Facts and Figures on Collaborative Projects in Climate and Energy Research

Report based on Qualitative Data from the SUCCESS project

Knudsen, Line Gry; Hansson, Finn; Mønsted, Mette

APPENDIX 5.2

SUCCESS PILOT PROJECT WP1
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Report based on Quantitative Data from the SUCCESS project

by

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1. Introduction

The present report is drafted for the SUCCESS[1] project; a pilot project launched by the EIT with the purpose of benchmarking past and ongoing collaborations in the knowledge triangle of research, education and innovation in the European Union. The empirical focus is the field of climate and energy research. This field is in specific need of more efficient collaborative models that can facilitate knowledge sharing and thereby ease the development of new sustainable energy technologies. By analysing existing projects and processes in this field, we are able to derive new and improved models of governance structures for integrated partnerships in order to improve the innovation processes. The final goal is to work towards recommendations on the process of strengthening relations within the Knowledge Triangle of education, innovation and research in the European Union. With this report, we aim at providing a solid ground for establishing and analyzing best practice collaboration in the field of climate and energy research.

With this aim in mind, data is gathered from a substantive number of successful collaborative projects. A questionnaire is designed and is subsequently completed in 12 countries throughout the European Union[2]. More than 60 projects has been selected in these 12 countries and the projects are studied with a primary focus on issues such as the motivation to collaborate, the organizational form of the collaboration, the managerial boards, and the challenges of collaboration. The present report will provide an insight into the quantitative data material gathered by the survey questionnaires. Jointly with other reports on the more qualitative data collected in the questionnaires we will aim at providing a thorough picture of best-practice collaborations in order to inspire future collaborative projects.

[1] SUCCESS is the abbreviation for Searching Unprecedented Cooperation on Climate and Energy research to ensure Sustainability

[2] Partners from 10 countries participate in the SUCCESS project. The countries are Germany, Denmark, Sweden, Finland, Poland, Portugal, Italy, Spain, France, and the Netherlands. Still, due to various reasons not all member countries have been able to provide completed questionnaires to the project before the deadline.

Table 1: number of interviews done in each country.

Country	Number of interviews
Belgium*	1
Denmark	7
Finland	5
France	7
Germany	8
Italy	3
Norway*	6
Poland	0
Portugal	6
Spain	2
Sweden	8
The Netherlands	12
UK*	1

*= not member of the SUCCESS project)

As shown in table 1, the data is collected from projects done in a number of countries and as the figures show, we have been able to collect data in almost all SUCCESS member countries. As we will not do a benchmark analysis between countries, but rather between project types, the unequal number of projects from each country is not seen as a challenge to the project as such.

All collaborative projects are done in the field of climate and energy research; still the projects involve many different technological sub fields. Areas such as wind energy, wave energy, hydrogen energy, and sun cells (photovoltaic cells) are highly represented, just as projects on bio fuel cell and biogas in general. A few projects deal with a safe and clean development of already known technologies such as nuclear fuel. A number of projects aim at developing new ways of limiting the CO^2 emission from various energy forms and some deal with the required adaption of the distribution net to new energy forms. Others work with the challenges of handling and storing new energy forms or they focus on adjusting machineries and motors. The majority of projects cover more than one technology; in fact, nearly all respondent state that interdisciplinary research is a prerequisite of success in their projects.

1.1 Data and Method

66 questionnaires have been completed in this project.[3] The aim of the questionnaire has been to collect data about present collaborative projects and thereby delineate best possible ways of organizing and managing collaborators. We focus on the challenges that exist in collaborative projects in the knowledge triangle and how these challenges can be mitigated. The projects vary a lot in regards to size, age and aim, yet they are all located in the knowledge triangle of research, education and innovation, with a varying weight on any of the three kinds of activities. Still, in most projects the overall aim is collaborative research of some kind. In accordance with the theme of the SUCCESS project all collaborations are all in energy and climate research.

Members of the SUCCESS project conduct the interviews, and respondents are all participants from collaborative projects throughout Europe. A few interviews are done with participants from countries not involved in the SUCCESS project as these projects were spanning national borders and included participants from numerous countries. The interviewers have forwarded the completed questionnaires to the work group at Copenhagen Business School who (in close collaboration with the work group at ESADE Business School in Barcelona), have done the data analysis and outlined the projects that are to be studied even further. We had to reject a few questionnaires due to incompleteness or lack of core information .

2. Characterizing the Different Types of Collaborations

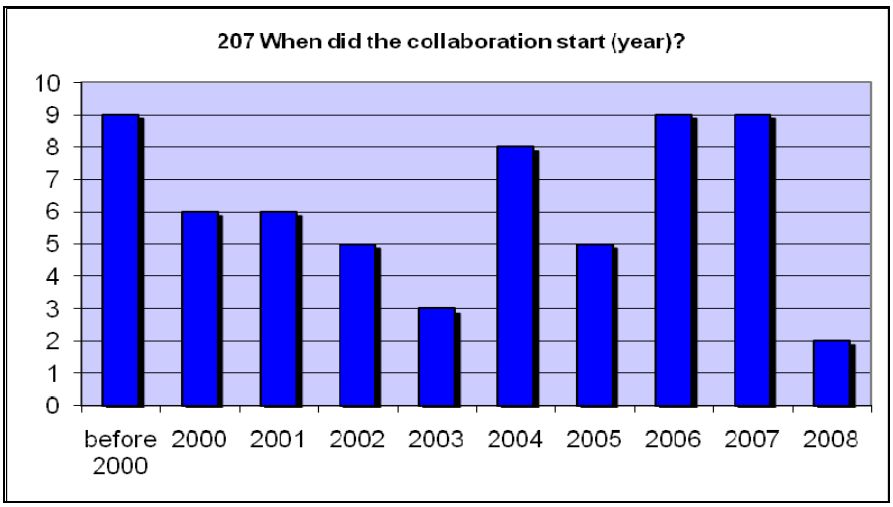
The collaborative projects described in the questionnaires differ in regards to size, organizational complexity and aim, etc. In order to give an overall impression of the projects, their similarities and differences, this section will display the core characteristics of the collaborative projects described in this report.

20 of the 66 projects are initiated less than 3 years ago (q 207)[4] (note: in 2 of the projects date of initiation was not informed) and many respondents indicate that the aim of the projects has not yet been fulfilled. In both new and older projects a majority of respondents state that they draw

[3] In fact, we received 69 completed questionnaires but 3 was rejected due to insufficient information, thus the final number of questionnaires that from the basis of the information in this report is 66, all in all. As not all respondents have filled in all questions, the total sums may vary throughout the report. The 66 questionnaires refer to 62 different projects as some projects are described in two questionnaires, completed by two of the involved partners. The answers from partners involved in the same project may be very different, thus we treat them as separate responses. For later use in the case-studies these are interesting as well.

[4] The number following some of the information refers to the question in the questionnaire. Some of the answers to the questions will be illustrated by pie charts or bar charts. **These are to be printed in colour to get the full benefit**.

on previous relations between the partners. 9 of the projects have been running for more that 8 years in the present form.



The number of partners involved in the different collaborative projects varies from 2 partners to nearly 70 partners. In 6 cases a partner is functioning as a network facilitator but it is hard to tell how many partners are included as this is either not mentioned or the number is varying. This type of organising differs from the majority of collaboartions as the network facilitator is not as such part of the collaboration; rather this partner is supporting the other partners who in practice are doing the research, education or innovation activities.

Table 2: Number of Projects Cathegorized According to Size

Number of partners in the group	Number of projects
Joint Unit *	6
1-4	16
5-9	18
10-19	13
20+	12 (10)
NA	1
Total	66

* In these six projects, a joint unit exists. It has the form of either a joint teaching initiative or a regional office, which have responsibility for linkages to networks.

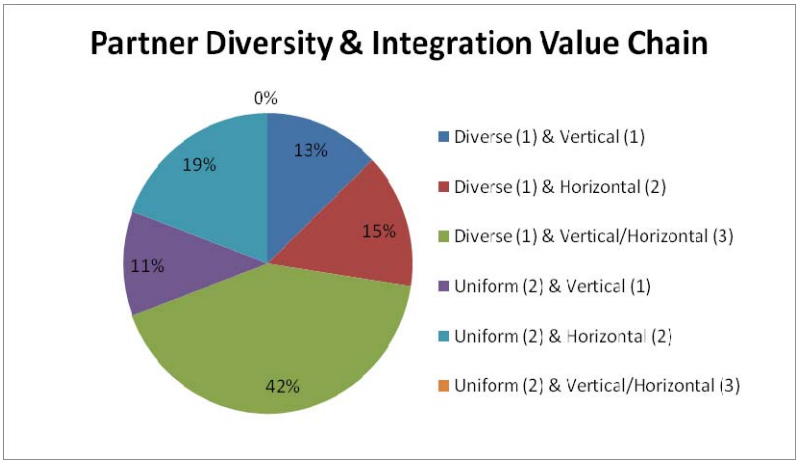
The larger collaborations involving more than 20 partners are interesting to study in a separate manner as we expect them to be more complex and hard to manage than the smaller projects. In 12 of the questionnaires, the project described has 20 or more partners. Two international associations

(EAWE and ENEN on Wind and Nuclear energy) are described twice in two separate interviews and therefore the number of large projects is actually only 10, thus the bracket. Three of the large collaborations are associations (EAWE, ENEN, ENES) such as interest association or political association favouring the interests of the sector, in relation to either politicians and education of competent staff. One is a regional hydrogen experiment with buses in Oporto. This is an interesting regional collaboration, which shows some of the complexity of energy collaborations as so many partners are involved locally. One project is a large network in the Netherlands and Belgium, which has the form of a framework for other embedded projects, as it includes 9 sub projects organized in a matrix linking the projects together based on subject of interest. One of these are focusing on hydrogen and the relation to other technologies and an additional project is on new materials (unfoutunately poorly described).

8 out of the 10 different large scale projects are finansed by the EU framwork programs. This is interesting as it may incate that partners do no tend to design very big projects unless it is prescribed by the framework program. Additional its interesting to see that 6 out of the 10 different projects are functioning without a joint governing board. This could indicate that the partners in the large scale projects operate as independent units, and that they meet only for knowledge exchange or a few shared activities. A number of the respondent state, that exchange of PhD students is a core aim of the collaboartion and a few mention the benefits of being able to influence policymakers when they join forces with other big actors in the energy field. The bigger project are not necessaraly also complex in regard to the variation in technologies

In order to be able to analyse the level of complexity we have to combine the dimensions of cross-disciplinarity or diversity in technology, and look at whether or not the projects are working on vertical collaboration along the value chain. It is interesting to study the technological diversity, but also to assess whether the collaboration is carried out at the same ‘level’ of either research or innovation; that is, whether it is a project including, for example, basic research projects. Some projects have only two or a few partners who all come from one core technological field. These projects are characterised as ‘uniform’. In other projects the participants come from many different discipinary fields and span different technological areas. These projects are termed ‘diverse’. Additionally the projects are characterised by the way the partners are scattered along the value chain. Some projects comprises, by way of example, partners from both basic research, development and many even production. These projects are categorized as ‘vertically integrated’ as they span many parts of the value chain. Other projects are undertaken with the aim of doing basic research on a core part of a technology and are not dealing with the further development or

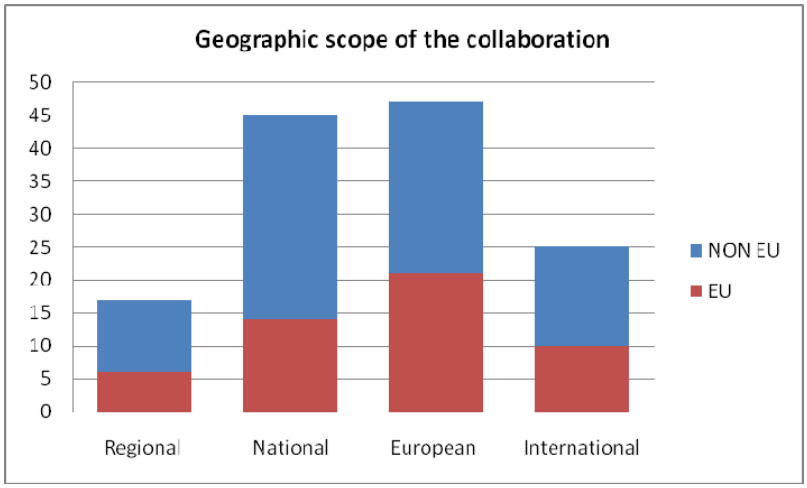
production. These projects are regarded as 'horizontally integrated'. The below pie chart show the connection between partner diversity (diverse or uniform) and the form of integration (horizontal/vertical).



42% of the projects are characterized as being both diverse in relation to the disciplinary or technological background of the members *and* characterized as being both vertically and horizontally integrated on the valuechain. Being both horizontally and vertically integrated means that these projects are focused both on basic reaserch in a manner that includes many disciplines and has a vertical scope as well, as partners from more applied field are also included. In general, 70% of the projects are labelled as diverse in relation to partner background. 19 % are uniform *and* horizontal which may give the lowest degree of complexity and the the most narrowly focused or specialized projects. The issue of diversity is interesting as an outcome of combining the disciplines of R&D. Vertical collaboration describes where partners from different 'stages' of the value chain work together. This could be a univeristy department providing basic research and a indutrial company utilizing these results in relaton to product design. The application of the technologies are related to vertical collaboration beyond the university level. As we expect the issues of diversity and vertial partnerships to be related, we have crosstabulated on these and there do seems to be a close relation as desribed above.

Many of the projects span national borders; 26 projects bridge the borders of different European countries and 15 are international projects going beyond the borders of Europe. The European projects may be coincident with the international projects. 31 are national and only 12 projects consider themselves strictly regional in scope (q210). The diagram below shows the projects grouped according to geographical scope and the red colored part of each pillar illustrate the number of projects based on EU funds (EU framework program 6 or 7). Accordingly, a little

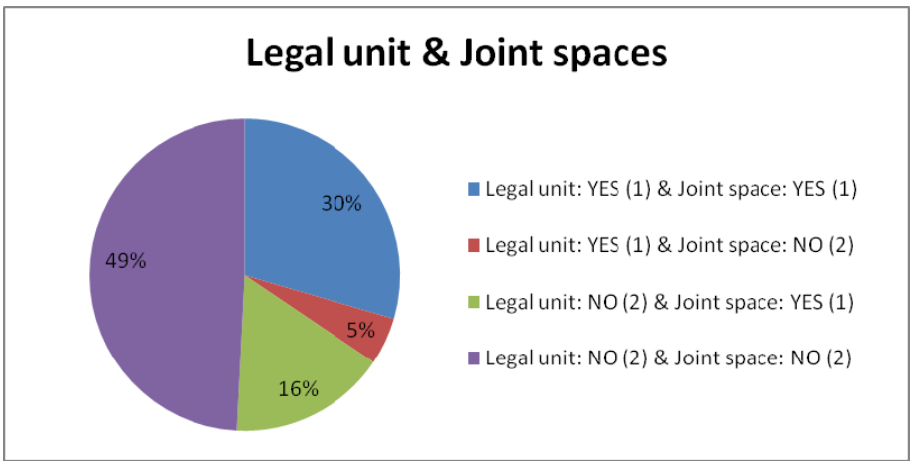
more than one third of the projects that are national in scope are undertaken under an EU framework program, whereas the EU funds a little less than half of the European projects. This is quite surprising, as we expected more the European collaborations to be initiated based on EU-funding.



2.1 Legal Units and Joint Spaces

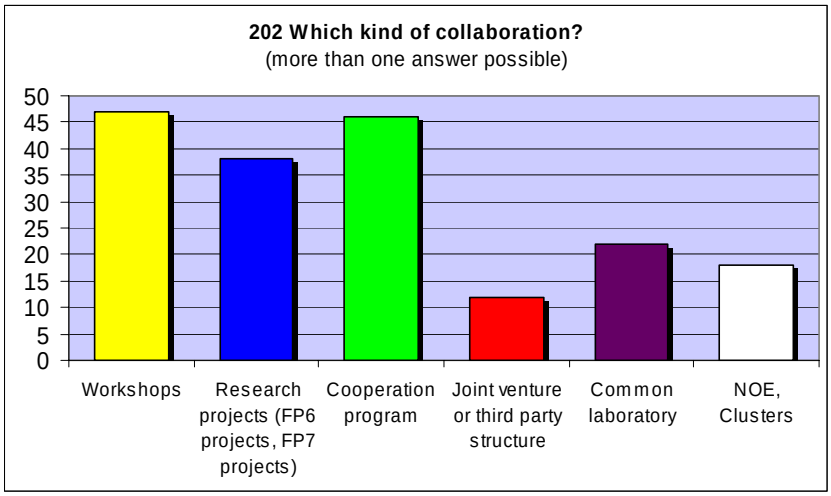
21 of the 64 interviewees state that they have formed a shared legal entity in the collaborative project (q 203), and 29 say that the project has its own physical entity (q204). Thus, some projects are located at a shared physical domain even though no legal entity is established. Only one third of the projects studied have a legal entity, meaning that a specific unit takes care of legal issues before and after project initiation. This central unit takes care of certain limited activities such as determination of property ownership, contract design, and prosecution of potential lawsuits. A little more that a third of the projects; that is, 22 projects share a physical space in the in the form of a shared laboratory or offices. When searching for a possible conjunction of legal units and shared spaces we get the results illustrated below. As shown in the pie chart 49% of the projects have neither a legal unit nor a shared physical space, and 30 % of the projects have both a legal unit and a shared space. 5% have a legal unit, but no shared space, whereas 16% of the projects have no legal unit but do have some shared facilities. This provides us with a clear picture of a relation between the existence of a shared space and the need for a common legal unit: almost 80 % of the projects have either none or both. The central unit or the shared space may be reflecting the type of collaboration. The larger collaboration networks where some of them are closer to associations or regional development offices will have a shared space or joint unit. The central unit may act as 'the spider in the web', or as a kind of joint venture. It is hard to make a precise interpretation on this

subject as a joint unit can both reflect a very diverse and weak collaboration, or it may be a very strong-committed collaborations developing into a joint venture as the joint co-operative unit.



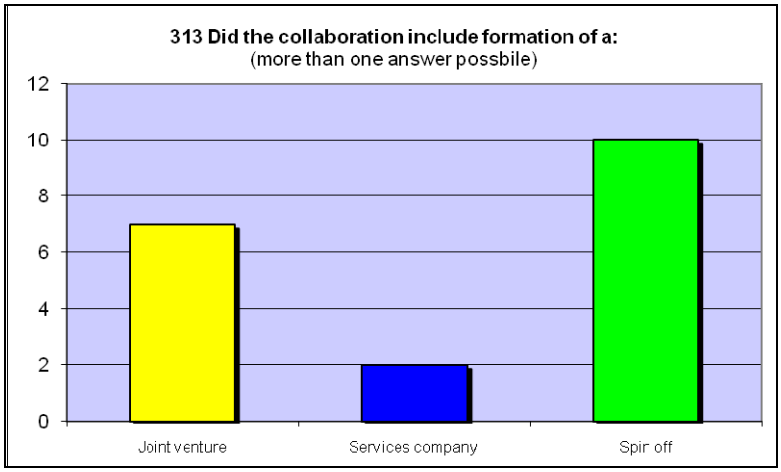
2.2 Types of Shared Activities

As described the partners of the collaborative projects undertake a number of different activities and the activities are very diverse in regards to how they are formally organized as well. 12 projects is organized as joint ventures or based on a third party structure and 47 projects include the convention of shared workshops. 38 of the projects are EU projects, meaning that they are either part of the framework 6 or the framework 7 program, and 46 are characterized as cooperative program. In 21 projects a common laboratory is established. 18 projects are NOEs or clusters (q202).

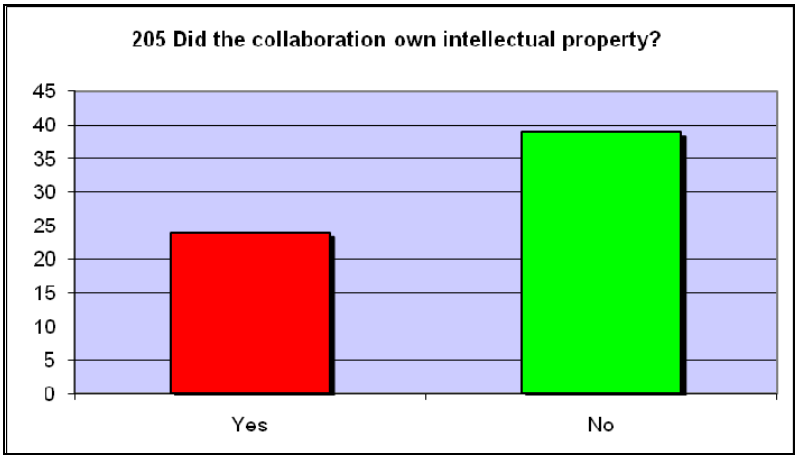


When asked whether the collaboration included the formation of a new formal entity, 7 respondents answered that they formed a joint venture, 2 that they formed a service company and 10

respondents answered that they have formed a spin-off on the basis of the collaborative project (q313). Then we know that some of the joint ventures are not legal units, or maybe they are more organizations initiating the whole project, and not a result of the collaboration.

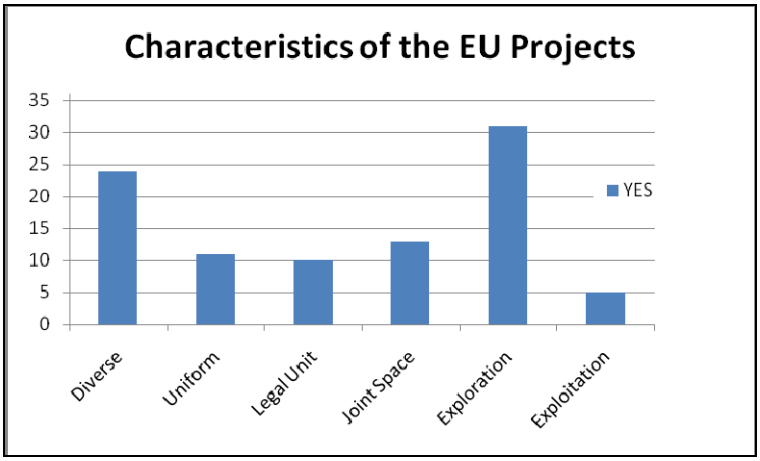


In 24 of the 66 the partners own the intellectual property jointly (q205). This means that almost 2/3 of the projects are undertaken with split rights to the results or the partners have just been planning on dealing with IPR issues along the way. This may seem as a potentially problematic situation, but as we will se later, only 7 respondents state that they have experienced problems due to IPR matters. This does not imply that disagreement cannot potentially pop up, but it indicates that many have taken precautions against these kinds of troubles.



2.3 Characteristics of the EU Framework Program Projects

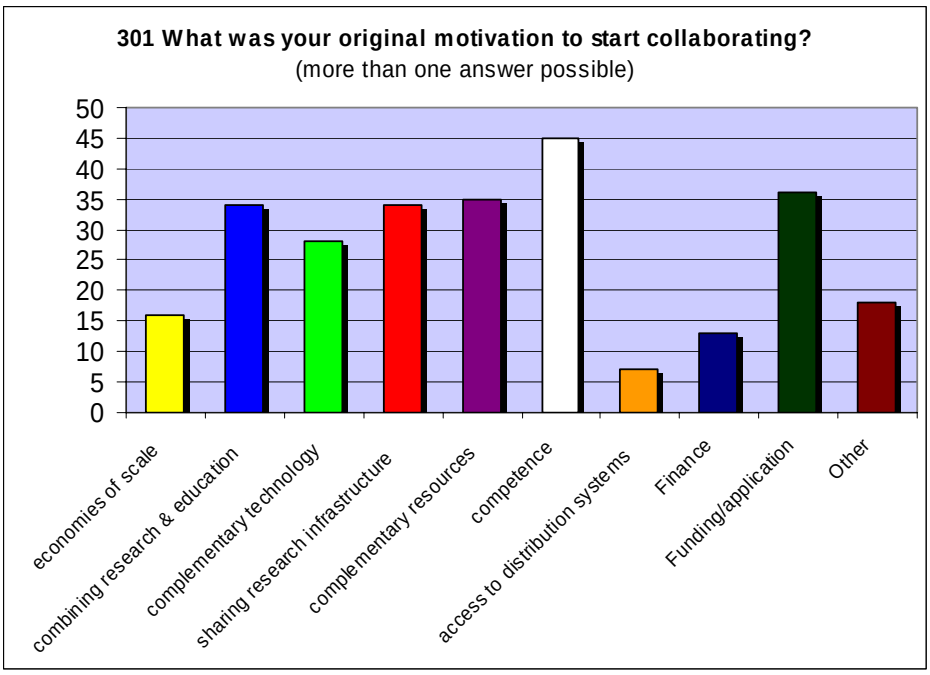
When focusing exclusively on the 38 projects that are undertaken under the EU framework programs some trends stand out. 31 of the 38 respondents state that the main motivation to join the project is to explore new knowledge, and 5 point to exploitation of already existing knowledge or resources as the main driver for engaging in the collaborative project (2 have not answered this question). 10 of the EU projects have a shared legal unit and 13 have a joint physical space. 24 EU projects are perceived as diverse as they have more than two partners that belong to different organizations and they have a broad focus on different technological areas. 11 EU projects are characterized as uniform as they have either only two partners or a narrow research scope with a focus on one primary technology, i.e. they stay in collaboration with the same type of partners and on the same technology.



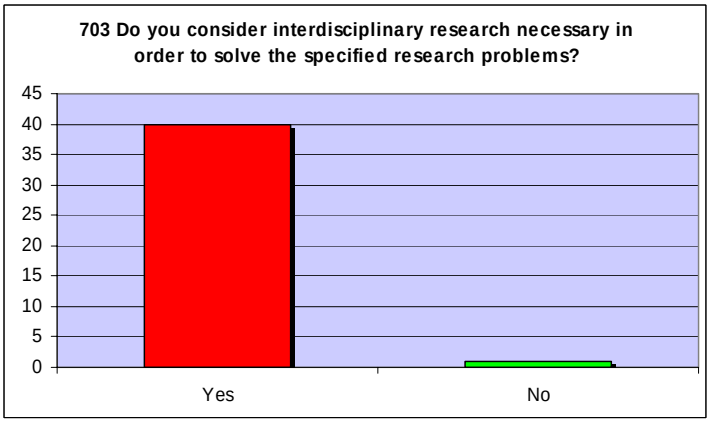
3. Motivation to Collaborate

When asked why they wanted to engage in a collaborative project at the outset, 45 interviewees state that they were motivated by the need for new competences (q301). In a little more than 30 projects the reasons for collaborating are to be found in the need for combining research and education, the wish to share research infrastructure or the need for complementary resources. In 36 projects an opportunity to collaborate on funding or application activities is said to be the motivation behind the collaborative project, whereas only 13 partners state that access to financial resources are the reason for their involvement in the collaboration. 16 point to economies of scale as and original motivation to collaborate. This show that the main motivational factors does not pertain to economic considerations alone in a narrow sense. Rather they are motivated by the opportunity to access new knowledge or to share the tasks related to the application process. In the EU projects,

this may be understated, as the purpose is to get funding is very clear. Only they would not do this work, if there were no other benefits besides economic funding. 7 partners say that access to the distribution system has caused their engagement in the project and 13 point respondents point to other reasons.

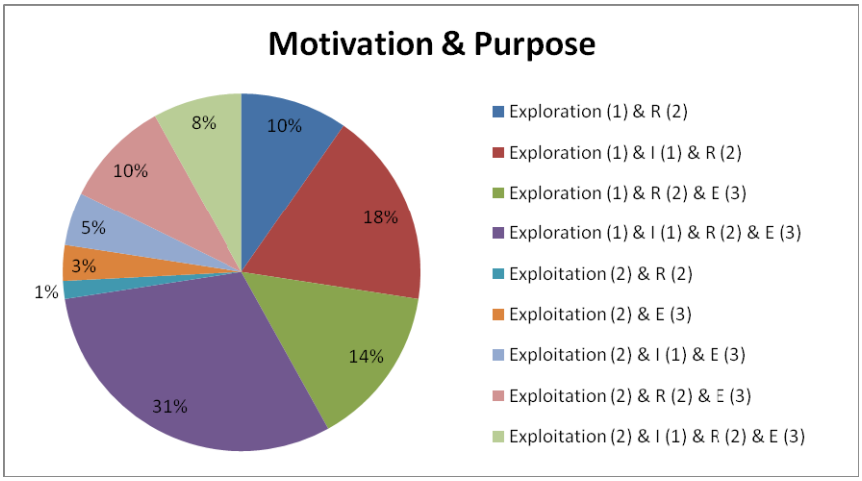


An additional motivational factor relates to the fact that many of the partners see interdisciplinary research as necessary in order to solve the research problems of their field. Of the 41 respondents who answered this question 40 states that interdisciplinary research is necessary, while it in 1 project seems to be adequate to have one discipline represented (q703).



In addition to being characterized by the motivation (measured as either exploration of new knowledge or technologies or exploitation of already existing knowledge or resources), the projects

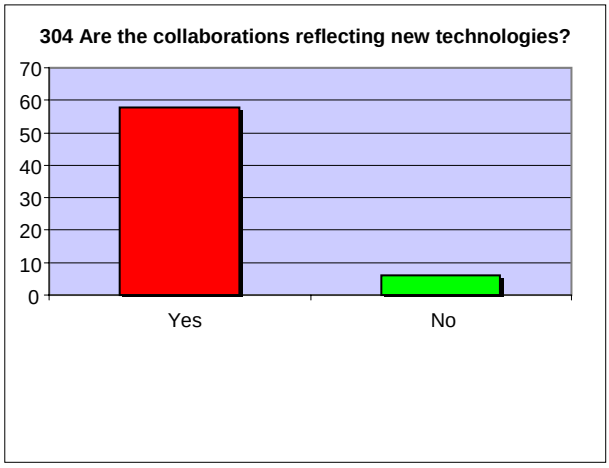
are also categorized concerning the kinds of activities they are going to undertake. In keeping with the overall focus of the SUCCESS project and the idea of the Knowledge Triangle, the collaborative projects are categorized as being oriented towards innovation activities (I), Educational purposes (E) or research activities (R), or a mix of the three. In the below pie chard we have illustrated how the motivation to collaborate relates to the kind of activities that are essential to the projects.



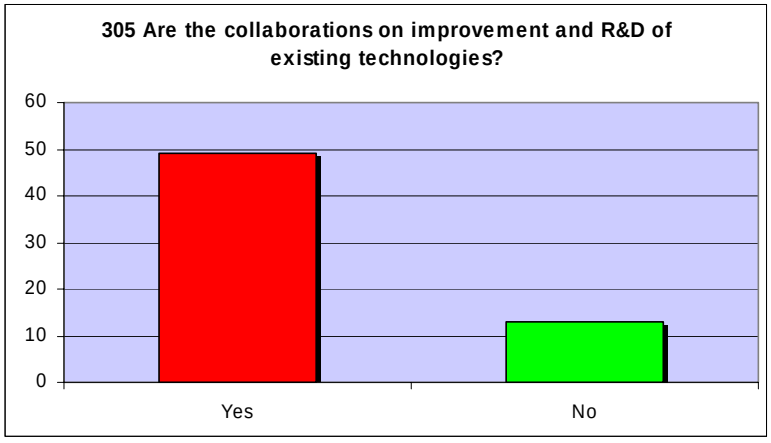
As it becomes clear from this pie chart almost a third of the projects are undertaken with the aim of exploring new knowledge and simultaneously engaging in innovation, education as well as research activities. This could be part of the EU-projects, as this is emphasizing the 3 aspects of the knowledge triangle. Probably it relates to university-industry relations, where innovation and exploitation is the target, and where the involving universities will inevitably have an educational agenda as well. In general, it seems that the projects initiated with an exploratory aim are keener on engaging in a diverse range of activities. Additionally, it is illustrated by the pie chard that the majority of projects aim to explore new knowledge, which may also reflect the emphasis in the project on university partners.

4. Benefits and Results of Collaborations

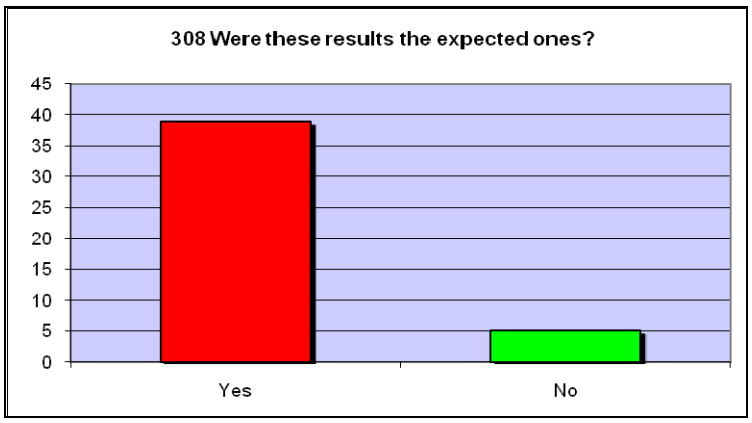
61 respondents consider the collaboration to be a win-win situation for all partners and 58 of the respondents state that the project conveys new technologies (q304).

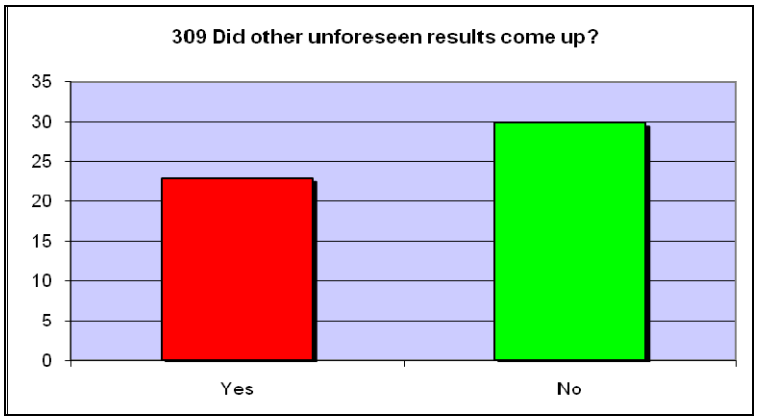


At the same time, 49 respondents state that their project is an improvement of existing R&D and technologies (q305), and this shows that many projects may hold elements of both improving existing technologies and developing new technologies. Fundamental innovations are found in 38 of the projects and 40 projects are said to be economically beneficial.

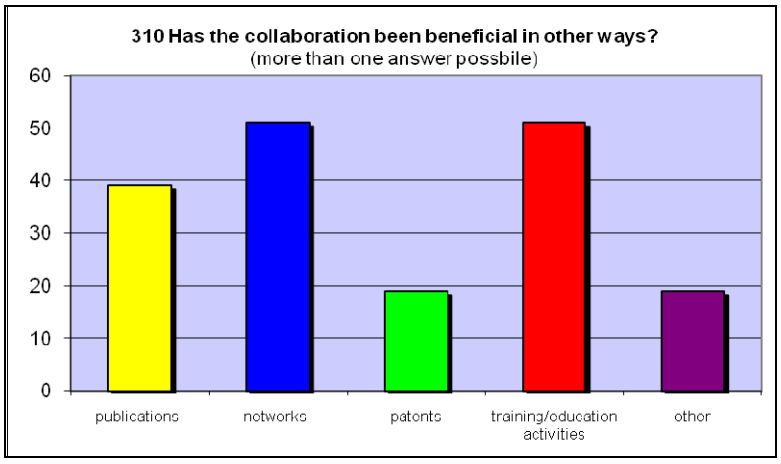


39 of the interviewees respond that the results of the projects were the expected ones (q308) and 23 state that unforeseen results has occurred during the project (q309). However, in many projects results have not yet shown as the projects are launched recently. Compared to this it is a relatively high percentage reflecting the embedded uncertainty in advanced R&D.



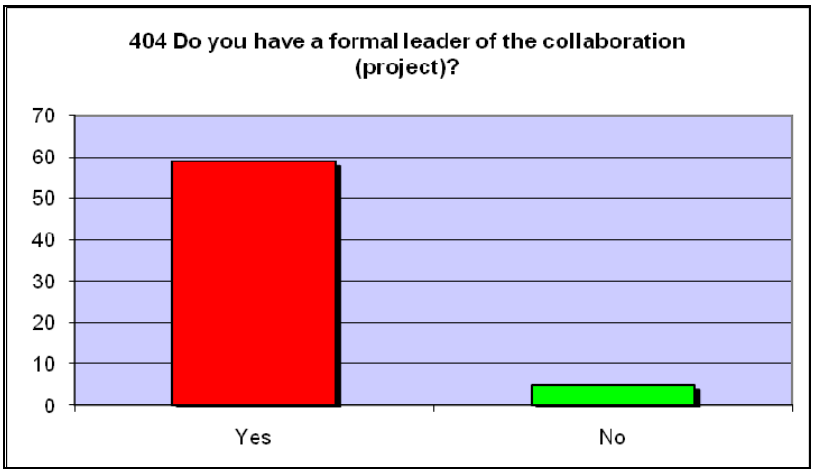


I addition to answering questions about the expected reults, respondents were also asked if the project was beneficial in other respects. 39 answered that the project has resulted in publications, 51 have participated in new networks due to the engagement in the project, in 19 cases new patents are taken, and 51 respondents point to new training or educational activities as an additional benefit. This implies that a number of additional benefits does come up while these projects are carried out. This reflects the fact that R&D activities are never completely predictable.



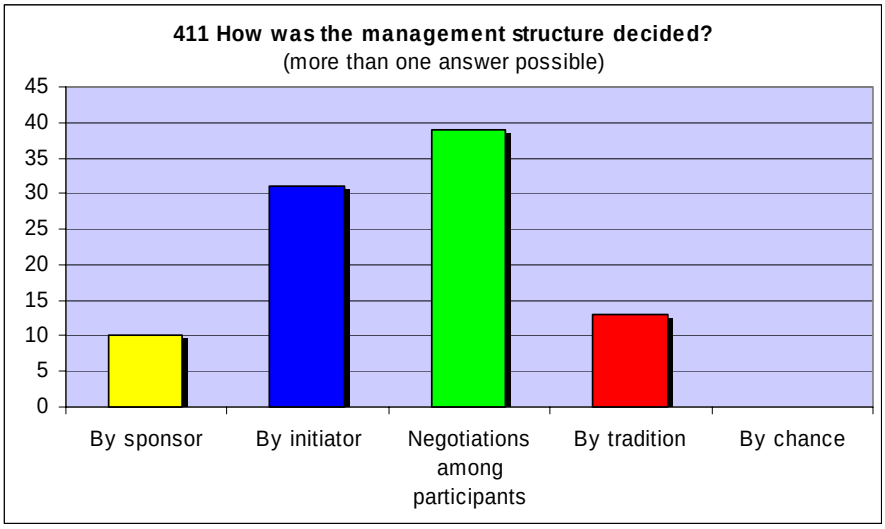
5. Management

In almost all projects; that is, in 59 cases, a formal leader is appointed to take care of the management of the diverse workgroup. 5 projects are operating without any formal leader. Even though it is most usual to have a formal leader, some characteristics of the projects without leader may be interesting to look into. In brief the five cases where the projects were done without a formal leader were characterized by the facts that they had no own legal entity, no shared physical space and they did not own intellectual property. Still they were all successful projects, and all of them reflected new technologies.

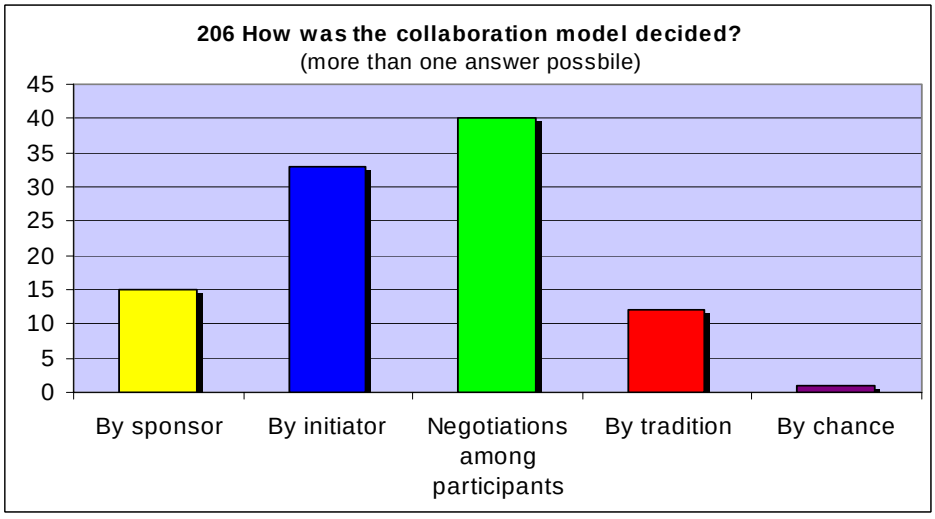


As the bar chart below shows, the management structure is most often decided in a negotiation among the participating partners (q411). 39 state that this is the case, while 31 persons point to the initiator of the project, as being the mind behind the managerial master plan. 10 of the respondents

mention the sponsor of the collaborative project as the one who has decided on the management structure and 13 respondents say that the management structure is decided in accordance with the tradition.



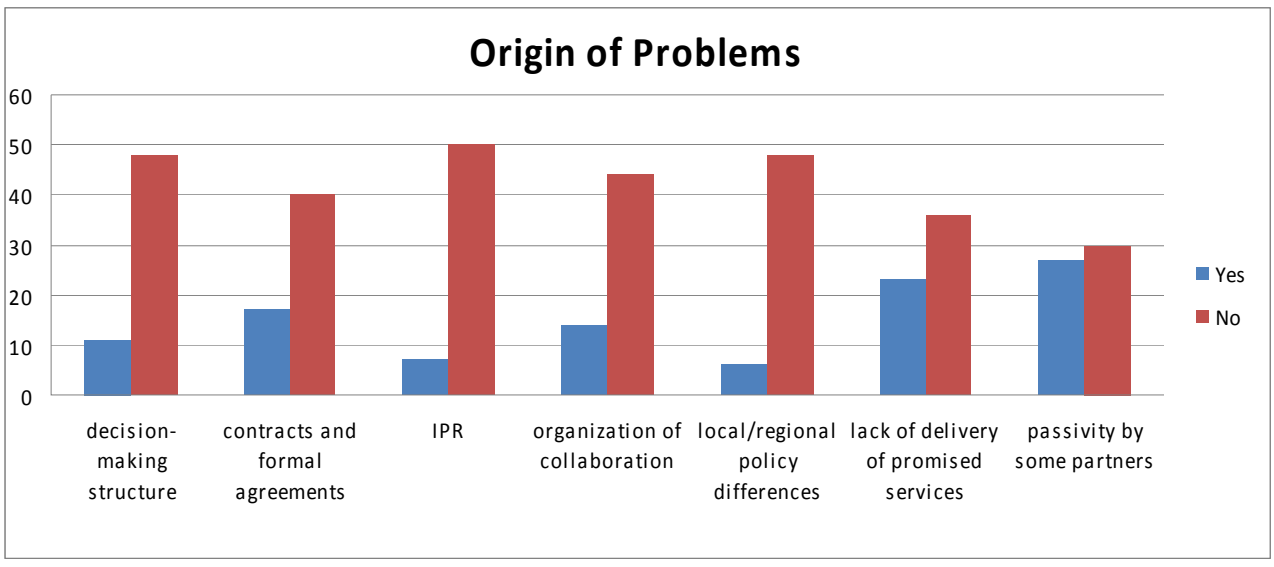
In 40 projects, that is approximately 2/3 of the collaborations, the collaborative model was decided in concerted action. 12 respondents state that the collaborative model was decided by tradition and 15 point out the sponsor to be the mind behind the collaborative model. In 33 projects, the initiator is the one who designed the collaborative model. Only in one project the collaborative model is formed by chance (q206). When comparing the bar charts q411 and q206, that both illustrate the planning of the formal structures of the project (management structures and collaborative model) it becomes apparent that they look very similar. This may be taken to imply that the collaborative model and the management structures of the project are often decided simultaneously, and may have been interpreted as nearly the same question.



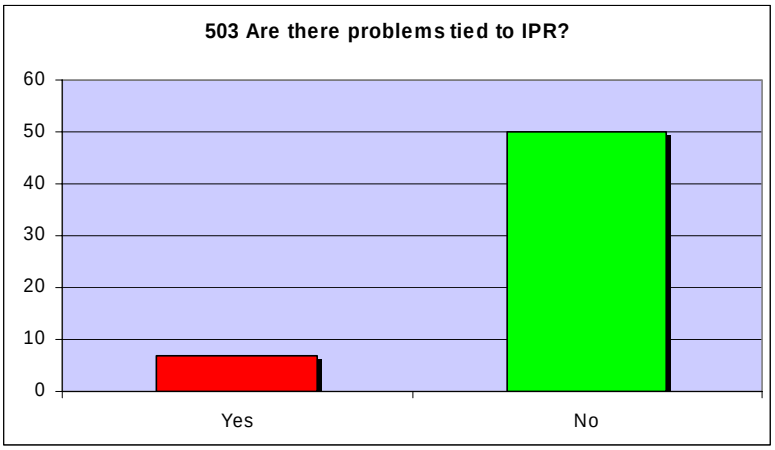
6. Challenges

From previous studies of collaborations, strategic alliance and the like, we know that many collaborative projects fail to live up to the expectations of the participants. In the questionnaire, we aimed at getting information about the reasons for controversies to crop up. As the projects in this study are all characterized by being successful we expect that no major problems have occurred, still we aim at getting information about the issues that may have or have had some negative effects on the projects.

The most cited kinds of problems that the respondents refer to in the collaborations are passivity of the partner or lack of delivery of promised services. Additionally, 14 respondents say that they have experienced problems tied to organizational issues such as problems in management structure or in relation to the steering group. Some respondents have mentioned that the word 'problems' might be too harsh, but that they had in fact experienced a number of challenges or obstacles throughout the project. This indicates that 'project challenges' is a potentially problematic issue to examine as people may have vey different perceptions of what problems are and when an issue transforms from being a minor discrepancy of perceptions into being a distinct problem that impedes the project. Still the below bar chard illustrates that a number of different issues may challenge the projects in different way. The blue bars are the ones that contain information on problems still the 'no problem' answers (the red bars) are interesting as well, especially when they are so dominant.

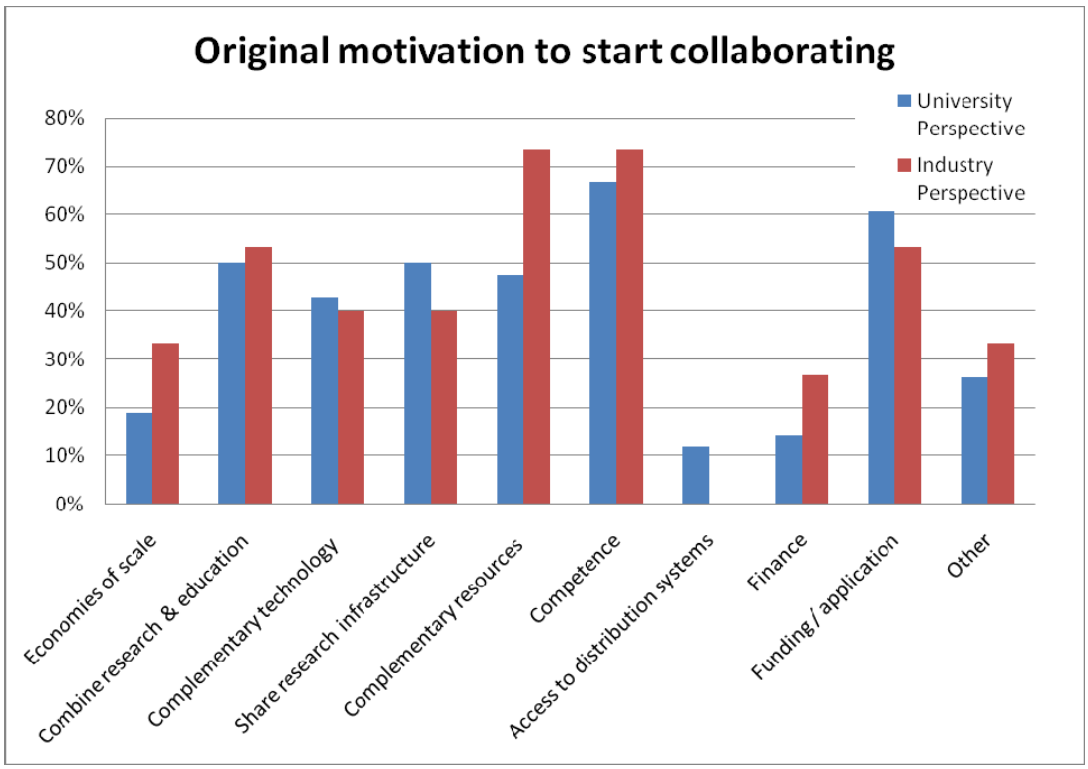


Even though many firms state that this development is a challenge because firms and universities now fight for the rights to patent and to commercialize the research results, only a few display controversies or problems related to IPR matters (q503). Only 7 respondents tell about problems due to IPR disagreements while 50 respondents state that no such problems have occurred. Even though IPR issues are among the less mentioned reasons for problems to occur contracts and formal agreements are still mentioned by 18 respondents as a problematic area.

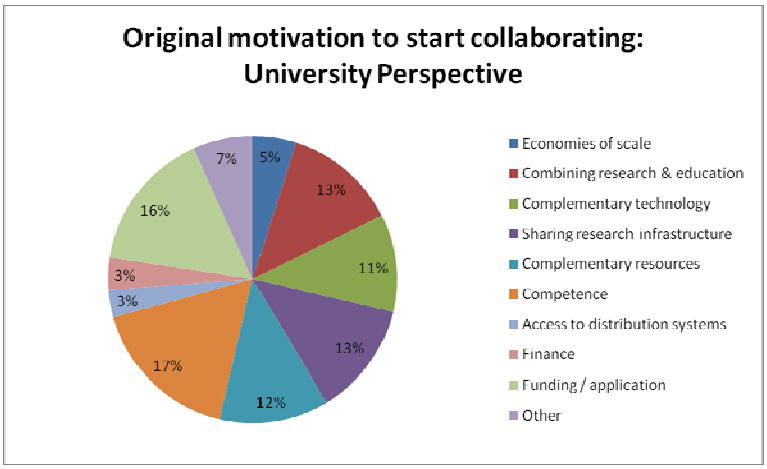


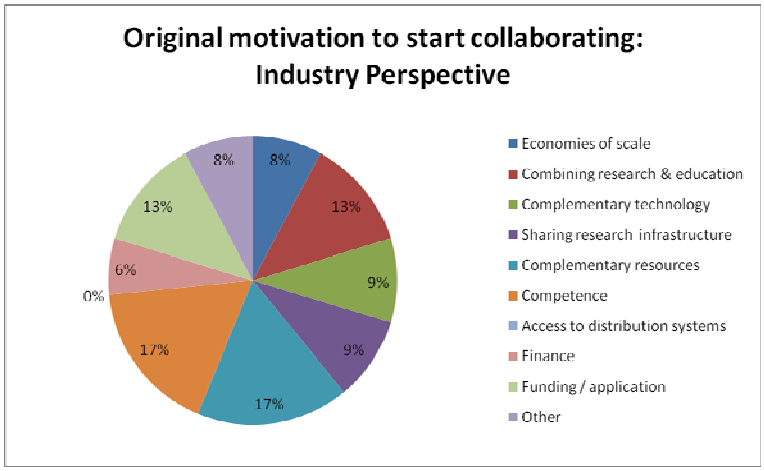
7. Industry/University Differences

We asked a number of questions to either the university partner or the industry partner separately. 44 respondents answered the questions targeted to the university people and 14 answered the industry questions. This means that in 7 cases the respondents did not answer these questions. The questions related for example to their perception of the collaboration or their motivation to start collaborating in the first place, and on most issues, they tend to agree.

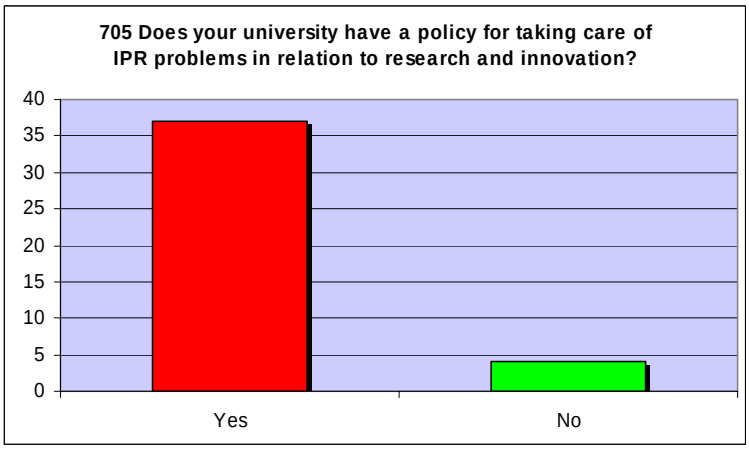


As shown, a need for new competences is the primary reason for collaborating by both industry and university partners. Additionally, a wish for gaining access to complementary resources is stated as a core motivation to collaborate by 73% of the industry respondents whereas only 48% of the university people refer to this as a motivational factor. This is the largest divergence in motivation factor. Only 19% of the university respondents point to the option to utilize economies of scale whereas 32% of the industry people see this factor as an important reasons for collaboration. The motivational factors that are more important to the university people than the industry people, comprise the opportunity to get access to complementary technologies, the option of sharing research infrastructure, access to the distribution system and the opportunity to get funding of apply for funds as a joint activity. The pie charts below illustrate the combination of motivational factors of the two different types of partners.

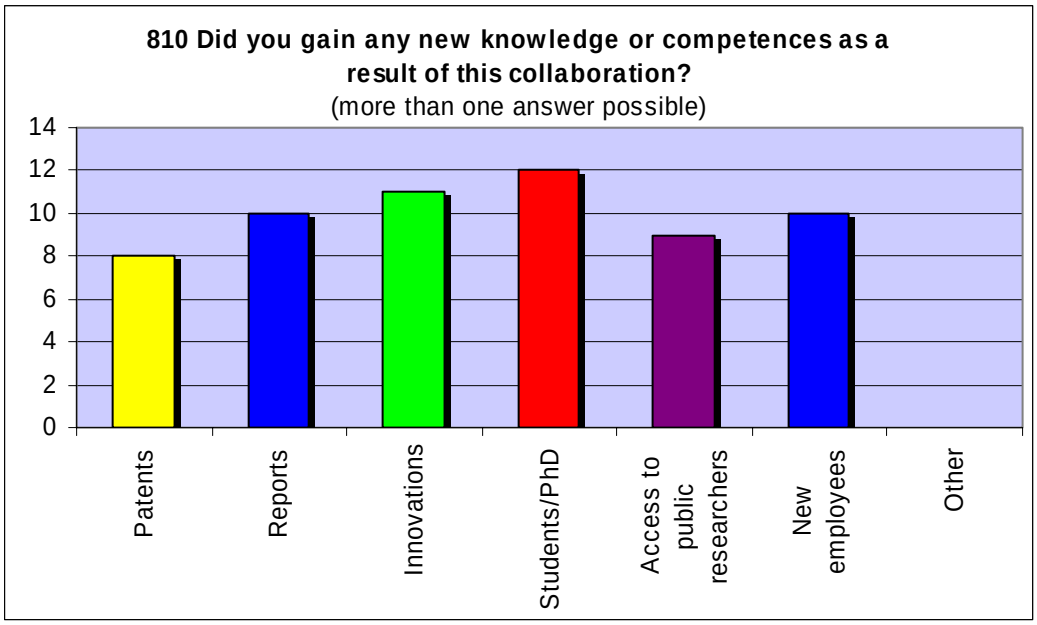




When looking at the answers given by the university respondents alone it is legible that a majority of universities are very keen on taking care of IPR issues. 37 respondents out of 41 answered that their university (or the university involved in the collaboration) has a policy for taking care of IPR matters (q705).



As a final question, the industry partners were asked to point to what kind new knowledge or competences they have gained. Industry partners only answered this question, thus it is interesting to see that the access to new master or PhD student was the most often mentioned gain from collaborating, but the multiple purpose of innovation, access to public research, and new employees are nearly as important.



8. Conclusion

At the beginning of the SUCCESS project, we constructed a survey with the purpose of screening the best collaborations in the area of climate and energy research. We are not aiming at presenting a representative selection of collaborative projects in this field; rather the goal is to present a selection of successful collaborations. The questionnaire was developed based on existing knowledge and experience gathered by the partners of the pilot project. Having analyzed the received 66 completed survey questionnaires, we have gained a lot of knowledge on the core issues defined in this project, including management forms, challenging issues and the perspective of diversity of collaborations.

The initial ambition of benchmarking project is a fundamental problem, both because of the diverse material and the more general problems related to benchmark these types of activities (see [8] Notes on challenges in benchmarking). Instead we have used the unique and valuable—but diverse—material from the surveys in order to fulfill two goals. The first is to give an overall presentation of the material on collaboration in sustainable energy research in the EU, the second goal is to select a small number of typical cases (from the stock of survey forms with sufficient information) to be used for developing more detailed and elaborated models of collaboration. The material collected through the survey is in many ways unique, and to our knowledge, there are no equivalent study in the area of research collaboration. We are, therefore, able to produce an interesting description of a variety of projects pointing to several important aspects of research collaboration in the field.

Clear models describing the variation in collaborative projects do not emerge easily from the material, and we have looked into a few of the cases in order to get some other kind of qualitative data to supplement this overview of the survey results. We describe this in a separate document. Still, we find this present report describing the complete number of projects interesting and very informative. We are able to extract a number of core findings that will be briefly described in the following.

First, it has become clear that decisions taken on how to govern collaborations are closely related to questions of size, age and the specific type of organizations that participate in the collaboration. However, the core challenge in these projects show to be general to all projects. It has to do with the passivity of partners, who fail to deliver the promised knowledge or resources. Often, the management of the collaboration have no real option to sanction passive partners by managerial intervention, and this is a typical problem in networks of this kind.

Second, we have asked about success criteria for collaboration, unfortunately most of the respondents do not answer this question. It seems that the majority of respondents perceive their projects to be generally successful, but they do not specify along these specific dimensions. However, a few have stated that some specific events are seen a critical as they have either kick started the project process or made the benefits of collaboration visible.

> *"The key moment was when we get together the first time and we decided to do this. We were just the key partners, the initial core group partners, and we realized that we can do this and we can win this proposal."*

Others have pointed to the evaluation of whether the milestones are reached as vital. Additional the process of evaluation is also said to entail a dilemma as it is hard to asses the results of new project, yet at the same time, they need good evaluations to proceed.

> *"Critical moments are the evaluation. The programme is only three years old and the evaluation must be made before planning the next phase, before continuation. On the other hand, the evaluation must wait until sufficient amount of results and experience of the programme is ready. This creates a tension"*

> *"Milestones and deliverables have been set in the project proposal and have been the key moments for the finalisation of project results."*

> *"The annual external review"*

> *"The Annual review by general assembly leading to changes in research directions"*

> *"A milestone was the event in which we signed the agreement for the Academy."*

Partners also refer to the physical meets as essential to the success of the project.

> *"Frequent meetings of the key core partners including the funding agency [are essential]. Flexibility is required, we must be able to react whenever immediate decisions/action. Open communication of issues. Trust is important and it is gained through personal long-term relations."*

This quotation points to the importance of creating trustful relations.

> *"The real test cases where the collaboration based on [exchange of] documents are not calling for strong collaboration. Yet, if [the collaboration] involves real demonstrations and real implementation, then the collaboration needs to be strong. The big milestone was starting operating the hydrogen buses in the city of Oporto."*

Third, there seems to be some correlation between the size of the collaboration, its inclusion of different types of partners and the setting of a managerial unit, often with its own location. The larger collaboration networks have their own location, and a clear management structure. 10 of the EU projects (F6 and F7) share a legal unit whereas only 15% of all projects have a joint ownership to IPRs, leaving a large number of collaborations open for potential conflicts. It seems though to be possible to negotiate these matters as only seven collaborations reports on conflicts in this area. The issue of size of collaboration is an important dimension, and this is increasing the difficulty of creating trust in relatively homogeneous groups, or between people who have collaborated before. The type of informal trust-based organization is difficult to maintain in large collaboration networks. A few of the smaller collaborations are based on earlier experience with large, collaborative EU projects, and they are stressing the need for collaborating with people that can rely on and know well. The process of selecting the right partners is essential. The need for a clear management structure and a clear contract to specify IPR issues is another theme raised a number of times and stressed as important.

Fourth, the level of engagement in the partnerships is very different, as some are not close collaborations affecting core activities, but a part of forming associations and contracts beyond the firm or local university. The assessment of the need for firm management structures are to be evaluated in this light. Additionally it seems that when an industry partners is involved as initiators of large projects they want to stay in charge of the project.