Success Factors in Large Construction Projects

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Abstract

The study aimed to identify and define general success factors in large construction projects. The basis for the study was interviews with 15 project managers and additional project team members, all working in different construction projects with an individual contract sum of 200 – 1000 MSEK, in four of the Nordic countries. The interviews were complemented by a 2-day workshop with experienced project managers, directors and specialists, and two additional interviews as 2nd opinion. The study identified an extensive list of potential success factors, and by using the combined experience gathered in the workshop the most important success factors were defined. The result in terms of comprehensive success factors was then analysed and compared to some previous related research. The comparison confirmed many conclusions made in previous research but did also put forward new aspects to what important success factors are. The overall conclusion is that focus on organizational aspects is crucial - management skills and a culture/attitude ensuring an open and effective communication, but also competence and availability of resources. The use of a well composed project board with defined purpose and agenda is another important success factor, as is the application of a common and structured approach to project risk management. Monitoring of project performance gives an early indication of deviations from plan, enabling swift actions. Furthermore, a stringent process and stringent handling of contract and commission are also important factors.

Keywords: project management, construction, success Factors, organization, risk management
1. Introduction

1.1 Construction industry – project oriented business

According to PMI (2004) – A guide to the Project Management Body of Knowledge (PMBOK Guide), the definition of a project is: *A temporary endeavour undertaken to create a unique product, service or result*. Though there are process based activities in the construction industry, for instance regarding manufacturing of building materials, from a contractor or a property developer perspective most of the activities in the construction industry are project based. Also when considering different initiatives to industrialise the construction process the recent years it is fair to say that a major part of the money spent in the construction sector is invested in project activities. Considering this, it is crucial for the players in the construction industry to be experts in management, monitoring and control of projects, thus find the recipe for successful projects. Major parts of a recipe for successful projects ought to be generic for all kind of projects, but it is reasonable to believe that some other features are more specific to the construction industry, to certain types of projects, to the project size and to other characteristics of a project.

According to Jaafari (2001), complexity is one distinctive characteristic of many projects to manage to enable successful projects. The complexity in construction projects is mentioned by Tah and Carr (2000), and Chan and Scott and Chan (2004). Complexity in terms of turbulent environment in large-scale engineering projects is emphasised by Floricel and Miller (2001).

Key Performance Indicators (KPIs) may be used to monitor performance and measure how successful certain projects are. This topic has described by for instance Chan and Chan (2004), and they state that it is essential to define what project success means, or it will not be feasible to discuss performance measurement. Further, they conclude that both qualitative and quantitative KPIs are desirable. A set of methods on how to measure the performance is presented by Salminen (2005), and that the criteria cost, schedule deviation, quality and safety form a coherent description of construction project success. Often failure in one aspect indicates failure in more of the aspects, though this dependency is not necessary.

Even though this paper is focused on how to create success, a study of the related topic of how to measure performance and success may serve as inspiration.

1.2 Success factors for projects - previous research

Other researchers have previously investigated success factors for projects. Some researchers have defined success factors for projects in general, while others have studied construction projects specifically.
Cooke-Davies (2002) defines 12 different comprehensive success factors for projects in general, divided into three categories: Factors critical to project management success – enabling achievement of cost targets, and time schedule; Factors critical to success on individual projects – enabling the reach of project specific objectives as anticipated by main stakeholders as the customer and sponsor; Factors that consistently leads to successful projects – forming the basis for continuous improvement of a corporate general principles for how to manage projects. One core element is a defined routine for collecting and analysing portfolio metrics to reveal the relation between current performance in a specific project and the final success of the same project.

Chan and Scott and Chan (2004) define a conceptual framework to describe factors affecting success of a construction project: Project Management Actions, Project Procedures, External Environment, Project-related Factors, and Human-related Factors. 44 more specific factors and actions are listed – example for each area, in the same order; Communication system, Procurement method, Economic environment, Type of project, Client’s experience.

Chua and Kog and Loh (1999) have investigated critical success factor for projects in the construction industry. All in all 67 expected success factors were examined in a questionnaire to get the relative importance for each of the projects objectives; budget, schedule and quality. When analysing the results, they took into consideration what organization each respondent were working for; consultant, contractor; client, or project management. The result is a top ten list of success factors for each objective and perspective, where adequacy of plans and specifications is considered as one of the most important factor for most objectives, by most of the respondent categories. Other top ranked factors are constructability, project manager commitment and involvement, and realistic obligations/clear objectives.

According to Salminen (2005) one important area of success factors for construction projects is Work Behaviour and Leadership. The management style is important, and it is needed to combine focus on people with focus on production, with a slightly higher importance of the latter. Furthermore, for work behaviour – control is slightly more important than flexibility – thus communication and effectiveness & clarity of tasks are more important than community spirit and satisfaction & growth. Other areas of success factors according to Salminen (2005) are Preconditions – defined as the support from client/consultant, designers and company headquarters, and Management Systems defined as the principles and methods of operation and documentation. One interesting result is that management systems are indicated as only slightly important for project success.

2. Research scope

The study aimed to identify and define success factors in large construction projects, and focus was set on four of the Nordic countries; Sweden, Norway, Denmark and Finland. In this study, people within a contractor organization were asked to elaborate on project success factors – thus in practice project success was defined as achieving the contracted objectives within the calculated cost, in time and with the agreed quality – enabling a satisfied customer.
The research question:

- What is apprehended as crucial Success Factors in large construction projects – in the minds of people working as contractors in the construction industry?

2.1 Research method

The chosen research method is a multiple case study, based upon interviews with people actually working with management of large construction projects. For further refinement of the results, a 2-days workshop was conducted, and then additional interviews with two very experienced project managers were made for comparison with the results from the workshop.

- Interviews with the project manager and his/her closest team at each large construction project part of this study, with the aim on identifying success factors in each specific project.

The basis for the interviews was implicit questions of a quite open nature, not to influence the person interviewed. A predefined set of questions was used, but not sent to the project in advance, nor shown during the interview sessions. Instead, the author used the questionnaire as a checklist to ensure that the same topics were covered in each project review. This approach was chosen to enable the interviewees to emphasise whatever issue they considered as most important.

The interviews resulted in a thorough list of potential success factors, but also notifications of phenomenon to avoid and attitudes that ought to affect the project success. The implication is that the avoidance of these phenomenon and understanding of attitudes in reality is an important basis for how to create successful projects.

- To prioritize the findings and establish a platform for definition of what the most crucial success factors are, a workshop was conducted. With the author acting as process leader, a group of 16 people including project experienced project managers, directors and specialists gathered for 2-days for discussions and analysis.

- Finally, two additional interviews were made to evaluate the results that far. Two very experienced project managers that did not take part in the workshop were simply asked to mention the success factors for large project according to their preferences.
2.2 Prerequisites / delimitations

The following prerequisites and delimitations were chosen to define a feasible scope of the project:

- The initial investigation comprises interviews with personnel active in 15 large construction projects, with an individual contract sum between 200 MSEK and 1000 MSEK (1 SEK ~ 0,1 Euro; 2009-12-11), in four of the Nordic countries; Sweden, Norway, Denmark and Finland. The aim was to mix experiences from different kind of projects/objects as civil engineering, retail, offices, housing and other buildings, and to mix experiences from different type of contracts.

- Focus is on production phase, though the research methodology applied made it possible for anyone to put forward any success factor, no matter what project phase. Furthermore, the main perspective is the contractor view on successful projects – defined by asking experienced project managers, directors and specialists active within a contractor organisation.

- All interviewees are/were active within the same large Nordic domiciled construction company – a fact that imposes a risk of vague general validity. However, considering the geographical spread – from the very north to the south of the four countries, and the fact that many of the interviewees have also been active in other contractor organizations over the years thus bringing in broad experience into the actual project execution, the risk is mitigated. The positive side of the specific sample of interviewees is the simplified access to people and information forming the foundation for this paper.

3. Result

The complexity is put forward in many interviews as one important feature of large construction projects. The main sources of complexity indicated though not analysed with stringency seem to be; the size of the project organization, many dependent activities, logistics, and long lasting projects with many change requests and variation orders.

The most important success factor established is the importance of keeping focus on organizational aspects. This was emphasised by most interviewees and was clearly an important subject during the workshop as well. Aspects included are: 1) Appointment of a project manager with the appropriate experience, great managerial skills, and an ability to delegate and to deal with conflicts. Furthermore, the project manager has an important role in terms of symbolic leadership – forming the culture and attitude in the organization. 2) Appointment of key personnel with the needed knowledge and specialist competence, and if possible with experience from similar projects. To mitigate the effect of information gap between project phases, it is good if some personnel in execution phase are involved already in tender phase.

3) Resources enough – for production, but also for administration and management. If the scope of work increases it is important to adjust the organization accordingly. 4) A project culture
emphasising open communication and avoidance of the attitude “I manage on my own”. This will enable early identification of risks and potential problems, enable more creative solutions, but also create involvement and good social working environment. The aim should be to combine different competence areas and perspectives on a common set of project objectives. It is important to continuously spend some efforts on creating a good team spirit to handle the changes in the project team that will always be the case in a long lasting project. 5) Use the experience that the blue collar workers have – for better planning and choice of production methods.

The use of a Project Steering Committee (Project Board) is an effective way to deal with decisions outside the mandate of the Project Manager. To achieve good results though, a structured approach is needed; 1) A clear and communicated purpose of the Project Steering Committee – support to the project manager to get the best project outcome possible. 2) Extra effort when defining what stakeholders that should be included in the Project Steering Committee. 3) A predefined agenda, scheduled meetings but also a preparation for extra meetings on demand.

A clear distribution of responsibility and authority minimizes the risk of unforeseen activities. At the same time, it helps the project members to focus on their own main tasks. This is true within the project organisation, as well as between the project manager and the project steering committee.

A systematic Risk Management approach is another success factor. A common methodology should be applied from the start of the project and follow it to the very end. In addition to a structured approach, it is important to always strive to develop the personnel further – improved risk awareness, improved competence in risk management and an increased understanding of how people make decisions (thoughts versus feelings).

A continuous monitoring of the project performance and status is a good way to get early warnings and early indications of deviations from plan. This enables swift actions to minimize the effect and set the project back on track.

The use of a common process with strictly defined milestones dividing the project into different phases contributes with structure to the project execution. One important aspect of the process is a strict and formalised handover of information and knowledge from one phase to the succeeding one.

The number of variation orders and the corresponding additional contract sum is often very high in a large construction project; hence a successful project is dependent on a strict handling of variation orders, new requirements and on how such changes affect cost and time schedule. To achieve this it is important to be strict from the very beginning and appoint resources enough, including experts in contract specifics and jurisdiction as soon as a claim is arising.

An open mind to previous experiences enables a project to take part of success stories and best practice from other projects. Even if there are some differences in terms of technology, geography, customer etc, there are most certain similarities and analogies to learn from.
An overview of the most important comprehensive success factors are presented in table 1 – in order of spelling.

*Table 1: The most important comprehensive Success Factors as defined by the study, with a short comment on whether it was confirmed by the concluding interviews or not.*

<table>
<thead>
<tr>
<th>Headline / Area</th>
<th>Description</th>
<th>Confirmed by the concluding interviews?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commission</td>
<td>Clear distribution of responsibility and authority.</td>
<td>No</td>
</tr>
<tr>
<td>Contract Management</td>
<td>Stringent handling of variation orders and claims – appoint resources enough and engage legal experts.</td>
<td>Yes, both interviews cover this aspect to some extent.</td>
</tr>
<tr>
<td>Monitoring</td>
<td>Continuous monitoring of project status to get early warnings of deviation from plan.</td>
<td>No</td>
</tr>
<tr>
<td>Organization</td>
<td>A project manager with good leadership skills who facilitates open communication and cooperation creating a common view on objectives, team members with experience from large projects.</td>
<td>Yes, both interviews defined this as the most crucial success factor. Also details were confirmed.</td>
</tr>
<tr>
<td>Process / Phases</td>
<td>Milestones with clear requirements, and a formalised handover of project information from one phase of the project to the succeeding phase.</td>
<td>Not specifically, but one interview emphasises the importance of planning.</td>
</tr>
<tr>
<td>Project Steering Committee</td>
<td>Define and utilize a well functioning Project Steering Committee, with clear purpose and agenda.</td>
<td>Yes, confirmed by both interviews.</td>
</tr>
<tr>
<td>Risk Management</td>
<td>A comprehensive Risk Management System – used through the entire project. Risk awareness and competence in risk management methodology.</td>
<td>Not specifically</td>
</tr>
<tr>
<td>Success stories</td>
<td>Share of Success Stories and Best Practice between projects.</td>
<td>Yes, one interview puts this forward strongly.</td>
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</tbody>
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4. Analysis and discussion

This study focused on production phase, hence the success factors identified are close to “hands-on actions during execution” to optimize project performance. There are also important aspects on how to create projects success in the preparations of the project – and in the continuous learning and development between projects, as mentioned in the references. This deviation in approach might be
one explanation to differences in success factors defined. One other possible explanation is that the
nature of this study has been open questions, while Chua and Kog and Loh (1999) tested the internal
order of 67 predefined success factors, Salminen (2005) examined specific hypothesis and Chan and
Scott and Chan (2004) made a literature review. The advantage of the approach used in this study is
that preconceived notions can be mitigated, but at the same time conclusions are not as well
established as with other methods.

The complexity in large construction projects as mentioned by Jaafari (2001), Tah and Carr (2000),
Chan and Scott and Chan (2004), and Floricel and Miller is confirmed by this study. During
discussions on the subject organisation it was specifically stated that large construction projects are
complex, thus when forming the organization it is needed to have personnel with experience from
large/complex projects – not only experienced personnel in general.

The success factor “Monitoring” confirms the need for measurements of performance as mentioned
by Chan and Chan (2004), and Salminen (2005). However, many of the tentative performance
indicators that were discussed are important in the sense that they enable future successful projects
(in terms of cost, time and quality) and a successful corporate all together. This is similar to the
conclusions made by Cooke-Davies (2002) regarding consistently successful projects and corporate
success. There was a tendency that the need for a common and comprehensive monitoring process
was more emphasised by directors and specialists than by project managers. The reason for this is
probably that the project managers (usually) have control of their respective project on a daily basis,
using far more detailed monitoring principles. It is logic that the need for overview and early
warnings is greater amongst the managers in a contractor organization, not working in detail or on
daily basis in the specific projects but still very dependent on the result in the same projects.

Salminen (2005) concludes that “Work Behaviour and Leadership” is very much affecting the project
success, thus a similar conclusion as made in this study under the headline “Organization”. Other
similarities can be found in table 2.

As many as 8 of the 12 success factors listed by Cooke-Davies (2002) are to some degree confirmed
by this study, as presented in table 2. The overall conclusion made by Cooke-Davies (2002) regarding
“The people side of project management” is very close to what this study summarizes under the
comprehensive success factor “Organization”.

The factors affecting the success of construction projects as defined by Chan and Scott and Chan
(2004) are to some extent identified in this study as well. Those factors are a bit different from
success factors, but still important to reflect upon. Details can be found in table 2.

The comparison of success factors as defined by Chua and Kog and Loh (1999) is based upon the
contractor perspective on each project objective budget, schedule, and quality – hence, similar to this
study. Many of those success factors are more detailed than the ones defined in this study, still there
are similarities to elaborate around. Details can be found table 2.
Table 2. Comprehensive comparison of the result from this study with success factors defined by previous research. Similarities identified in each reference are referred to as a “quote”.

<table>
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<tr>
<td><strong>This study</strong></td>
<td></td>
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<tr>
<td>Commission</td>
<td>Yes, success factor “F5”</td>
<td>Yes, “organization structure” and “organizing skills”</td>
<td>Somewhat, “project manager authority”</td>
<td>Yes, “clarity of tasks”</td>
</tr>
<tr>
<td>Contract Management</td>
<td>Yes, success factor “F7”</td>
<td>Somewhat, “adaptability to changes”</td>
<td>No, not specific</td>
<td>No, not specific</td>
</tr>
<tr>
<td>Monitoring</td>
<td>Somewhat, success factor “F8”</td>
<td>Somewhat, “control mechanism”</td>
<td>Somewhat, “construction control meetings”, “Site inspection”</td>
<td>Yes, “performance management” is the main topic of the thesis.</td>
</tr>
<tr>
<td>Organization</td>
<td>Yes, as described in “people side of project management”</td>
<td>Yes, by many specific factors and actions</td>
<td>Somewhat, “project manager’s competence and commitment”</td>
<td>Yes, “Work behaviour and leadership” is one main area</td>
</tr>
<tr>
<td>Process / Phases</td>
<td>Somewhat, success factor “F6”, “F9”</td>
<td>No, not specific</td>
<td>Somewhat, “clear objectives”</td>
<td>Somewhat, “mgt systems”</td>
</tr>
<tr>
<td>Project Steering Committee</td>
<td>Somewhat, success factor “F9”</td>
<td>No, not specific</td>
<td>No, not specific</td>
<td>No, not specific</td>
</tr>
<tr>
<td>Risk Management</td>
<td>Yes, success factor “F1-F4”</td>
<td>No, not specific</td>
<td>No, not by contractor, but client</td>
<td>Somewhat, part of “mgt systems”</td>
</tr>
<tr>
<td>Success stories</td>
<td>Somewhat, success factor “F12”</td>
<td>No, not specific</td>
<td>No, not specific</td>
<td>No, not specific</td>
</tr>
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</table>

5. Conclusions

The first finding established is the complexity in large construction projects, a factor that very much affects the recipe for achieving successful projects. The complexity is one reason to why focus on
organization is crucial. The best crew, with experience from other complex projects – lead by an excellent project manager with great managerial skills seem to be more important in large and complex projects than in smaller projects with more obvious tasks. In a large project there is time to harvest investments in education and training of the project personnel, and there is budget for bringing in specialists of different kind instead of trying to solve all obstacles with the permanent crew. Whether this is utilized or not is very much dependent on the attitude of the project management team and on the situation. There is a risk that a project struggling to keep time and budget will try to solve even more issues by themselves to save costs, with the effect that poor decisions are made causing even more costs and further delay. This aspect is true also regarding the project manager in the sense that a project manager for a large project needs to be willing to delegate tasks to his/her team, while this is not possible to the same extent in a small project. Thus, experience in general is good – but specific experience from other large projects is essential.

Project success is also dependent on the interaction of the success factors; Project Steering Committee, Commission, Process/Phases and Monitoring. A well composed and well functioning project steering committee can be a great support for the project manager, who from the clearly defined commission knows what decisions he/she may effectuate without escalation. The dialogue between internal stakeholders and the ability to focus on the most important issues is supported by a continuous and structured monitoring of the project performance. Such a monitoring routine should clearly point out deviations from the agreed plan to meet the requirements for each milestone and project phase. In the planning phase, it is a great opportunity for the project to learn from success stories from other similar projects – both as inspiration and not to re-invent solutions that are already defined as best practice in other projects.

Project success is supported by the application of a common and comprehensive risk management system, from start of the project to the very end. From a contractor perspective, the project most often starts with a tender phase – but from the customer perspective it starts with an idea and some sort of pre-study. In addition to a structured approach, it is important to spend some effort to create risk awareness, increase the competence in risk management methodology and to increase the understanding of human behaviour.

If one could guarantee that all thoughts, ideas and information that have been once mentioned in a certain project were available at all time, most projects would reach a far better result for all involved parties. However, for different reasons information, thoughts and ideas disappears along the road especially if not documented properly. One way to mitigate this negative effect is to introduce a formalised and focused routine for handover of information between the different phases in the project, another way is to let some key personnel be engaged in the entire project – from tender to handover.
References


