Resource Development and Use Across Project Boundaries

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Abstract

The interest in projects as a form of organising seems to increase in a number of empirical and academic fields. Lately, several authors have stressed the relevance and importance of not considering projects as isolated, but as part of wider contexts (Kreiner 1995; Karlsen 1998; Bengtsson and Ericsson 2002; Engwall 2003). This paper presents a case study of an inter-organisational research project in which four parent organisations are part: two university departments and two companies. The case focuses on how resources are developed and used in interplay between the project and its external contexts. Based on the case we elaborate further on what has been identified as a paradox of project organising referring to the tension between identity and difference (Marshall 2002). First, the project members' embeddedness in different 'permanent' networks provides a basis for resource use and development beyond the project boundary but may also make individual members less flexible within the project. Second, the differences among project members provides a basis for complementarities among their resources, but these differences may also imply different views on resources as ends and/or means which may produce tensions among them. Third, the uncertainty characterising development projects implies that projects cannot be planned in any detail at the outset. While discoveries are important outcomes of development projects they also make the development process difficult to predict and plan among the parties involved.

Keywords: resource development, projects, project boundaries

Introduction

While the boundaries of firms are getting increasingly fuzzy and unclear, owing to increasing interdependence among their activities and resources, other boundaries are being created to achieve specific goals. This paper focuses on inter-organisational research projects and what takes place across their boundaries. In contrast to firms, projects are designed for particular purposes and are limited in time and 'space'. Hence, project boundaries are instrumental in that they define and delimit what is 'inside' of them, what is supposed to come out of them, and when.

Projects as a form of organising have received increasing interest during recent years (Lundin 1995). There is an abundance of literature on management of intra-organisational projects (see Packendorff 1995), and on 'project organisations', referring to organisations in which most of the work is organised as projects (Sydow et al 2004). Projects are described as a fast and flexible mode of organising (ibid:1475):

"Because of their limited duration, project-based organizations do not constitute irreversible resource commitments of fixed costs. Hence, companies and other types of organization may launch a variety of ventures through project based organizations and may terminate unsuccessful ventures at low cost and little disturbance to the organizational sponsor."

Engwall (2003) argues that research on projects typically applies a perspective on them as isolated from their contexts in time and space. In particular, the growing literature on project management typically describes projects as discretely and consciously designed and planned organisations. Project managers are hence instructed to "explicate and operationalize the goals of the effort, to define and analyze the work breakdown structure, to coordinate implementation by comprehensive planning, to supervise the work processes towards task accomplishments, etc." (Kreiner 1995:335). In a similar vein Gilbert (1983:83-4) notes that "most of the project-planning models currently available consider the project as though it was developed in a vacuum. Such an approach may be necessary for analytical purposes, but is a gross oversimplification". Hence, how to manage projects by setting clear-cut goals and through designing project processes have become strong, but also questioned, themes in the project management literature.

The need for studying and managing projects with consideration of how they relate to their contexts or environments has been emphasised by several authors (Gilbert 1983; Kreiner 1995; Karlsen 1998; Bengtsson and Ericsson 2002; Engwall 2003) although their arguments differ. For instance, Gilbert (1983:84) argues that: "A project, by definition, sets out to make some change to the environment, usually over a short time period." Therefore it is a mistake for project management to ignore the environment. An understanding of the environment is necessary in order to develop an understanding of projects. Moreover, Bengtsson and Ericsson (2002) argue that if projects are decoupled from other activities, knowledge and competence transfer is made difficult in between a project and its environment as well as between projects.

Hence, there is a number of arguments in favour of viewing projects, not as isolated, but as organising units that are parts of one or several contexts. In analysing these contexts we will focus on what takes place across the project boundary. This also permits scrutiny of the boundary itself which may be of interest since this boundary is created for certain purposes. Hence, focusing on what takes place across the project boundary permits analysis of how this boundary relates and separates activities and resources from the project's contexts.

According to Marshall (2002) project boundaries are characterised by ambiguity owing to the paradox entailed by maintaining both difference and identity:

"The multifunctional and often multi-organizational nature of projects, bringing together diverse individuals and groups, lend them a hybrid character of being simultaneously inside and outside, of difference within identity." (ibid:55)

Marshall suggests that boundary-constituting processes associated with projects therefore assume multiple forms that are not always contiguous or compatible. Hereby, tensions appear between "alternative bases of identity and difference, which tend to pull projects in many different directions."(ibid:67).

In a similar vein, Ancona & Caldwell (1992) discuss intra-organisational teams and how their activities may relate to other internal and external activities:

"Organizations' increasing reliance on teams to develop products and processes requires that teams span traditional organizational boundaries. Furthermore, teams are being given increasing responsibility to define, market, carry out, and transfer their work. These new responsibilities require extensive external interaction with organization members outside the group's boundaries. The study of such groups thus must reach beyond the traditional research boundaries of groups and their internal processes to the wider organizational arena in which the group does its work." (ibid:17)

The purpose of the paper is to discuss how the project boundary works to relate and to separate activity structures and resource constellations in inter-organisational development projects. Empirically the paper draws on a case study of a research project aiming at developing 'winter oats'. Since this paper focuses on inter-organisational research projects there are certain features that may distinguish them from projects of other kinds. In contrast to firm internal projects there are several parent organisations involved which point to a more diversified project context. Furthermore, research projects can be assumed to differ from projects with more concrete tasks and outcomes such as construction projects, in that they are to a higher extent characterised by uncertainty. This is in line with Bengtsson and Söderberg's (2002:263) description of technology development projects:

"Technology development is often a boundary spanning activity where insights and discoveries from different organisations or organisational units are merged into new projects or new technical solutions."

To provide a platform for analysis of what takes place across the project boundary the case presented below focuses on some of the main project activities and the development and use of resources.

The winter oats project[1]

The aim of the case project is to develop frost resistant oats. The four organisations taking part in the project are: first, a co-operative where the majority of the members are farmers. The co-operative's development division has an interest in improving certain characteristics of oats, in this case its frost tolerance. The second member of the project is an international plant breeding and seed group specialising in developing new varieties and producing seed for customers in cold climate areas. The rationale for this firm to be involved in the project is that they have not succeeded in breeding oats that survive the winters, in spite of several attempts with hybridisation. The cold resistance characteristics of oats are expected to be of high interest for the farmers owing to the higher yields that would be the result of sowing in the fall instead of in the spring and this is apparently the reason why both the above mentioned actors have initiated, and been involved in, the project.

In addition to these two firms, two research groups are involved, representing two university departments. One of them is specialising in molecular biology and focuses among other things on research on organism and plant structure and function. The other is specialised in computer science and especially on developing methods and algorithms for structuring and handling huge amounts of data. The data focused on in this project consists of "nucleotide sequence information" in which the key to frost resistance, a first step towards developing winter oats, is expected to be found. Hence, the project's activities are mainly directed towards identifying the genes involved in regulating frost resistance in oats. In contrast to winter crops developed through hybridisation, which requires their cold adaptation to be a monogenetic characteristic, the cold resistance of oats is assumed to be dependent on the interplay among several genes.

The winter oats project can be described by four main research phases: 1) Preparations for sequencing, 2) Sequencing, 3) EST data analysis, and 4) Preparations for microarray analysis. These

[1] The case study of the winter oats project builds on 13 interviews with the four project members (2 with the co-operative, 2 with the plant breeding firm, 4 with the biologists and 5 with the computer scientists) and 23 interviews with people of other organisational units in the project environment. The data was collected between 2001 and 2004 and is part of an ongoing PhD thesis (Lind, forthcoming).

research phases are briefly described below with particular focus on the development and use of some of the key resources. See figure 1 below.

Preparations for sequencing

One of the project members had developed a technique to transform oats genes in a previous research project. When the winter oats project started this technique was considered to be useful in the development of oats characteristics. The previous project was funded by the West Swedish Farmers Supply and Crop Marketing Association funding body (henceforth the VL-funding body). The VL funding body also funded the winter oats project. From the VL funding body's perspective, the winter oats project was seen as a continuation of the previous project. The transformation technique was considered to be central and the discussions went: "Now when we have the transformation technique what can we do with it?". The winter oats project was seen as one interesting application. Consequently, the transformation technique was considered to play a central role in the project. However, thus far, this has not been the case since the efforts to identify and develop the characteristics in oats have taken other routes.

The first main research activity of the winter oats project was the preparations for sequencing. The preparations included production of material to be used as a starting point for the actual sequencing activity. In order to produce the material different types of oats sorts were needed. One of the project members, the plant breeding firm, contributed with oats sorts from the international breeding firm it is part of. In particular, oats sorts from England that had survived the relatively mild English winters were used. In addition, English spring oats sorts, also accessed via the plant breeding firm, were used. These oats sorts are thus examples of resources that were accessed externally and used within the project.

Parallel to the preparations for sequencing, the plant breeding firm also contributed 'winter oats' sorts for field study tests on oats sown in the south of Sweden. For that purpose the plant breeding firm managed to find Russian and American 'winter oats' sorts on the Internet. Those sorts were important resources for the field study activities. One of the American sorts, "Nebraska" has, against all odds, survived several Swedish winter field tests. Those field tests will become important resources later on in the work with microarray analysis.

Sequencing

Sequencing means deciding the order of the nucleotide bases of the genome. Knowing this order is a first step towards identifying the genes and understanding their function. For the sequencing, an important external resource was used. MWG Biotech, a sequencing firm, was engaged as a supplier and performed the oats sequencing at their facilities in Germany. Test tubes with prepared oats, based on the English winter and spring oats, were delivered to MWG Biotech who returned, so called, 'raw EST data'. MWG Biotech is also used by a number of other research groups all over Europe and the activities are considered as standard sequencing services. The sequencing resulted in the first main resource developed in the project to be further refined, used and analysed in subsequent research activities.

When it was realised that a huge amount of data was to be analysed, the need for knowledge and experience in handling and analysing huge data sets arose. The realised need for knowledge about computer science resulted in discussions with the Department of Computer science at Skövde University. The computer scientists, who were not involved from the beginning in the project, were asked to join the project at this point.

The EST-data analysis

The raw EST data supplied by MWG Biotech was considered a central resource developed within the project. The data was stored in a large file that does not tell anything unless it is combined with tools and knowledge on how to interpret and further refine the data. Initially the project members worked with the raw EST data in order to develop an understanding of what had been delivered from MWG Biotech. It was not clear at first what types of sequencing analyses the company had performed and how well they were performed. To understand and make sense of the EST data, the project members studied the data and tried to figure out what had been done at MWG Biotech. Manuals found on the

Internet were used in these efforts and MWG Biotech was contacted to get some additional information. That contact, however, resulted only in limited information. It was concluded that the sequencing performed had some weaknesses. Eventually the project members managed to develop a refined set of EST data that was generated by use of a mix of resources. Some of these and how they were accessed is described below.

In order to facilitate the analysis of the EST data an EST database was developed. The EST database contains both the original raw data delivered from MWG Biotech in addition to other data concerning the EST characteristics. For example, information from public database searches was stored in the database, which made it possible to structure essential information on specific ESTs. Hence, the EST database was a result of using a resource, the EST data, developed within the project. At the same time, the EST database can be considered as a new resource that was developed in the project in order to be used further on in the project.

The project members frequently searched and used publicly available tools on the Internet to be able to analyse the EST data. For instance, the results from other research projects stored in databases, and tools for searching among and within the databases were used.

Another vital set of resources for analysing the EST data was results from a parallel research project on a 'model plant'; Arabidopsis thalia. This opportunity was due to one of the project members who is also involved in the research project on the Arabidopsis thalia plant. This plant has, due to its simplicity, the potential to explain characteristics of other plants. In addition, there are vast amounts of research on the Arabidopsis thaliana plant that may benefit research on oats.

The analysis of the EST data resulted in identification of a set of genes and also an understanding of the function of certain genes in oats. Based on the EST data analysis there were a number of potentially cold related genes identified in oats. Hence, so far in the project, knowledge regarding the oats genome in general and more specifically regarding the cold associative parts of it has been developed.

Some of the general results of the oats genome analysis have also been used in other settings, i.e. beyond the project boundary. A specific fraction of the EST data has been used further as a starting point for development of a so called gene family tree. The design of the tree has mainly been done by one of the project members, the computer scientists. The gene family tree describes what other plants oats is most related with. In this case, oats has been compared with wheat, rye, corn and rice. It can be useful to know what species oats is most similar to. For instance, if a certain characteristic that is not known in oats is studied, it is possible to use knowledge concerning that characteristic of a related plant. The family tree may contribute to the winter oats project later on owing to comparisons of this kind, but this is still uncertain and depends on other findings. Hence, it is an application that primarily interests and benefits the involved computer scientists and was made beyond the scope of the project. In designing the family tree for oats, external resources were also needed. One important resource was the software programme Phylip which is used for kinship analysis. It is distributed as source code, documentation files, and a number of different types of executables. The work with the family tree also required botanical knowledge and so a contact was established with the Botanical garden at Göteborg University.

The EST data analyses also resulted in identification of a number of health related genes. Those genes in combination with the transformation technique formed the basis for cooperation among two of the project members and a project external research group: the Swedish farmers' supply of crop and marketing organisation, the molecular biologists, and the Department of Food Science at Chalmers University of Technology. Inspired by the identification of health related genes this constellation put together a joint research application where they suggested further research on oats especially with a focus on its health characteristics. The health related genes identified in the EST data analysis, which are not directly related to the cold adaptation, were hence identified as useful beyond the scope of the project. The Swedish farmers' supply of crop and marketing organisation has in earlier research projects on oats worked with the Department of Food Science at Chalmers. Hence, one of the project members saw an opportunity to use its existing relationships in an effort to exploit on some of the results from the winter oats project. The three parties started their discussion in relation to an ongoing large project application on making minerals available in food that the Department of Food Science already was involved in. The project focused especially on herring, yeast and oats. However, the

programme did not receive continued funding. The three parties have ongoing discussions on filing for joint research funding on oats from other sources.

Another example of the project members' ideas for further use of the resources developed in the project was the efforts to commercialise the EST data and the EST database. In these efforts the methods for generating, analysing and building an EST database were in focus. The EST data knowledge was considered to be useful in combination with previous knowledge regarding the characteristics of trees. Some of the project members offered EST data generation and subsequent analysis of rubber trees to a contact that had been developed with the Malaysian Rubber board. The EST data generation and analysis were to be applied in identification of the genes that regulate cell zones building firewood. This was not realised, however, but instead performed in-house by the 'potential customer' without the winter oats researchers' involvement.

Another example of ideas to commercialise resources developed in the project was focusing on the methods used for building the EST database and their use in other settings. Discussions regarding building a wheat database for Plant Science, BASF, who work with wheat breeding, were initiated but did not result in further co-operation.

Preparations for microarray analysis

Microarray analysis is a technique for deciding exactly what genes are active in an organism at a certain moment under certain conditions. A microarray chip is a grid in which each square represents one gene. Both the design of the oats microarrays chips and the microarray analysis are ongoing. Already when planning the winter oats project, microarray analysis was part of the plan. To be able to conduct microarray analysis, EST data is needed. Hence, the EST data is a condition for performing microarray analysis in general and more specifically for designing the microarray chips. Since there were no oats microarray chips available on the market, the first step towards performing microarray analysis became to develop those chips. In order to design the chips, facilities at Göteborg University were needed. Those facilities were accessed via the parent organisation of one of the project members, the molecular biology department.

When the microarrays eventually become available, real oats plants from the field experiments will be tested against the chips. In this test process, plants grown by the plant breeding firm will be used. The plant specimens are sent on a regular basis to the molecular biologists in Göteborg. The plant specimens are resources used in order to be able to perform microarray analysis, and thereby develop a deeper understanding of cold association in oats. Also barley field experiments are used as input in the microarray analysis. The barley specimens can be analysed with standard microarrays and are useful as comparison material. In addition, research findings from Arabidopsis microarray analyses have been reviewed and used as a point of departure.

The EST data has also found other uses beyond the project boundary e.g. as input to a traditional plant-breeding programme in England. Through one of the project member's parent organisation, Svalöf Weibull, the EST data has been transferred and further used in a new setting. This use was not planned initially but represents an opportunity that has been identified along the way. In contrast to Sweden where there are no national breeding programmes focusing on oats, there are far more extensive activities regarding oats breeding in England. Svalöf Weibull is involved as a member in one of the national breeding programmes. Part of this programme is a project called 'Oat Link' that started during the spring 2004.

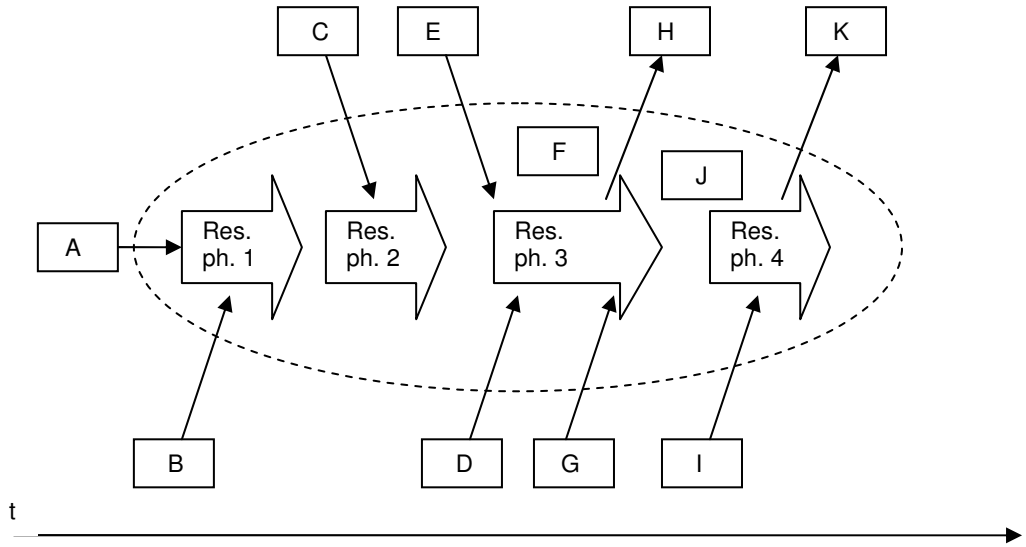
The EST data will, in the 'Oat Link' project, be used as a starting point for developing breeding markers for oats. The EST data consists of 600 micro satellites, i.e. areas of repetitions, but it is still not known whether any of those are close to a gene regulating any interesting characteristics and thereby qualifies as a breeding marker. Hence, it is still to be evaluated if the micro satellites discovered within the EST data can be used for developing breeding markers. The ESTs have been sent to Svalöf Weibull in Canada who has specialists that may prepare EST data to micro satellites. Svalöf Weibull Canada will then provide the 'Oats Link' project with prepared micro satellites.

The breeding markers that may be developed in the breeding programme might become useful in the winter oats project depending on the results of these efforts. Regardless of whether or not the micro satellite research will be of use for the winter oats project, the EST data is anyhow an important

contribution to the breeding programme and to the 'Oat Link' project in particular. The parent organisation, being a member in these research efforts may thus, even if the winter oats project does not, benefit from the use of the EST data.

Discussion

Resource use and development may cross the project boundary either in time or in 'space'. Hence, when the time dimension is concerned the project may use resources that were developed prior to the project, and also develop resources to be further developed or used after the project is 'completed'. In the 'space' dimension, there are resources developed within the project and used beyond and vice versa, in addition to resources that are developed *and* used within the scope of the project. Figure 1 illustrates some of the main resources whose development or use crossed the project boundary.



Research phase 1: Preparations for sequencing
Research phase 2: Sequencing
Research phase 3: EST-data analysis
Research phase 4: Preparations for microarray analysis

A – Technique to transform oats
B – Oats sorts
C – Sequencing facilities
D – Manuals and contacts with the seq. firm
E – Publicly available tools
F – The EST database
G – Parallel research project
H – Use of identified genes in other settings
I – Facilities for designing microarray chips
J – Plant specimens
K – Use of the EST data in relation to a hybridisation programme

Figure 1: Resource use and development in relation to the winter oats project.

The case provides several examples of resource use and development across the project boundary. The basis both for accessing project external resources, and for combining what is developed in the project with resources beyond the project boundary, can be found in the project members' network contexts. Hence, the complementarities provided by the project members' different contexts are essential for the links between resource development and use across the project boundary. However, differences in network contexts and goals may also cause tensions among the project members. Below, we discuss three tensions that may arise owing to differences among the project members and their respective network contexts.

Different perspectives on ends and means

Overall, the project in focus seems compatible with the diverse goals of the individual organisations. The two firms involved in the project can be described as representing future users of the main outcome of the project, i.e. frost resistant oats, while the two research organisations represent

knowledge development in their respective areas. The involved parties may, owing to their different 'permanent' network contexts, view ends and means differently. Hence, the views on what are considered ends and means and how these are related to the project may differ among the project members, although they are sharing a common view and understanding of the overall goal of the project.

According to Engwall (2002) project goals may be important in order to get projects started but their meanings may evolve during the project and therefore it is impossible to know beforehand how a stipulated goal will turn out. For inter-organisation projects this might be even more relevant than for projects carried out within one organisation e.g. a firm. The differences among the project members discussed by Marshall (2002) are essential as they have to do with the complementarities among the parties. However, these differences reflect both means and ends, and therefore the variety do not only imply possibilities to access resources beyond the project boundary, but also that the project members see different opportunities in combining resources developed within the project boundaries with external ones. In addition, the project members may change their views on how the project fits with their general aims, and these aims may also change during the project.

The EST database developed within the project may exemplify the tension that may arise owing to different views on ends and means. Although the database was developed for solving project specific tasks it also became identified as a tool that could be used for other purposes. The database became the starting point for efforts to commercialise some of the results of the research in the project. In addition, it became a vital resource for developing an oats family tree, an application identified and explored by the computer scientists, and one that was not directly related to the development of winter oats. The database thus became related to ends outside the scope of the project. However, some of these efforts might result in resources that may become useful to the project later on. This depends both on developments outside the project and within. Other examples of this tension are some of the unexpected research results generated in the project. In the search for oats genes that regulate the cold adaptation, other oats genes have been identified, e.g. genes that are related to human health. This has resulted in applications for funding of new projects, together with other parties, for some of the project members. Hence, the more or less unexpected identification of health related genes in oats has thus given rise to ideas about new ends.

Although the project members efforts to combine resources that have been developed within the scope of the project with resources beyond the project boundary may cause tensions, a too heavy focus on joint exploration of resources within the project might not be a solution to problems of diverse ends and means among the project members, not even from the point of view of the actual project. Ancona & Caldwell (1992:17) identify so called 'technical scouting teams' that by focusing too much on exploring:

"[…] enter a cycle of complexity and negative performance. Our observations of these teams suggest that they enter a pattern of exploration that they cannot escape. Whether due to external conditions or their own beliefs, members of these teams continue to search for new approaches to their product. In turn, this exploration brings large amounts of conflicting information into the team, thus requiring complex internal interaction. As the complexity grows, both external and internal frustration develops, leading to negative managerial ratings of performance and internal conflict."

Hence, for the performance of the project the access to external resources is essential, while the external use of resources developed in the project may, on the one hand, contribute to the project and, on the other hand, lessen the focus on the project's goals. However, for the individual project members the possibilities to combine and relate the resources developed in the project with other resources and activities are essential for the extent to which the project contributes to their respective aims. Below, we discuss two aspects that follow from this notion. The first addresses the tension that may arise owing to differences in possibilities to combine the resources developed in the project further. The second concerns the process and the tensions that may arise owing to the uncertainty characterising research projects.

Differences in possibilities of further resource combining

While the project boundary provides direction and limits in time and scope for the parties involved, it relates differently to the contexts of the individual parties. The assumption of resource heterogeneity

entails that the value of an individual resource depends on with what other resources it is combined. Hence, resource combining is essential from a value creation point of view. For the project members, the possibilities to combine resources further into their respective 'permanent' network contexts differ among them. These network contexts provide continuity as a complement to the temporal nature of the project. Hence, the extent to which the different parties are able to embed the development and use of resources in their permanent network contexts differs.

Project members who have limited opportunities to further combine the resources, at least in some dimensions, may be more flexible within the project, but they also lack the prerequisites to exploit on, or to further explore, the resources developed in the particular project. Therefore, especially when inter-organisational projects are concerned, tensions may arise owing to the parties' different opportunities to benefit from the results of their joint achievements. These tensions do not necessarily appear as direct conflicts over how to combine a certain resource with other resources towards the project goal, but they imply that the value of jointly developed resources may be unevenly distributed among the project members.

The case includes a project member, the plant breeding firm, who is part of a larger organisation that continuously engage in activities closely related to the aim of the project. This firm has, over the years, been involved in several projects on improving certain characteristic of plant sorts and there will likely be a number of them in the future. Hence, the plant breeding firm seems to have good possibilities to use the results from this project in other related projects and activities. In contrast, the molecular biology university department works almost entirely on a project basis, implying dependence on external funding for participating in, or initiating, other projects in which the resources developed within the project may be further exploited or explored. Also, maintaining and developing their facilities such as laboratories requires matching project funding over time. When there is a lack of funding, there are no possibilities to work systematically even on research issues that are considered to be highly central. This entails a lack of continuity and limited opportunities for using and developing results from a particular research project.

Planning for the unknown

Hellgren and Stjernberg (1995:378) describe projects as "…processes of organizing where ends and means are continually redefined in the interactions of actors". The interplay between ends and means among the actors involved in a project is closely related to the planning of project activities and the identification of what resources to activate. When both search and discovery are essential parts of the joint efforts, the extent to which a project can be planned is limited. Hence, although in some cases even the end or goal of a project may change during the process, certainly the exact means required to get there are uncertain. The learning that takes place within the scope of a project may be as much concerned with identification of new ends and means as with achieving the overall goals of the project. The distribution and direction of this learning, as well as the opportunities to exploit on it in further efforts (e.g. in other projects) may differ among the parties involved. This may create tensions concerning the planning of the project in relation to the learning that takes place within it. Consequently, in situations where the uncertainty is high, the distinction between ends and means may become blurred and subject to disagreement.

The case demonstrates how research activities in general, and the results that spring from these research activities in particular, may only be planned to a certain degree. For example, the search was set on identifying oats genes that are regulating the cold adaptation, while the identification of health related genes was not planned in advance. The potentials in further exploring these findings beyond the project boundary were identified by two project members. Another example is the nucleotide sequence data developed in the project that could be used as input in the English national plant breeding programme. In return from this programme the project might receive breeding markers that may become useful for field tests within the project. The co-operation with the breeding programme was an opportunity that appeared since the winter oats project had developed useful means that were possible to combine with resources developed within the breeding programme. This and further exchange of resources between the breeding programme and the winter oats project is depending on the breeding firm's relationships with other researchers.

Concluding discussion

While the project boundary works to separate activities and resources belonging to the project from others, it may also work to relate them to activities and resources beyond, or outside of, the project boundary. Although some resources may both be developed and used within the project boundary, others are developed within the scope of the project and used outside, and vice versa. All development and use efforts that cross the project boundary are depending on the specific context of the project. Two layers can be identified in this context. First, the project members provide a close context to the resource combining and activity co-ordination in the project. Focusing on this layer alone the project can be described as an organised network including the project members and the relationships among them. Second, the project members' networks provide a context in which resources may be accessed and used. Adding this context layer extends the view of the project into 'a network within a network' (Dubois and Gadde 2000). The paper discusses and provides examples of how an inter-organisational project is embedded in different ways and to different extents in the project members' specific network contexts and how the project boundary works to separate and relate activities and resources within and beyond this boundary. Clearly, the structuring of these contexts influences the 'success' of the project itself and the extent to which the project benefits different parts of its contexts.

From an industrial network perspective (Håkansson and Snehota 1995; Håkansson and Waluszewski 2002) these are not surprising conclusions. The differences among the project members in terms of network contexts provide a rich and varied project context from which resources can be accessed and used within the project. The different network contexts and goals represented by the project members also entail possibilities for value creation in terms of further combing of resources developed within the project boundary and resources used or developed within the network contexts of the project members. From a strict project perspective, however, the latter might weaken the focus on the project goal. Three related tensions have been identified pointing at some of the difficulties in managing projects when these are not carried out in isolation. Obviously, 'isolating' projects in order to reduce these tensions would not be a solution.

In conclusion, the three tensions may not be considered as problems to be solved but as instrumental in maintaining both the relating and separating functions of the project boundary. A too strong external focus might hamper the resource combining towards the project goal. On the other hand, a too strong focus on the project goal might entail an introverted approach were the resources developed are only used in combinations towards the project goal and are not tried out in combinations with resources beyond the project boundary. This external relating may not only benefit the project members, or other parties in their networks, but also the project per se as illustrated by the case.

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