1 Background and Theory

The construction industry has been criticised for lack of competition, quality, efficiency and competence\(^1\). To increase the efficiency of the construction process and to reduce construction costs there is a need for awareness of logistics on construction sites. Today, the competence and awareness of logistics in the construction industry is relatively low among the majority of players. This is a barrier for developing effective on site production\(^2\). The wastage in the construction industry is as large as 30-35 percent of the project's production costs. A construction worker spends an average of only 40 percent of his time on work that adds value to the product\(^3\).

Non-value adding work, also called waste, can be divided into eight parts; over-production, waiting, unnecessary movements, unnecessary transport, over-processing, inventory, rework and unused creativity\(^4\). The biggest potential for improvement and cost reduction is by focusing on the non value-adding work and the wastage\(^5\). The concept of total cost is important and is defined as all costs incurred from the purchase of materials to the as-built design\(^6\). A balance of costs must be made because a particular decision or change will mean that some costs decrease while others increase.

Another aspect that has an impact on construction costs is the lack of communication. Improvement of communication can reduce the cost of a normal construction project by 13 percent\(^7\). To improve communication there is a need for an understanding of its importance and of the impact of costs. It is also important to have clear procedures for how to communicate\(^8\).

More efficient logistics by improving collaboration between the parties and usage of other ways for procurement than the traditional ones are other ways to reduce costs\(^9\). Traditional procurement creates sub-optimization, loss, time waste, high costs and continuing problems\(^10\). One way of achieving better collaboration can be by partnering\(^11\). Partnering means that procurement is conducted on parameters other than price and the work is based on trust and openness between the parties. The

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\(^1\) (Langseth, 2010)  
\(^2\) (Boverket, 2007)  
\(^3\) (Josephson & Sa.ukkoriipi, 2005)  
\(^4\) (Hamon & Jarebrant, 2007)  
\(^5\) (Hamon & Jarebrant, 2007)  
\(^6\) (Friblick, 2009)  
\(^7\) (AB Svensk Byggtjänst, 2009)  
\(^8\) (AB Svensk Byggtjänst, 2009)  
\(^9\) (Svedmyr, Strand, Lööw, & Samuelson, 2007)  
\(^10\) (Acrona, 2010)  
\(^11\) (Svedmyr, Strand, Lööw, & Samuelson, 2007)
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different professionals’ experiences complement each other and everybody work together as a team towards a common goal\textsuperscript{12}. Experience shows that this approach is effective in terms of cost, technical performance, quality and meeting customer needs\textsuperscript{13}.

Good planning eliminates the risk of emergency and unsuitable solutions\textsuperscript{14}. The purpose of planning is to select and implement the best practices, tools and equipment. It is also to use the appropriate resources, achieve a good working environment, minimize waste, facilitate material handling and minimize unwanted interferences. Coordinating activities and resources as optimally as possible, in terms of being on time, will ensure good economy and that the target is reached\textsuperscript{15}. Planning of a construction project results in a number of plans and documents that communicate and inform how the project will be organized.

One of the plans that are developed for the production stage is the construction site plan\textsuperscript{16}. The construction site plan is a plan to show how the area of the construction site should be used. The planning depends on the geographical size of the workplace, geometry, ground conditions etc\textsuperscript{17}. The construction site plan includes many logistical aspects such as transportation routes, lifts, cranes, crane placements and ranges, gates, passages, unloading areas, storage areas and much more\textsuperscript{18}. The purpose of the construction site plan is to optimize the structure of the workplace and it flows. Today the construction site plan is considered an important tool, but despite the dynamics of a construction site there is no priority for either the establishment or follow up of the plan\textsuperscript{19}.

2 Problem definition

How can logistics be integrated in the construction process by using the construction site plan and thereby generate a more efficient construction site?

How can the usage of the construction site plan develop and thus make it a prioritised and appreciated planning and management tool?

\textsuperscript{12} (www.partnering.se, 2010)
\textsuperscript{13} (Byggdialog, 2010)
\textsuperscript{14} (Nordstrand & Révai, 2002)
\textsuperscript{15} (Nordstrand & Révai, 2002)
\textsuperscript{16} (Hansson, 1999)
\textsuperscript{17} (Nordstrand & Révai, 2002)
\textsuperscript{18} (Boverket, 2009)
\textsuperscript{19} (Hansson, 1999)
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3 Purpose

The aim of this thesis is to investigate and clarify the use of the construction site plan in the construction process today. This should result in highlighting potential improvements to a construction site from a logistical perspective.

The purpose is to explain how a developed practice of construction site plans can increase the consciousness of the importance of logistics for a more efficient construction site.

4 Method and empirical data

The authors have through education a scientific background and therefore find it easier to identify with a positivistic approach\(^{20}\). Despite this, the thesis is based on empirical materials in which a hermeneutic approach has been used by the authors for interpretation of interview material.

A qualitative approach was chosen for the thesis as this approach seeks knowledge through reviews, interpretations and understandings\(^{21}\), more than providing precise statistics and figures\(^{22}\). Case studies have been performed at construction sites of the contractor company ByggDialog, located in Karlstad, during the spring of 2010. Four construction projects were examined and they had all used procurement through partnering. Information has been obtained through open interviews and observation. The authors have done interviews with site managers, supervisors and working supervisors (foremen) of both the general contractors and of the subcontractors. Collection of information for the thesis has also been gathered through literature studies of books, reports, articles and from the internet.

The conclusions that have been drawn are mainly deductive, but inductive conclusions have also been drawn mainly as a result of the case studies. To ensure the quality of the thesis the authors have taken account of the validity, reliability and generalization.

5 Results

5.1 What development of the construction site plan will provide

The construction site plan is already an established document. Thereby it is good to develop this plan to its full potential.

\(^{20}\) s 27 Wallén (1996)
\(^{21}\) s.43 Patel, Tebelius (1987)
\(^{22}\) s.76-78 Holme, Solvang (1997)
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According to the figure below, areas has been identified where there are currently barriers to good logistics. It is by tackling these areas that the greatest potential for improvement is obtained;

Through a new approach on the construction site plan, with greater cooperation and visualization, the barriers can be broken down in order to obtain better logistics on construction sites.

Increased awareness of logistics on construction sites can be achieved through active work with the construction site plan. The construction site plan can be part of the planning of logistics and thereby increase the awareness of the importance of good logistics solutions among parties in the project. Planning logistics and using the construction site plan is essential by this means to create an efficient construction site with good logistics solutions. A consequence of having a functional plan will lead to continuous improvements, doing the opposite can result in an inefficient construction site, as the figure shows below.
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The construction site plan serves as a channel of communication to convey tacit knowledge. Furthermore the plan serves as a communication and information channel by providing easy and quick information and an overview of the construction site and logistics solutions. It also provides clear and simple procedures for communication, which simplify the complex flow of information in construction projects. Additionally the plan also allows newcomers to quickly get acquainted with the construction site, the conditions and the production methods.

5.2 How the usage of construction site plan can be developed

It is important to have awareness and understanding of the advantages that the construction site plan can provide to make it a popular planning and management tool. To do this a collaborative development of the plan should be performed by working supervisors. This will extract the individual knowledge and convey it among the participants. A collaborative development also leads to an increased engagement and a holistic view for the working supervisors. The working supervisors are the ones that spend the most time on the construction site and therefore they should also be planning it. Comprehension is increased among the supervisors from all professionals of the construction site, on logistics functions and how they can be improved. When working supervisors from different professions develop the construction site plan more needs are met as it’s not only the needs of the general contractor that is regarded. Working in a partnering project is a good way to increase collaboration and thereby obtain an improved development of the construction site plan.

To make the construction site plan into a popular planning and management tool the benefits the plan provide should be made visible, so called visualisation. By following up the plan with signs on the construction site, intensions of planning become clearer. The plan leads to a neater and tidier construction site with more efficient flows of both material and people. For an extensive use of the construction site plan it can be applied to a whiteboard with supplementing information about supervisors and workers on the site, delivery times for materials etc. Using a supplemented whiteboard is also a way to visualise and clarify the information and thereby improve communication. The construction site plan should also include interior parts of buildings. There are often problems with the interior parts that can be avoided by improved planning and it will also result in a better working environment with improved security.

The summarize of the results is that by developing the construction site plan, as explained above, logistics can be integrated in the construction process and thereby generate a more efficient construction site. This will make the plan a prioritised and appreciated planning and management tool.