



Mid-term report

Complexity in Engineering R&D Projects

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Background

Project complexity has been shown to be an illusive subject throughout the years, with many authors like Baccarini (1996), Williams (1999), Geraldi and Adlbrecht (2007), etc. adding new concepts or even redefining the concept. Our previous work tried to consolidate this knowledge and help project managers out there deal with complexity in their projects. The insight gained by dividing complexity into elements (project characteristics that make it complex) and situations (arising from the elements add extra complexity to the project) seems to be very helpful for practitioners trying to deal with complexity. However, the findings still seem to be very general and it is hard, so far, to link them with a specific industry. Projects of engineering R&D are an example of project type that is greatly influenced by complexity. For starters, they are usually very large projects, interconnected with several departments or even companies; which will certainly contribute to the structural type of complexity. Also, they deal with the development of new solutions and products, which is always a bit of a step into the unknown; which makes these projects have a large amount of uncertainty. Both these elements give rise to situations that will make these projects even more complex and have a higher failure rate, however they also are what we have studied closely in our previous work. The knowledge of handling complex situations can be linked with this specific kind of industry, and through this work gain a better insight into how project managers in these type of projects can handle complexity better, leading to better results from them.

Problem description

The framework developed in our previous work allowed us to get a better understanding of how to handle certain situations that arise from specific elements of project complexity. Our results mainly point that to handle higher structural complexity (many interrelated parts) you need a better integration of the project team, and that to handle uncertainty generated situations flexibility and team cohesiveness are necessary. However, these findings are still very general and would need to be more closely applied into a single industry for them to start working in practice.

The engineering R&D industry is the target industry that was chosen for this master thesis, mainly because projects in this type of industry would tend to present high structural complexity and high uncertainty, making it a perfect candidate to apply our previous knowledge. However, much needs to be learned about this industry, which should firstly begin with a small literature review that will let us know what kind of problems and barriers are usually encountered in the industry, and how complexity is contributing to them. Also, there is much to find out about the life cycle of these projects, and the kind of specific situations which would arise in each part of it. This is the basic knowledge to be gotten before we can start applying our concepts into the engineering R&D projects.

With an insight into how these projects work we will move on to the empirical research, which will be the largest part of this work. For this, two companies have been already contacted for interviewing: Aibel, and Kongesberg Defense and Aerospace. However, we already contacted other managers for a few more interviews in the same industry, to further increase our research samples. The insights we will get from the interviews will let us know

specific examples of situations given for different projects, and what the project managers were able—or not able—to do about it; in a way, how complexity was handled without any specific knowledge about it. Analyzing this information and combining it with our previous knowledge, will let us come up with the theories that will help practitioners handle complex situations in these type of projects. Also, having already known how to handle the situations, it will also be possible to find out what kind of competences a project manager will need to have in order to successfully manage projects in the engineering R&D industry.

Project objectives and scope

The purpose of this thesis can be divided into three parts:

- First of all, to identify elements in engineering R&D projects.
- Secondly, identify, classify and analyze complex situations that arise from these elements.
- Thirdly, identify the type of competences needed to manage these complex situations in each step of the project life cycle, and what is the role of the project manager in this process.

Methodology

The methodology we will follow to write this master thesis is going to be based on the theoretical background which was developed in our previous work. We built up our framework on how to deal with complex situations based on the literature from 2002-2012. For this report the first step is a literature review about engineering R&D projects, in order to acquire more knowledge about them. For the engineering R&D projects we were looking into literature from 1985- 2012. After this we will identify the elements of these type of projects and their life cycle. The second part of the project work will be an empirical study—by means of face to face or conference call interviews— of companies involved in these kind of projects. With the information gathered in the empirical research, the final analysis, and cross-referencing can be made, and so the report—with its conclusions— finalized.

Findings

The work so far includes a literature review, which will be the background for our empirical research analysis, and the better understanding of R&D projects in particular. In it we have firstly defined the framework (elements and situations) that is the basis of our work. This framework is a summary of our previous work and it is based on the findings of: Azim et al. (2010), Baccarini (1996), Bosch-Rekvelde et al. (2010), Chronéer and Bergquist (2012), Duimering et al. (2006), Geraldi (2008), Geraldi and Adlbrecht (2007), Geraldi et al. (2011), Gul and Khan (2011), Maylor et al. (2008), Remington et al. (2009), Richardson (2008), Söderlund (2002), Vidal et al. (2010) and Williams (1999). And also on the empirical research done last semester, in which two project managers from the medical sector in Norway were interviewed.

The second part of the literature review deals specifically with the nature of R&D projects and the types of complexity situations that are unique to them. This will be the basis for the empirical research, which will also be done on the engineering R&D setting. This review was based on the work of: Balachandra and Friar (1997), Carbone (2005), Chiesa (2000), De Meyer (1985), Elmquist and Le Masson (2009), Iansiti (1995), Kim and Wilemon (2003,2009), Lager (2002), Larson and Gobeli (1989), McGrath and Romeri (1994), Moenaert et al.(1995), Naveh (2007), Tatikonda and Rosenthal (2000).

For the empirical research part some progress has been done as well. So far 6 interviews have been done to project managers in the R&D sector. A questionnaire of 10 questions was developed for this purpose (see Annex 1.), which is meant to extract: first, general information about managing complex projects, and how the company is set to run projects; secondly, the focus is on a singular project which excels in the informant's view as being very complex, from this we extract information regarding the situations that made it complex and how they were handled. For the final question we ask the informant to give general recommendations to project managers in the same position, this question is personal and is meant to give us insight for what is really important to the informant.

For now the interviewing part is not finished, so the findings are not complete in this regard, but we can still see the more general points in which our investigation is heading.

Work progress and follow-up

Based on our program delivered in the pre-study report we are on schedule. We have completed the whole Literature Review work package. On the Case Study work package the deliverables: Making Questionnaire and Research of the Case Companies have been completed; and the Interview of Engineering R&D Projects is in progress. This is exactly according to the schedule so far (see Annex 2.).

For the continuation of the work finishing the Interview of Engineering R&D Projects deliverable is the next step. After that we will continue according to the original Gantt Chart in order to deliver our work on time. If any deviations appear along the way, we will rightly re-plan the schedule and make sure they do not affect the final delivery, also close work with our supervisor will be engaged if required.

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Annexes

Annex 1. Questionnaire

Complexity in Engineering R&D projects

Questionnaire

This questionnaire will help to make research work for NTNU students. As the result they will provide the paper document about complexity in engineering R&D projects.

1	Could you give a brief introduction about your company and what sort of projects does it do?
2	What do you think is unique in R&D projects?
3	Success factors: -What kind of organizational structure do you use in your company? (matrix, departments) -Interaction with other departments during the project life cycle -What kind of competences (skills, knowledge and attitude) project manager have to have to finish project successfully? -Do you transfer knowledge from one project to another? How?
4	Think about one particular project which was complex for you. (why it was complex) When did you understand that it is complicated?
5	What was the impact of the complexity? (project life cycle) What measures did you used to reduce the impact?
6	What was the most important goal of this project? (time, money, quality)
7	<i>How flexibility is performed?</i>
8	<i>Approach to risk, risk analysis or risk management</i>
9	<i>What leadership style do you use in projects? The same one in all projects or different?</i>
10	Recommendations for other project Managers who are dealing with project complexity.

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