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Projects and the interplay between ends and means – A case study of an inter-organisational research project

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Introduction

Literature focusing on projects typically applies a perspective on them as isolated from their contexts in time and space (Engwall 2003). 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). Consequently, how to manage projects by setting clear-cut goals and through designing project processes have become strong themes in the project management literature.

However, authors rooted in organisational theory have pointed at problems in these assumptions and recommendations. For instance, Hellgren and Stjernberg (1995:378) argue that most projects include phases and aspects where normative project management tools don't apply since projects are "…processes of organizing where ends and means are continually redefined in the interactions of actors". In a similar vein Engwall (2002) argues that project goals may be important in order to get projects started but that the meaning of project goals evolves during the project and that it is impossible to know in beforehand how a stipulated goal will turn out.

Literature focusing on behavioural aspects of projects and their social environments has provided inspiration for this paper. However, rather than focusing

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on the social dimension we aim at focusing the resources that are used and developed in the course of a project. In the simplest form of description, any project concerned with research or development may be described by the resources activated and the ones that are developed by it. What resources that are activated and developed are typically uncertain at the outset and also during the process. Furthermore, the resources may or may not be found within the project boundaries, but are activated and/or developed as a result from interaction with various resources in the network context of the project.

Aim and scope of the paper

The aim of the paper is to discuss how an inter-organisational project may be analysed in its network context. By analysing the interplay between ends and means we aim at developing an understanding of how a project evolves and how it relates to resources across the project's boundaries. The next section introduces some different views on ends and means and suggestions as to how they may be applied on projects. Thereafter, we present a case study of an inter-organisational research project based on which we discuss some aspects of the interplay between ends and means.

Views on the interplay between ends and means

Based on a brief literature review we have identified different approaches to how ends and means are assumed to be related. First, some authors stress the role of ends in guiding efforts to identify appropriate means. For instance, Lindkvist and Söderlund (2002:284) argue that "what" issues are typically rather well specified in projects, while it is "very much up to the team to find out "how" to accomplish this, during the project execution phase." Furthermore, they identify three process phases for the understanding of problem solving and knowledge development in a project: Pre-selection, variation and learning. Hellgren and Stjernberg (1995) also characterise projects as processes in which different phases of design and implementation are distinguished. In addition, they develop the concept of 'project network', which describes network formation to solve a specific task, arguing that the networks in the two respective phases may differ and affect each other. For instance, implementation may turn out to require other competencies than design.

In contrast, Weick's model of group development describes the development of ends and means differently:

> *"Having first converged on shared ideas of how a structure can form (i.e., on means), the persons then activate a repetitive series of interlocked behaviours – that is, they form a collective structure. The range of their behaviours narrows before a group forms, not after; the group is made possible by this narrowing and convergence." (Weick 1979: 90)*

Hence, Weick (1979) stresses that people tend to converge first on means rather than on ends and that people do not have to agree on goals to act collectively. Rather, they can pursue quite different ends and for quite different reasons. Of main importance is the contribution of their action. He further argues that in the early stages of formation (of a structure) it is not essential to agree on ends in order to implement interdependence. Instead the more basic agreement involves interdependence as a means to pursue ends that need not be similar. That is, a common understanding of means might be more important than a common understanding of ends in order to engage in interactive behaviour.

When connections to other groups are concerned Weick's (1979) concept of 'partial inclusion' can be related to embeddedness in time and structure as it refers to how individuals belong to several groups. Blomquist and Packendorff (1998:38) refer to embedded projects as projects in which "… most team members have positions in the surrounding permanent structure and they also refer to that structure in terms of social/cultural belonging and career paths." According to the authors, project embeddedness can thus have negative impact on a project since it results in a lack of commitment to the actual project. However, they also argue that there are possibilities to handle embeddedness and to create benefits for the project and the surrounding organisations.

Kreiner (1995) explains why a goal that was relevant at the time it was formulated may not be relevant at the point of time for delivery by 'drifting environments'. To deal with drifting environments Kreiner suggests networking, in contrast to hierarchy, as a strategy for managing projects. In a process sense this is a way of invoking a notion of temporal orders as an alternative to the vertical orders of hierarchies.

> *"When temporal orders are invoked, things become related, significant and responsive not by design but by co-presence. There is no organizational fixed point to rely upon, but only an uncertain*

> *and moving position from which to justify action choices. [...] Networking as a managerial strategy does not imply that concern for the integrity of the project has in any way been given up. The non-hierarchical relations imply that none of the parties can dictate specific options and conclusions to the others. Networking is affected in interaction and communication amongst actors, whose possibly strong identities may even be reinforced through networking."* (Kreiner 1995:342)

Snehota (1990:85) relates the uncertainty and ambiguity of both means and ends to bounded knowledge: "Future ends and means can be unknown and unknowable. The desired goals can be difficult to articulate or even to identify, the means known can become irrelevant and new means can be conceived."

Focusing on the dynamics of project work Engwall (2003) suggests that projects need be seen as linked to history and context implying that "a conglomerate of procedures and practices with different origins" are used. Some of these may be applied for the first time, others have been exploited previously and some are tailored specifically for the project. In addition, some may well be in line with the standard routines of the surrounding organisational context. According to Engwall these microstructures need be included in the analysis of an in-depth understanding of the dynamics of projects.

Hence, when structural aspects of projects are concerned the actors' past and current interaction with various counterparts can be assumed to have influenced the parties' ends and means in the project. By analysing the different parties' contexts, in terms of partial inclusions or embeddedness, a platform for understanding the interplay between ends and means can be built. Furthermore, process related issues can be identified concerning how different research activities are related to each other and how each research activity is featured by different means and ends. Therefore, we suggest a focus on the *ends* and *means* at play in two dimensions. First, in terms of a structural dimension focusing on the actors involved. Herein, their ends and means are related to their respective network contexts. The other dimension is related to the process of activities within and in relation to the project. For each such activity (or rather 'bundles of activities' performed in some 'phases') certain ends and means can be identified and related to each other, to the actors and to other phases. The way in

which the means are identified, used and changed in relation to the ends is of interest in order to develop an understanding of *what* is developed in the process and *how*.

The case study

In this section we describe the actors that are involved in the project, referred to as the winter oats project, and some of the main activities undertaken within this project. In this description we focus on the means and ends related to the different activities or phases in the project.

The winter oats project

The aim of the ongoing research project is to develop winter oats i.e. oats that can be sowed in the autumn, survive the winter and be harvested in the spring. In Sweden there are several winter-crops available, for example winter wheat, developed with methods based on hybridisation, while efforts to develop winter-oats with these methods have failed. The main advantages that winter-crops hold over other crops are that the output levels are higher due to a longer vegetation period and that winter-crops bind the soil, which hinders leakage of environmentally unfriendly nitrogen.

There are four organisations taking part in the project: First, the Swedish Farmers Supply and Crop Marketing Association (SFA), which is a co-operative where the majority of the members are farmers. The co-operative's development department has an interest in improving certain characteristics of oats, in this case its frost tolerance. The second member of the project is Svalöf Weibull (SW), an international plant breeding and seed group specialising on developing new varieties and producing seed for customers in areas of cold temperature climate. The rational for this firm to be involved in this project is that SW has not been able to breed oats to survive the winters by themselves even though there have been several attempts. The cold resistance characteristic of oats is expected to be of high interest for the farmers and this is apparently the reason for both SFA and SW to initiate and be involved in the project.

In addition to these two firms there are two research groups involved representing two university departments. One of them is the department of Cell- and Molecular biology (CMB) at Gothenburg University, focusing among other things on research on organisms' and plants' structure and function. The other is the department of Computer Science at Skövde University where the research focus is on developing

methods and algorithms for structuring and handling huge amounts of data. The data in focus of the project consists of nucleotide sequence information in which the key to frost resistance, a first step towards winter-oats, is expected to be found. Hence, the project activities are mainly directed towards identifying the genes involved in regulating frost resistance in oats. In contrast to winter-crops that have been possible to develop through hybridisation, which requires that their cold adaptation is a mono-genetic characteristic, the cold resistance of oats is assumed to be dependent on the interplay between several genes. The co-operation between biologists and computer scientists in general is described as a new research area referred to as bioinformatics. Hence, the research project is also part of a wider attempt at developing this area.

The two firms involved in the project can be described as representing future users of the results of the project while the two research organisations represent 'knowledge development' in their two respective areas. The interaction between these two research groups (further on referred to as the biologists and the computer scientists) is in focus here since their activities are dominating within the winter oats project so far.

Research activities in the winter oats project

Below follows a brief description of some of the main activities of the winter oats project, most of which were undertaken in sequence where the results of one activity were used as input in the next.

1. The biologists prepared the development of suitable biological material through research on various oats sorts and green house experiments aiming at acclimatisation of a certain oats sort. The results of these preparations were sample material ready for gene sequencing. The samples were thereafter sent to MWG Biotech, a firm specialising on sequencing, who performed sequencing by use of standard equipment used on a large scale for commercial purposes. MWG Biotech was known previous to the oats sequencing by some other researchers at the department of Cell- and Molecular biology. The resulting EST-data was returned as raw data to the project.
2. The EST-data was analysed by the computer scientists identifying genes by matching EST-data with publicly available gene data. In these efforts the software tool Blast was used, which is publicly available and thus was downloaded from the Internet. An EST-database was developed to facilitate data analysis. The EST-

database was built on general principles and may be used for other purposes where EST-data is used. The analysis resulted in a number of identified oats genes. The biologists contributed by relating the identified genes to research results achieved elsewhere, in this case with a focus on tolerance against different stress factors in various plants. For instance, a research team had made interesting findings on how tomatoes react to salt stress and a Canadian research team had studied how wheat reacts in cold climates.

3. The computer scientists and biologists together tried to narrow down the amount of genes with potential impact on frost tolerance. This was done with the use of computers and software, so called in-silico based research, in two steps:
   a) The biologists and the computer scientists made comparisons within the EST-data set, to be able to reduce repetitions. The resulting EST-data set is called a 'unigene set' and thus contains only one copy of each candidate gene.
   b) The unigene set was compared against research results achieved by others using the Internet and public databases to be able to make a functional classification of the genes in the data set. The computer scientists were aiming at finding ways of searching public databases and methods to ensure that a data match could be interpreted as a significant result.

A number of oat genes that were not considered interesting for the project were identified. These, however, may be used in further research since they are vital for the use of oats in various applications. Hence, initial contacts with a research group working within the area of Functional Foods were taken on this basis.

4. In parallel to the in-silico research, the biologists were planning research experiments with potential genes in other plants that are in focus of other research projects within the department of Cell- and Molecular biology. Those plants are also well known with regard to gene transformation. The basis for those planned experiments is the transformation technique that has been developed by the biologists. As preparation for further experiments on oats this technique has been modified for this particular purpose. This technique is hence general to oats but may be used for different kinds of genes.
5. The biologists currently prepare another set of experiments, called Micro array analysis, in which the EST data will constitute the input. By doing Micro array analysis it will be possible to study what genes are active in cold induced oats in

further detail. There are companies specialising on Micro array analysis, although the researchers have no previous experience with any of these.

Analysis

Structural aspects of ends and means

The winter oats project is described or defined by an end set by the Swedish Farmers Supply and Crop Marketing Association, i.e. to develop frost resistant oats. That is an interest that is well within the scope of SFA and SW but not necessarily one that the two research organisations would define themselves. However, their different means suit this end and their respective ends can be seen as complementary to this particular task. The initial idea of the 'contribution of their respective actions' can be broadly related to what molecular biologists and computer scientists respectively can do in general. However, as reflected by the ends and means of the various research activities undertaken within the project the specific contexts of the two research organisations also impacted on the way in which the project evolved and on the results of it.

Ends and means in the process

In the first phase aiming at achieving EST data to analyse further some of the resources activated were known to the biologists: the green house facilities and the external resource (MWG Biotech) used for sequencing. The search for useful biological sample material, i.e. some oats sort with proper cold characteristics, was guided by the overall aim of the project.

The second phase was focused on EST data analysis where a bundle of resources were used. The computer scientists were able to use software tools with which they had some previous experience. In order to be able to structure the analysis of the data they developed the EST database that can be described as a new resource with potential for other applications. In parallel, the biologists searched for research findings elsewhere in relation to stress tolerance in plants. This entailed interaction with external research teams to further the understanding of the function of certain genes. Hereby, they got ideas on what genes to look for in the oats genome. Hence, the two research groups were both working towards identification of potentially interesting genes. Their means in these efforts were very different and the results of

their efforts could be combined into a set of potential genes for further analysis in the third phase. Hence, they worked by using different means towards the same end.

The third phase entailed use of tools that were known by the computer scientists in order to 'clean' the gene data from copies and to look for matching gene data in public databases. The EST database that had been developed was used in these efforts. A need for development of proper methods for data matching was identified. Also, by initiating contacts with researchers interested in the applications of oats in food other discovered features of the oats may become related to other ends.

In the fourth phase the biologists worked together with other research groups at the same department since they could use resources that were developed mainly for other purposes. Previous experiments on other plants entailed possibilities to further the knowledge of the function of certain genes. The transformation technique that had been developed as a resource for use on these other plants could be developed for oats for possible use later in the project. This resource may also be used in further research on oats since it permits transformation of any gene.

The fifth, ongoing, phase will entail use of a resource (micro array analysis) that is 'new' to the researchers although they know what can be achieved by it. This also means further search for resources external to the project.

Resources being used and developed

So far a bundle of resources have been used in the project. Some of these were previously known and available by the two research groups, some needed to be developed in the process. The process was guided by the aim of the project but also by the available means, some of which were identified as useful in the process.

When resource development is concerned some of the resources that needed to be developed in the process have potential use outside the project. For instance, the EST database, the transformation technique and the methods for matching a specific set of gene data with publicly available gene information. Yet other resources with potential further use were not used in the project but appeared in the efforts to identify the genes impacting on frost resistance. The knowledge of other genes found in oats may, for instance, be useful in further research together with the Functional Foods group. Further use of these means, hence, depends on with what ends they may be related to in the future.

Discussion

To further our understanding of resource use and development in inter-organisational projects, were actors with very different general ends and means are involved, it seems interesting to analyse how these ends and means are used and developed in the process. The project and its context, in terms of external resources that in different ways become involved, is one obvious unit of analysis. In addition, since the parties involved can also be assumed to strive for reinforcing their resources through networking, their different perspectives on the development of ends and means as a result from participating in the project, is of interest. Of particular interest for our continued study of the winter oats project is how the resources developed as means within the project become used in other research efforts. For the two research groups participating in the studied project, these further uses are far from certain. They may, however, influence these potentials by entering into co-operation with others based on particular ends that suits the resources that have been developed.

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