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Mobilizing for change: A study of research units in emerging scientific fields

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ABSTRACT

Local research units, this article argues, play a very important role for the scientific field they belong to, for example by mobilizing financial support, offering job opportunities, attracting talented recruits, and providing adequate training. Little is known, however, about such units, at least in the fields under study here, i.e., studies of innovation, entrepreneurship and related phenomena. This article focuses – with the help of a survey of 136 research units worldwide supplemented by a number of case-studies – on the factors that influence the extent to which local mobilization efforts succeed. The research shows that universities provide the most fertile grounds for such research units, and that external support and support from the leadership of the university are important factors behind their establishment. In the longer term, however, attracting core (basic) finance is essential for the unit's ability to maintain cognitive control of its research program. Units that develop their own Master and PhD programs appear more likely than others to achieve these aims.

1. Introduction

Emerging scientific fields (Whitley, 2000) have cognitive, social and institutional characteristics. The cognitive dimension, which is the main focus of several contributions in this issue (Fagerberg et al., 2012; Landström et al., 2012; Martin et al., 2012; Martin, 2012), refers to the character of the knowledge base that researchers in a field share. As shown by a wealth of previous research (Price de Solla, 1963; Crane, 1972; Becher and Trowler, 2001), such fields, as with the world of science more generally, also have a social dimension, among other things through the existence of smaller networks of researchers with similar aims, often with different affiliations, linked together by a shared knowledge base, common meeting places and publication channels (Frickel and Gross, 2005; Fagerberg and Verspagen, 2009; Aldrich 2012). However, as pointed out by Hambrick and Chen (2008), the survival of a new scientific field crucially depends on the ability to continuously mobilize resources and support. For this, the creation of new research-performing organizations arguably is a must (Braun, 2011).

Hence, local research units, in the form of dedicated centers, departments, institutes and so on, are essential for the development of new scientific fields. They mobilize human and financial resources, create employment opportunities, and develop training programs for newcomers to the field. With the help of a survey supplemented by case studies, this article studies the factors that influence the extent to which such local efforts succeed. Although the study is limited to the fields covered by this special issue, i.e., studies of innovation, entrepreneurship and related phenomena, the lessons regarding factors that support – or hamper – renewal processes in the scientific world may have wider relevance.

Another term for what we call new "scientific fields" (Bourdieu, 1975; Whitley, 2000) is new "scientific/intellectual movements" (Frickel and Gross, 2005). The latter is defined as "collective efforts to pursue research programs or projects for thought in the face of resistance from others in the scientific or intellectual community" (Frickel and Gross, 2005, p. 206). The emphasis on "resistance" to new ideas in academia underlines the relatively inert character of the scientific establishment. New initiatives that may be seen as challenging the cognitive authority of established centers of power in academia, often face strong resistance (Braun, 2011). Moreover, the new initiative may be seen as an unwelcome competitor for scarce resources (Braun, 2011). Hence, success in mobilizing for change at the local level usually requires more than good ideas. It also requires academic entrepreneurship (Van de Water, 1997) by respected academics that identify with the new initiative. We expect such entrepreneurial individuals to have played an important role in successful attempts to establish new research units in the emerging scientific fields under study here.

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However, the fates of such attempts do not only depend on the energy and talent of academic entrepreneurs, or the attractiveness of their ideas, but also on the opportunities for mobilizing support from the environments surrounding the initiative. Support for the new initiative may be obtained from the organization – often a university – where the attempt takes place, or from sources outside the organization such as research councils, governmental departments, and foundations. Often entrepreneurs attempt to exploit several of these sources. Support from different sources – with different motives and strings attached – may influence the character of the organization differently and, thereby, also the prospects for the unit's long term survival.

The development of a new scientific field requires continuous support over a long period of time. Such stability is, as pointed out by Braun (2011), a hallmark of the university system. Although new initiatives may appear both within universities and elsewhere in society, we regard the chance of survival for a research unit to be higher in the first instance. Outside universities it may be more difficult for the new initiative to develop a sufficiently clear profile, because it may be forced to adapt to changing opportunities for finance. To use a term from sociology of science (Merton, 1973; Hambrick and Chen, 2008), the new initiative may well run into problems with respect to its "differentiation" from other organizations providing knowledge-based services. It should be noted, though, that this may differ somewhat across countries, as governments in some instances have a tradition for establishing and supporting dedicated research institutes providing services to selected parts of the public sector such as ministries for education, science, and industry.

Attempts to introduce new fields into universities have to take into account the special characteristics (or selection criteria) of such environments. As emphasized by Whitley (2000), one such characteristic is that to succeed the proponents of a new initiative have to convince their colleagues in other disciplines and fields that their cause deserves their support (or at least that it should not be actively resisted), what he calls high "strategic dependence" (p. 88). So what can the adherents of the emerging field do to achieve this aim? First, rather than attack head on within an established niche and threaten established "cognitive authority" (Braun, 2011), they can argue that their initiative is a complement to existing fields and serves a socially useful function by providing new knowledge in high demand by society. We would therefore expect the "need for new knowledge" to be a dominant motive behind the establishment of the new unit. Second, to avoid conflict based on competition for resources, it might be beneficial if the new unit, especially in the early phase, can point to success in mobilizing financial support from stakeholders outside the university system. Third, scientists in the new field have to be able to convincingly demonstrate to their colleagues that they adhere to established standards and procedures in the world of science, e.g. by establishing criteria for good work, providing opportunities for publication and scholarly interaction, organizing training of new researchers. The latter, we shall argue, is particularly important. Without training programs for recruits, neither the field as a whole nor its constituent parts are likely to persist. We therefore expect many of the new research units to devote efforts to the development of adequate training programs, particularly at advanced levels. Such efforts may also contribute to the success of the initiative by increasing its legitimacy in the university system. After all, research and teaching are key activities in universities. By contributing to both of these the new unit may be regarded by others as a more legitimate player when it comes to decisions on how internal resources should be distributed across competing ends.

An important source of information to be analyzed in the following is a survey of 136 research units associated with the fields in focus in this special issue, namely studies of innovation, entrepreneurship and related phenomena. The next section considers methodological questions pertaining to the survey and presents the main results. The research units included in the survey are, naturally, all "survivors". To allow comparisons between successful initiatives and attempts that failed, we include in Section 3 a comparison between two successful units and four that for various reasons were closed down. This also allows us to introduce a more dynamic perspective on the reasons for the success – or lack of it – of these units. Finally, based on the results from the study and the literature on the subject, Section 4 considers the lessons with respect to renewal processes in science and, in particular, the role played by local mobilization efforts in such processes.

2. A survey of research units in new scientific fields

It is not straightforward to identify research units that are active in fairly new (but not widely studied) scientific fields such as those considered here. Since the population of units in these fields is unknown, we had to search for this information ourselves.[1] To begin with we identified a sample of research units, mainly within innovation studies and science/research policy, by consulting well-known scholars in these fields, exploiting lists obtained from conferences, networks and professional associations and searching for research centers/departments focusing on these fields on the internet. Later we placed more emphasis on identifying units in entrepreneurship and STS, using the same approach as above. For each identified unit we collected contact information on the leader or, failing to do so, a senior staff member. These were then approached through and asked to fill out a questionnaire. They were also invited to suggest names and affiliations of other suitable recipients of the survey, i.e. a so-called "snow-ball" approach.

The purpose of the questionnaire was to get as much information as possible about what motivated the establishment of the research unit, factors that helped – or hampered – its development, the disciplinary composition of its research staff, its scientific profile, activities, sources of finance, organizational status (whether it was located to a university or not, and in what form), etc. Some questions were aimed at revealing facts (and could for example be of a yes/no nature). In other cases the recipients were asked to assess the importance of a factor, or indicate to what extent they agreed with a statement, on a five point scale with "1" signaling no importance (or complete disagreement) and "5" indicating high importance (full agreement). Hence, we strived to include both questions about factual aspects and questions asking for more subjective assessments of the unit's history and its present situation. A preliminary version of the questionnaire was tested on a small number of prominent scholars, which led to several modifications. For more details about the questionnaire the reader is referred to Appendix A.

The survey was carried out between December 2009 and November 2010. In the end 415 research units, considered by us to be potential respondents to the survey, were invited to take part. Answers to the questionnaire were obtained from 143 units, a response rate of 34 percent, which we consider to be quite satisfactory.[2] There may be several reasons why two thirds of the recipients did not respond to the invitation to participate in the survey. For example, the extent to which research units had updated

[1] Note that since the population of is unknown, we cannot claim that the present survey is "representative". However, we did what we could to identify and approach as many potential recipients as possible.

[2] Sheehan (2001), in an overview of response rates in 19 email surveys published between 1996 and 2000 in scholarly journals in marketing, sociology, communication, organizational behavior, education, statistics and health, reported an average response rate of 31%, a little bit less than in the present case.

Table 1
The extent to which a research unit conducts research in a given field.

Field	% Saying "high extent"	Mean
Innovation studies	81	4.2
Science/research policy	47	3.2
Entrepreneurship studies	58	3.5
Science and technology studies	35	2.8

N = 136. *Note*: "High extent" means score 4 or 5 one 5 point scale measuring the extent to which a unit conducts research in a field.

websites varied, and it is likely that some recipients listed as "leaders" or senior staff members of research units may not have had this function anymore (and hence did not reply for that reason). In addition, the survey contained relatively detailed questions about the history of the research unit, and it is possible that this may have led recipients not sufficiently familiar with this history to not fill out the questionnaire. More important, perhaps, the invitation was sent out by a group of Europeans (the authors of this paper), using an email-address at the University of Oslo, and it is possible that this may had an impact on the probability of recipients from different parts of the world to participate in the survey. Consistent with this, the response rate was markedly higher in Europe (39%) than in other world regions (apart from Oceania but in that case number of invitations was small). The lowest response rate was obtained in America (24%). Country specific factors, perhaps related to language (the invitation was sent out in English), culture or institutions, may also have been at work in some cases, for example we did not receive any answers to invitations sent out to Chinese recipients.

2.1. Basic characteristics

Of the 143 replies to the survey 136–95% – reported doing research within at least one of the scientific fields covered by the survey (innovation studies, science/research policy, entrepreneurship studies and STS). The information that follows is based on the answers obtained from these units. The 136 research units came from 39 different countries. The USA and the UK were particularly well represented, with 21 and 19 units each, far ahead of other countries.[3] Their size varied from just a few to around one hundred employees. Some were of fairly recent origin, while others had existed for around half a century. However, their age was sometimes difficult to establish with precision, since many units have been through extensive organizational changes during their lifetime such as mergers, splits and name changes.

Table 1 provides the results to the questions about the extent of their involvement in "innovation studies", "science/research policy", "entrepreneurship studies" and "science and technology studies", using a scale from 1 to 5 where 1 indicates "no extent" and 5 indicates "high extent". The second column in Table 1 shows the percentage of respondents that ticked either 4 or 5. The third column shows the mean on the five-point scale.

The results indicate that most units are engaged in research within innovation studies. However, the other three fields are also relatively well represented. This means that many units do research in more than one of these fields. Table 2 documents this overlap in more detail. Less than one third of the units are specialized in one field only, while more than one third cover three or more fields. Of those focusing on a single field "Only Innovation" and "Only Entrepreneurship" are the most common.

[3] Nine countries, all Western, had more than five units each. These were the USA, the UK, the Netherlands, Sweden, Italy, Norway, Australia, Canada and Germany. About one half of the countries had only one unit. Although all continents were represented in the sample, only 10% of the units came from Africa, Asia and Oceania.

Table 2
Involvement in different fields.

Field involvement	Percent
Only innovation	14.0
Only entrepreneurship	12.5
Only science/research policy	2.2
Only STS	1.5
Innovation and entrepreneurship	15.4
Innovation and science/research policy	7.4
Innovation and STS	5.1
Science/research policy and STS	1.5
Science/research policy and entrepreneurship	0.7
Innovation, science/research policy and entrepreneurship	12.5
Innovation, science/research policy, STS	10.3
Innovation, entrepreneurship, STS	4.4
Science/research policy, entrepreneurship, STS	0.7
Innovation, science/research policy, entrepreneurship, STS	11.8

N = 136. *Note*: For definition of "Involvement", see Table 1.

Combinations of innovation and entrepreneurship, sometimes extending to science/research policy, are relatively frequent. STS, when present, tends to overlap with innovation studies. These findings are consistent with the observation of Martin (2012) that the notion "innovation studies" increasingly is used in broad sense which includes areas such as "science/research policy". However, it may also indicate that the "innovation studies" field acts as a bridge to the other fields considered here.

Another indication of the scientific profile of the units may be obtained from the educational background of their scientific staff. The most frequent backgrounds are listed in Table 3; these are Economics and Management/Business. However, the four fields, headed by innovation studies, follow next, well above several other (much larger and more established) disciplines. The fact that the fields the units belong to appear to educate a significant share of the scientific personnel in the units under study here may arguably be seen as an indication of these fields' (increasing) maturity.

It was argued in the introduction to this article that new initiatives of the type studied here are more likely to survive in universities than elsewhere. Consistent with this assumption Table 4 below reports that the overwhelming majority belong to a university. There is, however, a wide spectrum of organizational forms possible in this case (Table 5). The most common is to be a research center, either under a faculty or directly under the leadership of the university. About one quarter reports to be a sub-unit of a department. However, only one in six reports to be a department, usually a more prestigious alternative that exercises more power and commands more resources in universities.

Table 3
Main educational background of scientific staff.

	% High extent
Economics	43
Management/business	40
Innovation studies	35
Entrepreneurship	29
Science/research policy	21
Science and technology studies	20
Sociology	18
Natural science/engineering/medicine	16
Geography/regional studies	13
Organizational science	10
Political science	10
History/law/philosophy/other humanities	9
Psychology	6
Other	4

N = 136. *Note*: "High extent" means score 4 or 5 one 5 point scale measuring the extent to which a unit has research staff with the relevant educational background.

Table 4
Nature of research units.

Is your research unit	% Yes
Part of a university	85
Part of a public or non-profit research institute	19
Part of a government agency	1.5
Part of a public or private company	3.0
Other	3.0

N = 136. *Note*: Multiple answers allowed.

Table 5
Universities: character of research units.

Is your research unit	% Yes
A research centre under a faculty	27
A sub unit of a department	25
A research center directly under university leadership	19
A separate department	16
Other	13

N = 115. *Note*: Question applies only to units that are a part of a university.

Table 6
Key reasons for the establishment of each unit.

	% Important	Mean	*N*
Initiative of one or a few key individuals	84	4.39	122
Need for new academic knowledge	68	3.87	117
Need for cross-disciplinary work	57	3.57	122
Creation of a new academic teaching program	34	2.61	127
Initiative from policy-makers/non-academic actors	30	2.54	125

Note: "Important" means score 4 or 5 one 5 point scale measuring degree of importance.

2.2. Key factors behind the establishment of the units

Tables 6 and 7 contain information on the respondents' views on what motivated the establishment of the unit and on key factors that influenced its formation and subsequent development. The hypothesis that academic entrepreneurship is a crucial factor behind the establishment of new research units is overwhelmingly supported: 84 percent of the respondents rank this as "important" (Table 6). The results also show, as we would expect, that the most important motive for the establishment of the new unit was a need for new knowledge. However, the need for more cross-disciplinarity also ranks high on the list of motives, indicating that a perceived need for combining insights from different disciplines to produce new, socially relevant knowledge may have been an important driving force in many cases. This may indicate that most research units were formed as complements rather than alternatives to existing units within the organization they belong to. Although less common, the need for a new teaching program also contributed to formation of new units: About one third of the respondents ranked this motive as "important".

Table 7
Barriers and support.

	% Agree	Mean	*N*
Support from the university leadership has been crucial to our development	53	3.45	120
Other research units at the same university have been supportive of our organization	42	3.21	117
Our unit would not have developed without support from policy-making organizations	38	2.78	125
We have been met with strong skepticism from many disciplinary academic departments	29	2.57	124
There are sub-groups in the organization with little interaction with one another	17	2.01	123
It has been difficult for us to find partners within our home country/home region	15	2.06	125
Our organization has seen major conflicts between the original founders and other staff members	6	1.54	125

Note: "Agree" means score 4 or 5 on a 5 point scale measuring degree of agreement.

However, as pointed out in the introduction, high motivation and entrepreneurial spirit are not enough. The proponents of the new initiative also need to mobilize support, not least financial, if the unit is to survive and prosper. The results (Table 7) suggest that for the units surveyed here, which all are survivors, support from the leadership of a university was of crucial importance. Other important sources of support were support from other parts of the university[4] and support from policy makers. Slightly less than one third of the respondents claimed that the initiative had been met with strong skepticism from disciplinary departments. However, it is possible that this underestimates the impact of such skepticism, since initiatives facing fierce opposition from disciplinary traditionalists may have been filtered out at an early stage.

2.3. Activities and funding

To what extent can the units be said to be firmly in control of their own activities? Who, for example, makes decisions about the profile of their research? Is it the units themselves or, say, those that finance the activity? The results from the survey suggest that there may be a combination of both. Table 8 shows that the most common form of research, as reported by the respondents, is "research on own defined problems", consistent with a fairly high degree of internal control of the research undertaken. But "research on externally defined/negotiated problems" also figures relatively high on the agenda, as does policy advice, pointing to a widespread focus in these units on issues of wider societal relevance and interaction with external parties. Other types of knowledge-based services, such as evaluation and consultancy, which are commonly transacted in markets, are less common, though. This clearly differentiates the units surveyed here from actors specialized at providing such knowledge based services in markets such as consultancy companies.

In the introduction to this article, the importance of taking part in education activities for the survival of the units and the field(s)

Table 8
Extent to which a research unit pursues different activities.

	% High extent
Research on own defined problems	77
Research on externally defined/negotiated problems	48
Policy advice	40
Evaluation	23
Consultancy	21

N = 136. *Note*: "High extent" means score 4 or 5 one 5 point scale measuring the extent to which a unit pursues the activity.

[4] Support from other parts of the university is positively correlated with university leadership support (the correlation coefficient is 0.37, significantly different from zero at the 1% level in a two tailed test). In contrast, there is no significant relationship between university leadership support and the third most important source of support, i.e., support from policy makers.

Table 9
Involvement in educational programs.

	% Offers today
Courses at Master's level	58
Courses at PhD level	48
Courses at Bachelor level	46
Own PhD degree/program	35
Own Master degree(s)	33
A formal program for visiting researchers	32
A formal program for visiting students	26
Own Bachelor's degree(s)	16
A formal post-doc Program	13

$N = 136$.

Table 10
Extent of funding from different sources.

	% High extent
Basic/core funding	38
Other national funding	28
Research council	26
EU funding	19
Other university funds	13
Private foundations/non-profit	13
Other international	10
Private firms	8

$N = 136$. *Note*: "High extent" means score 4 or 5 one 5 point scale measuring the extent to which a unit receives the relevant type of funding.

they belong to was pointed out. Consistent with that emphasis, the survey shows that most units participate in education activities in one way or another. Indeed, three out of four report being involved in courses at some level and within universities the share is, as one might expect, even higher (four of five). The most common type of involvement is courses at the master level. About one third of the units have their own masters degree and the same goes for a PhD program. However, relatively few units have established their own bachelor's degree (Table 9). Hence, the education they offer may in most cases be regarded as a supplement rather than an alternative to the undergraduate programs offered by traditional (disciplinary) departments.

The funding structure may be where the units surveyed here differ most from traditional departments (Table 10). Although the most common source of funding is "basic/core" funding, as is common in universities, only 38 percent report receiving this to a "high extent". Other important sources are research councils and "other national funding" (from public sources). Funding from international sources, particularly the EU, and private sources also matter, but less so. Hence, the surveyed units draw on a variety of sources in order to finance their activities.

An interesting question – highlighted in the introduction to this article – is to what extent differences in the structure of funding matter for what the units do. Table 11 reports the correlations between the three main sources of finance and the main activities of the units. The results show that research on "own defined problems" and engagement in master and PhD programs correlate positively with basic/core funding. In contrast, research on "externally defined problems", policy advice, evaluation and consultancy correlate positively with a high degree of "other national funding" from public sources (excluding research councils). Hence, these two sources of finance – which according to respondents also are the most important ones – tend to be associated with very different activities.[5]

[5] The third most important source, support from the research council, seems to be situated between the other two in terms of its correlation with activities, but arguably closer to "other national" than "basic/core" funding.

2.4. Discussion

The units surveyed in this section are examples of attempts – so far successful ones – to establish research units in new scientific fields. The success of these attempts, which were mainly motivated by a perceived need for new knowledge and more cross-disciplinarity in research, owe much to the entrepreneurial activity of a few key individuals. The overwhelming majority of these units are located in universities, and support from the university leadership and other parts of the university have been crucial in their establishment and subsequent development. Resistance from traditional disciplinary departments, a factor often emphasized in the literature on emerging scientific fields, is present to some extent but appears not to have been very consequential. However, as pointed out earlier, it is possible that a survey of a sample of non-survivors would have led to a different result in this regard. Nevertheless, to the extent that the conclusion holds, it may indicate that the units surveyed here have succeeded in presenting themselves as complements rather than as alternatives to existing disciplines and that cognitive conflict has been largely avoided.

Arguably, the survival of a new initiative is more than anything else dependent on the ability to mobilize the necessary resources (Hambrick and Chen, 2008). As pointed out by Braun (2011), even if cognitive authority is not threatened, conflicts about distribution of resources may still be a major hurdle for attempts to establish new units in emerging scientific field. It was pointed out in the introduction that access to external finance may help to dampen such conflicts, especially at an early stage. The diversified financial structure that characterizes the units surveyed here, with a significant element of external funding, may indicate that this has worked in many cases.

However, while external funding may be important for the new unit's establishment and its subsequent development, too high a reliance on such funding may also lead to problems, for example a gradual loss of control of the unit's research agenda through adaption to shifting needs among those that finance research and, possibly, a gradual dilution of the research profile of the unit (and hence in its "differentiation" vis-à-vis other units). A drift along such a path is likely to lead to a loss of legitimacy which may well be detrimental to the unit's long term survival. Therefore, in order to survive and grow, the unit may need to gradually increase its basic or core funding, which – as the results from the survey confirm – gives it more room for setting its own priorities with respect to research. Such support also represents a "cushion" against fluctuations in other types of finance. Hence, units with a high degree of core, long-term funding are clearly more robust to withstand sudden changes in the environment. The results from the survey indicate that the leaders of the research units were highly aware of the importance of the funding structure. Indeed, they identified the need for more long term (and basic/core) funding as one the greatest challenges the units currently faced (Table 12). Although one should be careful not to draw strong inferences about the direction of causality (i.e. what leads to what), it is interesting to note that the success in acquiring basic/core funding is strongly correlated not only with more independence in research but also with a strong engagement in master and PhD education.

3. Case studies

A methodological problem with the survey is that the research units we study are all "survivors". To alleviate this bias, we searched for information on units that for various reasons were closed down. This appears to have been a relatively rare phenomenon in the fields covered by the study. However, we were able to identify and research the histories of four such

Table 11
Correlations between main activities and funding sources.

	Basic/core funding	Research council	Other national funding
Research on own defined problems	.227**	.168	−.034
Research on externally defined/negotiated problems	−.236**	.144	.263**
Policy advice	−.241**	.177*	.366**
Evaluation	−.213*	.195*	.321**
Consultancy	−.241**	.262**	.228**
Master program	.325**	.05	−0.10
PhD program	.358**	.20**	.016

$N = 136$.
* Significance at the 0.05 level.
** Significance at the 0.01 level, at a two-tailed test.

Table 12
Greatest challenges.

	% Agree	Mean	N
More long-term funding and work	80	4.12	118
Attracting qualified personnel	67	3.88	121
More basic/core/unrestricted funding and work	61	3.80	115
Increasing the international scientific publishing	57	3.60	116
Attracting good students	51	3.39	111
Improving international collaboration	51	3.35	117
Developing a (better) scientific research program	45	3.18	114
Support from/relationship to university top leadership	44	3.21	115
Improving the scientific leadership	38	3.07	116
Support from/relationship to policy actors/public agencies	36	3.02	117
Improving the job opportunities for graduates	34	2.85	110
Improving ties to industry	33	2.88	117
Development of educational program	31	2.66	111
More policy-oriented/practical funding and work	30	2.97	115
Support from/relationship to other academic departments	29	2.89	114
Improving the research culture in the organization	26	2.63	117
Support from/relationship to other universities/research units locally	25	2.65	116
Dealing with internal communication/collaboration problems	12	2.35	120

Note: "Agree" means score 4 or 5 on a 5 point scale measuring degree of agreement.

units, which are briefly recapitulated below. The emphasis in the case studies is on the same issues as in the survey, such as the factors behind their establishment, the role of academic entrepreneurs, sources of finance, their organizational status, and the character of their activities. To facilitate comparison we also included two successful cases, taken from innovation studies and entrepreneurship studies, respectively. The studies draw on a multitude of sources; interviews (face-to-face or through email), web-pages, published material and other documents (such as annual reports).[6] Some of our informants also provided us with written accounts of their unit's development. Although the case studies are small in number, their geographical coverage is broad. Five countries in three different continents are represented. These are Australia, The Netherlands, Sweden, the UK and the USA (two cases). As in the survey five of six are (or were) located in universities. They comprise both centers focusing mostly on research and units that combine research and teaching on a regular basis. Hence, the research units included in the case studies share many of the characteristics of those covered in the survey. The case studies are presented in chronological order (based on the date of establishment).

3.1. SPRU, United Kingdom[7]

SPRU – the Science Policy Research Unit – came into existence in 1966 at the recently founded University of Sussex. In the beginning it had a scientific staff of just three persons, including the director, Chris Freeman, who previously among other things had worked as a consultant for the OECD on R&D statistics (he was the principal author of the first Frascati Manual in 1962). The combined scientific profile of these first three staff members was unusually broad, covering economics, history and natural science, yet with a fairly focused research program. A high proportion of employees with a background in natural sciences and engineering, usually around 30–40 percent, came to be a defining characteristic of the new venture. When Freeman stepped down as director sixteen years later, the research staff had grown to close to fifty. Most of this expansion was externally financed. On average in these early years, about 85 percent of the unit's income came from external research grants.

The creation of SPRU was the result of initiatives from a number people who, to a large degree, worked relatively independently of each other. To some extent, the idea that science – and in particular, its priorities, funding, governance and so forth – was an important political issue that required a more developed knowledge-base to be adequately dealt with was already in the air in the early 1960s. It is probably no coincidence that similar initiatives were taken in other countries at approximately the same time. In the British context, much of the credit should go to the philosopher and historian of ideas, Stephen Toulmin, who in the early 1960s was actively lobbying for the creation of a center for science policy studies in a British university. He found a receptive environment in the University of Sussex, established in 1960, the leadership of which supported cross-disciplinarity, especially with regard to teaching. However, failing to obtain the desired scale of support, Toulmin aborted the initiative. But the University leadership and especially the Pro-Vice Chancellor for Planning, the historian Asa Briggs, did not give up on the new idea, and after some reflection an offer was made to Freeman, who had been involved in Toulmin's earlier plan for the new center.

Even if the new venture was primarily supposed to be a research unit, the finance for it was sought from funds originally set aside for cross-disciplinary teaching (across the natural and social sciences and the humanities), and the first two scientific employees of the unit therefore agreed to teach in various existing programs in the university. Gradually the unit increased its influence on the teaching activities in which it was engaged, although it took 17

[6] Every effort was made to check the case studies included here with our informants. The responsibility for remaining errors and omissions is our own, however.

[7] The study of SPRU draws to a large extent on Fagerberg et al. (2011).

years before it became formally responsible for its own teaching program. This happened as a result of changes in the funding of academic research in the UK during the 1980s, which increasingly came to favor large, well-established units. SPRU adapted to the new conditions by among other things increasing its involvement in teaching. As a result of these changes, a major increase in the university's support to SPRU occurred in the mid-1980s. Nevertheless, the lion's share of SPRU's resources continued to come from external research grants and this is still the situation today.

The support – and the entrepreneurial drive – of the leadership of the new university was a decisive factor not only in SPRU's creation but also in its subsequent development. This, and the position of SPRU as an independent "school", gave it direct access to university leadership, and thus contributed to its continuing success. However, the major credit for its subsequent growth undoubtedly should go to its first director, Freeman, who, in cooperation with other members of the staff, gradually managed to secure large-scale and long-term financial support from external sources, mainly from the UK research councils but also from governmental departments, foreign and international bodies and private firms. During his tenure as SPRU director, Freeman also established himself as one of the world's leading academics in the area. Under his leadership, SPRU quickly developed into a global hub in what later came to be termed "innovation studies".

Although SPRU continued to be relatively successful, the "post-Freeman" period (after 1982) also presented certain difficulties. First, SPRU gradually lost its privileged access to the top leadership of the University. This process ended with a reorganization in 2010 in which SPRU finally lost its status as an independent school and was incorporated as one of several units (albeit the largest one) in a new School of Business, Management and Economics. Second, it is often claimed that the way in which public funding of research is allocated in the UK, based on periodic research assessments dominated by traditional disciplinary perspectives, has made the financial climate more difficult for cross-disciplinary, problem-oriented research of the type undertaken by SPRU (see Rafols et al., 2012). Third, although the initial transition of leadership was quite orderly, for a period of about four years after 2004, it proved impossible to find a permanent full-time Director, a situation which has only recently been resolved. Nevertheless, SPRU continues to be regarded as one of the central research environments internationally within the field of innovation studies, with a number of vibrant research groups focusing on different thematic priorities, and attracting a large number of doctoral students from all over the world.

3.2. Center for Policy Alternatives (CPA), United States

The Center for Policy Alternatives (CPA) was established at the Massachusetts Institute of Technology (MIT) in the US in the early 1970s and thus represents one of the early attempts at institution building in this area. The founders were prominent academics who had previously worked on science and technology policy for the US government, and who saw a need to improve the knowledge base on how best to shape such policies. Among the supporters behind its establishment was the then MIT President and the Dean of Engineering. The first director became John Herbert Hollomon, an engineer by training, who, among other things, had previously been the general manager of General Motor's research activities and assistant secretary for science and technology at the United States Department of Commerce.

The tradition at MIT is that centers are temporary research organizations financed through external grants. Hence, the center did not have its own educational program, although some of its staff participated in teaching activities in other parts of MIT. Support for the center's establishment was secured from the Alfred P. Sloan Foundation, a well known philanthropic institution in the US with an interest in science and technology. An endowed professorial chair was obtained from the Japan Iron and Steel Foundation and Hollomon became the first holder of the chair. For a while, CPA flourished through grants from the US government, private foundations, firms and various foreign governments. But the center experienced a setback in the early 1980s after Hollomon became seriously ill and was unable to fulfill his role in the same way as before. Eventually he decided to quit the university. Following this a committee was set up by the university to assess the future of CPA. The committee concluded that the center had several problems and recommended that it was closed down. In the course of a few years, CPA gradually dissolved, and its staff dispersed to a number of institutions.

Although CPA disappeared, work on technology policy and related issues continued in various guises and settings at MIT in the years that followed. One of these was the Technology and Policy Program (TPP), set up with support from the Alfred P. Sloan Foundation in 1975, which offered a new masters degree. About a decade later, after CPA was closed down, this program became part of a new Center for Technology, Policy and Industrial Development (CTPID), directed by Daniel Roos, the second holder of the Japan Iron and Steel Foundation chair. CTPID had a broader platform than CPA, since it had its own master program, and to larger extent focused on policy issues of relevance for industry. It also placed more emphasis on interacting with faculty in other parts of the university. The process culminated in the creation of the multidisciplinary Engineering Systems Division (ESD) at MIT in 1998, again with Roos in a leading role.[8] At ESD researchers combine engineering techniques with management and social sciences to tackle social, economic and managerial challenges. ESD also has an extensive teaching activity. Currently, approximately 300 students are enrolled in ESD's five master's programs. Particular emphasis is placed on its PhD program which currently has around 60 students enrolled.

3.3. Arthur M. Blank Center for Entrepreneurship, United States

The Arthur M. Blank Center for Entrepreneurship, focusing on co-curricular programs for student entrepreneurs and applied research programs that help expand the practice of entrepreneurship, is located at Babson College outside of Boston, Massachusetts. The college was created in 1919 by the entrepreneur and business theorist Roger Babson. The center, which is a private institution, is located in the College's Entrepreneurship division. The division, established as late as in 1999, currently has one of the largest entrepreneurship faculties in the world.

There have been professors teaching entrepreneurship courses at Babson since the early 1970s. The Center for Entrepreneurial Studies (CES), established in 1978, brought those teaching such courses into a separate organizational unit. This was as a strategic move by the then Babson College President, Ralph Sorenson, who had identified entrepreneurship as a niche in which Babson could excel. The CES also provided an entity to leverage fundraising efforts (endowed chairs, grant-writing, etc.). In the early years, the main focus of the center was on developing courses and curriculum on entrepreneurship. The first undergraduate major in entrepreneurship was created in 1979, and the first MBA with new venture creation and entrepreneurship at its core came in 1993. Gradually the emphasis on research increased as well. The Babson College Entrepreneurship Research Conference (BCERC) and the associated publication 'Frontiers of Entrepreneurship' were

[8] On the long process leading to the establishment of the ESD, see Roos (2004).

established in 1981. BCERC was the first entrepreneurship research conference in the world and is currently regarded as one of the most important conferences within the field (Aldrich, 2012).

Private support has been absolutely critical to the operation and expansion of the center.[9] The Academy of Distinguished Entrepreneurs, created in 1978, with which many famous US entrepreneurs came to be associated, participated in the establishment of the center. The Babson College, in conjunction with the Babson Family, endowed the first chair, the Paul T. Babson Professor of Entrepreneurial Studies. In 1998 The Center was renamed as the Arthur M. Blank Center in honor of the entrepreneur who had co-founded the company Home Depot (and who was himself a graduate from Babson College). Blank – the entrepreneur – provided financial support for a new building and finance for a part of the Center's operations. Several other individuals (in many cases themselves entrepreneurs and former Babson graduates) as well as private foundations have also given support to the center. One example is Frederick Hamilton (entrepreneur and Babson graduate), who endowed the second chair in entrepreneurship. The Louis and Harold Price Foundation has funded programs at the center and has provided an endowment which partially funds ongoing activities. The Ewing Marion Kauffman Foundation provided funding over a ten-year period (ending December 2004) helping the Center to launch the Global Entrepreneurship Monitor (GEM).

GEM is the only database based on interviews with entrepreneurs and the most wide-ranging source of information on entrepreneurial attitudes, activities, and aspirations world-wide. Both the GEM project and the Babson conference have been important for the development of the entrepreneurship research field (Aldrich, 2012). Other important projects at the center are the Diana project (a multi-year and multi-university study of female business owners and business growth activities) and the STEP project (a global applied research initiative that explores the entrepreneurial process within business families).

3.4. The Department of Science and Technology Dynamics, The Netherlands

In 1980 the Netherlands' Council for Science Policy Advice initiated a competition among the Dutch universities for a research unit to study science dynamics. A budget of DFL 400,000 (which was a considerable sum at the time, with one DFL worth around half a Euro) was envisaged. The University of Amsterdam competed with a cross-disciplinary proposal prepared by a guest professor (Wolfgang van den Daele) and an interfaculty committee. Amsterdam eventually won the national competition which went through several stages.

The new unit in Amsterdam was expected to focus on academic studies on science and technology policies. Initially, the Board of the University had provided a guest professorship for one year with the promise that this would be continued if the competition was won. In addition to resources obtained by winning the competition the participating faculties provided matching resources, to a large extent in the form of personnel. This included teaching staff for subjects such as science and society, philosophy of science and sociology of knowledge. These were all housed in the new department which offered opportunities both in teaching and research. Between 15 and 20 people worked in the center in its most vibrant years, of which six to eight were tenured staff (including one Chair), along with a number of postdocs and PhD students.

During the 1980s and early 1990s the new unit flourished. At the time of the startup, the structure of the university was rather decentralized. The new unit was defined as a Department with its own budget, located in the Faculty of Chemistry which had agreed to house the new interfaculty unit. However, internal university participation in the Department represented a constant challenge. There was much ongoing negotiation, not least in relation to fluctuating student numbers of the different faculties. Over the course of time, the various faculties began to discuss their participation. Although the university board did what they could to protect the unit, the operation of the Department was characterized by considerable friction. By the mid 1990s the growth of the unit's activities had ceased.

The department was closed down in 2000. This happened for a variety of reasons, most of them related to the changing context. A wave of centralization took place; the university wished to be organized in larger, discipline-based units, a criterion the department could hardly be expected to satisfy. It was by nature cross-disciplinary. Moreover, the unit was seen as too small in size and annual student numbers. In addition, internal management became increasingly difficult because of different disciplinarily affiliations, career perspectives and opportunities among the employees.

3.5. Centre for Research Policy, Australia

The Centre for Research Policy (CRP) grew out of two separate organizations at the University of Wollongong: The Centre for Technology and Social Change (TASC) and the Department of Sociology in the Faculty of Humanities. TASC was a contract-based organization that relied entirely on external income. In 1990 the head of TASC and a professor of sociology specializing in science policy prepared a joint bid to the Australian Research Council (ARC) for funding for a Special Research Centre (SRC). A SRC, expected to concentrate on basic and postgraduate research, received core funding for three years, with the possibility of a further three-year extension.

The higher education system in Australia had undergone considerable change during the 1980s. The divide between universities and colleges was removed; existing institutions merged and new ones were created. The number of academic staff seeking research funding increased considerably, as did the number of postgraduate research students. At the same time the finance of national research institutes had been made more competitive. However, there was little systematic policy analysis, evaluation or advice to understand the impact of these changes or to "fine-tune" policies. The competence that existed was scattered and characterized by little interaction. It was in this context the CRP submission for a research centre creating a common framework for national researchers on the issue (and leading to qualified policy advice) was successful. In addition to the funding from ARC, the University of Wollongong agreed to contribute the salary for a full-time Director, accommodation and some administrative support.

Expectations were that the Centre would undertake analytical studies of the research system in Australia and elsewhere. The studies were to generate theoretical insights, produce academic international publications and provide policy advice to Australian research-funding agencies. The Centre was also expected to bring together other researchers in Australia concerned with research policy. Initially two Directors (one full-time and one part-time), three research fellows, two research assistants and two administrative staff worked at the Centre.

A management committee was set up including both Directors, the Pro Vice Chancellor (research) and a representative from another faculty at the university. A high-level advisory board was also established, including the Australian Chief Scientist, a representative of the Vice Chancellor and a number of senior people from science agencies. In addition, the Centre established a Research Policy Network that met twice each year. The network included

[9] See Aldrich (2012) about the importance of private funding for entrepreneurship studies in the US.

researchers working in related areas at other universities. It soon became clear that maintaining such a network was costly and required external funding.

The Centre had three research Programs: one directed toward the higher education research system, one toward research policy, research culture and organizational change, and one toward science and research policy in the Asia Pacific region. Each program was led by a Research Fellow, who was also responsible for bringing in external research funds to support new projects. The main emphasis was on research, although there was commitment to a small group of doctoral students. Degrees were awarded through the Faculty of Humanities, with the Centre as the enrolled 'School'.

After three years ARC funding the Centre received one additional year to become "self-sufficient". From ARC's perspective, the Centre had a stronger emphasis on applied research and, while they saw value in this, they did not consider it appropriate for continued special research centre funding. The University agreed to maintain the Centre but on the condition that it would become self-sufficient. At this point both of the original directors had resigned, and one of the original research fellows was appointed as Director with the task of generating sufficient external funds to cover the salaries of its research and administrative staff.

The pressure to be self-sufficient meant that a small centre like CRP was pushed in various directions, depending on potential sources of funding. Two options seemed viable: a large number of small projects, or a small number of large projects. CRP tried both options and both proved problematic. Many small projects required additional sources of funding to underpin on-going salary commitments since new projects did not flow in on a sufficiently regular basis. Larger projects allowed for more flexibility in this regard but tended to divert the Centre's activities from its original program.

Initially, the Centre had School status within the Faculty of Humanities. Later, after ARC funding ceased, it moved to the Faculty of Commerce with the support of the university leadership, which, among other things, agreed to underwrite the salaries of a small number of academic staff. However, the move also implied that additional pressures were placed on the Centre to develop, nurture or support other research initiatives. In retrospect these additional activities diverted CRP from its core research interests. In 2002 the Director since 1996 took a long-term leave and subsequently (in 2004) resigned from the University of Wollongong. The CRP closed shortly afterwards. Only one member of the CRP research team is still at the University of Wollongong. Although he continues to carry out research in the field, there is no center structure in place.

3.6. SISTER, Sweden

SISTER – the Swedish Institute for Studies in Education and Research – was established around the end of the millennium as an independent research institute outside the higher education sector. It was set up to cover the three broad areas of study – innovation, research policy, and (higher) education policy – with activities ranging from policy advice and evaluations to scientific research.

The initiative came from a number of individuals in the Swedish research foundations and academies of science. They had seen an increasing need for independent analysis of the Swedish system of higher education and research, a need which had also been mentioned in a government Green Paper in 1996. Here, it was argued that a competitive funding system required independent quality monitoring. Higher education and research had grown rapidly and become subject to various types of performance-based funding. However, qualified and independent knowledge about how this system worked was generally lacking.

SISTER was governed by an association set up by the large and influential Swedish academies of science, engineering, agriculture, and humanities, along with research foundations with responsibilities for funding research in different areas. The association gave a core grant to the new institute and four foundations guaranteed this funding for a period of five years with an option to continue for a further five years. It was expected that SISTER would also carry out commissioned research and apply for funding from research councils and elsewhere.

The institute was located in Stockholm and three prominent Swedish researchers were hired as research directors, all from the university system and bringing with them a number of existing projects. Many of the projects were carried out with significant involvement from established innovation and science policy researchers elsewhere in Sweden. A number of large research projects were started on "culture in the knowledge society", on science and innovation policy issues, and on the higher education system in Sweden. The first years saw a steady stream of publications from SISTER in the form of reports, books in Swedish and some articles in international scientific journals. The institute was not involved in teaching.

The need for independent advice was as mentioned commonly acknowledged. This enabled the new research unit to differentiate itself from existing groups. However, some established actors were more dubious about the newcomer. This skepticism was first and foremost found in the ministries and agencies responsible for research and in the higher education system. These often had their own analytical staff and were not keen to have a new organization studying and evaluating their activities. Moreover, independent research institutes are relatively rare in Sweden. Instead, most contract research has been carried out within universities. Thus, the basic strategy of SISTER seemed to some extent to lack legitimacy in the Swedish context. In addition, it was clear from the beginning that the association would not be able to finance the research institute permanently, and that a new source of core funding would have to be found.

Some of these challenges were pointed out in an evaluation of the institute in 2003, and several changes took place from 2004 to push SISTER closer to the policy community. It started referring to itself as a think-tank as well as a research institute, and the topics of study were more directly tied to public policy analysis rather than broader studies of research, education, and innovation systems. "Relevance for policymakers in the Swedish landscape" became a new slogan. This change was to some extent successful in terms of enhancing SISTER's reputation in the relevant communities. The leader of the association governing SISTER commented that the previous "negative attitudes" had changed and that there was now more appreciation of SISTER's work. Although scientific work was still carried out, more emphasis was given to syntheses of existing knowledge, consultancy work, and involvement in policy-oriented projects.

However, the institute failed to mobilize the long-term resources needed, as the ministries of education/research and trade and industry did not want to provide basic funding for SISTER. Furthermore, a downside with the new direction was that it became harder for the institute to obtain funding from the research councils. As a consequence the institute became ever more dependent on short-term projects. Leading senior researchers started to look for jobs elsewhere. Most of the staff in the final years of operation was relatively junior with little chance of attracting research council funding. In addition, a new Swedish innovation agency had given long-term funding to several high-profile research units within the university system, focusing on some of the same issues as SISTER. Towards the end of 2008 the association decided to close down SISTER, citing lack of basic funding, lack of opportunities for expanding the core funding from the foundations and limited success in obtaining research council grants as key reasons for "this regrettable decision". The negative attitudes in the government agencies were also mentioned.

3.7. Discussion

The six cases differ considerably in character, timing and context. However, instead of highlighting the unique aspects in each specific case, we will here concentrate on what we can learn from these cases with respect to the questions outlined in the introduction and the evidence from the survey presented above.

As would be expected in most cases, entrepreneurial individuals responding to opportunities in the environment played an important role in the initiatives, particularly in the early phase. However, often it was initiatives from several people, acting to some extent independently of each other, rather than actions by a single individual that led to creation of the new unit.[10] In general, the initiatives considered here received strong support from the leadership of the organization, in five of six cases a university, in which it was embedded. Indeed, in several cases the leadership of these organizations (or individual representatives therein) was very proactive in promoting the new initiative. The cases of SPRU and CPA may serve as examples of this.

The opportunities that these academic entrepreneurs reacted to were partly scientific (the need for new knowledge), partly political (the application of this new knowledge may have important social and economic consequences) and partly financial (significant external finance for new initiatives may be available). The organizations that hosted the new research units were often willing to provide some financial backing (or "matching funding") in the anticipation of substantial external financial support to the new initiative. The evidence from the case studies suggests that without such prospects for external financial support, the initiatives under study here would probably not have come very far. This is consistent with the argument that availability of external financial support is a very important factor facilitating the creation of new research units in emerging scientific fields. If such finance falls short of expectations, the new initiative may face serious problems as happened, for example, in the cases of SISTER and CPR.

In the introduction it was argued out that the chances for local organization-building in an emerging scientific field to survive should be expected to be higher within universities than elsewhere, and the findings of the survey are consistent with this proposition. The experiences of SISTER are illustrative of the problems that initiatives outside universities may face. Encountering problems in competing with university-based research-teams in the research councils, and failing to capitalize sufficiently (in terms of long-term, core funding) on its policy-oriented work, it became ever more dependent on short-term projects on various issues. As a result the profile of the center became blurred, its legitimacy in academic circles (and, hence, its possibilities for finance of long-term research) decreased and academically ambitious researchers started to leave, resulting in a vicious circle in which the center gradually drifted towards a market niche already populated by players well adapted to the conditions there (such as consultancy companies).

Although life for a new initiative may be difficult outside universities, it may be quite challenging within universities as well. Indeed, three of the five university units considered here were closed down. This happened despite the fact that all five units initially were supported by the leadership of their respective universities. However, after a decade or more, both the leadership and the conditions within which they operate may have changed considerably, and the new research unit can not take for granted that the support it initially enjoyed will continue independent of changes in the organization's environment. For example, when CPA ran into trouble after about a decade of operation, both its initial supporters, the University President and the Dean of Engineering, had left their positions. This illustrates how the new unit, in order to survive, needs to transform the initial backing from the top into a more broad-based support from the environment in which it operates. Mobilization of support is, as pointed out by Hambrick and Chen (2008), not a once-and-for-all event but a continuous process.

To succeed, the proponents of a unit must be able to convince a sufficient number of colleagues from other disciplines and fields that what they do is a worthwhile addition to the university (Whitley, 2000). It was argued in the introduction that this is easier to achieve if the new unit contributes to both research and teaching, the two main activities in universities, and the results from the survey are consistent with this hypothesis. The case studies are illustrative in this respect. In fact, two of three university units that were closed down, CPA and CPR, did not have any educational programs of their own, while the two survivors, SPRU and CES, combined research and teaching to a larger degree.[11] SPRU and CES, to a greater extent than the other two, also increased their legitimacy in the academic world by contributing actively to the development channels for scholarly exchange, communication and distribution of reputation in their respective fields.

Both CPA and CPR were – or became – marginal activities at their respective universities, totally dependent on external funding. When financial problems mounted, it was easy for the leadership to close them down. The Dutch case, The Department of Science and Technology Dynamics at the University of Amsterdam, was also discontinued but apparently for different reasons than the other two. First, the relationship to other departments and faculties, which supplied a large part of the staff, became increasingly problematic. This may indicate that the initially quite broad support from the university became narrower over time. Second, the environment in which the unit operated changed. Arguably, in the new context the activities of department, especially its teaching program, became too small to merit continuing support. Hence, to survive over the long run it is not sufficient to adapt successfully to the environment at the time when the unit was created. It is also necessary to be able to adapt to changes in the environment over time.

4. Conclusions

The lives of research units in new scientific field will of course be tied the development of the field they belong to. If the field for some reason starts to decline, for example because its thematic focus is seen as less important today than earlier on, this may feed back negatively on the survival possibilities of local research units in the field. However, this is not the situation for the fields considered here, i.e., studies of innovation, entrepreneurship and related topics. On the contrary, as demonstrated by several contributions (Fagerberg and Verspagen, 2009; Aldrich, 2012; Fagerberg et al., 2012; Landström et al., 2012; Martin et al., 2012), these fields continue to grow and this provides opportunities for the creation of new research units within – but also outside – universities. Such local research units, it is argued, play a very important role for the field they belong to, for example by mobilizing financial

[10] For example, in the case of SPRU we can identify an "inventor" (Stephen Toulmin), a "manager-supporter" (Asa Briggs) and an "entrepreneur" (Christopher Freeman). Toulmin sold the idea to Briggs who brought in Freeman when Toulmin gave up.

[11] From a humble beginning SPRU gradually increased its teaching activity, although it took nearly two decades before it assumed full control of its own teaching program. This, together with other organizational changes that occurred around the same time, led a significant increase in the core finance from the university to the centre. While SPRU had its origins in research, CES was a research arm of an essentially teaching based organization, the Babson college and (later on) its Entrepreneurship division. Thus, the connection between research and teaching, although the latter is nowadays for most part not formally within the centre, is strong.

support, offering job opportunities, attracting talented recruits, and providing adequate training. Hence, they are important change agents in the scientific world. This article has analyzed the factors that influence the extent to which they succeed in their aims.

4.1. An evolutionary interpretation

As pointed out above, the world of science is an evolving structure. From this perspective a study of the role of local organizations as change agents in the system is very relevant, because their experiences may tell us something about how change in the system as a whole is brought about. Indeed, the life of such units may be seen as subject to evolutionary processes such as variation, retention and selection. Variation in the present context may be seen as just another term for what sociologists of science call "differentiation", i.e., the creation of a program, platform or profile which is new to the specific environment into which it is introduced. Retention is the process through which this new variety is reproduced over time. As pointed out above, this has to do with things such as attracting talent, creating employment opportunities and offering training to newcomers to the field. Such activities require access to resources, which may be obtained from the selection environment(s) in competition with other agents with different interests and ideas.

This is where selection intervenes; hence it is clear that withstanding selection pressures is essential for the survival of the program and its social carriers, i.e. the research units. Selection is not a once-and-for-all event but a continuous process. Successful adaptation, which contributes to building and maintaining "legitimacy" in the system, may be called into question if the criteria on which this adaptation was based change, as shown in at least one of the case studies presented above. Moreover, such selection occurs at multiple levels (Hodgson, 1993; Aldrich, 1999), for example, within a faculty, at the level of the university as a whole (including its leadership), and in organizations outside universities that may – or may not – provide support, financial or otherwise. Being able to succeed in selection processes at different levels may increase the "legitimacy" and survival propensity of a new initiative. Hence, gaining a certain level of "currency" (Bourdieu, 1975; Braun, 2011) at one level, say in parts of government or among firms, may feed back positively on selection processes at another level, within a university for example. Indeed, without such multiple sources of support, many if not most of the units considered here would probably not have been established.

However, the fact that selection goes on at multiple levels also implies that the criteria that the organization has to adapt to, may differ across different parts of the selection environments and – possibly – come into conflict. Different parts of the selection environment may give different and contradictory signals about the future direction. For example, as discussed above, the success criteria within academia are not the same as in various parts of government. As shown in the previous section, adaptation to the needs of users outside universities, especially when these change frequently, may lead to a path in which the profile of the unit becomes blurred, short term projects dominate, the most qualified members of the staff leave for more attractive research positions elsewhere and eventually the unit is dissolved. Note that even if such a unit survives, in contrast to the examples in the previous section, its original program – the basic unit of selection in a new scientific field – may well be lost (or selected against). What happens in such a case is that the social carrier of the new ideas transforms itself to something else as the result of adaptation to selection pressures.

This does not of course mean that it is totally impossible for a new research unit in an emerging scientific field to survive outside universities. What is required is a source of financial support that allows it to exercise sufficient cognitive control over its own research activity so that it can retain its original purpose or program. But such support, such as "core" or "basic" finance, is hard to obtain on a substantial scale outside universities, although this may differ somewhat across countries and fields.[12] Nevertheless, our expectation was that, outside universities, such units will be few and far between, and this is also what our data shows. In contrast, within universities this type of financial support is common, which is one reason why we hold universities to be a more fertile ground for establishing and sustaining new research units in emerging field. However, to merit such support the new initiative needs to adapt to the selection criteria in the university system, which, in addition to establishing credible systems for scholarly interaction, publication and assessment, includes engaging in education and training activities, particularly at advanced levels. The results from the survey indicate that a high degree of cognitive control over the unit's research agenda, access to core (basic) finance and active participation in master and PhD education tend to go hand in hand.

4.2. Mobilizing for change: lessons

What are the lessons for potential entrepreneurs in the world of science wishing to establish and sustain a new unit within an emerging scientific field? First of all, the evidence suggests that the probability for succeeding is higher within the university system than in other places. This primarily has to do with the fact that long term support for an academic program is commonplace in universities but rare in other contexts. Second, rather than attacking established power centers in academia head on, which might lead to stiff resistance, a more viable strategy might be to position the new initiative as an attempt to produce socially and economically much needed knowledge on a problem not sufficiently dealt with by others. This arguably reduces the possibility for cognitive conflicts which may be detrimental to the survival possibilities of a new initiative. For the same reason (and this is our third lesson) it is better to appeal to several rather than just one disciplinary environment for moral and intellectual support. However, as pointed out by Braun (2011), even in the absence of serious cognitive conflicts, conflicts about distribution of resources may arise that jeopardize the new initiative. Fourth, it is therefore advisable in the early phase to mobilize financial support from several sources, including external ones, because this reduces the potential for damaging conflicts over resources (which might block the new initiative for good). In the longer term, however, such scattered support from different sources needs be converted into more stable (core) funding that gives sufficient room for the development of the "scientific/intellectual movement" in question (Frickel and Gross, 2005). The research indicates – and this is our fifth and final lesson – that the prospects for this to succeed is higher for units that focus not only on research but also engage in teaching, particularly at advanced levels. This has to do with the fact that teaching is a key activity in universities, so that by contributing to it the new initiative becomes more "legitimate" in the view of other actors in the system, for example when decisions about the distribution of resources are made. But it is also important for another reason: Engaging in graduate and postgraduate teaching is the best way to attract talent and train new entrants to the emerging field, which in the long run is essential for its survival.

[12] Governments in some countries have a tradition of supporting independent research institutes in areas of high priority, while in other countries this is much less common. This implies that the prospects for such new ventures may differ somewhat from one national system to another.

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Appendix A. Extract from questionnaire

Question[13]	Response categories
To what extent do you consider your research unit to be part of (Tables 1 and 2 in the paper)	
Innovation studies	Scale from 1 (no extent) to 5 (very high extent)
Science/research policy studies	Scale from 1 (no extent) to 5 (very high extent)
Entrepreneurship studies	Scale from 1 (no extent) to 5 (very high extent)
Science and technology studies (STS)	Scale from 1 (no extent) to 5 (very high extent)
To what extent do scientific staff (excluding PhD students) have their main educational background from the following disciplines (Table 3 in the paper)	
Economics	Scale from 1 (no extent) to 5 (very high extent)
Management/business	Scale from 1 (no extent) to 5 (very high extent)
Innovation studies	Scale from 1 (no extent) to 5 (very high extent)
Entrepreneurship	Scale from 1 (no extent) to 5 (very high extent)
Science/research policy	Scale from 1 (no extent) to 5 (very high extent)
Science and technology studies	Scale from 1 (no extent) to 5 (very high extent)
Sociology	Scale from 1 (no extent) to 5 (very high extent)
Natural science/engineering/medicine	Scale from 1 (no extent) to 5 (very high extent)
Geography/regional studies	Scale from 1 (no extent) to 5 (very high extent)
Organization science	Scale from 1 (no extent) to 5 (very high extent)
Political science	Scale from 1 (no extent) to 5 (very high extent)
History/law/philosophy/other humanities	Scale from 1 (no extent) to 5 (very high extent)
Psychology	Scale from 1 (no extent) to 5 (very high extent)
Other	Scale from 1 (no extent) to 5 (very high extent)
Is your research unit (Table 4 in the paper)	
Part of a university	Yes, No
Part of a public or non-profit research institute	Yes, No
Part of a government agency	Yes, No
Part of a public or private company	Yes, No
Other	Yes, No
Your research unit is a part of a university and it is organized as (Table 5 in the paper)	
A separate department	The respondent was asked to choose one of the alternatives
A sub-unit of another department	
A separate research centre under a Faculty	
A research unit directly under the university leadership	
Other	
In your opinion, what were the key reasons for the establishment of your research unit? (Table 6 in the paper)	
Initiative of one or a few key individuals	Scale from 1 (not important) to 5 (very important), Don't know
Need for new academic knowledge	Scale from 1 (not important) to 5 (very important), Don't know
Need for cross-disciplinary work	Scale from 1 (not important) to 5 (very important), Don't know
Creation of a new academic teaching program	Scale from 1 (not important) to 5 (very important), Don't know
Initiative from policy-makers/non-academic actors	Scale from 1 (not important) to 5 (very important), Don't know
Consider your research units history, and state your agreement with the following claims about barriers and support (Table 7 in the paper)	
Support from the university leadership has been crucial to our development	Scale from 1 (do not agree) to 5 (agree fully), Not applicable
Other research units at the same university have been supportive of our organization	Scale from 1 (do not agree) to 5 (agree fully), Not applicable
Our unit would not have developed without support from policy-making organizations	Scale from 1 (do not agree) to 5 (agree fully), Not applicable
We have been met with strong skepticism from many disciplinary academic departments	Scale from 1 (do not agree) to 5 (agree fully), Not applicable
There are sub-groups in the organization with little interaction with one another	Scale from 1 (do not agree) to 5 (agree fully), Not applicable
It has been difficult for us to find partners within our home country/home region	Scale from 1 (do not agree) to 5 (agree fully), Not applicable
Our organization has seen major conflicts between the original founders and other staff members	Scale from 1 (do not agree) to 5 (agree fully), Not applicable
Please indicate the extent to which your research unit pursues the following activities. (Table 8 in the paper)	
Research on own defined problems	Scale from 1 (no extent) to 5 (very high extent)
Research on externally defined/negotiated problems	Scale from 1 (no extent) to 5 (very high extent)
Policy advice	Scale from 1 (no extent) to 5 (very high extent)
Evaluation	Scale from 1 (no extent) to 5 (very high extent)
Consultancy	Scale from 1 (no extent) to 5 (very high extent)
Has your research unit offered the following (Table 9 in the paper)	
Its own Bachelors degree(s)	Offers today, used to offer in the past, never
Courses at the Bachelor level	Offers today, used to offer in the past, never
Its own Masters degree(s)	Offers today, used to offer in the past, never
Courses at Masters level	Offers today, used to offer in the past, never
Its own PhD degrees/program	Offers today, used to offer in the past, never
Courses at PhD level	Offers today, used to offer in the past, never
A formal post-doc program	Offers today, used to offer in the past, never
A formal program for visiting students	Offers today, used to offer in the past, never
A formal program for visiting researchers/professors	Offers today, used to offer in the past, never
Please indicate the extent to which your research unit is funded by the following sources (Table 10 in the paper)	
Basic/core funding	Scale from 1 (no extent) to 5 (very high extent)
Other national funding	Scale from 1 (no extent) to 5 (very high extent)
Research council	Scale from 1 (no extent) to 5 (very high extent)

Question[13]	Response categories
EU funding	Scale from 1 (no extent) to 5 (very high extent)
Other university funds	Scale from 1 (no extent) to 5 (very high extent)
Private foundations/non-profit	Scale from 1 (no extent) to 5 (very high extent)
Other international	Scale from 1 (no extent) to 5 (very high extent)
Private firms	Scale from 1 (no extent) to 5 (very high extent)
What do you think are the greatest challenges for your research unit today? (Table 12 in the paper)	
More long-term funding and work	Scale from 1 (do not agree) to 5 (agree fully), Not applicable
Attracting qualified personnel	Scale from 1 (do not agree) to 5 (agree fully), Not applicable
More basic/core/unrestricted funding and work	Scale from 1 (do not agree) to 5 (agree fully), Not applicable
Increasing the international scientific publishing	Scale from 1 (do not agree) to 5 (agree fully), Not applicable
Attracting good students	Scale from 1 (do not agree) to 5 (agree fully), Not applicable
Improving international collaboration	Scale from 1 (do not agree) to 5 (agree fully), Not applicable
Developing a (better) scientific research program	Scale from 1 (do not agree) to 5 (agree fully), Not applicable
Support from/relationship to university top leadership	Scale from 1 (do not agree) to 5 (agree fully), Not applicable
Improving the scientific leadership	Scale from 1 (do not agree) to 5 (agree fully), Not applicable
Support from/relationship to policy actors/public agencies	Scale from 1 (do not agree) to 5 (agree fully), Not applicable
Improving the job opportunities for graduates	Scale from 1 (do not agree) to 5 (agree fully), Not applicable
Improving ties to industry	Scale from 1 (do not agree) to 5 (agree fully), Not applicable
Development of educational program	Scale from 1 (do not agree) to 5 (agree fully), Not applicable
More policy-oriented/practical funding and work	Scale from 1 (do not agree) to 5 (agree fully), Not applicable
Support from/relationship to other academic departments	Scale from 1 (do not agree) to 5 (agree fully), Not applicable
Improving the research culture in the organization	Scale from 1 (do not agree) to 5 (agree fully), Not applicable
Support from/relationship to other universities/research units locally	Scale from 1 (do not agree) to 5 (agree fully), Not applicable
Dealing with internal communication/collaboration problems	Scale from 1 (do not agree) to 5 (agree fully), Not applicable

[13] Some respondents did not answer all the questions. We inspected this manually and it became clear that some respondents did not bother to tick "no" to some questions and instead skipped them. In such cases we have interpreted the latter non-response as a "no/no extent answer".

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