SPRU History Project

A SPRU history based on bibliometric analysis of the studies of SPRU PhD students

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Executive summary

The SPRU history project explores the work done in SPRU during its first 50 years, through oral history interviews, archival analysis, and bibliometric analysis of research undertaken by SPRU staff and PhD students. This report summarises findings from the study of the collected PhD theses supervised by SPRU staff. SPRU has long had a relatively large doctoral student body, and doctoral students have played a crucial role in the intellectual renewal (and ultimately the staffing) of SPRU. It is therefore fitting that in SPRU's anniversary year this contribution is documented. This study resulted in the generation of a dataset of SPRU PhD theses, containing details of 350 doctoral theses completed in SPRU between 1971 and 2014. The dataset is considered as comprehensive, based on the records available.[1] Although for most of SPRU's history a DPhil rather than a PhD has been awarded to successful Sussex doctoral candidates, we use the term PhD in this report to refer to DPhils, in keeping with current practice, and because this is a more widely recognised term.

The analysis in this report focuses on the numbers of PhD theses completed per year, the links between staff revealed through co-supervision, and information about the countries studied by SPRU students, as well as the sectors studied and trends in the focal topics.

The first SPRU PhD was completed in 1971. There have been peaks and troughs in the number of PhD completions over the years, with the highest peak in 1996 (nineteen completions). Completion numbers seem to follow SPRU staff numbers with a four to six-year delay.

Most of the theses (62%) have been supervised through the single supervisor model, although since 2008, 75% of the students had two supervisors (and very occasionally more). By the end of 2014, 78 SPRU staff had supervised 350 PhD students through to completion. Of the supervisors, 20 have themselves completed their PhD at SPRU. About half of the supervisors have only supervised one or two students to completion, while a third supervised five students or more. Supervisors with the most student completions include Professor Von Tunzelmann with 49 students, Professors Bell and Pavitt with more than 30 students, and Professors Martin and Steinmueller with more than 20. These high completion numbers

[1] The dataset includes the last name and first name (or initials) of the PhD students who graduated from SPRU, the year of completion, the title and abstract of the thesis, and the supervisors. The data are complete for all 350 PhD students identified to have completed their theses before the end of 2014.

reflect both the long service in SPRU of these individuals and their dedication to doctoral supervision. Von Tunzelmann has also been co-supervising students with a high number of colleagues (thirteen colleagues). Pavitt and Bell have co-supervised within SPRU with eleven different colleagues each, Steinmueller with nine colleagues, and MacKerron, Martin and Clark (NG) with seven each.

The countries studied by SPRU PhD students cover much of the globe, although many African countries and central Asian countries have yet to be studied by SPRU students. Overall 296 out of 350 theses mention one or more countries of focus. In the majority of cases only one country is studied, and only ten studied four countries or more. The UK is the country the most studied by far (around 100 theses), but European and South American countries, as well as South Korea and Japan have also been a large focus of attention for PhD research. After the UK, the second most studied country is Brazil (studied in 26 dissertations), followed by Germany (studied in 20). Six countries were studied by SPRU doctoral students between ten and nineteen times – these were Mexico, the US, France, Italy, Japan and Korea. The countries studied most consistently over the years include Brazil, the US, Mexico, the UK, Germany, France, Portugal, India, Japan, Korea and Thailand.

In terms of sectors studied, 244 PhDs focus on just one, while 31 address two sectors and 62 do not mention a specific sector at all. On level one of the NACE classification[2], the PhD theses have covered 20 out of the 21 sectors (the only exception being "Activities of households as employers"). Among those 20 sectors half of these have been studied by less than five theses. The sector that is the most studied is manufacturing (99 studies). Manufacturing includes many sub-sectors; the most studied of which are the computer and electronics sector (25 studies) and the chemical sector (12 studies). Professional, scientific and technical activities is the next highest sector (56 studies), followed by the Information and communication sector (41 studies), Electricity gas, steam and air conditioning supplies sector (32 studies), and finally the Agriculture Forestry and Fishing sector (27 studies). Professional, scientific and technical

[2] NACE is the statistical classification of economic activities in the European Community. NACE aims to give a standard for European countries to show statistical data according to field of activity or sector. For more information, see http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Statistical_classification_of_economic_activities_in_the_European_Community_%28NACE%29

activities is a highly studied sector as it includes studies related to science but also work related to biotechnology which are both popular sectors among PhD theses.

Data from the title and abstracts of the theses was analysed to identify thematic clusters, of which thirteen were identified. These are: (i) Diffusion of innovation on a macro level, (ii) Technical change and technological evolution, (iii) User innovation and diffusion on the micro level, (iv) Security, Defence and Safety, (v) Energy systems, (vi) Science, academia, (vii) Economics, growth, modelling, (viii) Renewable energy/grassroots innovation, (ix) Firm Behaviour and Strategy, (x) Firm capabilities, learning and management, (xi) Science-Industry collaboration and KTT (Knowledge and Technology Transfer), (xii) Food safety and regulation, and (xiii) Governance/Public policy. Among these themes, Firm capabilities, learning and management is particularly well represented (with 56 theses), especially over the last ten years. Studies looking at Technical change and technological evolution (34 theses) were particularly popular between 1985 and 1994 and have attracted decreasing interest since this period. When the Renewable energy and Energy system topics are combined, this also makes a popular area of study with 36 theses. In recent years (since 2005) Governance/Public policy has been a particularly popular topic (with 15 theses). Science-industry collaboration and Knowledge and Technology Transfer has been studied consistently from the early days of SPRU to the present with an average of seven theses every decade. Finally, the study of Food safety and regulation has also been consistently studied since 1985, with around 8 theses every decade.

Introduction

SPRU has long had a relatively large doctoral student body, and doctoral students have played a crucial role in the intellectual renewal (and ultimately the staffing) of SPRU. It is therefore fitting in SPRU's anniversary year that this contribution be documented, and so this report explores the history of SPRU through analysis of completed PhD studies. Before starting to analyse the data we first define the material studied. We consider **SPRU PhD theses** to be those completed by students that successfully completed a DPhil (or more recently a PhD), who were registered at Sussex and had at least one supervisor from SPRU. The data gathered about these PhD theses includes the final title of the thesis, an abstract, the year of completion and the supervisors' name (only SPRU supervisors are included in the dataset). Information about the year of completion was the most challenging data to collect, as different types of records hold different information for the year of completion (some take the submission date, some the date of submission of corrections, and others the graduation date). More information is given in the methodology section about the choices made during data gathering.

The first section gives a brief overview of the data in the dataset together with general trends in numbers of PhD graduations over time. The second section focuses on patterns in supervision and co-supervision. This is followed by sections that examine the content of the theses, through analysis of terms used in the abstract and title of each thesis. The third section is particularly focused on the countries studied in SPRU theses and how this has evolved over time, and the fourth section focuses on the sectors studied. The fifth section looks at general topics tackled by these studies. The sixth section gives a detailed explanation about the methods employed to produce this report, such as the way the data were gathered, as well as information about the analysis performed in the other sections. At the end of the document, the references and appendices can be found. The Appendices give a more detailed overview of data represented as graphs in the report, and include a breakdown of the number of supervisions per supervisor, the countries studied in PhD work, some preliminary findings on cross departmental supervisions and a full list of the SPRU PhD titles.

1. Overview of the data

In total this study identified exactly 350 Doctoral theses as being completed at SPRU between 1971 and 2014. A larger number of PhD students have undoubtedly commenced doctoral training at SPRU, but some did not complete their thesis. Some PhD students supervised by SPRU staff were not formally registered at the University of Sussex and therefore do not appear in the records used for this study. This observation must be kept in mind when looking at the results, as **the dataset is not a comprehensive picture of PhD students supervised by SPRU staff, but rather it is a comprehensive study of PhD theses completed within SPRU by the end of 2014**. As the dataset includes only those theses completed before the end of 2014, this means that if a student had their viva before the end of 2014 but some corrections remained, the student would not be included in the dataset.

Figure 1 shows the trends in the number of DPhil/PhD graduations over the history of SPRU, and Figure 2 shows the names of all these graduates.

Figure 1: Number of completed PhDs at SPRU per year, from 1971 to 2014.

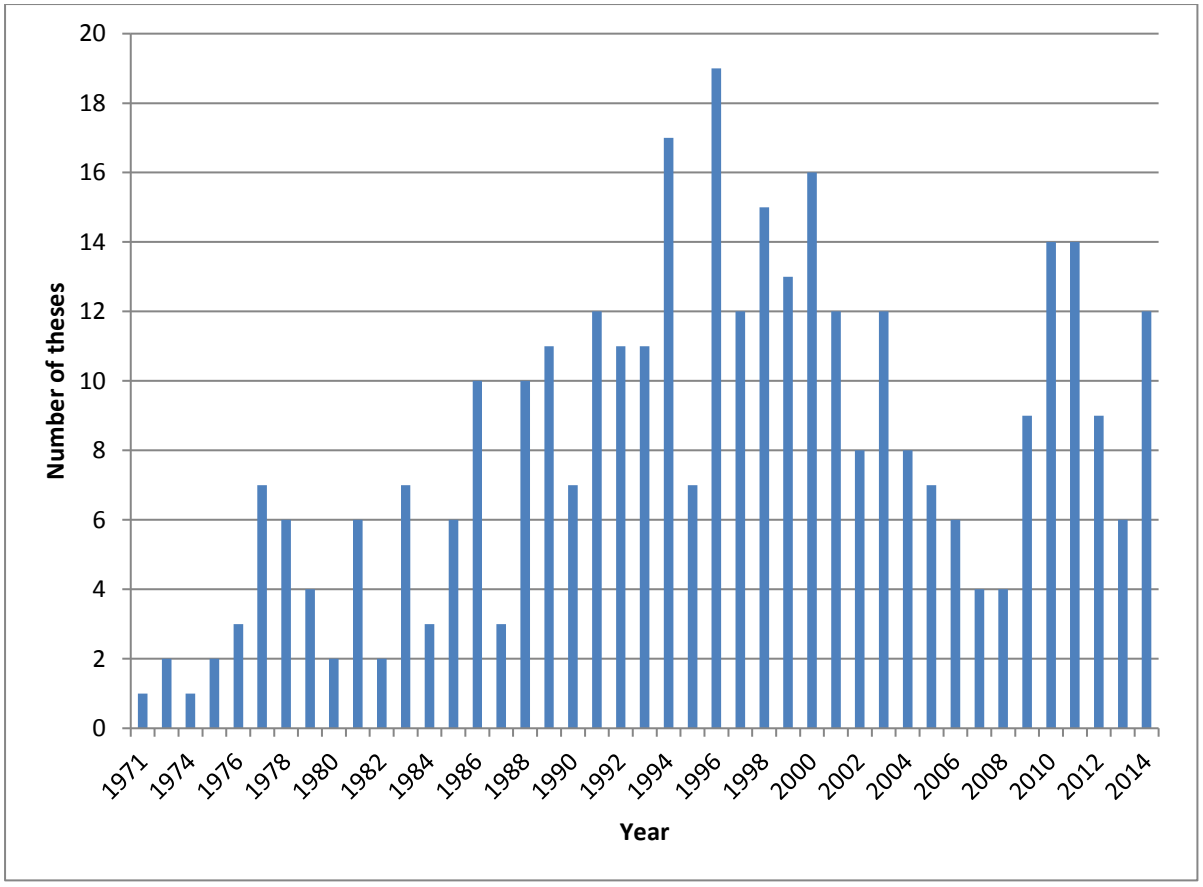
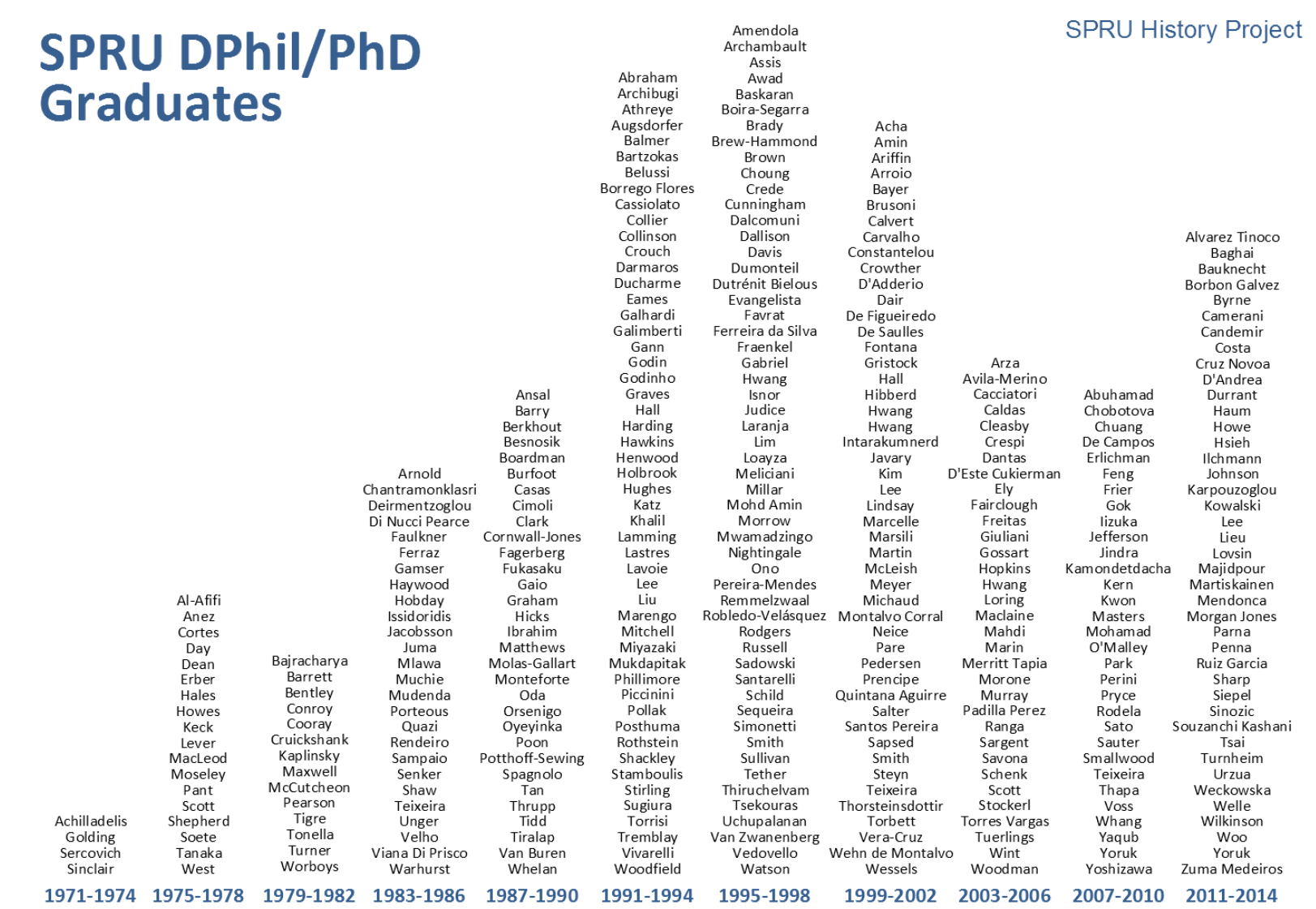
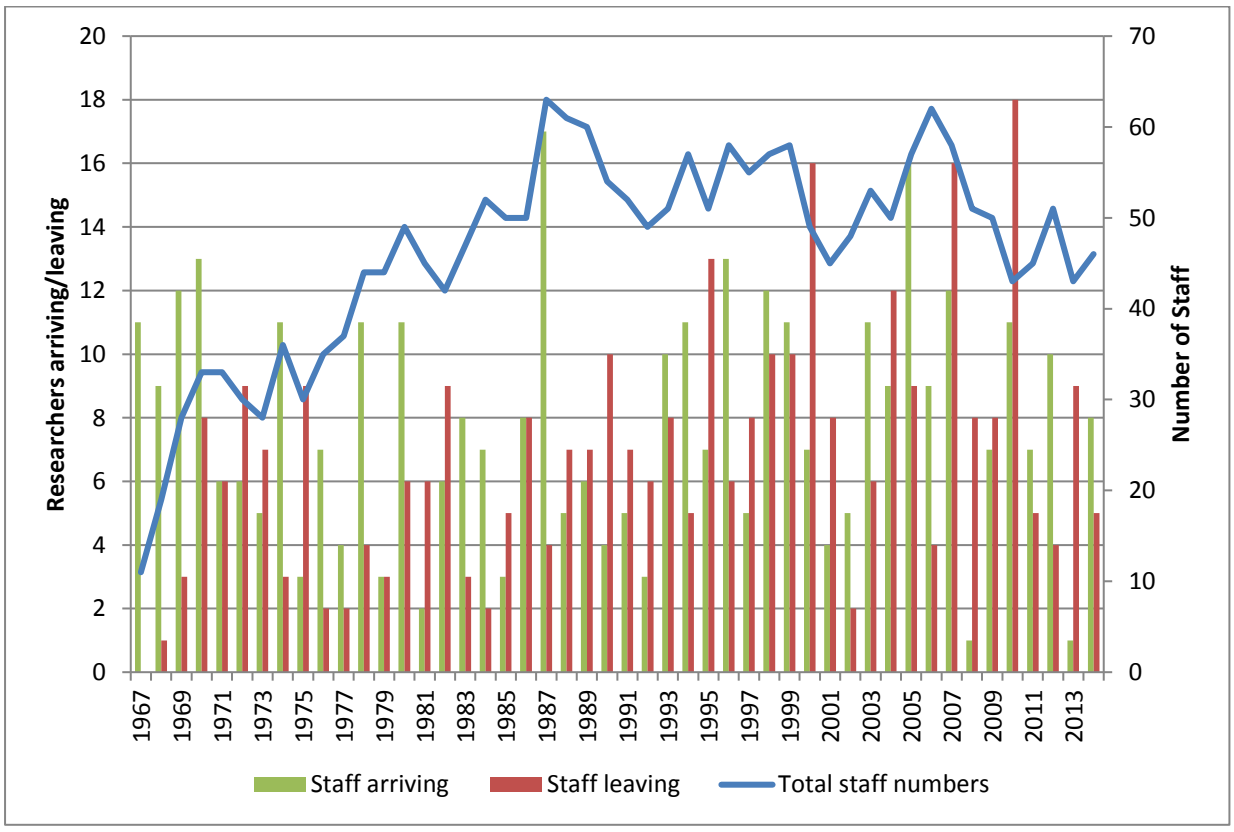


Figure 2: Names of all SPRU DPhil/PhD graduates between 1971 and 2014.



When SPRU started there were no formal teaching activities and no formal supervision processes. This may explain the slow start in terms of the graduation numbers in the early years of SPRU. Only two or fewer students graduated annually before 1975. We can see that from the mid-80s the growing numbers of graduations per year coincides with the growing staff numbers, which had a sharp increase in 1987 (as shown in Figure 3). This may explain why there is a peak in graduations around 5 to 6 years later around 1991-1996. After a period of gradual reduction in graduation numbers between 2000 and 2008, there is again a sharp increase around 2009 and 2011. This peak also coincides with a large wave of new staff arrivals in 2005, so this could be one of the reasons for the change.

Figure 3: SPRU Research staff turnover between 1967 and 2013.



In the next sections of the report, an overall picture of the data gathered is provided, together with a dynamic overview of the data. This dynamic aspect involves the delimitation of phases within SPRU's history in terms of PhD graduations, and is based on both numbers of completions over a period and comparable periods of time (number of years included). Periods are based on the number of PhD completions per year as shown in Figure 1. This figure shows that the first graduations from SPRU PhD students only started after 1970, and

the numbers of graduations were very low in the first six years. For these reasons it was decided to start the first time period in 1971, and instead of it covering only 10 years like the other periods, it would cover 14 years. This balances better the number of students included per period. Table 1 below shows the number of students completing PhDs in each time period.

Table 1: Number of students completing PhDs at SPRU in different time periods.

Time Period	Number of PhDs completed
1971-1984	46
1985-1994	98
1995-2004	121
2005-2014	85
Total	**350**

2. Supervision data

This section focuses on data relating to the supervision of SPRU PhD students. Table 2 shows the number of supervisors recorded for each SPRU thesis; most of the students were supervised by either one or two supervisors[3]. The majority were supervised by one supervisor from SPRU, although some were co-supervised with those from other departments (further information can be found in Appendix 3).

Table 2: Number of SPRU supervisors per thesis.

Number of SPRU supervisors per thesis	Number of theses
1 Supervisor	217
2 Supervisors	130
No formal supervisor	3
Total	**350**

In three cases no supervision information was found in the thesis or acknowledgements. After thorough reading of the acknowledgements it was apparent that these students were actively working in SPRU, in some cases being part of a project, and did not appear to have formal supervision in place. This was the case in the early years of SPRU (for students graduating in 1973 and 1976). A closer look at the data shows that more than 75% of SPRU students had two supervisors by or after 2008. One of the reason for this sudden increase may be due to

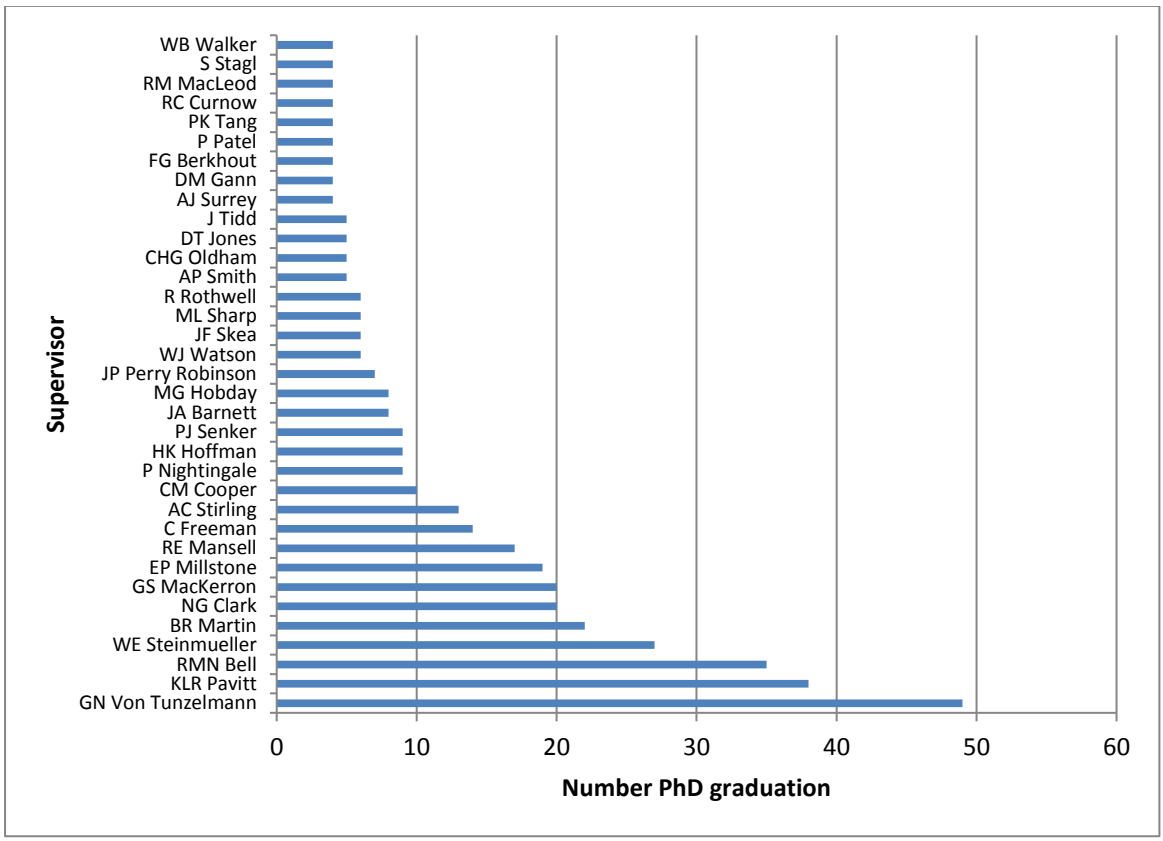
[3] The records available only included two supervisors. Some students may have had more than two supervisors. However, it is the supervisors at the time of submission which are officially recorded, and so it is only possible to systematically present this data.

the ESRC studentship policy that requires two supervisors. When looking at joint supervision one has to consider some limitations for the mapping presented in this report. The first limitation concerns the fact that the official supervisors may contribute unevenly in supervision time and inputs – this record is not captured here. Secondly in a small research group, supervision may be a collective effort, as has been the case in the Sussex Harvard Program.

Data has also been collected about co-supervisions involving other departments within the university. The results are included in Appendix 3, as we believe the data collected for co-supervision between departments are not complete yet, and further work would need to be done to obtain an accurate picture.

The next part of the analysis concerns the SPRU supervisors themselves. The dataset identified 78 researchers that have supervised students that completed their thesis by the end of 2014. Among these supervisors, 20 have completed their own thesis at SPRU. From the 78 supervisors, about 50% have supervised one or two students, 32% have supervised five or more, and 15% have supervised 10 or more. All those that have supervised or co-supervised four or more students (35 members of staff in total) are shown in Figure 4. A full breakdown of the number of supervisions undertaken by each supervisor can be found in Appendix 1. From Figure 4 below, the number of supervisors who have supervised twenty or more students can be easily identified. These staff members have logically spent a long part of their careers in SPRU in a senior position. Six out of the seven of them have spent 25 years or more of their careers at SPRU. In terms of individual counts, one can see that Figure 4 is highly skewed.

Figure 4: Number of supervisions undertaken by different researchers at SPRU[4].



Professor Von Tunzelmann has supervised the most students with 49 supervisions of students registered at SPRU. Professors Pavitt and Bell, who have both spent more than 30 years at SPRU, have supervised more than 30 students each. If the number of graduations per supervisor is compared to their time spent within the unit (number of graduations/years spent in the unit), Mansell, Steinmueller, Pavitt and Von Tunzelmann have seen one student or more graduate per year.

Figure 5 uses co-supervision links between staff to show how PhD supervisions have been an important force for coherence in SPRU over the years. Figure 5 has been built from a two mode network (supervisors, students) but displays only the supervisors and the links created or reinforced through supervisions. A more detailed description of the mapping approach used is given in the methods section[5].

[4] Figure 4 only shows staff that have undertaken three or more supervisions. Additionally, only students supervised within SPRU are counted. There may be a number of people affiliated to other universities that were supervised by SPRU staff members but these students are not represented here because this information is not available from SPRU records.

[5] In this section when using the terms node or degree we refer specifically to terms used in network analysis.

Figure 5: Network of Co-supervisions in which students are represented as lines and supervisors by nodes.

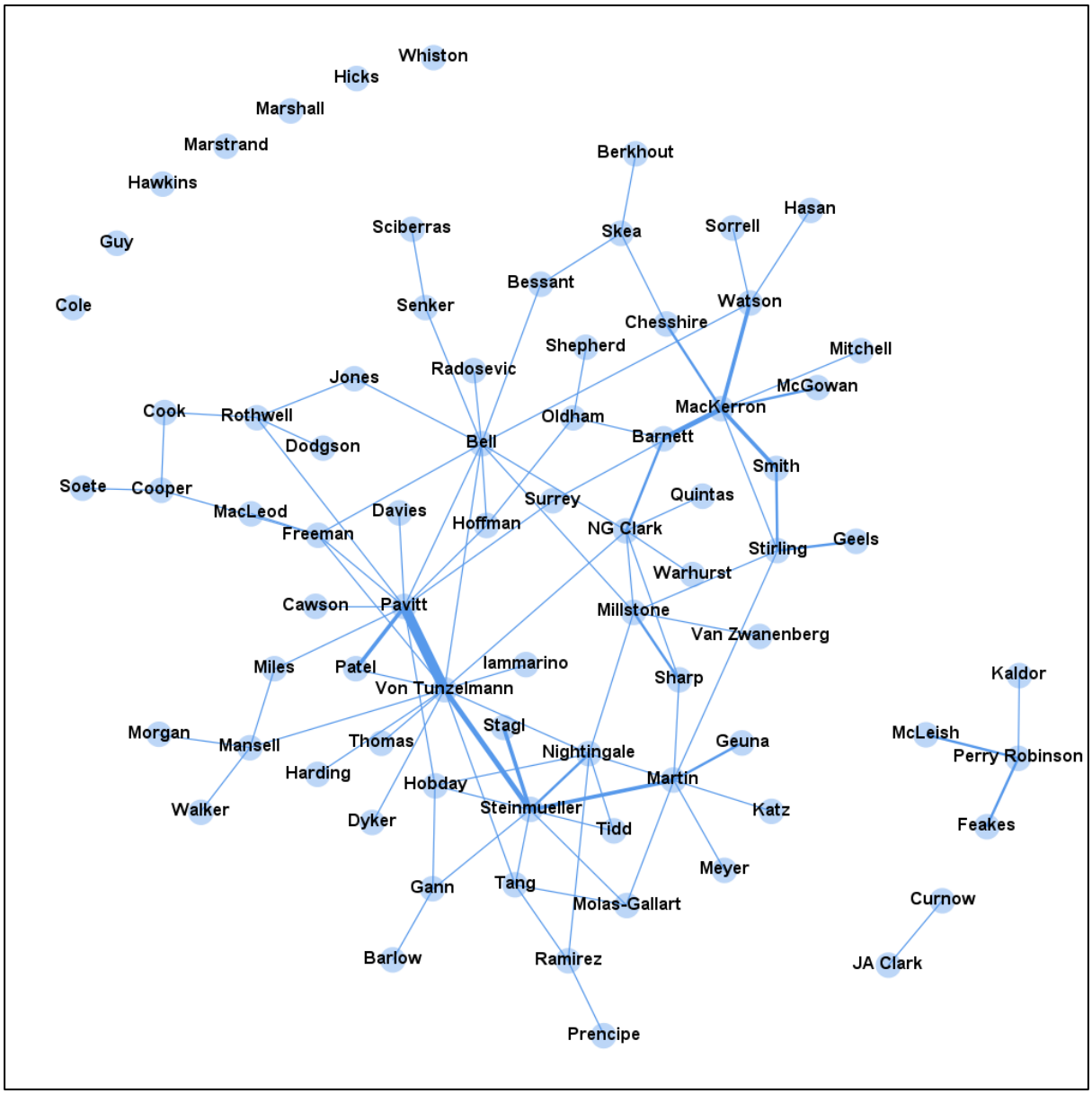


Figure 5 shows that Von Tunzelmann has co-supervised with the highest number of colleagues (13). Pavitt and Bell co-supervised within SPRU with 11 different colleagues each, Steinmueller with 9 and MacKerron, Martin and Clark (NG) with 7 each. Von Tunzelmann has co-supervised most often with Pavitt and Steinmueller. One can also clearly identify a distinct network representing researchers from the Harvard Sussex Program (HSP) with co-supervision between its members (including Perry Robinson, Feakes, McLeish, and Kaldor). Single nodes (visible at the top left in Figure 5) show researchers that have supervised students without a second SPRU supervisor (although these may have been collaborative supervisions with colleagues outside SPRU).

Figures 5a and 5b show supervisions and co-supervisions over four different time periods. These maps also indicate sole supervisions (represented by loops back to their node), which gives an idea of how many students researchers supervised on their own, indicated through line thickness. The size of the node is proportional to the nodes' degree (defined by the number of connections it has with itself or other nodes). In the first period (1971-1984), Cooper and Freeman both have the most supervisions. In the second period (1985-1994), Pavitt and Von Tunzelmann are both strong in terms of supervisions; they both have a high number of sole supervisions, but also have a high number of co-supervisions (with six and four other people respectively). In this period Clark (NG) also has a high number of sole supervisions, and co-supervisions with four other colleagues.

In the third period (1995-2004), the network visibly increases its number of supervisors, coinciding with a period when there were a high number of graduations (see Figure 1). In this period Pavitt and Von Tunzelmann have the highest numbers of supervisions and co-supervisions, while Bell also has a high number of these, and Steinmueller and Martin have a growing role in the network. In the fourth period (2005-2014), Steinmueller and Von Tunzelmann both have a high number of sole and co-supervisions, which makes them the most prolific supervisors at this time. Nightingale and Martin also have a high number of supervisions. The last two periods show an increasing number of co-supervisions, with the network becoming increasingly dense as a result.

Different reasons can be observed for why different supervisors have achieved high numbers of supervisions. Starting with the most prolific supervisor, Von Tunzelmann, although he was not present in the first period, from his arrival at SPRU he has supervised a high number of students in every period since then. Pavitt, who also supervised a high number of students over the years, had very high supervision activity mainly in the second and third periods, but had few supervisions in the first period. Bell never had the highest number of supervisions in any given period, but has maintained a fairly constant number of doctoral students while staying at SPRU for over 46 years. Steinmueller arrived later, but achieved a high number of supervisions over the two last periods, especially with an increase in the last period in which he had the highest degree. Martin had a slowly increasing number of PhD students over each period starting with a small number in the second period, but steadily increased his number of students to become a central part of the co-supervision network, even if he did not obtain

the highest supervision numbers. Millstone and MacKerron have both been supervising within SPRU since the second period, and both have had a steady number of supervisions over the years. While Millstone co-supervised in each period with a limited number of colleagues in the different periods (from 0 to 4 per period), MacKerron co-supervised increasingly with colleagues over the years.

Mansell only stayed at SPRU for the second and third periods, but achieved a high number of student completions in those years, with an especially high number of sole supervisions in the third period. The lower number of Freeman's supervisions can be explained by the fact that he had a prominent role in the early years of SPRU (in the first two periods) during which the unit and teaching activities were still relatively small. He then had a decreasing number of students in SPRU as he only had a visiting status in the unit, and was a Professorial Fellow in Maastricht (in the Netherlands).

Figure 5a: Evolution of co-supervision, showing supervisions and co-supervisions over the period of 1971-1984 and the period of 1985-1994.

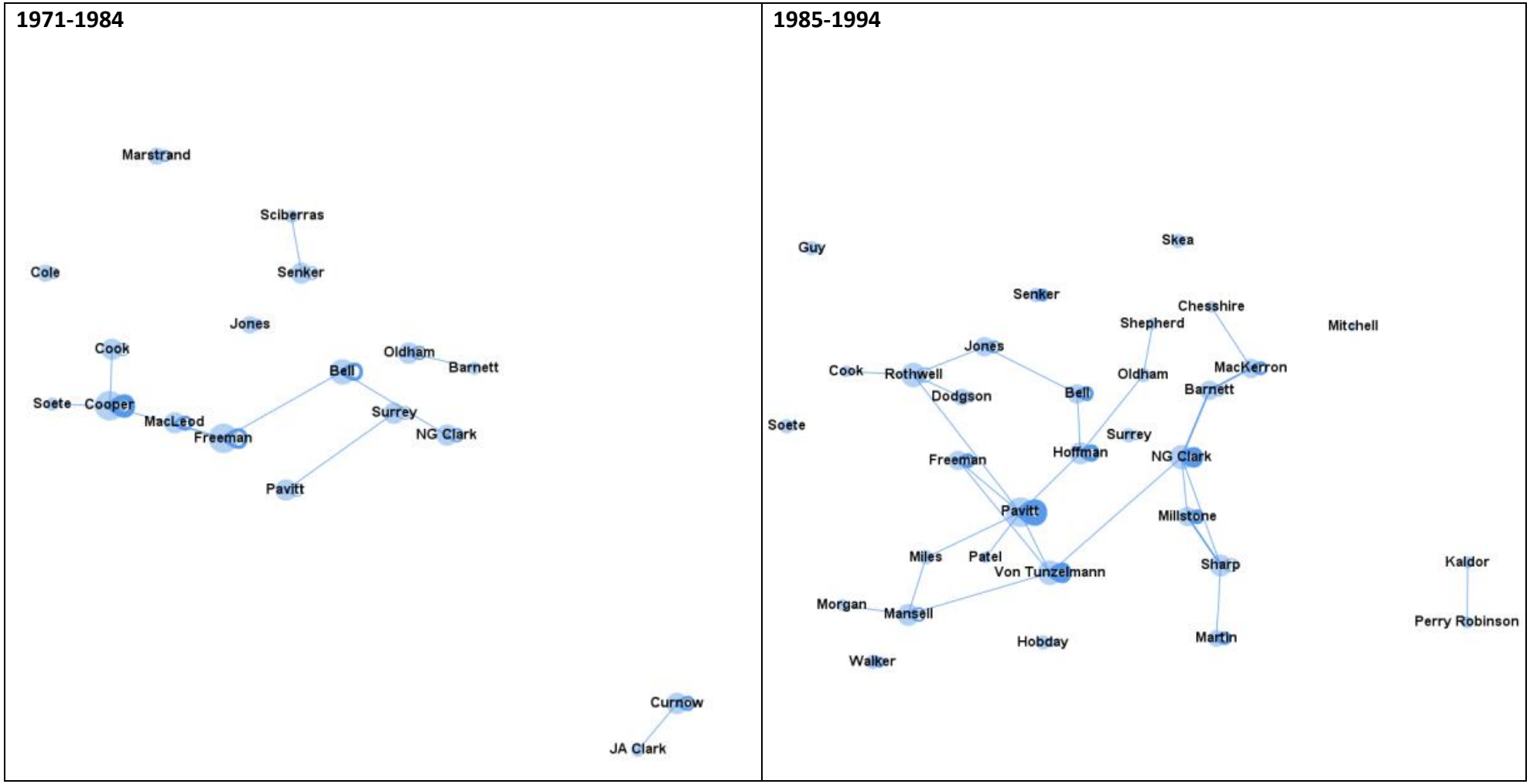
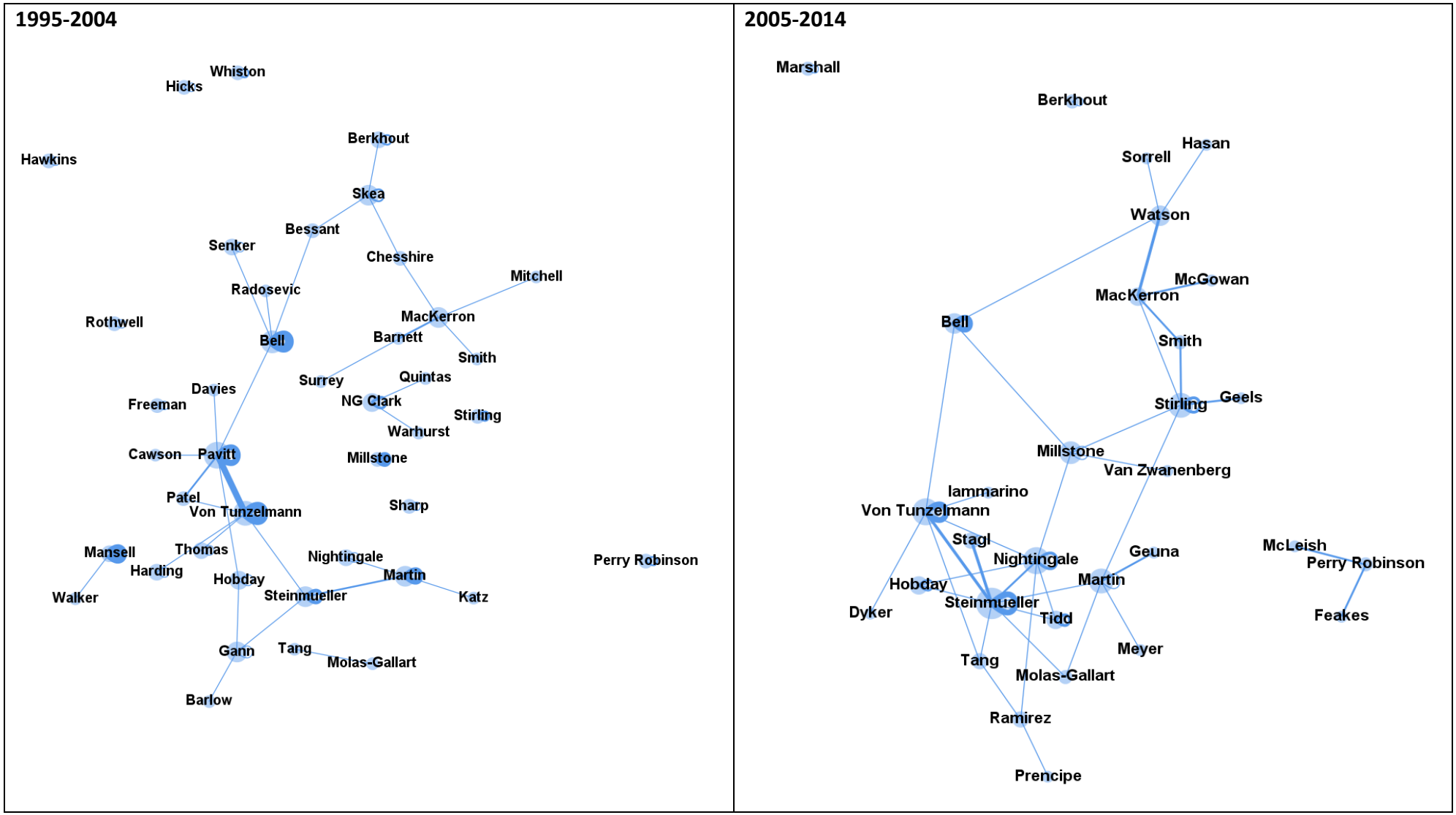


Figure 5b: Evolution of co-supervision, showing supervisions and co-supervisions over the period of 1995-2004 and the period of 2005-2014.



3. Countries studied in SPRU PhD theses

This section draws on data from the titles and abstracts of SPRU PhD theses to look at the countries they studied. SPRU is a well-known institution that attracts scholars from around the world and this feeds into the diversity of countries studied in SPRU theses. These are counted here to make cross-country or supra-national area (such as European Union or North America) comparisons over time.

Out of the 350 theses, 296 mention one or more specific country. Table 3 shows the distribution of theses by number of countries studied. Some theses mention larger geographic areas (such as the EU, northern America, or Soviet Union) which are classified as 'groups'.

Table 3: Numbers of countries studied by PhD theses at SPRU.

Number of countries studied	Number of theses
0	54
1	202
2	48
3	22
4	7
5	1
7	1
9	1
Group*	14
Total	**350**

*This refers to a group of countries such as the European Union, Northern America etc.

The data from Table 3 shows that in the majority of cases SPRU theses focus on a single country. 70 theses undertake international comparative work mainly on two or three countries. There are very few theses that study four or more countries (only 10); one of these studies nine countries.

In order to have a better understanding of the share of countries studied, Figures 6 and 6a show maps highlighting countries studied over different periods. Figure 6 shows the frequency with which countries have been studied in the overall period. The exact number of times each country has been studied can be found in Appendix 2.

Figure 6 shows that a large part of the world has been studied by SPRU students, covering most of North and South America, Western and Northern Europe, as well as India and China, Japan, Australia and Russia. Eastern Europe has only been covered through the study of the Soviet Union, and not as individual countries. Some territories are less covered such as Africa, South East Asia and central Asia. In terms of numbers the UK is by far the most studied territory by SPRU students, with 99 theses focusing on it. The second most studied country is Brazil, which was studied in 26 theses, while Germany has been studied in 20 theses. There are six countries that have been studied between ten and nineteen times, which are Mexico, the United States, France, Italy, Japan and Korea.

Figure 6: Countries studied in PhD work[6] at SPRU between 1971 and 2014.

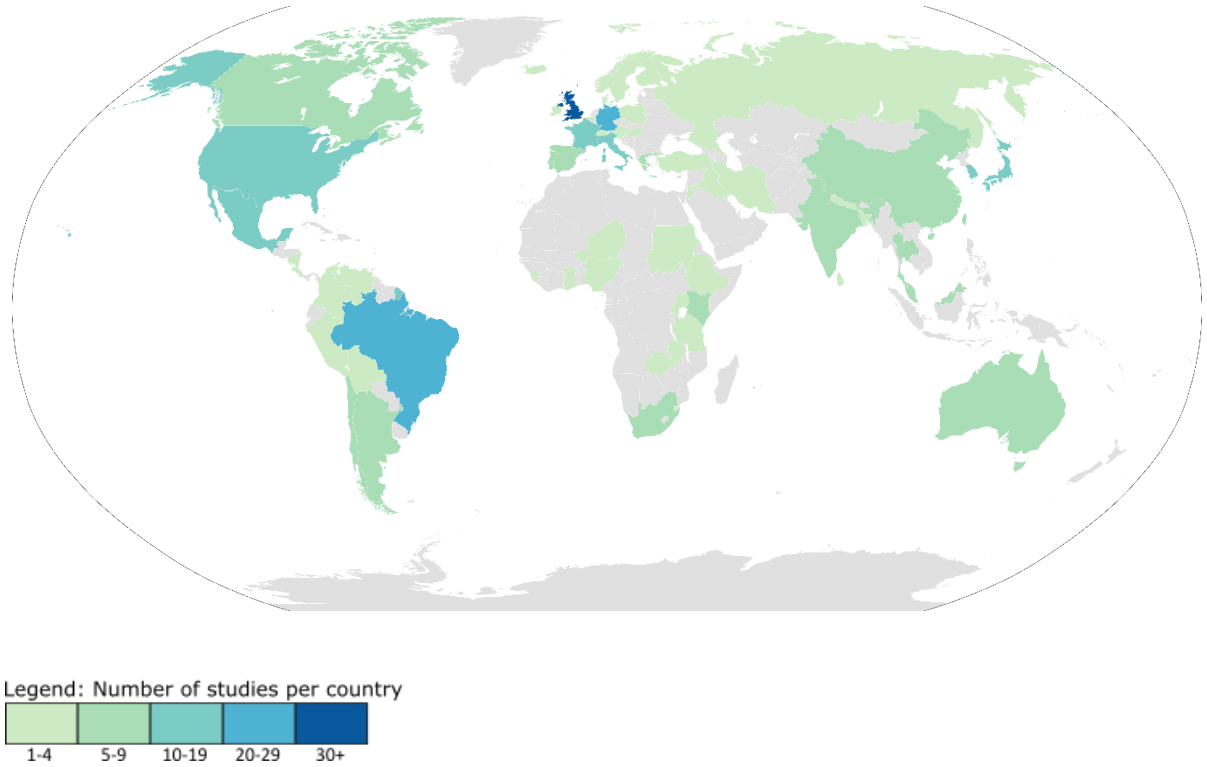
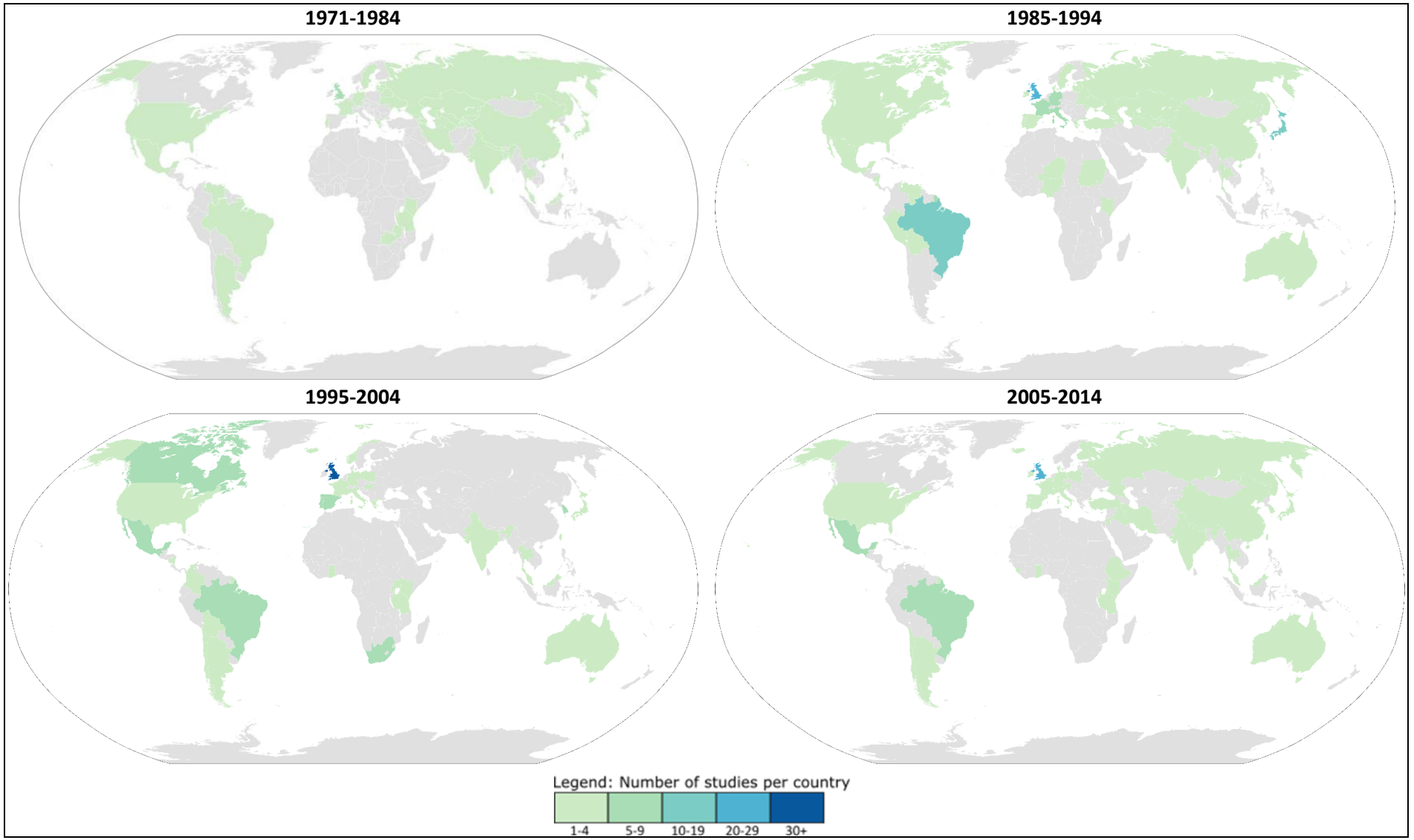


Figure 6a explores shorter periods to reveal how consistently different regions have been studied over time. In this figure we can first of all observe that the study of the UK has been strong over every period. The United States and Mexico have also been studied in every single period while Canada has been studied during the two middle periods. There are slight variations in the number of studies per period, but one can observe that the proportion of

[6] Here we counted countries studied per thesis (there can be more than one country studied per thesis). We did not count larger areas than countries (for instance, studies focused on Latin America, North Africa, and the European Union are excluded in this map).

studies focusing on Mexico has been increasing. There is also a strong interest over every period in studies on South American countries, especially Brazil, which seems to attract a high proportion of studies over every period, but is particularly studied in the 1985-1994 period. Argentina is also frequently studied, apart from in the period 1985-1994. And finally Chile has been studied in the two last periods. Concerning the Asian Continent, India, Japan, Korea and Thailand have been studied over every period, and China has not been studied in 1995-2004. Japan has received particular attention between 1985 and 1994 with 10 studies or more in that period. Finally regarding Europe, the countries present in every period are France, Germany, Portugal and the UK. Greece, Denmark, Spain, Italy and Ireland have been studied in most periods.

Figure 6a: Countries studied in PhD work at SPRU in four different time periods.



4. Sectors studied in SPRU PhD Theses

This section focuses on the sectors studied in SPRU PhD theses. The sector was attributed with data contained by titles and abstracts. This section aims to give an overview of the sectors that have been studied by SPRU PhD students. It gives some descriptive statistics about sectors studied using the NACE classification, at levels 1 and 2. The next section focuses on sectors that have attracted a high number of studies, and attempts to explain why those sectors have been of interest.

Table 4 gives a basic overview of the number of sectors studied in SPRU PhD theses, with sectors identified from the level 2 NACE categories. Of the 350 theses, in 62 cases a particular sector could not be identified as they either dealt with theoretical issues about innovation and technical change, or focused on a macro level analysis with no focus on specific sectors. Some of them did not give much detail about the activities under study and therefore conclusions on the sector(s) in focus could not be drawn. For six theses, the focus was rather on large areas and they could not be conclusively attributed to the level 2 NACE categories, but could be attributed to level 1 NACE sectors. Of these, 5 out of 6 were focused on manufacturing and the last on mining. Table 4 also shows that 244 theses were focused on one specific sector, 31 on two sectors, and only seven on three or more sectors.

Table 4: Number of sectors studied by individual theses.

Number of sectors	Number of theses
1	244
2	31
3	6
4	1
None	62
Total	**344**

Table 5 looks at the theses which focused on general sectors, using the NACE Level 1 classification. The table includes the theses that were solely focused on one of these sectors, but also includes in a separate column the total number of theses focused on these sectors (including theses that focused on 2 sectors or more).

The table shows that at Level 1, students have studied 20 out of the 21 sectors. In those 20 sectors, half have been studied by less than five theses. Three sectors have been studied between five and ten times, two between ten and 20 times and five studied more than 20 times. The sector that is the most studied is Manufacturing (99 studies), followed by Professional, Scientific and Technical activities (56 studies), Information and Communication (41 studies), Electricity, Gas, Steam and Air Conditioning Supply (32 studies), and finally Agriculture, Forestry and Fishing (27 studies).

Table 5: Number of theses studying different sectors (based on Level 1 of the NACE classification).

ID	Sector	Number of theses focused solely on this sector	Number of theses focused on this sector and others
A	AGRICULTURE, FORESTRY AND FISHING	17	27
B	MINING AND QUARRYING	12	13
C	MANUFACTURING	81	99
D	ELECTRICITY, GAS, STEAM AND AIR CONDITIONING SUPPLY	32	32
E	WATER SUPPLY; SEWERAGE, WASTE MANAGEMENT AND REMEDIATION ACTIVITIES	4	5
F	CONSTRUCTION		2
G	WHOLESALE AND RETAIL TRADE; REPAIR OF MOTOR VEHICLES AND MOTORCYCLES	4	7
H	TRANSPORTATION AND STORAGE	1	1
I	ACCOMMODATION AND FOOD SERVICE ACTIVITIES	3	3
J	INFORMATION AND COMMUNICATION	32	41
K	FINANCIAL AND INSURANCE ACTIVITIES	4	4
L	REAL ESTATE ACTIVITIES		2
M	PROFESSIONAL, SCIENTIFIC AND TECHNICAL ACTIVITIES	44	56
N	ADMINISTRATIVE AND SUPPORT SERVICE ACTIVITIES	4	4
O	PUBLIC ADMINISTRATION AND DEFENCE; COMPULSORY SOCIAL SECURITY	10	13
P	EDUCATION	1	2
Q	HUMAN HEALTH AND SOCIAL WORK ACTIVITIES	4	5
R	ARTS, ENTERTAINMENT AND RECREATION	1	1
S	OTHER SERVICE ACTIVITIES	2	2
U	ACTIVITIES OF EXTRATERRITORIAL ORGANISATIONS AND BODIES	1	1
None		62	62

To go deeper into the sectors studied, Table 6 uses Level 2 of the NACE classification.

The manufacturing sector includes 24 subsectors, and 20 of them are represented here. Even if manufacturing is a very popular sector to study, the studies were not evenly distributed between the 20 sectors. The manufacturing of computers, electronics and optical products was the most studied subsector within manufacturing, accounting for a third of the overall theses on manufacturing (32 of them). The manufacture of chemicals and chemical products was the second most studied subsector, and was the focus of 13 theses. These included various studies about pesticides and fertilizers but also those looking more generally at the chemical industry (which also includes the manufacture of chemicals such as fuel). A second sector that was well studied relates to energy issues, here represented by sector D35 - Electricity, gas, steam and air conditioning supply. The studies were based on various energy supplies such as nuclear energy, coal and turbines, but also discussed the supply and production of electricity. In addition to the focus on the manufacture of computers and electronics, many theses have been concerned with the telecommunication sector, and also with computer programming and services (which can include many online activities). Thus it can be demonstrated that SPRU PhDs have frequently been concerned with Information and Communications Technology.

Table 6: Number of theses studying different sectors (based on Level 2 of the NACE classification).

ID	Sector	Number of theses focused on this sector
A1	Crop and animal production, hunting and related service activities	23
A2	Forestry and logging	3
A3	Fishing and aquaculture	2
B	MINING AND QUARRYING	1
B5	Mining of coal and lignite	1
B6	Extraction of crude petroleum and natural gas	3
B7	Mining of metal ores	7
B9	Mining support service activities	1
C	MANUFACTURING	5
C10	Manufacture of food products	5
C11	Manufacture of beverages	2
C13	Manufacture of textiles	7
C14	Manufacture of wearing apparel	1
C15	Manufacture of leather and related products	1
C17	Manufacture of paper and paper products	4

C19	Manufacture of coke and refined petroleum products	2
C20	Manufacture of chemicals and chemical products	12
C21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	4
C22	Manufacture of rubber and plastic products	4
C23	Manufacture of other non-metallic mineral products	2
C24	Manufacture of basic metals	3
C25	Manufacture of fabricated metal products, except machinery and equipment	5
C26	Manufacture of computer, electronic and optical products	25
C27	Manufacture of electrical equipment	1
C28	Manufacture of machinery and equipment	8
C29	Manufacture of motor vehicles, trailers and semi-trailers	7
C30	Manufacture of other transport equipment	6
C31	Manufacture of furniture	1
C32	Other manufacturing	2
D35	Electricity, gas, steam and air conditioning supply	32
E36	Water collection, treatment and supply	2
E38	Waste collection, treatment and disposal activities; materials recovery	3
F41	Construction of buildings	2
G46	Wholesale trade, except of motor vehicles and motorcycles	1
G47	Retail trade, except of motor vehicles and motorcycles	6
H49	Land transport and transport via pipelines	1
I55	Accommodation	3
I56	Food and beverage service activities	1
J58	Publishing activities	2
J59	Motion picture, video and television programme production, sound recording and music publishing activities	1
J60	Programming and broadcasting activities	4
J61	Telecommunications	21
J62	Computer programming, consultancy and related activities	12
J63	Information service activities	5
K64	Financial service activities, except insurance and pension funding	4
L68	Real estate activities	2
M72	Scientific research and development	56
N79	Travel agency, tour operator and other reservation service and related activities	1
O84	Public administration and defence; compulsory social security	13
P85	Education	2
Q86	Human health activities	5
R90	Creative, arts and entertainment activities	1
S94	Activities of membership organisations	2
U99	Activities of extraterritorial organisations and bodies	1
None	Activities that cut across sectors or are not applicable to a given sector	62

Scientific research and development has been studied in a very high number of theses, as it is the sector that covers research activities. These included theses that study science, academia, and universities and their activities (but did not include the study of teaching, which is a separate sector). This sector also includes biotechnology activities, a sector that has also been a popular technology to study. Finally, administration and defence has also been studied in more than ten theses. These include many studies of security issues including biological and chemical weapons, but also include other sectors such as space and public administration that have been studied much more sporadically.

5. Topics studied by SPRU PhD theses

Extracting topics from abstracts or titles is an arduous task, as defining topics can be subjective, and finding common patterns with a dataset of 350 thesis abstracts is challenging. Thus given the time and resources available, reviewing every abstract manually would have been a tedious and labour intensive task[7]. Instead, computer algorithms were used to extract topics relevant to work done within SPRU. A variety of algorithms were tested and the relevance of topics proposed directed the choice of a specific algorithm, the movMF (mixture of von Mises-Fisher Distributions). See the Methods section (Section 6) for further details. The algorithm assigned one theme to each title and abstract. In a second part of the work the themes found were reviewed and eventually amended when deemed necessary on a subjective basis. Each thesis was classified in a single topic area, representative of its main contribution - however they may have also been associated with other themes not recorded here. The cluster assigned to each thesis was also reviewed in order to readjust groups misplaced by the algorithm.

While it is desirable to classify the theses into topics, there are, however, limitations to the results of this exercise. The first limitation is in the choice of assigning each thesis to only one topic. Some theses may be closely related to another topic, but included these would have also affected the counts in descriptive statistics of the data. Secondly, when undertaking classification using only the title and abstract of the thesis, there is a likelihood of

[7] A trial of manual classification was already done for a previous event, a strategy meeting held in December 2014, where topics from SPRU research projects were explored, and this proved to be very labour intensive.

misclassification as the abstract does not always fully represent some aspects of the work. It has to be acknowledged that there is sometimes a fine line between assigning theses to one particular topic or another, and there might be slight differences in classification depending on the person who is assigning the theses. Finally, the themes are quite broadly defined and some work may be loosely associated with a theme where no other theme was available. Thus while the themes presented below may give an overview of the main interests of SPRU students, and the descriptive statistics may show some trends, these are best considered as a high level, low definition overview.

The final categories of topic are shown in Table 7. These are the topics after revisions.

Table 7: Topics identified as studied by SPRU PhD theses.

Topic ID	Topic Name
1	Diffusion of innovation at the macro level
2	Technical change and technological evolution
3	User Innovation/ Diffusion on a micro level (adoption)
4	Security/ Defence and safety
5	Energy systems
6	Science/Academia
7	Economics, Growth, modelling
8	Renewable energy / grassroots innovation
9	Firm behaviour and strategy
10	Firm capabilities and management - learning
11	Science-Industry collaboration and KTT
12	Food safety and regulation
13	Governance/ Public policy

In terms of the number of theses attributed to each topic, Table 8 shows that the most popular topic overall was Firm capabilities and management - learning (56 theses). This was followed by Economics of innovation (35 theses) and Technical change and technological evolution (34 theses). Some topics had lower numbers but could be grouped into a larger topic, such as theses looking at energy (36 theses), created by merging Energy systems and Renewable energy. Innovation diffusion was another category created by merging the micro and macro level studies in this area (35 theses). Some themes may be assimilated as well to sectors. This is the case for “Security and defence” (which may be related to the themes studied by the Harvard Sussex Program) and “academia and science”. Finally, the topic

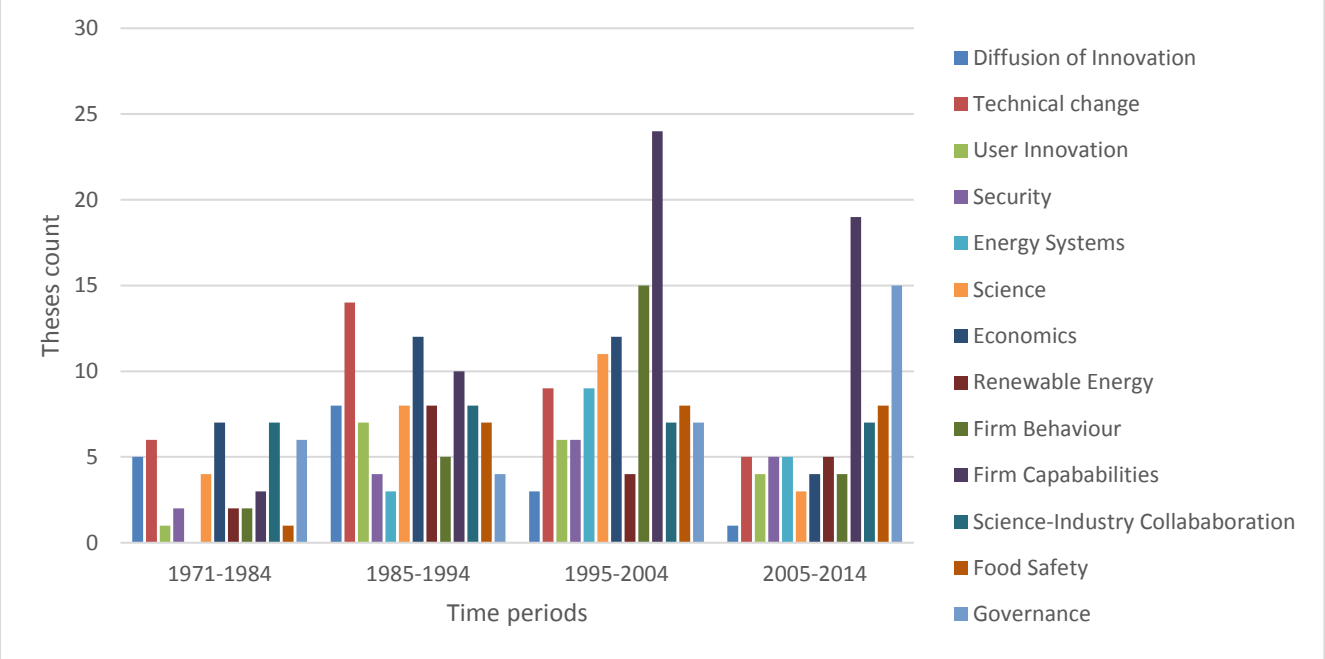
focused on Regulation included a high number of theses looking at food safety and the regulatory framework related to this area.

Table 8: Numbers of PhD theses focused on different topics.

Topic names	Number
Diffusion of innovation on a macro level	17
Technical change and technological evolution	34
User Innovation/ Diffusion on a micro level (adoption)	18
Security/ Defence and safety	17
Energy systems	17
Science/Academia	26
Economics of innovation (Growth, modelling…)	35
Renewable energy / grassroots innovation	19
Firm behaviour and strategy	26
Firm capabilities and management - learning	56
Science-Industry collaboration and KTT (Knowledge and Technology Transfer)	29
Regulation (including Food safety)	24
Governance/ Public policy	32
Total	**350**

Figure 7 illustrates which of these topics have been popular over the different time periods. The periods used here are the same as in previous sections. In the first period the interest of the PhD students was most focused on economics topics and science and industry collaboration and knowledge and Technology Transfer (7 theses each), followed by technical change and governance or policy topics (6 theses each). In the second period there was a sharp increase in the popularity of technical change (14 theses) and economics. Finally, there was a sharp increase in theses looking at firm learning and firm management. This trend continued in the following period (95-04), with 24 dissertations focusing on this topic. The second most popular topic in this period focused on the behavioural side or strategy of firms. There were still a high number of theses looking at innovation and technical change through an economic lens, and an increasing number looking at science and academia as a topic. While in earlier periods the energy topics focused more on renewable energy and energy use, in this particular period energy systems was a more attractive topic (energy topics altogether accounted for 13 theses). The latest period saw a decrease in the study of firm capabilities and learning, even if it was still one of the most prominent topics. The second most popular topic in the latest period was governance and policy related issues.

Figure 7: Evolution of topics studied at SPRU over different time periods.



Some topics were not subject to much variation over the years. For instance, for Science-Industry Collaboration and Knowledge Technology Transfer (KTT), which has been a popular topic since the early years, the number of theses focused on this has oscillated between seven and eight over all periods. The number of dissertations looking at regulation and food safety has also been quite constant in the three last periods, ranging between 7 and 8 dissertations per period.

6. Methods

The methods section is separated into two parts. The first part deals mainly with the data collection, by specifically discussing the sources used to build the SPRU PhD thesis dataset. The second part of this section focuses on the methods used to analyse the collected data.

6.1 Methods for Data Collection

The main source of data came from the Heritage system as most of the SPRU theses have been deposited in the SPRU Library and therefore appear in the catalogue. These items were easily identifiable as they have a specific mention in the '*Medium*' field which covers all the theses, including MSc Theses, PhD and MPhil theses (in the *SPRU Data* file). These data were extracted and needed minor cleaning. Firstly, PhD theses had to be differentiated from other

types of dissertation, through the '*NOTESCSVX*' field (in the *SPRU Data* file). Secondly, the theses that were written in more than one volume were merged as one item. Thirdly the '*NOTESCSVX*' field (in the *SPRU Data* file) could include diverse information such as abstracts and supervisors (but not systematically), which were extracted and put in separate fields.

In most recent years, the library entries have not been kept as thoroughly as in the past due to the winding down of the staffing of the library. Thus, PhD theses data were also gathered from a list kept by Janet Snow which covered the most recently completed PhDs; it also showed supervisors' information which was not held in most of the records from the Pavitt library.

It appeared after looking at the data found in the annual reports and from some comments reported by former SPRU members (reported to the authors by Angela Campos[8]) that the records of PhD students may have missed a few students in the early years of SPRU. Thus after gathering these data it became apparent that some data was missing mainly in terms of abstracts (for 132 of the 350 theses) or supervisors (for 128 of the 350 theses).

The missing data have been retrieved through checking different sources. Concerning the abstract data, recent records with missing information were checked through the ethos website (http://ethos.bl.uk/Home.do) which holds all of the theses submitted in the UK. On the ethos website it is possible to check directly the abstract on the webpage for most recent records or download the full PDF for each thesis, which is freely available. In the case of missing elements, especially for older records, resources left from the SPRU library or the annual reports were used. The first resource used from the library was a folder containing information about theses (including titles, abstracts and authors). When the record was not found there, the physical thesis was searched in the SPRU Library, and the abstract was scanned and added to the dataset. Also in the early years, some theses did not have a summary or abstract. In this case part of the introduction and/or conclusion was used to build an appropriate summary. These are indicated by a pink highlight on the accompanying dataset. After this process only a few were left and data was searched for directly from physical copies in the library. In a few cases theses were not found or were embargoed from

[8] Angela Campos is the author of an accompanying report to this one – Campos, A. (2016) *SPRU History Project: A Report on its qualitative angle*. Unpublished.

public release. In this case the students or the supervisor were asked to provide an abstract or summary of their work.

Concerning the supervision data, some data had already been gathered through the 'field notes' in the Heritage Library system and Janet Snow's records. These records were especially useful to identify most recent PhD students, of which there was a complete list up until the end of 2014. These data were collected before submission and therefore the information on titles and abstracts was verified on ethos and amended in the dataset if necessary. In order to complete the data on supervisors, either the theses themselves were used (as the acknowledgements section usually thanks the supervisors) or other records on supervisors were found in SPRU annual reports. For some of the theses from the early 1970's no record of supervisors was found in the physical thesis and therefore it was considered that they had no formal supervisors (e.g. Achilladelis, B.G.; Scott T.W.K.; Sinclair C.)**.** For each of these, there is a note in the dataset indicating there was no supervisor information found in the physical copies.

While building the dataset the year field was particularly important to process, as there was sometimes conflicting information from different sources. After some research, different information could be found on public records (the ethos system from the British library and Sussex Research Online[9] from University of Sussex records). The physical thesis itself (or pdf of the thesis) also contained information, on the spine of the book or even inside it. A specific methodology was therefore used to choose an appropriate date of thesis completion. After discussion with Professor Steinmueller, it was decided to mainly base the records on dates provided by the ethos website because they coincided with the records at the British Library. However, some records in the dataset have shown that errors are possible in this dataset, therefore it was important to cross check the date found on the website. In cases in which the ethos website agreed with Sussex Research Online records or the date on the spine or inside the thesis, the ethos date was kept. In cases where the Sussex Research Online records corresponded to the date on the spine and within the thesis, but were different to the ethos date, the date in the thesis was kept.

[9] https://sro.sussex.ac.uk/

Finally, historical records of PhD students were completed by using SPRU annual reports. SPRU annual reports were searched for names of students that were not mentioned in the dataset, and ethos was checked for their finished theses. Where finished theses were found, the final title, year of completion, supervisors and abstracts were obtained using both ethos and library resources (the SPRU Library as well as the Sussex Library). In the first ten years of SPRU's existence, it was harder to know whether PhD students were formally in SPRU or not, as SPRU did not have a teaching programme. We therefore considered SPRU PhD students to be either those that had only SPRU supervisors (one or two), or those that had one supervisor in SPRU and a supervisor in another department in Sussex, and therefore having completed their degree at Sussex**.** Students who corresponded to the latter case are clearly identified in the database with a yellow highlight and there is also a note indicating the department they were registered with.

In the process of data gathering, we noticed that some of the studies identified as a PhD in the system were actually MPhils. These have not formed part of the analysis reported here.

6.2 Methods for the Analysis

This section focuses on some methodological points concerning the analysis of the data shown in the earlier sections. The first subsection here covers methodological points about the construction of the two mode networks, while the second covers points about the geographical maps building. The third subsection explains the methodological aspect of the sectoral analysis, and finally the fourth tackles the methodology behind topics analysis.

However before moving to these points, it is worth noting that the data in these sections have been divided into four periods, and explaining how these divisions were made. When designing the periods, not only the notion of time passed was considered, but also the number of cases included in the period. As Figure 1 in Section 1 shows, the first graduations by SPRU PhD students only started after 1970 and the numbers of graduations were very low in the first six years (either none or two graduations per year during these years). For these reasons it was decided to start the first time period in 1971, and instead of it covering only 10 years like the other periods, it would cover 14 years. This balances better the number of

students included per period. Table 1 in Section 1 shows the number of students completing PhDs in each time period.

In terms of distribution of students there are still some differences between periods, but the increase in the number of years covered by the first period is well justified as the number of students is still much lower than in later periods.

Methods for the 2 Mode network of co-supervision

This section aims to explain in more detail how Figures 5, 5a and 5b were constructed. These figures are two-mode networks which were constructed using the co-supervision data. The networks were built by using supervision data, with a link being made between two supervisors when they co-supervised one student. Figures 5a and 5b also show self-connections for some nodes, which represent sole supervisions. For all these figures the software *Gephi* was used to generate the positioning, size of the nodes and layout.

The design of Figure 5 aims to be simple and show the overall co-supervision between supervisors. As the network is quite dense, it was decided not to show centrality or in-degree for node size. An Atlas layout was used to visualise the data (Jacomy, Venturini, Heymann & Bastian, 2014). This type of visualisation behaves as if nodes are charged particles; the nodes that are connected to each other attract each other, but the ones that are not connected repulse each other. This means the position of the nodes do not mean anything when looked at individually, however nodes connected to each other are represented closer together. Therefore this type of network is good at showing local proximities, and clustering communities together, however maybe this is less true for global centrality (Noack, 2007). For instance, bridging nodes may be pushed on the side as repulsion of other nodes may be stronger than the attraction of the few links the node has. Thus in this network when nodes are relatively closer together they are more likely to be connected to each other and part of the same community. Lone nodes were also clustered in the top left of the figure for readability.

For the other two figures (5a and 5b), it was decided firstly to keep the same layout as the global network (i.e. Figure 5). This meant the coordinates of the nodes were fixed from the first network. This was done so it was easier to keep track of the nodes from the first graph

to subsequent visualisations. In construction the nodes were therefore kept in the same position, but a new network was made each time dependant on the time frame used. This was done in order to not affect the degrees measure that is displayed in the graph. In this graph loops were used and the size of the node was adjusted to their degree. As the graph was undirected the in- and out degrees were the same. The degree was defined by the number of edges that connect a node to other nodes.

Methods for identifying countries shown in maps

The statistics on countries were done using both abstracts and titles. In order to extract countries under study, a first document was prepared using a list of countries in the world, but also adding adjectives derived from country names (e.g. Mexican for Mexico). These adjectives were added by browsing abstracts that had not been tagged through the first search. In a second step the countries were searched according to this list, and country names were matched relative to the ones found in the two fields. After that search was done, a second search was performed for larger groups of countries, for the theses where no countries were found. Other terms were searched such as European Union (EU), North America and South America. When those territories were found they were added to the list of countries, but they were not represented on the map designed. These data were used to make Table 3 and Appendix 2.[10]

For the visualisation of the countries in terms of maps, an SVG map was found at *http://commons.wikimedia.org/wiki/File:BlankMap-World6.svg* and was coloured using a python programme. The shades of colours were chosen in function of the distribution shown in Appendix 2. While the UK had significantly more studies than other countries, to use a shade that ranged from the minimum to the maximum did not make much sense as the UK had around 100 studies while all the others had less than 30 studies, and apart from Brazil had 20 or less studies. It was therefore decided to use four shades for countries with under 30 studies, and a strong colour for the one country that had over 30 studies overall. It was also decided to use the same shading between maps in order to avoid confusion in terms of numbers. While this does not give many shades in the first period for Figure 5a, it does

[10] England, Scotland and Wales were added as UK in the maps but appear separately in the appendix.

however give a good basis to compare and see the evolution in terms of studies between maps.

Methods for identifying sectors and industries studied

In order to conduct the analysis on sectors, the main sources of information used were the titles and the abstracts. Each abstract was read in order to understand if there was a specific sector or activity under study. Sectors were attributed through the best judgement of the researcher following the NACE classification in order to have some standard. The NACE classification was used instead of the researchers making their own classification, as there are different levels that could be taken into consideration such as sectors, industries and sometimes technology, which ultimately may be confusing and have some overlap. When classifying, the boundaries in terms of sectors were not always clear: some studies referred specifically to known sectors or industries (by naming them) while others (in their abstracts) only gave a description of the boundaries of the study which covered a few sectors. Thus when possible the thesis was matched with a sector by comparing the definition of the work conducted in the PhD with definitions given by the NACE classification.

Topics analysis

The extraction of common themes was performed using a semi-automatic approach, and it was divided into two phases. The first phase consisted of using an algorithm to automatically choose a bag of words, which corresponded to a theme (defined by the researcher), and each paper was attributed to one of the themes. The second phase consisted of manually checking the classification of each PhD thesis, but also reshaping the themes when some major themes were missing.

The research was successful in consistently collecting text data (i.e. title and abstracts) that could be informative in terms of topics tackled. Before testing any algorithms to find themes or topics, the text data had to be pre-processed in order for the algorithm to assess only informative words. This included removing small words, stop words and words used very often (which were not representative of a particular theme). When this step was done, the words had to be organised, using a TF-IDF (term frequency – inverse document frequency) which assesses how some words are important in a text by looking at how many times a

specific word appears in a text (but takes into account that some non-meaningful words appear more frequently in general for example the word ‘the’ - which the method will eliminate).

In order to find topics, three different approaches were tested; the algorithm provided within the VOSviewer package, the LDA (Latent Dirichlet Allocation) and CTM (correlated topics model) algorithms (part of the same R library), and the movMF (mixture of von Mises-Fisher distribution) algorithm. The first algorithm is a user friendly software which already pre-processes the data in a similar manner to that explained above. The latter algorithms are used through R packages, and need the pre-processing steps done programmatically in order to run the analysis. These algorithms provide a bag of words (a predetermined number of words that co-occur in a recurring number of documents) which should cover a topic. A topic was then assigned depending on the words identified which matched best a bag of words as associated to one topic.

A first step, while working on topic modelling, was to find a good tool to extract themes, and while many tools are available, their performance may differ depending on the different tasks involved. After testing the various algorithms outlined above, most of the algorithms produced bags of words, to which the researcher could not clearly associate a theme, with the exception of the movMF algorithm. This algorithm used words that were more informative and enabled the researcher to make sense of the topic found. Therefore, the movMF algorithm was selected for doing the analysis.

After selecting the algorithm and using it to generate topics, twelve topics were found by the algorithm and each thesis was associated to one topic. From the bags of words, the researcher decided upon topic headers, and reviewed the topics attributed to the theses. This process helped to refine the topic headers, but also to identify topics (through theses associated to this topic) that were less coherent. This therefore enabled the researcher to change some topics (adding new topics by merging or dividing existing topics). After this process each thesis was reviewed again to see if it fitted best to topics associated by the algorithm, and when necessary theses were reattributed to a new topic.

7. References

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Noack, A. (2007) Energy Models for Graph Clustering. *Journal of Graph Algorithms and Applications*, 11 (2), 453–480. Available from: http://doi.org/10.7155/jgaa.00154 [Accessed 30th August 2016].

8. Appendices

Appendix 1: Number of supervisions undertaken by each supervisor

ID	Name of supervisor	Number of supervisions
29	JG Barlow	1
30	JA Barnett	8
39	RMN Bell	35
44	FG Berkhout	4
47	J Bessant	2
78	A Cawson	1
82	JH Chesshire	3
87	JA Clark	1
88	NG Clark	20
92	HSD Cole	1
96	PL Cook	3
97	CM Cooper	10
110	RC Curnow	4
114	AC Davies	1
131	M Dodgson	2
139	DA Dyker	1
150	DJ Feakes	2
154	C Freeman	14
159	DM Gann	4
163	FW Geels	2
166	A Geuna	2
187	K Guy	1
195	RA Harding	2
201	R Hasan	1
204	RW Hawkins	1
212	DM Hicks	1
220	MG Hobday	8
221	HK Hoffman	9
241	S Iammarino	1
265	DT Jones	5
270	MH Kaldor	1
274	JS Katz	1
317	GS MacKerron	20
318	RM MacLeod	4
323	RE Mansell	17
329	F Marshall	1
331	PK Marstrand	2
332	BR Martin	22
344	F McGowan	2
347	CA McLeish	2
353	M Meyer	1
355	I Miles	2
359	EP Millstone	19
361	CHC Mitchell	1
365	J Molas-Gallart	3
370	K Morgan	1
383	P Nightingale	9
391	CHG Oldham	5
402	P Patel	4
404	KLR Pavitt	38
415	JP Perry Robinson	7
420	A Prencipe	1
423	P Quintas	1
424	S Radosevic	1
428	M Ramirez	3
443	R Rothwell	6
471	E Sciberras	1
478	PJ Senker	9
482	ML Sharp	6
486	G Shepherd	1
499	JF Skea	6
503	AP Smith	5
507	LLG Soete	2
509	S Sorrell	1
513	S Stagl	4
519	WE Steinmueller	27
521	AC Stirling	13
526	AJ Surrey	4
533	PK Tang	4
539	SM Thomas	2
541	J Tidd	5
558	PF Van Zwanenberg	1
565	GN Von Tunzelmann	49
570	WB Walker	4
575	A Warhurst	1
576	WJ Watson	6
584	TG Whiston	2

Appendix 2: Number of times different countries were studied in PhD work

ID	Country	Number of times studied
1	China	6
2	India	8
3	United States	14
5	Brazil	26
7	Nigeria	1
8	Bangladesh	1
9	Russia	1
10	Japan	18
11	Mexico	15
14	Ethiopia	1
16	Germany	20
17	Iran	4
18	Turkey	3
20	Thailand	8
21	France	13
22	United Kingdom	99
23	Caribbean	1
24	Italy	11
26	South Africa	5
27	Korea	13
28	Colombia	1
29	Spain	9
31	Tanzania	4
32	Kenya	7
33	Argentina	7
35	Poland	2
36	Sudan	2
37	Uganda	1
38	Canada	9
39	Iraq	1
41	Peru	1
44	Malaysia	5
45	Venezuela	3
46	Nepal	2
50	Ghana	3
52	Taiwan	5
53	Australia	6
59	Sri Lanka	1
62	Niger	1
64	Netherlands	5
65	Chile	5
72	Zambia	1
73	Zimbabwe	1
76	Belgium	1
80	Greece	6
81	Portugal	8
88	Bolivia	2
89	Hungary	1
90	Sweden	2
95	Austria	2
98	Switzerland	1
106	Jordan	1
111	Sierra Leone	1
112	Nicaragua	2
114	Denmark	4
115	Finland	2
116	Slovakia	1
117	Singapore	2
119	Norway	2
121	Costa Rica	1
123	Ireland	2
147	Slovenia	1
155	Estonia	1
157	Swaziland	1
179	Iceland	2
244	England	9
245	Scotland	1
246	Wales	7
250	Latin America	3
251	EU	8
252	North America	1
253	North Africa	2
254	America	1
256	Soviet Union	2

Appendix 3: Preliminary findings on co-supervision

Co-supervisions across departments (i.e. between SPRU and another department) were only recorded for some of the PhD students. After discussion with the research assistant in charge of collecting the data, it appeared that the collection of this type of data was not complete and a little more work may be required in order to have an accurate picture of the co-supervision. Here the results are presented for the data already collected.

As SPRU is an interdisciplinary Unit, it is not surprising that it collaborates across the campus, and that its members are co-supervising jointly with other Sussex Departments. Table 9 shows the number of co-supervisions of SPRU with other departments. These departments cover a variety of fields such as Development studies (at IDS), Economics, and Electrical Engineering, and also a variety of Social Studies (from Labour Studies to Anthropology and Political and Social Science). Two students were registered to be co-supervised by other institutions. As this only includes the students actually registered at Sussex University, one can expect numbers to be much higher in case of co-supervision, where the student is registered in another institution.

Table 9: Number of students co-supervised by SPRU and another department.

School which co-supervised with SPRU	Number of students
IDS	11
Economics	6
Electrical, Electronic and Control Engineering/Computer Science	2
Social and Political Thought	2
Sociology/Anthropology	1
Labour Studies	1
Graduate Research Centre in the Social Sciences	1
Other universities*	2
Co-supervision total (NB: not comprehensive)	**26**

* Statistics Norway, Aalborg University (one student for the two previous universities), Stanford University

Table 9 shows that most SPRU co-supervisions were done with IDS which accounts for about 40% of the co-supervisions. Economics also has a high a number of co-supervisions with SPRU. Looking closer at the dataset, one can observe that these collaborations are not balanced over time. While collaborations with general social sciences have been observed sporadically from 1977 to the end of the 1990s, co-supervisions with other departments are less evenly distributed over time. For instance, the two co-supervisions with the Electrical Engineering

department both occurred before the 1980s (with both students graduating in 1977). The graduations of students co-supervised with the Economics department have all been concentrated between 1983 and 1990. Finally, co-supervisions with IDS have been observed first in the early 1980s (with the first graduation in 1983) up until 2013, with more to come in the following years according to the current registration records. In recent years, co-supervisions have been most frequent with IDS.

Appendix 4: List of SPRU PhD titles

Name	Year	Title
Golding, A.	1971	The semiconductor industry in Britain and the United States: a case study in innovation, growth and the diffusion of technology.
Achilladelis, B.	1973	Process innovation in the chemical industry.
Sinclair, C.	1973	Human life and safety in relation to technical change.
Sercovich, F.	1974	Foreign Technology and control in the Argentinian industry.
Dean, G.	1975	Technological development in the People's Republic of China: the implementation of technology policy in Chinese industry.
MacLeod, E.	1975	Politics, professionalisation and the organisation of scientists: the Association of Scientific Workers, 1917-1942.
Cortes, M.	1976	Transfer of petrochemical technology to Latin America.
Moseley, R.	1976	Science, Government & Industrial Research: the Origins & Development of the National Physical Laboratory, 1900-1975
Scott, T.	1976	Diffusion of new technology in the British and West German carpet manufacturing industries: the case of the tufting process.
Day, R.	1977	Fission and fusion nuclear reactors : a study of the environmental and social effects of a technology
Erber, F.	1977	Technological development and State intervention: a study of the Brazilian capital goods industry
Howes, M.	1977	Knowledge and Power: The Transfer and Exploration of Technology in a Rural Area in Thailand
Keck, O.	1977	Fast breeder reactor development in West Germany : an analysis of government policy
Pant, A.	1977	Optimum Allocation Strategies for Resource Limited Economic Systems
Shepherd, P.	1977	Computer Aided Design and Analysis of Dynamical Models
West, P.	1977	The Tyre Multinationals: A Study of Foreign Investment and Technology Transfer in Latin America
Al-Afifi, J.	1978	Digital Simulation of Dynamic Systems
Anez, C.	1978	International transfer of technology for oil and gas exploration and production with special reference to the Venezuelan oil industry.
Hales, M.	1978	Operational research and the forces of production: a Marxist analysis of science and ideology
Lever, B.	1978	Planning technological change: a case study of the agricultural chemicals industry.
Soete, L.	1978	Inventive activity, industrial organisation and international trade.
Tanaka, M.	1978	Industrialisation on the basis of imported technology: a case- study of the Japanese heavy chemical industry, 1870-1930.
Barrett, I.	1979	Wilderness: the last chance. A multidisciplinary approach to the problem of conserving natural environments.
Conroy, R.	1979	Industrial development and technology policy: the case of the Chinese scientific instruments industry.
Cooray, N.	1979	The technological factor and its relevance to the competition between synthetic and natural rubber in international trade.
McCutcheon, R.	1979	Modern construction technology in low-income housing policy: the case of industrialised building.
Kaplinsky, R.	1980	Appropriate technology in a developing country: the bakery industry in Kenya
Worboys, M.	1980	Science and British Colonial Imperialism 1895-1940
Bajracharya, D.	1981	Implications of fuel and food needs for deforestation: an energy study in a hill village panchayat of Eastern Nepal.

Bentley, R.	1981	Technical change in the GDR
Cruickshank, A.	1981	Innovation in new energy technologies
Maxwell, P.	1981	Technology policy and firm learning efforts in less-developed countries : a case-study of the experience of the Argentine steel firm, Acindar S.A.
Pearson, R.	1981	Technology Transfer and Technological Dependency: A Case Study of the Argentine Cement Industry, 1875-1975
Turner, R.	1981	The use of mathematical models in urban planning: the case of shopping models.
Tigre, P.	1982	Technology and competition in the Brazilian computer industry.
Tonella, G.	1982	Learning by Modelling for Development Planning
Arnold, E.	1983	Competition and technological change in the UK television industry.
Deirmentzoglou, A.	1983	Technological and structural change in the Greek textiles industry.
Issidoridis, G.	1983	Optimal diffusion: a theoretical and empirical analysis of the diffusion of innovations
Mlawa, H.	1983	The acquisition of technology, technological capability and technical change: a study of the textile industry in Tanzania.
Quazi, H.	1983	Technological capacity and production performance in the fertilizer and the paper industries in Bangladesh.
Rendeiro, J.	1983	Policies for change in the machine tool industry in Portugal: a study on market processes and public policies.
Ferraz, J.	1984	Technological development and conditioning factors: the case of the Brazilian shipbuilding industry.
Jacobsson, B.	1984	Technical Change and Industrial Policy: the Case of Numerically Controlled Lathes in Argentina, the Republic of Korea and Taiwan
Mudenda, G.	1984	The development of the mining industry in Zambia: a study in the transfer of technology.
Unger, K.	1984	Industrialization, Transfer of Technology and Industrial Organization in Mexico
Chantramonklasri, N.	1985	Technological responses to rising energy prices: a study of technological capability and technical change efforts in energy- intensive manufacturing industries in Thailand.
Haywood, B.	1985	Technical change and employment in the British printing industry.
Teixeira, F.	1985	The political economy of technological learning in the Brazilian petrochemical industry.
Velho, L.	1985	Science on the periphery: a study of the agricultural scientific community in Brazilian universities.
Viana Di Prisco, H.	1985	International technology transfer, technological learning and the assimilation of imported technology in a state-owned enterprise: the case of direct reduction in SIDOR steel plant in Venezuela.
Warhurst, A.	1985	The potential of biotechnology for mining in developing countries: the case of the Andean Pact copper project.
Di Nucci Pearce, M.	1986	Technology, competition and state intervention: development paths and public policies in the promotion and commercialisation of light water reactors.
Faulkner, W.	1986	Linkage between industrial and academic research: the case of biotechnological research in the pharmaceutical industry.
Gamser, M.	1986	Innovation, user participation, and forest energy development.
Hobday, M.	1986	Digital telecommunications technology and the third world: the theory, the challenge, and the evidence from Brazil.
Juma, C.	1986	Evolutionary technological change: the case of fuel ethanol in developing countries.
Muchie, M.	1986	Capitalist Technology and Socialist Development
Porteous, M.	1986	Recession and technical change in the Brazilian machine tool sector.
Sampaio, R.	1986	Accumulation and innovation: historical trends in a newly industrialized capitalist economy. The case of the cassava starch industry in Brazil.

Senker, J.	1986	Retail influence on manufacturing innovation.
Shaw, B.	1986	The role of the interaction between the manufacturer and the user in the technological innovation process.
Barry, A.	1987	The science of science; programmes of British space research.
Graham, M.	1987	Cruise missile development programmes in the United States since the early 1970s: a case study in the determinants of weapons succession.
Poon, A.	1987	Information technology and innovation in international tourism: implications for the Caribbean tourist industry.
Ansal, H.	1988	Technical change in the Turkish truck manufacturing industry.
Boardman, B.	1988	Economic, social and technical considerations for fuel poverty policy.
Fagerberg, J.	1988	Technology, growth and trade: Schumpeterian perspectives.
Fukasaku, Y.	1988	Technology imports and the development of technological capability in the industrialization of Japan: training and research at Mitsubishi Nagasaki shipyard 1884-1934.
Ibrahim , I.	1988	Agro-based Industries and the Industrialization Impasse in the Sudan
Oyeyinka, O.	1988	Technological capability acquisition under environmental constraints: the development of the steel industry in Nigeria.
Potthoff-Sewing, C.	1988	Strategic R&D Expenditures and Free Entry
Tan, L.	1988	An Analysis of Singapore's Dynamic Comparative Advantage in Manufacturing, 1970-83
Thrupp, L.	1988	The Political Ecology of Pesticide Use in Developing Countries: Dilemmas in the Banana Sector of Costa Rica
Van Buren, E.	1988	An Analysis of the Commercial Woodfuel System in Nicaragua
Berkhout, F.	1989	Radioactive waste: institutional determinants of management and disposal policy in three European countries.
Burfoot, A.	1989	The politics of innovation: the discovery, dissemination and regulation of in vitro fertilisation in Britain.
Casas, R.	1989	Biotechnology research in Mexico: relevance for the agricultural and food sector.
Clark, J.	1989	Great expectations: rationales for nuclear fusion research.
Hicks, D.	1989	Beyond serendipity: factors affecting performance in condensed matter physics.
Matthews, M.	1989	Time saving and economic growth: the UK 1963-1986.
Monteforte, R.	1989	Energy and Styles of Development: the Case of Electricity in Mexico
Orsenigo, L.	1989	Institutions and markets in the dynamics of industrial innovation: the theory and the case of biotechnology.
Spagnolo, F.	1989	Assessment of graduate programmes: the Brazilian case.
Tidd, J.	1989	Technological trajectories & emerging production paradigms: robotic assembly as an example of flexible manufacturing.
Whelan, A.	1989	The Effect of Technical Change on Existing Patterns of Intra-Industry Trade: A Case Study of the UK Agricultural Machinery Industry
Besnosik, R.	1990	The diffusion of biogas plants in rural areas of Brazil.
Cimoli, M.	1990	Technology, international trade and development: a North-South perspective.
Cornwall-Jones, K.	1990	The commercialization of artificial intelligence in the UK.
Gaio, F.	1990	The development of computer software technological capabilities in developing countries - a case study of Brazil.
Molas-Gallart, J.	1990	Military production and innovation: the Spanish case.
Oda, S.	1990	A theoretical study of non-proportionally growing economies with technical progress.
Tiralap, A.	1990	The economics of the process of technical change of the firm: the case of the electronics industry in Thailand.

Archibugi, D.	1991	The sectoral structure of innovative activities in Italy: results and methodology.
Collinson, S.	1991	Managing technology transfer: a comparison of manufacturing firms in Britain and Kenya.
Crouch, D.	1991	A political sociology of toxicology.
Ducharme, L.	1991	Inter-industrial technology diffusion: a macro analysis of technical change in the Canadian economy.
Galhardi, R.	1991	Small high technology firms in developing countries: the case of biotechnology in Brazil.
Graves, A.	1991	International competitiveness and technology development in the world automobile industry.
Harding, R.	1991	Technology and human resource strategy in their national context.
Henwood, F.	1991	Gender and Occupation: discourses on gender, work and equal opportunities in a college of technology
Lavoie, M.	1991	Technological change and economic spinoffs at the Filiere level: the case of hydroelectricity.
Marengo, L.	1991	Knowledge, coordination and learning in an adaptive model of the firm.
Posthuma, A.	1991	Changing Production Practices and Competitive Strategies in the Brazilian Auto Components Industry
Vivarelli, M.	1991	Technology and employment: the economic theory and the empirical evidence.
Abraham, J.	1992	A Political Sociology of drug testing and regulation with particular reference to the Benoxaprofen controversy
Bartzokas, A.	1992	Military technology transfer and domestic defence production: the case of Greece.
Belussi, F.	1992	Industrial innovation and firm development in Italy: the Veneto case.
Cassiolato, J.	1992	The role of user-producer relations in innovation and diffusion of new technologies: lessons from Brazil.
Darmaros, T.	1992	Implementing the integrated services digital network (ISDN): prospects and problems in the realisation of a telecommunications concept.
Hawkins, R.	1992	Standards for technologies of communication: policy implications of the dialogue between technical and non-technical factors.
Katz, J.	1992	Bibliometric assessment of intranational university-university collaboration.
Khalil, M.	1992	The acquisition of technological capabilities in the power sector: the case of the Olkaria geothermal plant in Kenya.
Lamming, R.	1992	Supplier strategies in the automotive components industry: development towards lean production.
Lastres, H.	1992	Advanced materials and the Japanese national system of innovation.
Liu, W.	1992	Technology transfer, technological capability and late entry into the international automobile industry: a case study of Shanghai- Volkswagen Automotive Corporation in China.
Balmer, B.	1993	Mutations in the research system? The Human Genome Mapping Project as science policy.
Borrego Flores, J.	1993	Technology transfer and industrial policy: the case of the computer industry in Mexico. DPhil thesis.
Galimberti, I.	1993	Large chemical firms in biotechnology: case studies on learning in radically new technologies.
Gann, D.	1993	Innovation in the built environment: the rise of digital buildings.
Godinho, M.	1993	Innovation diffusion in the Portuguese and Italian clothing industry
Holbrook, B.	1993	Do ICT's matter? The diffusion of information and communication technologies in Wales, the Republic of Ireland and the South East of England.
Hughes, R.	1993	An analysis of satellite services policy-making in Britain.
Lee, K.	1993	The role of user firms in industrial innovation: the case of machine tools in Japan and Korea.

Miyazaki, K.	1993	The dynamics of competence building in European and Japanese firms: the case of optoelectronics.
Piccinini, M.	1993	Technical change and energy efficiency: a case study in the iron and steel industry in Brazil.
Shackley, S.	1993	Regulating the new biotechnologies in Europe : development and application of a method for analysing and evaluating regulation of the new biotechnologies in the UK, Germany, Denmark, France and the EC.
Athreye, S.	1994	The spread of technology and the level of development: a comparative study of steel mills using the Electric Arc furnace technology in India and Britain.
Augsdorfer, P.	1994	Forbidden fruit: an analysis of bootlegging, uncertainty, and learning in corporate R&D.
Collier, U.	1994	Global warming and electricity supply: towards the integration of energy and environment policies in the European Community?
Eames, M.	1994	United Kingdom government food research and development policy: food safety, food science and the consumer.
Godin, B.	1994	The relationship between science and technology: a bibliometric analysis of papers and patents in innovative firms.
Hall, A.	1994	Agricultural biotechnology and small farmers in Asia: the case of Rhizobium inoculants in Thailand.
Mitchell, C.	1994	The renewable non-fossil fuel obligation: a case study of the barriers to energy technology development.
Mukdapitak, Y.	1994	The technology strategies of Thai firms.
Phillimore, A.	1994	Technology, work organisation and training: Australian trade unions, 1983-1994.
Pollak, S.	1994	Computers, telecommunications, and the microbiologist: the online hunt for microbes.
Rothstein, H.	1994	Science in the policy-making process : the case of the regulation of food contact plastics in the UK and EC.
Stamboulis, G.	1994	New technology in the European periphery: the development of the ICT industry in Hellas (Greece).
Stirling, A.	1994	Power technology choice: putting the money where the mouth is?
Sugiura, K.	1994	The technological role of machinery users in economic development: the case of textile machinery industry in Japan and Korea.
Torrisi, S.	1994	The organisation of innovative activities in European software firms.
Tremblay, P.	1994	Comparative analysis of technological capability and productivity growth in the pulp and paper industry in industrialised and industrialising countries.
Woodfield, R.	1994	An ethnographic exploration of factors mediating the relationship between gender and skill in a software R&D unit.
Isnor, R.	1995	Sectoral governance and sustainability in non-ferrous metals production: a study of policy convergence.
Laranja, M.	1995	Small firm entrepreneurial innovation in Portugal: the case of electronic and information technologies.
Loayza, I.	1995	Competitiveness, environmental performance and technical change: the case of the Bolivian mining industry.
Sadowski, B.	1995	Opportunities and constraints for public and corporate networks in post-reunification Germany.
Thiruchelvam, K.	1995	Utilisation of industrial R&D findings in Malaysia: a case study of selected public research institutions, universities and industry.
Vedovello, C.	1995	Science parks and university-industry links: a case study of the Surrey Research Park.
Archambault, E.	1996	Inventors, entrepreneurs and the metamorphosis of telecommunications systems.
Assis, J.	1996	External linkages, innovation and the small and medium sized enterprise: the role and effectiveness of public technology policy in Portugal.

Boira-Segarra, I.	1996	Industrial organisation and environmental performance of the electricity industry in England-Wales and Spain.
Brown, S.	1996	The role of the manufacturing function in developing strategies and managing manufacturing in the car, computer and telecommunications industries: a study of traditional and enlightened approaches.
Cunningham, S.	1996	The content evaluation of British scientific research.
Dallison, J.	1996	RDAs and DRVs: natural constants or social constructs? The case of Vitamin C.
Dumonteil, C.	1996	Agriculture and environment: the environmental implications of the changing relations between supermarkets and growers in the UK.
Evangelista, R.	1996	Embodied and disembodied patterns of innovation and industrial structure.
Favrat, E.	1996	Joint-implementation and the diffusion of technology: the case of cleaner coal technologies in Poland.
Millar, J.	1996	Interactive learning in situated software practice: factors mediating the new production of knowledge during iCASE technology interchange.
Mohd Amin, M.	1996	Energy planning and energy policy analysis for Malaysia
Mwamadzingo, M.	1996	The interaction of universities and industry in science and technology in Kenya.
Remmelzwaal, B.	1996	Technological learning and capacity building in the service sector in developing countries: the case of medical equipment management.
Santarelli, E.	1996	Technological change and the finance process: evidence, theory, and an application to the data processing industry.
Simonetti, R.	1996	Creative destruction' among large firms: an analysis of the changes in the Fortune list, 1963-1987. DPhil thesis.
Smith, A.	1996	Change and continuity in UK industrial pollution regulation: integrated pollution control.
Tether, B.	1996	Virtual panacea and actual reality: small firms, innovation and employment creation: evidence from Britain during the 1980s.
Van Zwanenberg, P.	1996	Science, pesticide policy and public health: Ethylene Bisdithiocarbamate regulation in the UK and USA.
Brady, T.	1997	Software make or buy decisions in the first forty years of business computing.
Brew-Hammond, J.	1997	Technological accumulation and electric power generation in Sub-Saharan Africa: the case of Volta River Authority, Ghana.
Crede, A.	1997	Technological change and the information society: an examination of credit risk assessment and cash handling procedures in commercial banks.
Dalcomuni, S.	1997	Dynamic capabilities for cleaner production innovation: the case of the market pulp export industry in Brazil.
Davis, M.	1997	Electrification and institutional reform in power utilities: case studies in South Africa and Swaziland.
Ferreira da Silva, L.	1997	US Cold War foreign policy and satellite communications: The case of earth station network build-up in Brazil and Argentina
Fraenkel, J.	1997	Growth and slowdown: profitability, capital and output in Britain, 1873-1973.
Judice, V.	1997	Plant biotechnology learning processes: export and food crops in Brazil.
Nightingale, P.	1997	Knowledge and technical change: computer simulations and the changing innovation process.
Robledo-Velásquez, J.	1997	The role of higher education institutions and the government in the industrial innovation process: the case of the Colombian capital goods industry
Russell, J.	1997	The control of lead exposure: a UK-USA comparative analysis.
Schild, I.	1997	The politics of international collaboration in polar research.
Watson, W.	1997	Constructing success in the electric power industry: combined cycle gas turbines and fluidised beds.

Amendola, G.	1998	Technology, competitiveness and patterns of specialisation.
Baskaran, A.	1998	Technology development in India's space programme 1965-1995: the impact of the missile technology control regime.
Choung, J.	1998	Co-evolution of national systems of innovation and sectoral systems of innovation: the case study of Korea and Taiwan.
Dutrénit Bielous, G.	1998	From knowledge accumulation to strategic capabilities: knowledge management in a Mexican glass firm.
Gabriel, N.	1998	Converging partial indicators': an assessment of their contribution to evaluative bibliometrics in Britain.
Hwang, H.	1998	Organisational capabilities and organisational rigidities of Korean Chaebol: case studies of semiconductor (DRAM) and personal computer (PC) products.
Lim, C.	1998	Sectoral systems of innovation: the case of the Korean machine tool industry.
Meliciani, V.	1998	Technical change, patterns of specialisation and uneven growth in OECD countries.
Morrow, S.	1998	Research strategy in UK academic medicine: four case studies in the University of London.
Ono, Y.	1998	Technological capabilities and productivity growth: the case of Japanese railway privatisation.
Pereira-Mendes, V.	1998	Knowledge and increasing returns in recent economic growth.
Rodgers, C.	1998	Producer responsibility and the role of industry in managing waste from electrical and electronic equipment.
Sequeira, K.	1998	The patent system and technological development in late industrialising countries: the case of the Spanish pharmaceutical industry.
Sullivan, G.	1998	Productive Adaptation and Industrial Relations in a Socialist-Oriented Development Strategy: a Study of Nicaraguan Metalworking Enterprises, 1980-87
Tsekouras, G.	1998	Integration, organisation and management: investigating capability building.
Uchupalanan, K.	1998	Dynamics of Competitive Strategy and IT-based Product/Process Innovation in Financial Services: The Development of Electronic Banking Services in Thailand
Constantelou, A.	1999	Transformation dynamics in Southern and Eastern Europe: the emergence of advanced communication networks and services.
Crowther, S.	1999	Patenting genes: intellectual property rights in human genomics.
De Figueiredo, P.	1999	Technological capability-accumulation paths and the underlying learning processes in the latecomer context: a comparative analysis of two large steel companies in Brazil.
Hall, J.	1999	Reducing environmental impacts through the procurement chain.
Javary, M.	1999	The economics of power.
Lindsay, A.	1999	The evolution of microfibre through technology and market pressure: a case study of product innovation and process innovation in the chemical fibre industry.
Marsili, O.	1999	The anatomy and evolution of industries: technological change and industrial dynamics.
Martin, P.	1999	From eugenics to therapeutics: science and the social shaping of gene therapy.
Salter, A.	1999	Faint expectations: science and technology policy in Ontario.
Sapsed, J.	1999	Restricted vision: strategizing under uncertainty.
Smith, K.	1999	Measuring the effects of organisational factors on research productivity and creativity in selected Canadian cardiovascular research institutions.
Thorsteinsdottir, O.	1999	Islands reaching out? External research collaboration in Iceland and Newfoundland.
Amin, A.	2000	The power of networks: renewable electricity in India and South Africa.
Ariffin, N.	2000	The internationalisation of innovative capabilities: the Malaysian electronics industry.
Arroio, A.	2000	Technological opportunities for Brazilian social development: an examination of low earth orbit satellite development.

Bayer, S.	2000	Cleaning up the furnace: patterns of environmental management in the British, Czech and German steel industries.
Dair, C.	2000	An evaluation of the UK regulatory system for the redevelopment of contaminated land.
De Saulles, M.	2000	Innovation within the service sector: the use of interactive networks by retailers.
Hibberd, M.	2000	The technology and structure of the British wood furniture industry.
Hwang, C.	2000	The aircraft industry in a latecomer economy: the case of South Korea.
Intarakumnerd, P.	2000	Thai telecommunication business groups: an analysis of the factors shaping the direction of their growth paths.
Neice, D.	2000	Conspicuous contributions: signs of social esteem on the internet.
Pare, D.	2000	Internet governance in transition: just who is the master of this domain?
Prencipe, A.	2000	Divide and rule: firm boundaries in the aircraft engine industry.
Quintana Aguirre, E.	2000	Arabidopsis thaliana and the origins of plant genomics in Europe.
Santos Pereira, T.	2000	Changing places? The extension of research groups through European research collaborations.
Vera-Cruz, J.	2000	Major changes in the economic and policy context, firms' culture and technological behaviour: the case of two Mexican breweries.
Wessels, B.	2000	The cultural dynamics of innovation.
Brusoni, S.	2001	The division of labour and the division of knowledge: the organisation of engineering design in the chemical industry.
Calvert, J.	2001	Goodbye blue skies? The concept of 'basic research' and its role in a changing funding environment.
Gristock, J.	2001	Organisational virtuality and the UK newspaper industry: a study of a system of innovation as a system of mediation.
Hwang, G.	2001	Diffusion of ICT and changes in skills: an empirical study for the 1980s in Britain.
Lee, T.	2001	Technological capabilities and international relations in developing countries: case studies of the nuclear fuel cycle in South Korea.
Meyer, M.	2001	Between technology and science: exploring an emerging field. Knowledge flows and networking on the nano-scale.
Michaud, P.	2001	Institutional innovation and the selection of complex engineering projects: a dual relation
Montalvo Corral, C.	2001	Assessing the willingness of the firm to develop clean technologies: a case study of the In-Bond Industry in the northern border region of Mexico.
Steyn, G.	2001	Governance, finance and investment: decision making and risk in the electric power sector.
Teixeira, A.	2001	Fission risk or inertia? Human capital decisions in the Portuguese textile industry during the eighties and nineties.
Torbett, R.	2001	Technological collaboration and innovation in the UK: evidence from the Community Innovation Survey.
Wehn de Montalvo, U.	2001	Crossing organisational boundaries: prerequisites for spatial data sharing in South Africa.
Acha, V.	2002	Framing the past and future: the development and deployment of technological capabilities by the oil majors in the upstream petroleum industry.
Carvalho, A.	2002	Technology alliances and firm performance: Portuguese SMEs in an EU sponsored research setting.
D'Adderio, L.	2002	Inside the virtual product: the influence of integrated software systems on organisational knowledge dynamics.
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Kim, B.	2002	The political economy of the internet system evolution.

Marcelle, G.	2002	Technological capability building and learning in the developing world: the experience of African telecommunication companies.
McLeish, C.	2002	Accommodating bio-disarmament to bio-technological change: the issue of dual use.
Pedersen, T.	2002	Is AMT necessarily best? The importance of product design and formal education.
Cacciatori, E.	2003	Total recall? Organisational memory and innovation in project-based firms.
Cleasby, B.	2003	Learning and capability in project-based firms.
D'Este Cukierman, P.	2003	Uncovering the origins of firm heterogeneity: evidence from the pharmaceutical industry in Spain.
Fairclough, C.	2003	An international comparison of policy-making for occupational health and safety: a case study of organophosphate pesticides
Maclaine, D.	2003	Determining the limits of competition: a critical evaluation of the process to introduce electricity supply competition.
Mahdi, S.	2003	Search strategy in product innovation: theory and evidence from agrochemicals.
Morone, P.	2003	Knowledge diffusion and inequality: learning by interacting and the risk of exclusion.
Murray, A.	2003	Public private partnerships in the Internet-based services sector in developing countries
Sargent, L.	2003	To what extent are the environmental provisions of the North American Free Trade Agreement (NAFTA) reconciling trade liberalisation with environmental protection?
Stockerl, K.	2003	Innovation intermediaries: the emergence of customer-active innovation systems in the British social housing sector.
Tuerlings, E.	2003	Dual-use bio-technology: prospects for governance through arms control.
Woodman, B.	2003	Shifting the balance of power? Renewables and distributed generation in liberalised electricity systems.
Avila-Merino, A.	2004	Internet service providers, global or local? Examining Mexico and Spain.
Caldas, A.	2004	The structure of electronic scientific communication: electronic networks, research collaboration and the discovery of digital knowledge bases.
Crespi, G.	2004	The microfoundations of aggregate productivity in a developing country: the case of Chilean manufacturing.
Hopkins, M.	2004	Technique-led technological change and the 'hidden research system': genetic testing in the NHS.
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Gossart, C.	2005	Routines and firms' HSE behaviour: the cases of European and North African oil refineries.
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Merritt Tapia, H.	2005	The performance, management and relevance of government-supported technology research centres: the SEP-CONACyT technology research centres of Mexico.
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Dantas, E.	2006	The development of knowledge networks in latecomer innovation systems: the case of PETROBRAS in the Brazilian offshore oil industry.
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