on the part of the respondents to decide the direction of the distribution.

By choosing an iterative method such as the co-nomination method, we are naturally limited by the number and composition of our respondents. The “sample” is in other words unknown, and we therefore have little knowledge of any potential skewedness in the data. We may potentially have covered one subfield almost completely, and another less well, which might generate false “hot spots” in either the cognitive or coordination network.

In the same way, the co-nomination method runs the risk of “digressing” excessively, thereby generating a skewed image of the RI-research field.

We see in the data (particularly in the keyword section) that we have encountered digressions and included individuals and environments, which would not under even a very broad a priori definition of RI-research fall within the scope of this mapping, e.g. researchers in certain areas of the natural sciences like biology, geology and some areas of health research. To avoid this happening to an excessive degree, an initial screening question was inserted in the survey, where the respondents were asked to indicate whether they saw themselves as part of the field. This opportunity was used by several, indicating that we have indeed reached the perimeter of the field, at least on some of its “sides”.

Another potential caveat that should be mentioned is the potential skewedness which might occur when some nominated individuals respond to the survey and others do not. This could potentially create false “hot spots” or at least leave some “hot spots” under-explored. If no individuals in a particular research area respond to the survey, this area may potentially not appear in the analysis, if they are also not mentioned by other adjacent research areas. Due to the relatively high response rate and the results from the other data collections, however, we are confident that the mapping presented in the report covers the field to a satisfactory degree.

Finally it should be noted that the authors of this report themselves are active researchers within the RI-research field. The advantage of the position within the field has clearly been a certain degree of initial knowledge of the national environments in RI-research and an understanding of key entry points to the field. Specifically, this has been helpful in conducting the desk research, developing a working definition of RI-research, and in nominating researchers for the first wave of the co-nomination procedure. However, the authors also belong more narrowly to a particular sub-field, one, indeed, which is characterized by modest cooperation with other national environments. Had this study been based on an a priori definition of the RI-research field, there would have been significant risk that the authors’ preconceptions and specific location on the map would have potentially created bias or blind spots in the mapping exercise. The methodology applied here is however tailored also to mitigate this potential problem. By letting the field practitioners, through iterative nomination processes, define the field themselves, the effect of the authors particular views and understandings is adequately reduced.

Appendix B: Department head survey and distribution list

Department head survey

Distribution list for department head survey

Department (Danish name)	University
SFI	
Institut for Statskundskab	AU
Økonomi	AU
AU Herning	AU
Marketing og Organisation	AU
Institut for Æstetik og Kultur	AU
Institut for Fysik og Astronomi	AU
DPU	AU
Institut for Kultur og Samfund	AU
Institut for Psykologi	AU
Department of Innovation and Organizational Economics (INO)	CBS
Department of International Business Communication (IBC)	CBS
Department of International Economics and Management (INT)	CBS
Department of IT Management (ITM)	CBS
Department of Management, Politics and Philosophy (MPP)	CBS
Department of Strategic Management and Globalization (SMG)	CBS
Institut for Organisation (IOA)	CBS
Økonomisk Institut (ECON)	CBS
Department of Finance (FI)	CBS
Institut for Regnskab og Revision (RR)	CBS
Juridisk Institut (JUR)	CBS
Designskolen i Kolding	Designskolen i Kolding
Kunstakademiets designskole	Det Kongelige Danske Kunstakademis Skoler for Arkitektur, Design og Konservering
DIIS	DIIS
Institut for Systemer, Produktion og Ledelse	DTU
ITU	ITU
Økonomisk Institut	KU
Institut for Antropologi	KU
Institut for Medier, Erkendelse og Formidling	KU
Institut for Fødevarer- og Ressourceøkonomi	KU
Institut for Statskundskab	KU
Institut for Naturfagernes Didaktik	KU
Institut for Plante- og Miljøvidenskab	KU
Sociologisk Institut	KU
Marketing og Management	SDU
Statskundskab (konstitueret)	SDU
Entreprenørskab og Relationsledelse	SDU
Grænseregionsforskning	SDU
Miljø- og Erhvervsøkonomi	SDU
Virksomhedsledelse og Økonomi	SDU
Jura	SDU
Institut for Kulturvidenskaber	SDU
Institut for Kommunikation	AAU
Institut for Økonomi og Ledelse	AAU
Institut for Elektroniske systemer	AAU
Institut for Kultur og Globale Studier	AAU
Juridisk Institut	AAU

Kortlægning af dansk forskning i forskning og innovation

Forskning i forskning og innovation (FoI-forskning) defineres som forskning i produktion, implementering, forbrug og anvendelse af viden, som skaber forbedringer i både virksomheder, samfund og policies.

Herunder tænkes der bl.a. (men ikke udelukkende) på forskning indenfor områder som: Innovation systems, Innovation management, Entrepreneurship studies, Effects of R&D and innovation, Networks and clusters, Forms of innovation, Higher education studies og Higher education policy, Research policy og Research management, Research evaluation og Scientometrics, Public innovation, Public understanding of science, Science communication, Science and Technology Studies, Science in Society, Responsible Research and Innovation etc.

Har instituttet udført forskning i forskning og innovation (FoI-forskning) indenfor de seneste 3 år?

- Ja
 Nej

1. Angiv skønsmæssigt hvor mange personer og årsværk (VIP) på instituttet, der var beskæftiget med FoI-forskning i 2013, fordelt på følgende stillingskategorier:

	Antal personer beskæftiget med FoI-forskning pr. 31/12-2013: Angiv antal personer i heltal	Antal årsværk anvendt på FoI-forskning i 2013: Angiv antal årsværk med max. 2 decimaler
Professorer	_____	_____
Lektorer/Seniorforskere	_____	_____
Adjunkter/Postdocs	_____	_____
Ph.d.- og kandidatstipendiater	_____	_____
Øvrige forskere og scholarships	_____	_____

2. Angiv skønsmæssigt procentfordelingen på forskningsart af instituttets samlede antal VIP-årsværk, der blev anvendt til FoI-forskning i 2013:

Forskningsart:

Grundforskning	_____ %
Anvendt forskning	_____ %
Udviklingsarbejde	_____ %
I alt - Summen af procenttallene skal være 100	100 %

Grundforskning er eksperimenterende eller teoretisk arbejde med det primære formål at opnå ny viden og forståelse uden nogen bestemt anvendelse i sigte.

Anvendt forskning er eksperimenterende eller teoretisk arbejde med det formål at opnå ny viden og forståelse. Arbejdet er dog primært rettet mod bestemte anvendelsesområder.

Udviklingsarbejde er systematisk arbejde baseret på anvendelse af viden opnået gennem forskning og/eller praktisk erfaring med det formål at frembringe nye eller væsentligt forbedrede materialer, produkter, processer, systemer eller tjenesteydelser.

3. Angiv skønsmæssigt hvor stor en procentandel af instituttets FoI-forskning i 2013, der blev finansieret af eksterne kilder:

Procentandel af instituttets/afdelingens FoI-forskning i 2013 finansieret af eksterne kilder: _____ %

4. Hvilke eksterne kilder har finansieret instituttets FoI-forskning i 2013? (inkl. tilskud/støtte og indtægtsdækket virksomhed/kontraktforskning)

Eksterne statslige fonde og forskningsråd:

- Danmarks Grundforskningsfond
 Det Frie Forskningsråd
 Det Strategiske Forskningsråd
 Andre eksterne statslige fonde, angiv venligst hvilke: _____

Ministerier og styrelser (ikke statslige forskningsråd)

Andre danske offentlige kilder:

- Regioner og kommuner
 Andre danske offentlige kilder, angiv venligst hvilke: _____

Danske private kilder f.eks. fonde, angiv venligst hvilke: _____

EU

Øvrige udenlandske kilder

5. Hvordan vurderer du instituttets forskning inden for FoI-feltet (fx i forhold til styrkepositioner, samarbejdsrelationer, tematiske prioriteringer) – og vurderer du, at der er særlige udfordringer for instituttets FoI-forskning?

Hvis du har kommentarer til undersøgelsen generelt eller til konkrete spørgsmål i spørgeskemaet, er du meget velkommen til at skrive dem her:

Besvarelsen er afsluttet.

Mange tak for hjælpen!

Appendix C: Co-nomination survey

Co-nomination survey

2/6/2014

SurveyXact

Kortlægning af dansk forskning i forskning og innovation

Forskning i forskning og innovation (FoI-forskning) defineres som forskning i produktion, implementering, forbrug og anvendelse af viden, som skaber forbedringer i både virksomheder, samfund og policies.

Herunder tænkes der bl.a. (men ikke udelukkende) på forskning indenfor områder som: Innovation systems, Innovation management, Entrepreneurship studies, Effects of R&D and innovation, Networks and clusters, Forms of innovation, Higher education studies og Higher education policy, Research policy og Research management, Research evaluation og Scientometrics, Public innovation, Public understanding of science, Science communication, Science and Technology Studies, Science in Society, Responsible Research and innovation etc.

Jeg anser mig selv for en del af FoI-forskningsfeltet, som det er defineret ovenfor

- Ja
 Nej

1. Angiv venligst op til 10 forskere i Danmark, hvis arbejde du anser som særligt væsentligt og relevant for din FoI-forsknings gruppe):

	Navn	Evt
Forsker 1:	_____	_____
Forsker 2:	_____	_____
Forsker 3:	_____	_____
Forsker 4:	_____	_____
Forsker 5:	_____	_____
Forsker 6:	_____	_____
Forsker 7:	_____	_____
Forsker 8:	_____	_____
Forsker 9:	_____	_____
Forsker 10:	_____	_____

2. Angiv venligst op til 10 forskere i Danmark, som du har direkte samarbejde med i din FoI-forskning inkl. forskere fra dit samme som i ovenstående spørgsmål):

	Navn	Evt
Forsker 1:	_____	_____
Forsker 2:	_____	_____
Forsker 3:	_____	_____
Forsker 4:	_____	_____
Forsker 5:	_____	_____
Forsker 6:	_____	_____
Forsker 7:	_____	_____
Forsker 8:	_____	_____
Forsker 9:	_____	_____
Forsker 10:	_____	_____

3. Angiv venligst op til 10 forskere eller forskningsmiljøer i udlandet, som du anser som særligt væsentlige og relevante fo

	Navn
Forsker/forskningsmiljø 1:	_____
Forsker/forskningsmiljø 2:	_____
Forsker/forskningsmiljø 3:	_____
Forsker/forskningsmiljø 4:	_____
Forsker/forskningsmiljø 5:	_____
Forsker/forskningsmiljø 6:	_____

<https://www.survey-xact.dk/ser/vet/com.pls.morpheus.web.pages.CoreSurveyPrintDialog?surveyid=450004&ocale=da&printing=true&enableAdvanced=false> 1/2

7:

Forsker/forskningsmiljø

8:

Forsker/forskningsmiljø

9:

Forsker/forskningsmiljø

10:

4. Angiv venligst op til 10 forskere eller forskningsmiljøer i udlandet, som du har direkte samarbejde med i forbindelse med

Navn

Forsker/forskningsmiljø

1:

Forsker/forskningsmiljø

2:

Forsker/forskningsmiljø

3:

Forsker/forskningsmiljø

4:

Forsker/forskningsmiljø

5:

Forsker/forskningsmiljø

6:

Forsker/forskningsmiljø

7:

Forsker/forskningsmiljø

8:

Forsker/forskningsmiljø

9:

Forsker/forskningsmiljø

10:

5. Angiv venligst op til 10 tidsskrifter (i prioriteret rækkefølge), som du mener er særligt vigtige/anerkendte inden for dit

Tidsskrift

1:

Tidsskrift

2:

Tidsskrift

3:

Tidsskrift

4:

Tidsskrift

5:

Tidsskrift

6:

Tidsskrift

7:

Tidsskrift

8:

Tidsskrift

9:

Tidsskrift

10:

6. Angiv venligst op til 20 emneord eller ordstreng (på engelsk), som du mener dækker din mest gennemgående forskningsinteresse inden for FoI-forskning:

Hvis du har kommentarer til undersøgelsen generelt eller til konkrete spørgsmål i spørgeskemaet, er du meget velkommen til at skrive dem her:

Tak for besvarelsen!

Appendix D: Interview guide

Interview guide (Danish)

Interviewguide – Kortlægning af forskning i forskning

Introduktion af undersøgelsen og formål med interview

Uddybe og nuancere forståelsen af de tematiske styrke-positioner i dansk Fol-forskning, samarbejdsrelationer og betingelser for Fol-forskning

Tematiske orienteringer

- Hvad forskes der primært i inden for dit miljø/det miljø du ser dig selv som en del af?
- Kan du sige lidt om udviklingen inden for den tematiske fokusering – har din/jeres forskning taget en bestemt retning – og i så fald hvorfor?
- Hvordan prioriterer du/I mellem forskellige temaer inden for dit felt – er der temaer I vægter særlig højt/særlig lavt?
- Er der efter din vurdering særlige temaer som den danske Fol-forskning er særligt fokuseret på/hvor de danske miljøer har en særlig position?

Samarbejder

- Kan du sige lidt om hvilke andre danske miljøer som du/I primært samarbejder med?
- Hvordan er samarbejdet kommet i stand?
- Hvilke internationale miljøer samarbejder du/I med?
- Hvordan er det samarbejde kommet i stand?
- Efter din vurdering, hvor stor er udbredelsen af Fol-forskning i Danmark – set i forhold til det internationale perspektiv?
- Hvordan vil du vurdere samarbejdet/vidensudvekslingen med eksterne parter og policy-makers på området?
- Kan man pege på steder hvor samarbejdet kan forbedres?

Strukturelle betingelser

- Hvilke finansieringskilder anser du som værende relevante for Fol-forskning?
– Hvordan vurderer du finansieringsmulighederne for denne type forskning?
– Er der særlige udfordringer eller barrierer?
- Forfølger du en særlig finansieringsstrategi?
– Hvorfor ikke/Hvilke kriterier ligger til grund for en sådan strategi?
- Efter din vurdering, hvilke strukturelle betingelser anses for at være særligt betydningsfulde for dit eget forskningsfelt/Fol-forskningen generelt?

Appendix E: Clustered journals and Danish publications

Table E1. Selected clusters and nominated journals assigned to them.

Cluster	
1	Sociologia Ruralis; Journal Of Rural Studies; New Media & Society; Discourse & Communication; Science Communi- cation; Public Understanding Of Science; Social Studies Of Science; Configurations; American Journal Of Sociology; American Sociological Review; Science Technology & Human Values; Social Science & Medicine; Biosocieties; Science As Culture; Journalism Studies; Economy And Society; Communication Theory; Information Communication & Soci- ety; Minerva; British Journal Of Sociology; Sociological Review; Culture & Psychology; Information And Organization; Science And Public Policy; Gender & Society; Qualitative Inquiry; International Journal Of Medical Informatics;
2	Academy Of Management Journal; Administrative Science Quarterly; Strategic Management Journal; Strategic Entre- preneurship Journal; Organization Science; Journal Of Business Venturing; Journal Of Small Business Management; Small Business Economics; Entrepreneurship And Regional Development; Industrial And Corporate Change; Academy Of Management Review; Entrepreneurship Theory And Practice; Journal Of Management; Management Learning; Organization; International Small Business Journal; Technology And Culture; Accounting Organizations And Society; Journal Of International Business Studies; Service Industries Journal; Human Relations; Journal Of Management Stud- ies; Organization Studies; Academy Of Management Learning & Education; Supply Chain Management-An Interna- tional Journal; International Journal Of Human Resource Management;
3	Economic Geography; Journal Of Economic Geography; Regional Studies; Industry And Innovation; Annals Of Tourism Research; Studies In Continuing Education; Tourism Management; Journal Of Evolutionary Economics; Progress In Human Geography; European Planning Studies; Journal Of Regional Science; Tourism Geographies; Cambridge Jour- nal Of Economics; Journal Of Consumer Culture; European Urban And Regional Studies;
5	Theory Culture & Society; Body & Society; Journal Of Product Innovation Management; Design Journal; R & D Management; International Journal Of Design; Journal Of Marketing; Journal Of Consumer Research; Acm Transac- tions On Computer-Human Interaction; Consumption Markets & Culture; Marketing Theory; Journal Of Consumer Behaviour; Journal Of Advertising;
6	Higher Education; Journal Of Higher Education; Higher Education Policy; Studies In Higher Education; Design Studies; Creativity And Innovation Management; Codesign-International Journal Of Cocreation In Design And The Arts; Inter- national Journal Of Engineering Education; Journal Of Engineering Education; Creativity Research Journal;
7	Governance-An International Journal Of Policy Administration And Institutions; Journal Of Public Administration Research And Theory; Public Administration Review; Administration & Society; Public Administration; Public Manage- ment Review; Environment And Planning D-Society & Space; Journal Of Social Policy; Planning Theory;
8	Journal Of The American Society For Information Science And Technology; Journal Of Informetrics; Appetite; Human- Computer Interaction; Scientometrics; Research Evaluation; Computer Supported Cooperative Work-The Journal Of Collaborative Computing; Evaluation And Program Planning;
10	Research Policy; Technological Forecasting And Social Change; Technology Analysis & Strategic Management; Fu- tures; Technovation; European Journal Of Information Systems; Journal Of Consciousness Studies;

Table E2. Number of Danish articles by nominated authors in the different clusters; the threshold is minimum two articles.

Cluster 1	No. pub.	Cluster 2	No. pub.	Cluster 3	No. pub.
A. Blok	6	N.J. Foss	15	A. Lorentzen	4
L. Koch	4	T. Pedersen	7	T. Knudsen	3
C.B. Jensen	4	D. Hjorth	6	A.M. Hjalager	3
M.N. Svendsen	4	L. Fuglsang	4	T. Reichstein	3
S. Brinkmann	4	J. Mouritsen	4	K.V. Andersen	3
M. Horst	4	T. Knudsen	3	J.H. Christensen	3
S. Ponte	4	K. Laursen	3	H.K. Hansen	3
J. Lassen	3	J. Sundbo	3	L. Winther	3
K. Christensen	3	D. Karreman	3	N.J. Foss	2
K.H. Nielsen	3	B.A. Lundvall	2	K. Laursen	2
P. Sandøe	3	L.B. Jeppesen	2	S. Askegaard	2
C. Borch	2	F. Sørensen	2	P. Maskell	2
C. Bossen	2	E. Boxenbaum	2	C. Ren	2
M. Hertzum	2	M. Kornberger	2		
S. Borrás	2	S. Korsgaard	2		
J. Hansen	2	B. Moeran	2		
A. Jamison	2	B. Petersen	2		
N. Mejlgaard	2	C. Schneider	2		
C. Nohr	2				
J. Sommerlund	2				
L. Tanggaard	2				

Cluster 5	No. pub.	Cluster 6	No. pub.	Cluster 7	No. pub.
S. Askegaard	3	A. Kolmos	4	E. Sørensen	3
J. Kjeldskov	3	B. T. Christensen	3	C. Greve	3
K. Hornbæk	3	F. Hansson	2	P.B. Mortensen	3
D. Kjeldgaard	3	F. Gertsen	2	J. Torfing	3
T. Markussen	2	M. Mønsted	2	M.B. Hansen	2
C.J. Varnes	2				

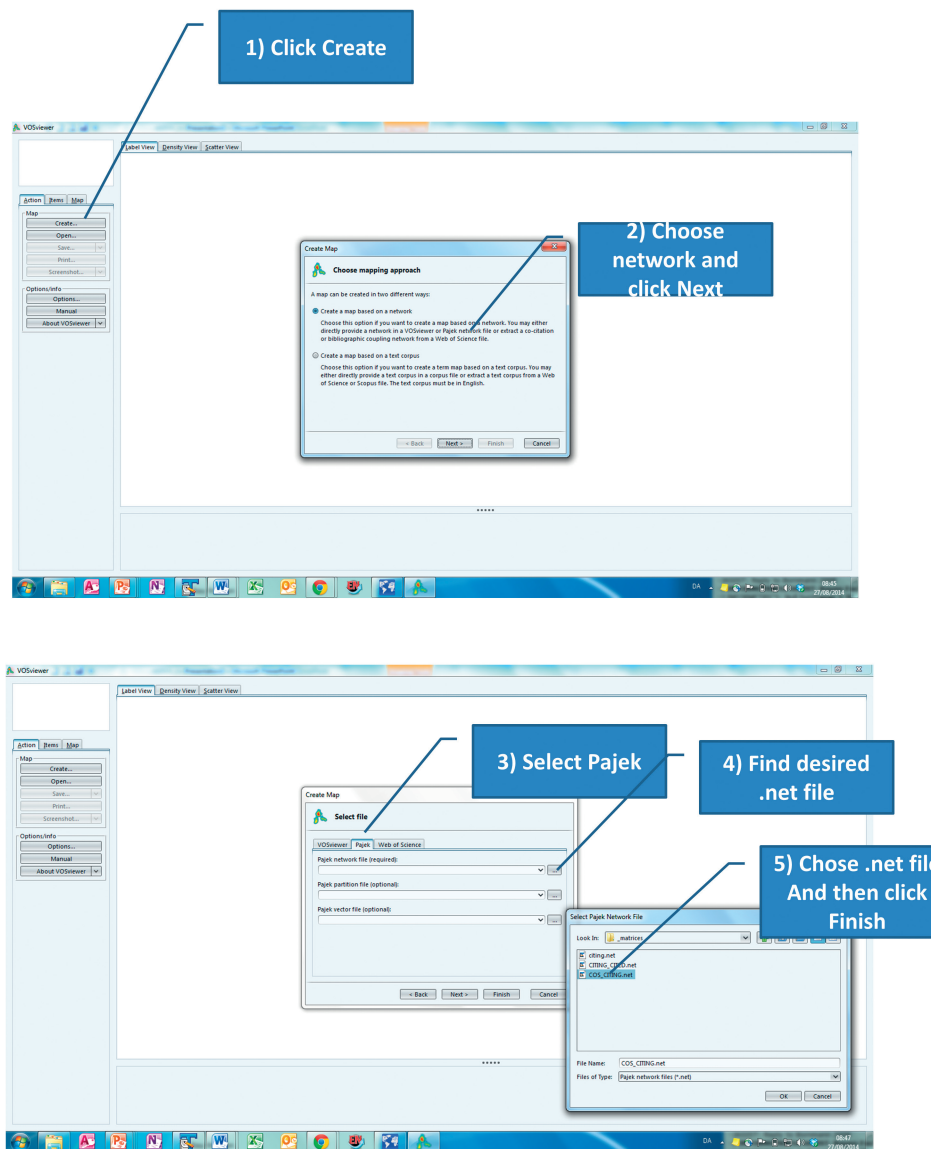
Cluster 8	No. pub.	Cluster 10	No. pub.
J.W. Schneider	4	U. Jørgensen	4
P. Bjørn	3	I. Drejer	3
L. Holm	3	K. Laursen	2
B. Larsen	3	B.A. Lundvall	2
J. Lassen	2	J. Sundbo	2
C. Bossen	2	F. Sørensen	2
P. Borlund	2		
A. Nielsen	2		
A. Olsen	2		

Appendix F: Introduction to Vosviewer

To obtain the full functionality of the visualizations of this report, the program Vosviewer can be used. All files needed to construct the maps are provided on the USB which accompanied the report.

Manual for starting the program:

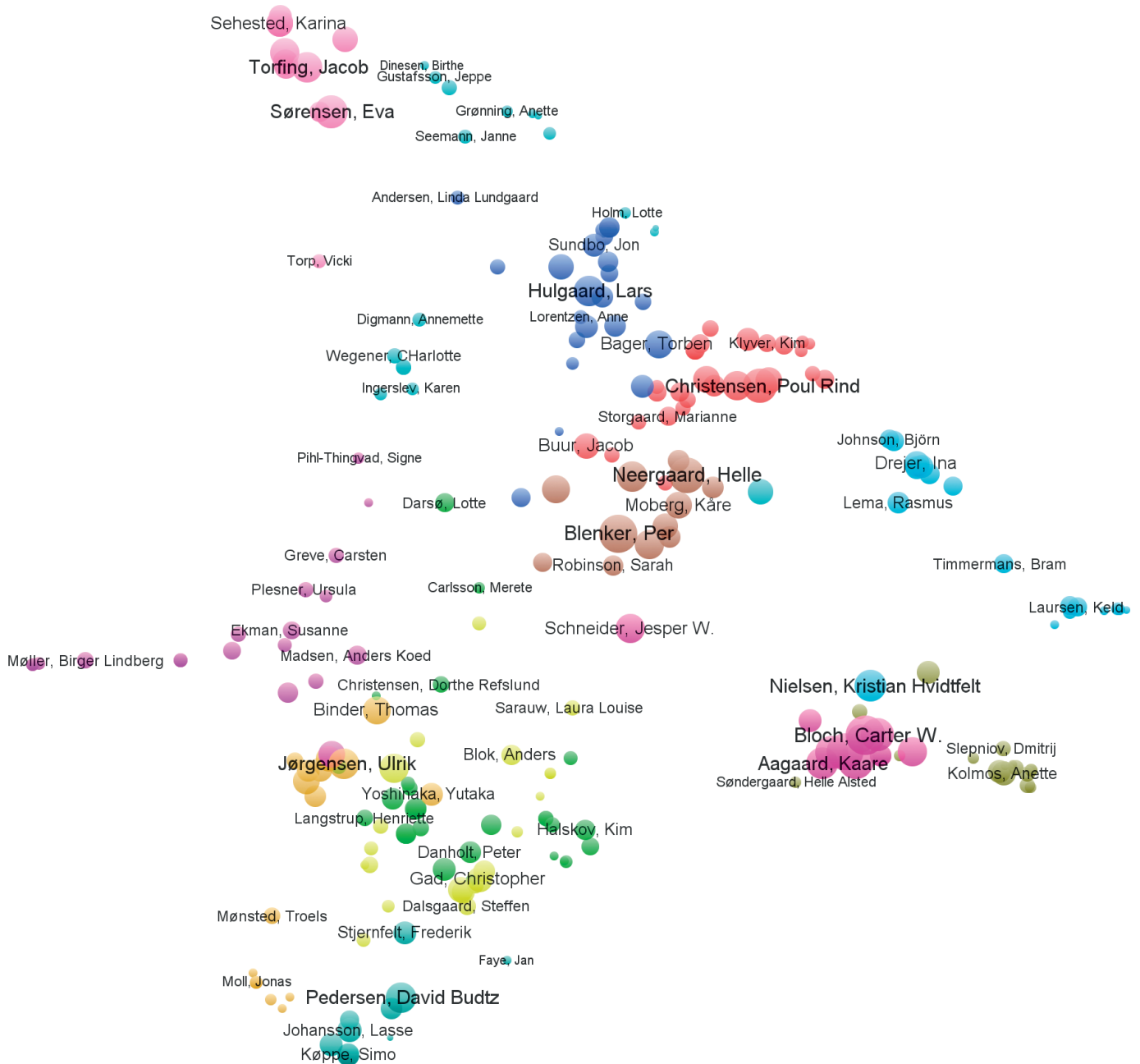
- Go to: <http://www.vosviewer.com/>
- Press LAUNCH – the program runs online
- vosviewer.jnlp is downloaded automatically
- Press – RUN
- The program opens



- Full functionality should now be available (e.g. zoom, selection of individual clusters etc.)

Appendix G: Additional figures and tables

Figure G1: Cooperation network clusters, "individual researcher" labels



Publications

Publications in the series of Research and Innovation: Analysis and Evaluation 2010-2014

2015

- 2/2015** Mapping Danish Research on research and innovation
- 1/2015** Internationalisering af virksomhedernes forskning og udvikling

2014 (Incl. forthcoming publications)

- 21/2014** Kommercialisering af forskningsresultater – Statistik 2013 (Public Research Commercialisation Survey – Denmark 2013)
- 20/2014** Erhvervslivets forskning, udvikling og innovation i 2014
- 19/2014** Evaluering af Vidensamarbejde, Kommercialisering og Teknologioverførsel
- 18/2014** Bibliometric analysis of the scholarly and scientific output from researchers funded by the Danish Council for Independent Research in 2005 to 2008
- 17/2014** Evaluering af Det Frie Forskningsråd
- 16/2014** Kortlægning af droneresforskning
- 15/2014** Kortlægning af kystturismeforskning
- 14/2014** Kortlægning af fiskeriforskning
- 13/2014** Udgået
- 12/2014** Kortlægning af polarforskning
- 11/2014** Analyses of the Danish R&D system – a compendium of excellent econometric impact analyses
- 10/2014** International Perspectives on Framework Conditions for Research and Technology Transfer
- 9/2014** Performanceregnskab for Innovationsnetværk Danmark 2014
- 8/2014** Performanceregnskab for GTS-net 2014
- 7/2014** Performanceregnskab for Innovationsmiljøerne 2014
- 6/2014** Danmarks Innovationsfond - Målgruppeanalyse
- 5/2014** Research and Innovation Indicator
- 4/2014** Tal om forskning 2013
- 3/2014** Sammenhæng for vækst og innovation – En kortlægning af sammenhænge i det danske innovations- og erhvervsfremmesystem
- 2/2014** The Short-run Impact on total Factor Productivity Growth of the Danish Innovation and Research Support System
- 1/2014** Productivity Impacts of Business Investments in R&D in the Nordic Countries - A microeconomic analysis

2013

17/2013	Evaluation of the Danish National Research Foundation
16/2013	Bibliometric Analyses of Publications from Centres of Excellence funded by the Danish National Research Foundation
15/2013	Forskningsbarometer 2013
14/2013	Samfundsøkonomiske effekter af Innovationsstrategien
13/2013	Analyses of Danish Innovation Programmes – a compendium of excellent econometric impact analyses
12/2013	An evaluation of the Danish Innovation Assistant Programme
11/2013	The Effect of the Industrial PhD Programme on Employment and Income
10/2013	Strategi for samarbejde om Danmarks klynge-og netværkindsats
9/2013	De skjulte helte – eksportsucceser i dansk industris mellemklasse
8/2013	An Analysis of the Level of Consistency in the Danish Innovation Ecosystem
7/2013	Key Success Factors for Support Services for Cluster Organisations
6/2013	Performanceregnskab for GTS-net 2013
5/2013	Kommercialisering af forskningsresultater – Statistik 2012 (Public Research Commercialisation Survey – Denmark 2012)
4/2013	Performanceregnskab for Innovationsnetværk Danmark 2013
3/2013	Tal om Forskning 2012
2/2013	Erhvervslivets forskning, udvikling og innovation i 2013
1/2013	Performanceregnskab for innovationsmiljøerne 2013

2012

13/2012	Evaluering af GTS-instituttet DFM
12/2012	Evaluering af GTS-instituttet Alexandra
11/2012	Evaluering af GTS-instituttet Agrotech
10/2012	Let's make a perfect cluster policy and cluster programme: Smart recommendations for policy makers
9/2012	The Perfect Cluster Programme - Nordic-German-Polish-Baltic project
8/2012	The impacts of Danish and Bavarian Cluster Services – results from the Nordic-German-Polish Cluster Excellence Benchmarking
7/2012	Kommercialisering af forskningsresultater – Statistik 2011 (Public Research Commercialisation Survey – Denmark 2011)
6/2012	Performanceregnskab for GTS-net 2012
5/2012	Performanceregnskab for Innovationsmiljøer 2012
4/2012	Innovation Network Denmark – Performance Accounts 2012
3/2012	Clusters are Individuals II: New Findings from the European Cluster Management and Cluster Program Benchmarking
2/2012	Erhvervslivets forskning, udvikling og innovation i 2012
1/2012	Evaluering af innovationsmiljøerne

2011

- 20/2011** Access to Research and Technical Information in Denmark
19/2011 Universiteternes Iværksætterbarometer 2011
18/2011 Impact Study: The Innovation Network Programme
- 17/2011** Clusters are Individuals: Nordic-German-Polish Cluster Excellence Benchmarking
16/2011 24 ways to cluster excellence – successful case stories from clusters in Germany, Poland and the Nordic countries
15/2011 Impact Study of Eureka Projects
14/2011 Evaluering af GTS-instituttet Teknologisk Institut
13/2011 Evaluering af GTS-instituttet DBI
12/2011 Evaluering af GTS-instituttet DELTA
11/2011 Kommercialisering af forskningsresultater – Statistik 2010 (Public Research Commercialisation Survey – Denmark 2010)
10/2011 Performanceregnskab for Videnskabsministeriets GTS-net 2011
9/2011 Performanceregnskab for Videnskabsministeriets Innovations-miljøer 2011
8/2011 Innovation Network Denmark – Performance Accounts 2011
7/2011 Erhvervslivets Outsourcing af FoU
6/2011 Evaluering af GTS-instituttet FORCE Technology
5/2011 Evaluering af GTS-instituttet Bioneer
4/2011 Evaluering af GTS-instituttet DHI
3/2011 Erhvervslivets forskning, udvikling og innovation i 2011
2/2011 Økonomiske effekter af erhvervslivets forsknings-samarbejde med offentlige videninstitutioner
1/2011 Analysis of Danish innovation policy - The Industrial PhD Programme and the Innovation Consortium Scheme

2010

- 12/2010** Brugerundersøgelse af GTS-institutterne 2010
11/2010 Universiteternes Iværksætterbarometer 2010
10/2010 Performanceregnskab for Videnskabsministeriets Innovationsmiljøer 2010
9/2010 Performanceregnskab for Videnskabsministeriets Innovationsmiljøer 2010
8/2010 Innovationsnetværk Danmark - Performanceregnskab 2010
7/2010 Performanceregnskab for Videnskabsministeriets GTS-net 2010
6/2010 Kommercialisering af forskningsresultater - Statistik 2009
5/2010 InnovationDanmark 2009- resultater og evalueringsstrategi
4/2010 Effektmåling af videnpilotordningens betydning for små og mellem store virksomheder
3/2010 An Analysis of Firm Growth Effects of the Danish Innovation Consortium Scheme
2/2010 Erhvervslivets forskning, udvikling og innovation i Danmark 2010
1/2010 Produktivitetseffekter af erhvervslivets 2012