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Remedies for managing bottlenecks and time thieves in Norwegian construction projects – public vs private sector

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Abstract

Reducing project execution time is an important aspect in today's construction industry. In practice, most construction projects are delivered behind schedule. This creates an incentive to find methods, processes and techniques to deal with elements which steal time and bottlenecks which cause delays. This paper address the magnitude, frequency and type of time-thieves and bottlenecks in various phases of construction projects from different construction firms and organizations in the public sector in Norway. It also discusses remedies to mitigate time thieves and bottlenecks. The questionnaire used was designed and tested to give a broad and open data collection. The purpose was to collect opinions from senior project managers and project members in order to identify time-thieves, bottlenecks and remedies and analyse the data to assertain if there are common and/or different opinions or perspectives in public and in private sectors. This study will provide an insight into the problem, time-thieves and bottlenecks, itself. The firms in this study are part of a larger national programme called SpeedUp. The programme focuses on every aspect of speeding up projects. The SpeedUp programme is a 10 million USD research programme with 5 researchers and 7-8 PhD students. It is linked to Project Norway which is a research-based collaboration of Norwegian project-based organizations in the public and private sector.

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Keywords: Time management ; Construction Projects; Speedup; Bottlenecks; Time-thieves; Remedies

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1. Introduction

Projects running behind schedule may serve as an indicator of poor productivity and bad project performance (Ramanathan et al., 2012). Any delay in a project may lead to cost and time overruns and these two are often related (Sambasivan and Soon, 2007). Delays can also cause increased cost, loss of competitive advantage and market share. Additional costs may be incurred through disputes and claims between involved parties (Odeh and Battaineh, 2002). When projects are delayed, they are either extended or accelerated and therefore, incur additional cost. Its common practice to keep a percentage of the estimated project cost as a contingency allowance in the contract price (Ramanathan et al., 2012). For the project owner; delays may lead to loss of revenue through lack of production facilities, rentable space or shortcomings with present facilities. For the contractor; delays may result in cost overruns due to a longer period of project work, penalties incurred, and higher material and labour costs (Assaf and Al-Hejji, 2006, Khoshgoftar et al., 2010). Given that utilizing time effectively and efficiently is one of the important factors determining the success of a project, understanding where time is lost, and the character of the bottlenecks are greatly important. Projects come across delays and unnecessary use of time due to various reasons, and hence suffer unfavorable consequences. To avoid or reduce the number of potential bottlenecks and time-thieves in a project it is crucial to have some data on the matter.

1.1. Causes of delays

Since delays in a project can have many unwanted consequences, and even a small success in delay recovery may have substantial impact on the financial returns for the interested parties of the project, it is important to address delay causes (Khoshgoftar et al., 2010, Faridi and El-Sayegh, 2006). Over the last forty years, significant efforts have been made to identify possible causes of delays (Yang et al., 2013). A review of project literature shows that causes of delays differs from country to country. Different factors such as the environment, working cultures, management style, methods of construction, geographical condition, stakeholders, government policy, economic situation, availability of resources, political situation as well as different perspectives of researchers can impact on projects and cause delays (Yang et al., 2013, Khoshgoftar et al., 2010). Ramanathan et al. (2012) proposes that there is no universal root cause. On the other hand, the literature review shows that factors causing delays in construction projects are mostly identical across developing countries, but with different rankings in terms of importance (Toor and Ogunlana, 2008). Analysis from Akogbe et al. (2013) shows that factors such as national income and GDP growth have a great impact on project delay. In developing countries financial difficulties are a common factor of delay. Other causes are similar for developed and developing countries (Akogbe et al., 2013).

1.2. Avoiding delays

Most of the theory (e.g. Pourrostam and Ismail, 2011, Sambasivan and Soon, 2007, González et al., 2014 etc.) focuses primarily on causes of delay. Despite existing methods that focus on schedule reduction, there has been a lack of discussions on specific procedures to overcome delays in projects; the focus being mainly on the cause and actions (Chan and Kumaraswamy, 1997). Keeping construction projects within approximate budgets and schedules requires clear strategies, good practices, and careful judgment (Pourrostam and Ismail, 2011). The basic strategy for preventing delay is to improve the contractor's ability to manage and administer the construction phase of projects (Yang et al., 2013). According to Sambasivan and Soon (2007), it is important that parties in construction projects avoid unrealistic contractual conditions and schedules. Akogbe et al. (2013) explains that avoidance of construction delay in developing countries may include the development and maintenance of planning, coordinating, controlling, organizing, and motivating program resources and supervising the component projects. It is suggested that the work should be awarded to the most successful bidder for execution and should be checked from time to time to ensure that the project is on schedule (Akogbe et al., 2013). Another suggestion is that that traditional building methods must be replaced by industrialized building systems (IBS), which could save on labour, cost and time of construction, and increase quality and durability (Alaghbari et al., 2007). In addition, greater attention must be paid to obtaining more accurate time and budget estimates from contractor (Mansfield et al., 1994).

Prioritising Considering contractor price over ability, experience and expertise will diminish project performance (Sambasivan and Soon, 2007). Besides adopting design- build, build- own- operate- transfer (BOOT) and construction management (CM) types of contracts, which limit owner interface, improving the design and contractual relationship between parties is suggested (Mansfield et al., 1994, Odeh and Battaineh, 2002). An Adequate source of finance, equipment, machinery, materials, and labourers should be provided (Assaf and Al-Hejji, 2006, Mansfield et al., 1994, Sambasivan and Soon, 2007, Hwang et al., 2013, Pourrostam and Ismail, 2011, Khoshgoftar et al., 2010). It is suggested that the client monitors the work closely with regular inspections, and maintains a good relationship with clients and contractors in order to achieve the goals and objectives of the project (Sambasivan and Soon, 2007, Khoshgoftar et al., 2010). Moreover, all parties should be involved in regular meetins, in order to communicate, coordinate and keep each other updated (Hwang et al., 2013). For contractors, long-term procurement contracts can be signed to decrease the impact resulting from the potential uncertainties of the availability and prices of material and equipment (Hwang et al., 2013). Effective data communication between various groups and levels involved in a project emphasizes the need for efficient methods of information processing in the construction industry. To accelerate communication and decision making among all parties, appropriate overall organizational structures and communication systems linking all project teams should be developed throughout the duration of the project. The roles and responsibilities of those involved in the project team should be clearly defined, and the designated decision-makers should also be clearly identified (Chan and Kumaraswamy, 1997).

Owner and clients should avoid delay in approving documents and decision-making (Khoshgoftar et al., 2010, Sambasivan and Soon, 2007, Assaf and Al-Hejji, 2006). The relationship between success on site and strong management teams underlines the need for effective site management and supervision by contractors and consultants (Chan and Kumaraswamy, 1997, Hwang et al., 2013). Insufficient knowledge of sites causes many delays in projects. The investigation of site conditions, together with the design of ground works and foundations, should be thorough, complete and clearly presented before commencement of construction so as to reduce the impact of any unforeseen ground conditions (Chan and Kumaraswamy, 1997). Contingency allowances may be incorporated for inevitable variations. These allowances may be better quantified by using risk analysis techniques. Strategies should also be formulated to mitigate the impact of such inevitable variations after obtaining the consultants' advice, together with the contractors' input, on their cost and time implications. Value management techniques may be useful at the conceptual design stage. The difference in perception between different groups of participants in the industry should be noted and discussed in suitable forums, with a view to bridging the gaps and avoiding or resolving some of the problems that have been highlighted herein (Chan and Kumaraswamy, 1997).

Hastak et al.(2008), by conducting three questionnaires and analysing them, shows that radical schedule reduction in excess of 25% is possible through use of schedule reduction techniques, and management techniques. The Results of Hastak et al. (2008) shows that the most important driver of cycle time reduction is owner commitment in projects. The Most important barriers to cycle time reduction are decision-making and lack of commitment followed by communication. The Preferred construction strategy for cycle time reduction is joint venture, whilst fixed price is less preferred. Hastak et al., (2008) rank CII best practices, schedule reduction techniques, and management techniques base on case studies and surveys.

1.3. Bottlenecks and Time Thieves

Two concepts are defined here. A “Bottleneck” is a constraint on resources that creates limitation in the production process (Goldratt 1985). A “Time thief” is any condition that reduces production capacity of a working process. It can be, for example, lack of people, lack of equipment, lack of support, errors that require the repetition or adjustment of the job, meetings that are not administrated and thus do not contribute to the necessary coordination, sickness among workers, etc. Time thieves are related to the concept of waste or non-value adding activities, as learnt from Lean, however we apply it in a more general and less rigorously defined concept in order to approach it more broadly. The term for the concept is adapted from Michael Ende’s novel *The Grey Gentlemen* (1973), though in this study we apply it without the novel’s slightly sinister undertone.

The concepts of *Bottlenecks* and *Time Thieves* carry semantic overlap, intentionally – as delays or scarcity of time can be a direct consequence of lack of flow – i.e. a bottleneck in the process. This paper will look at "time-thieves" and "bottlenecks" in projects. It will identify what respondents consider to be time-thieves and bottlenecks in various phases of their projects. This study represents a step in a mapping process that we hope will lead to a better understanding of time and flow problems in projects.

2. Methodology and research context

The methodology used followed an inductive reasoning approach, using a clustering analysis of qualitative survey data. In common with other types of field study, this type of research can contribute to the advancement of scientific knowledge in different ways (Forza, 2009). We adopted a descriptive survey research design to obtain further empirical data about the phenomenon of time management from ~~a~~ the perspective of project practitioner. A questionnaire was designed for this study based on analysis of literature. The survey was first piloted on a limited number of project managers in a private construction/engineering company and in the main survey the respondents were selected from a group of companies participating in an industry-led research project aimed at reducing project duration. The questionnaires were sent to the respondents via email, directing them to a to provide their answers ("Confirm It", a commercially available web-based survey tool). The questionnaire had three main parts:

- Background data about the respondents and their company (name of company, public or private sector, years of project experience, and typical role in projects).
- Time thieves and bottlenecks, asking the respondents to name (in free text) the three most important factors "stealing time" in their projects and three most important factors representing bottlenecks to efficient progress.
- Phased prioritization, where the respondents were asked to indicate the single most important internal as well as external time thief in, respectively, the planning- and execution-phase of projects and potential remedies to mitigate these time thieves and bottlenecks.

With the exception of the background data, the questions were formulated as open-ended questions, allowing the respondents to write their answers in free text. The analysis of the data was undertaken in these steps: 1) Coding the collected data, 2) First-pass analysis; grouping identical or near-identical responses and assigning frequencies of response to each time thief and bottleneck 3) Second-pass analysis; grouping related responses and identifying the dominant time thieves and bottlenecks 4) Third-pass analysis; looking for differences in responses across project role, length of experience, and sector.

After analysis of the data collected, the authors grouped common identified time thieves into ten groups, and each group had sub-groups with the same interpretation (e.g. management and coordination which is the sum up of the five subgroups: rush work, unstructured colleagues, unstructured meetings, unclear demands from management team and poor interdisciplinary coordination). A Similar approach was used for the remedies that were suggested by the respondents. Finally, the results emerging from our data were compared with the literature to verify whether the identified time thieves and bottlenecks are in accordance with previous findings or deviate from them. The respondents were from firms participating in a research project that focuses on reducing duration of projects, therefore this could cause some sort of bias. However, the majority of the respondents had not been directly involved with the research project, which is primarily attached to PMO-like entities in each organization. Similarly, there is an ever-present possibility of researcher bias in the analysis. As project professionals focused on time- and risk-management, our interpretation and induction steps will naturally be influenced by our academic and professional backgrounds.

3. Results; time thieves vs bottle necks – public vs private sector

We received completed questionnaires from 202 respondents out of approximately 300 potential respondents, due to distribution by e-mail, the exact number of recipients is hard to determine. This gives a return rate of approximately 67%. 94% of the respondents were team members or project managers and 47% had experience of between 1 and 10 years, 25% had more than 5 years' experience. 60% of the respondents were from the public sector and 40% from private companies. Analysis of the answers produces different diagrams. Figure 1 – Time

thieves; shows that most time thieves are related to "management and coordination", "administration and bureaucracy", "communication issues" and "quality issues and errors" respectively. Collectively these account for approximately 69% of time thieves.

The same figure can be compiled based on bottleneck answers. We can see from Figure 2 – Bottlenecks that the most frequent bottlenecks are "decision issues", "management and coordination", "lacking capacity" and "Owner/clients issues" respectively; which represent more than 62% of bottlenecks reported.

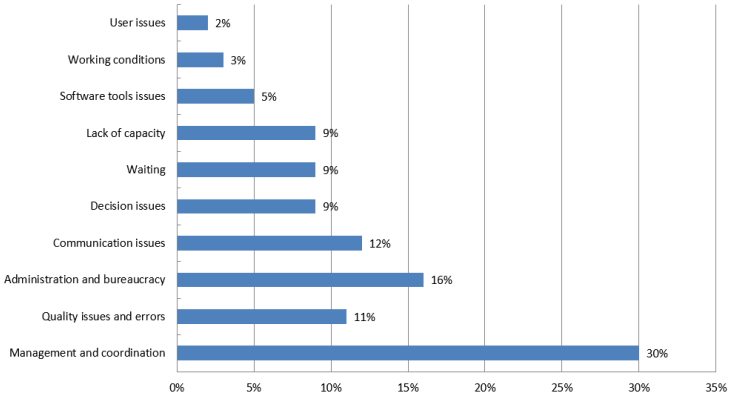

Fig. 1. Time Thieves.

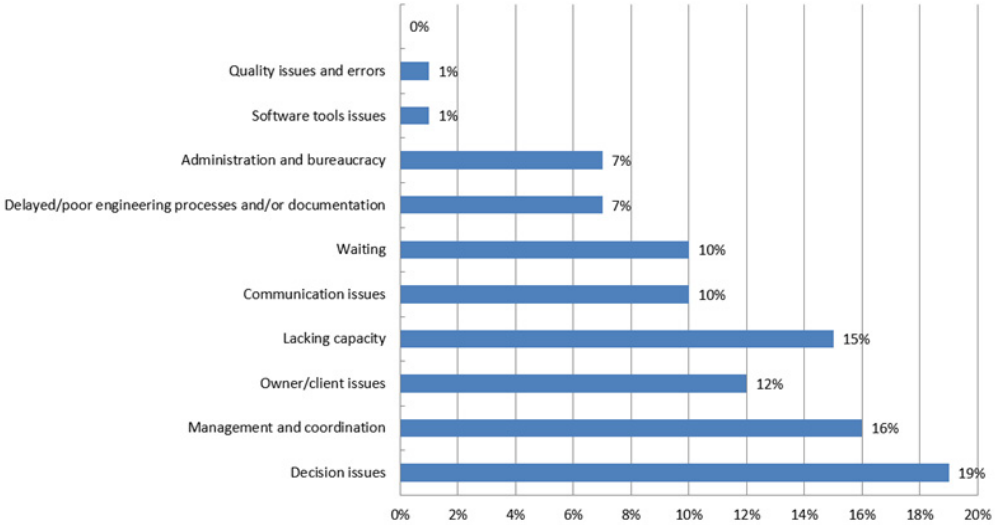

Fig. 2. Bottlenecks.

If we compare private vs public projects, there are some differences. This is seen in figure 3 – Time-thieves in private vs public projects.

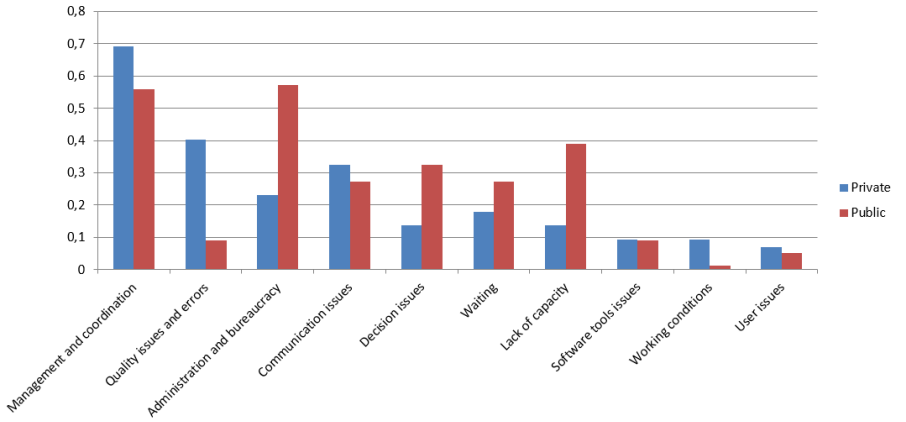

Fig. 3. Time Thieves in Private vs Public Projects.

In order to compare, we calculated the density of each time-thief by dividing its frequency over the total frequency within the same sector. Figure 3 reflects the results of the divergences in time-thieves for both sectors. From this comparison, we see that the most common divergences are “Administration and bureaucracy”, “Decision issues” and “Lack of capacity” with high occurence in public sector; whereas “Quality issues and errors” is the most important time-thief for the private sector, see figure 3. Figure 4 show the Bottlenecks in Private vs Public Projects.

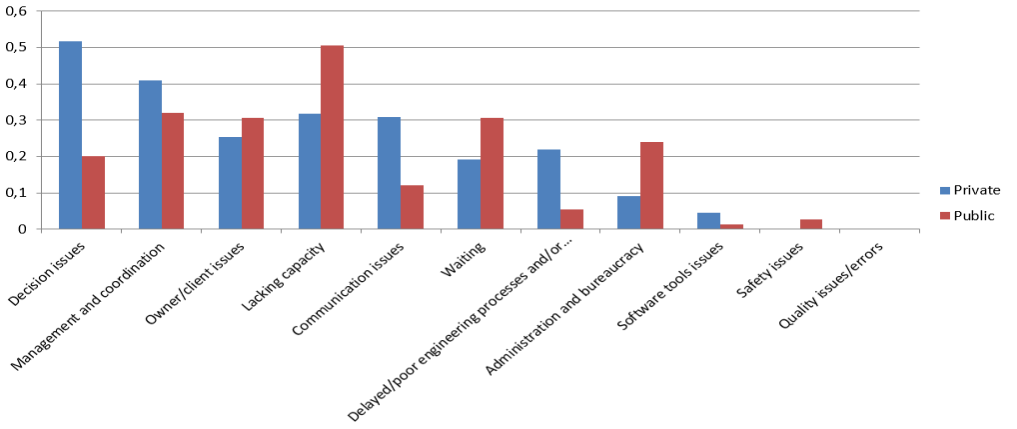

Fig. 4. Bottlenecks in Private vs Public Projects.

There are differences in “Decision issues”, “Communication issues” and “Poor engineering process”, they are of more importance to the private sector than the public sector; “Waiting”, “Administration and bureaucracy” and “safety issues” are of more importance to the public sector.

4. Remedies for managing bottlenecks and time thieves

Analysis of the questionnaire answers showed there were 126 respondents who made suggestions for how to improve bottlenecks and / or time thieves, . There were however many answers which couldn`t be categorized and many respondents didn`t give any suggestions. The remedy categories have been clustered through many steps. Open answers in questionnaires create a challenge but we established some common remedies. Respondents with low experience asked for better or more information, this was a clear common opinion. They also asked for more

controlled meetings, fewer unnecessary meetings, and better procedures. More experienced respondents asked for more competence and experience among project employees, better up front planning and less bureaucracy. An interesting dissent among the experienced respondents is that one half asked for simplification of procedures whilst the other asked for stricter procedures and for procedures to be followed more rigorously.

The difference between public and private is clear on one parameter. Very few responsdents from the private sector asked for higher levels of competence, whilst many from the public sector did so. From the results we see a potential for better planning and management structures. Especially better up front planning and more effective use of human resources.

5. Discussions

From Figures 3 and 4, it is evident that the major sources of time thieves and bottlenecks are "Owner/ client issues", "Lacking capacity". "Decision issues" is the main source of bottlenecks, and less of time thieves. In the private sector 81% of respondents were contractors. Their clients/owners are delaying them, by delaying the decision-making; but when it comes to their decisions, they are faster to make them. We can see also that quality issues and errors are major sources of time thieves, while they are not regarded as bottlenecks. When errors occur, or quality is deficient, time will be required for their resolution, but this is not considered a bottleneck. However, if a lack of human resources delays such resolution work, this is considered a time thief.

When comparing public and private companies; there are some obvious underlying differences in funding- and bureaucracy-mechanisms. However, it seems that the challenges for the two sectors are similar. Going back to time-thieves, "Management and coordination", "communication issues" and "software tools issues" are judged the same in the two sectors. On the other hand, "administration and bureaucracy" and "Lacking capacity" are rated more importantly in the public sector. A reason could be the strict rules regarding the use of public funds. On the other hand; the private sector has flexibility and less administrative procedures. The Private sector believes time-thieves come from quality issues and redoing the work. For the bottlenecks, "decision issues" is the main reason for the private sector to be delayed. Most companies in the private sector are contractors, subcontractors, providers or suppliers, all of whom are dependent on their clients for progress. This could explain why this bottleneck is so important to them.

Remedies to avoid or reduce the effects of bottlenecks and time-thieves are mostly related to management issues. Management issues in this context are; better procedures, stricter chairing of meetings, more structure, more checklists and more procedures. Also better initial planning and better project control. We see that fewer remedies are linked to organisational and resource issues.

6. Conclusions

According to all participants "management and coordination" and "decision issues" were the most important delay factors (time thieves and bottlenecks). All parties agreed when ranking the five most important time thieves, which were "management and coordination", "quality issues and errors", "administration and bureaucracy", "decisions issues" and "waiting". The two first were important to all parties, whilst the three others were more important for contractors and subcontractors and less to the clients and sponsors. As For the bottlenecks, the most important one out of all nine was "decision issues". This factor represents the main reason for delays, as the clients can delay their decisions due to many reasons. Other operational factors are "management and coordination", "lacking capacity", "communication issues" and "waiting". Time thieves and bottlenecks generates delays, delays are costly, retard the project delivery and the development of the construction industry. Respondents think that better up front planning, project control, procedures and structure will reduce bottlenecks and time-thieves. They ask for more stringent management and control.

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