TIME ALLOCATION OF SITE MANAGEMENT

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ABSTRACT

The purpose of this paper is to elicit how much time general superintendents and superintendents spend on different functions and, in specific, how much time is spent on work planning and preparation and supervising the work.

A survey, in which 14 general superintendents and 10 superintendents filled in their time usage into a web database for one month (22 days on average) each, was carried out. The respondents could allocate their working hours in 16 different functions with the accuracy of a half an hour daily. In addition, one question was asked concerning the laboriousness of office work and IT systems, for which 14 answers were obtained. All answers were categorised based on the occupation of the respondent in general superintendents and superintendents.

The supervision of work is still the most time consuming function for the general superintendent and the other superintendents; whereas work planning takes up only 15% of the site management's time. This finding shows that at the moment the site management rather supervises than plans and makes pre-requisites ready. Much of the non-value adding time could be eliminated by improving project management and designer cooperation and putting more emphasis on work planning and preparation.

KEY WORDS

Time allocation, site management, general superintendent, foreman, production control

INTRODUCTION

The elimination of waste is the main objective of lean construction, defined for example by Koskela (2000). Koskela also lists seven types of waste first identified by Ohno (1988); two of which refer to work of men: waste of waiting and waste of motion. A foreman is not directly subject to these wastes due to his versatile job description. However, his actions contribute largely to how much waiting and unnecessary motion the workers do.

Although improving performance is vital to increasing productivity in the construction industry, the evaluation of construction trade foremen has been a limited area of research (Poveda and Fayek, 2009). Nevertheless, the use of construction worker's working time has been studied, for example, by Josephson and Saukkoriipi (2005) and Kalsaas (2010). In their study Josephson and Saukkoriipi divided the work time into directly value-adding work, preparations and pure waste. As it is difficult to distinguish directly value-adding work and preparations for a manager, in this report

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the foreman's functions are divided into only two categories: value-adding and non-value adding work.

This study was made as a part of a research project called TuoVa (Managing factors influencing productivity of construction work), which was started in 2009. One part of the TuoVa project is the temporal planning and control of construction production. In order to improve the foremen's operations models we must first discover what they do. This paper describes the distribution of the site management's working time between the different functions included in their job description in the present state. The supervision of workers and work planning and preparation are of special interest since we predicted them to be the most time consuming functions. The interest lies in the legally liable general foremen, also called the general superintendents in this paper, as well as the other foremen, the superintendents, and the differences between the two roles.

BACKGROUND

ORGANIZING WORK

The purpose of project management is to plan how goals and requirements can be achieved using resources as economically and efficiently as possible (PMBOK, 1996). Planning defines the criteria for success and produces strategies for achieving objectives. Control causes events to conform to plan and promotes learning and re-planning. (Howell, 1999)

Although much of the management's focus is on planning, various papers on lean construction have emphasized the complex and apparently chaotic nature of production (Bertelsen 2003, Bertelsen and Koskela 2003). The problem is not always in planning but, in fact, keeping plans up-to-date and implementing the plans properly (Alsehaimi and Koskela, 2008). Time lost in poor plan implementation needs to be compensated by unplanned compression of schedule, which happens in the majority of projects (Seppänen, 2009). In recent years, ineffective communication practices, organisational fragmentation and lack of integration between design and production processes have been identified as some of the fundamental components contributing to the construction industry's poor performance (Dainty et al., 2006).

Kankainen (2004) states that the use of construction companies own workers has diminished and subcontracting has increased in the last years. In the projects of the companies that participated in a recent study (Työvoimatiedustelu, 2010) by Rakennusteollisuus RT in Finland, the contractor's own workers made up approximately 40% and subcontractors' and leased workers 60% of all workers. As buildings become more complex, the ability to coordinate the fulfilment of all preconditions simultaneously using traditional management approaches is diminished, and the relevant result is the waste of workers waiting. Subcontracting per se does not eliminate this potential waste; it simply transfers the risk from the general contractor to the subcontractor. A common result of extensive subcontracting is that construction project managers and engineers abdicate their role and responsibility for designing and managing production systems (Sacks, 2008).

SITE MANAGEMENT'S TASKS AND COMPETENCIES

Management of construction changes continuously, as procurement, methods and information management change (Wikforss and Löfgren, 2007). Technological development of buildings and tightening of quality, environmental, energy efficiency and occupational safety regulations have added to the significance of the site phase and the need of production know-how (Koski, 2010).

A superintendent must act, for example, in accordance with the law, regulations, national building code, company's policies, contracts and plans. The Finnish Land Use and Building Act was renewed in 2000 and the new legislation sets the general superintendent in a more empowered position than before. At present, the general superintendent has the legal liability of the construction management even when there are foremen of special trades on site. (Suomen ympäristö 565, 2002) By the law, the general foreman is, among other things, responsible for managing the work in accordance with the regulations, for the quality of the end product, for organising the required inspections and for occupational and site safety. The general superintendent has the principal responsibility to see to the fulfilment of the contractor's on site obligations.

Foremen's actions impact directly on the productivity and final quality of the work they are responsible for. Thus, their performance is of particular importance for achieving a project's objectives. (Serpell and Ferrada, 2006) This key person is susceptible to extreme pressure of work (Djerbarni, 1996; Styhre and Josephson, 2006) and often works alone, taking care of a variety of complex tasks on many different levels.

To be productive one needs to be managed productively. Differences in productivity between individuals doing the same work are significant. These differences are greatest among the management, so it can be stated with good reason that the most central target for development exists within the management. Like Rojas and Aramvareekul (2003) state, management skills and manpower issues are the two areas with the greatest potential for affecting productivity and performance.

In their study (2006) Serpell and Ferrada identified three main critical activities of the site supervisor: 1) To plan the site and operational processes in accordance with tactical plan of construction project and company policies, 2) To lead internal and external work teams carrying out project construction in accordance with personnel management policies of organization and 3) To supervise the progress of construction activities and their execution, ensuring compliance with the organization's quality system, safety and environmental standards. They also defined a competency profile of the site managers, which consists of 12 competencies in the areas of education and training, abilities and performance, and attitudes.

At present more and more tasks are piled up to the site managers and no tasks are taken away in return. According to Bell and Orzen (2011), lean should be utilised to remove non-value-adding work from all phases of project management. Eliminating the wasteful management tasks will leave the managers more time for developing their working methods, etc.

PRIOR STUDIES

In their research, Darshi de Saram and Ahmed (2001) asked construction project managers and coordinators in Hong Kong and Singapore to classify 64 coordination

activities as “high”, “mid” or “low” based on how much time they consumed. According to the study the most time-consuming activities of the construction project coordinators were 1) Conducting regular meetings and project reviews, 2) Analyzing the project performance, detecting variances, and dealing with their effects, 3) Identifying/gathering information on requirements of all parties and consolidating for use in planning, 4) Interpreting all contractual commitments and documents, 5) Resolving differences/conflicts/confusions among participants and 6) Liaison with the client and the consultants.

In a Chilean study by Alarcón and Pavez (2006) seven executives held a personal log of tasks at 15 to 30 minute intervals for 3 days each. The project manager’s most time demanding activities were found to be 1) Project planning (9.3%), 2) Meetings with owner/Owner Technical Inspection (8.9%), 3) Task supervision and reception (8.7%), 4) Project meetings (7.4%), 5) Coordination meetings with subcontractors and suppliers (7.0%).

Lee and Kano (2004) studied the time use of General Construction Engineers (GCE) in Korea. The site management collected the time use data with the accuracy of 10 minutes for one week each. In the analysis, the respondents were divided by their occupation; of interest for us were the construction work manager and the project manager. They found that a construction work manager spends 12% of his time on planning, 16% on documenting and 15% in meetings, and 52% consists of work on the site, whereas a project manager planned 8%, documented 4%, attended meetings 40% and worked on the site for 29% of his time.

METHODOLOGY

The main goal of the study, the determination of time allocation of superintendents, was approached with a survey. We analysed possible objects of a site manager’s time use and established 15 different functions. In addition the option “Other tasks” was given. In order to avoid overlapping functions, each function included for example the planning, preparations and documentation related to it. Here, we have also grouped the 16 functions in six sets. The functions are presented with examples in Table 1, grouped in the sets.

The respondents themselves could allocate their working hours to the different functions in a web database. The allocation was requested to be done daily and with the accuracy of a half an hour. Besides the time allocation options, the web based survey contained a section for the background data of the respondent. Among other things the working experience, the number of other foremen on the site, stage and scope of the project and the number of workers were asked.

The data were collected in 8 different construction companies in Finland. A total of 24 responses, from 14 general foremen and 10 foremen, were received out of the 34 distributed. The aim was for each respondent to fill in the data for 20 days. However, there was a variance from five to forty days in the number of days each respondent filled in the form. An average of over 22 days of information was gathered per person and a total of 4 258 hours were allocated. In addition, one question was asked concerning the laboriousness of the company’s information systems and the amount office work: “The time required by the IT systems and paper work”. The hours allocated in this question were a summary of the time spent in the above

mentioned actions, not alternative to the hours allocated in the foremen's functions. Five general foremen and nine foremen filled in also this data daily.

Table 1: Site management's time allocation options grouped

Group	Functions
1) Work planning	- Work planning and preparations: Plan examination, Task plan formulation, Construction phase schedules and their control, Task start-up meetings, Documentation
	- Cost planning and control
	- Alterations and additional work: Negotiations, Documentation, Planning and control
2) Worker supervision	- Supervision and control of the contractor's workers: Quality control, Inspections and tests, Documentation
	- Supervision and control of the subcontractor's workers: Quality control, Inspections and tests, Documentation
	- Personnel and employment matters: Orientation, Employment contracts, Working time logging
	- Industrial safety: Weekly safety check circuits of the site, Inspections
3) Procurement	- Procurement: Plan examination, Invitations for tenders and tenders, Quantity surveying, Orders and material reception, Invoice handling
	- Contracts and negotiations
4) Communication	- Meetings and work related to them: Other than the meetings related to individual tasks, Preparations, Writing the proceedings
	- Development activity and networking: Trainings, Exhibitions, Development projects
5) Unclarities	- Unclarities in drawings: Contact to the designers, Correction of deficiencies
	- Sorting out unexpected problems
6) Other functions	- Documenting unrelated to other functions: Internal reporting, Administrative documenting
	- Another project: Next or previous project, Repairs under warranty
	- Other functions

This research method was chosen to obtain data based on actual time use from a relatively large group of people. However, the methodology provides results, which are the foremen's subjective views on what they like to think that they are doing. The foremen may, for example, be biased regarding coverage of the time usage caused by their own mistakes. Moreover this method does not reveal the content of the functions; a large amount of time spent on a function does not guarantee for it to be well-managed.

FINDINGS

The data were analyzed in two separate groups based on the role of the respondent, general foreman/foreman. Before calculating the average time allocated to the functions, we divided the number of hours a respondent had allocated to each function by the total number of days the respondent had filled in the form. This was done so that the answers of any individual would not be emphasized because of the great variability in the number of days answered per respondent. The percentage of working

time spent on each function was calculated directly from the sum of the daily hours for both occupational groups.

According to the survey, on average, a general superintendent's working day lasted for 8.2 hours and that of a foreman 8 hours. This is quite precisely the amount of the working time in the collective labour agreement. In the Finnish construction industry, the workers have an 8 hour working day which includes two approximately 15 minute breaks. In addition there is a half an hour unpaid lunch break.

The functions of special interest, supervision of workers and work planning and preparation, were in fact the most time consuming functions. A total of 25% of the general foremen's time was spent on the supervision of all workers. Work planning took up 16% of the working time. The foremen spent a total of 40% of their time on supervising all the workers and 14% on work planning. Figure 1 presents the average working time allocation in the 16 functions of a general foreman and a foreman in percentages.

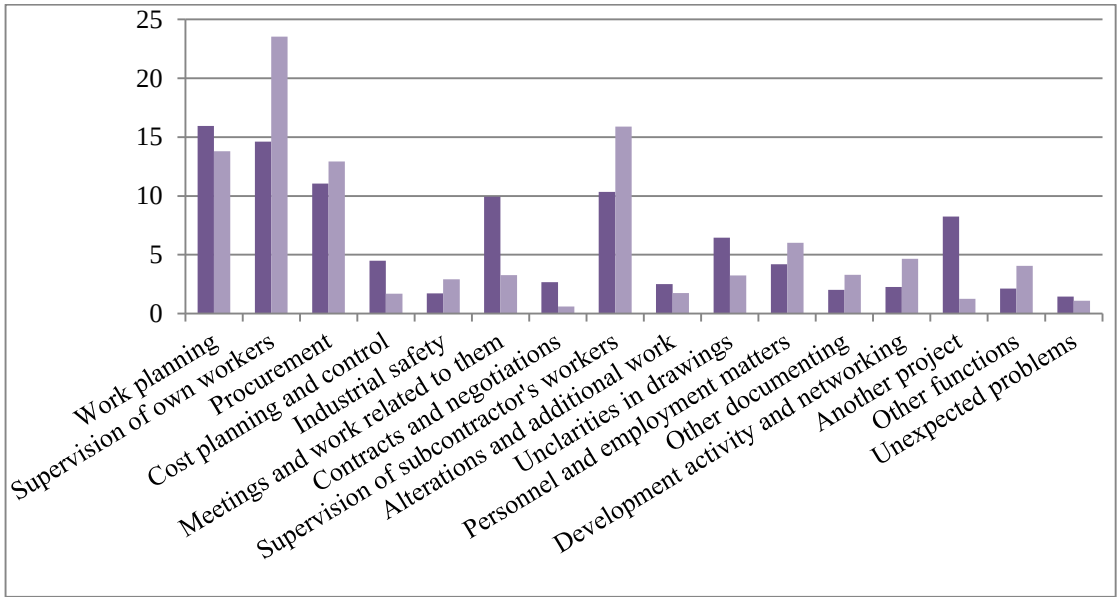

Figure 1: Working time allocation of a general foreman in darker colour and that of a foreman in lighter colour

The different roles of the foremen and the general foremen can easily be perceived in the results. The general foremen participated in meetings more frequently (10% of the time) and were more often involved in several projects simultaneously (8% of the time) whereas the foremen were more concentrated on supervising the workers. Three of the functions were considered non-value adding: alterations and additional work, unclarities in drawings and sorting out unexpected problems. General foremen spent altogether 11% and foremen 7% of their time on these three functions. Unclarities in drawings alone made up over 6% of the general foremen's time usage. After work planning and worker supervision, procurement and meetings were the next most important areas of work.

In Figure 2, the functions are presented in sets for both roles. The functions appear clockwise in the pie charts in the order listed on the right, starting from top-centre.

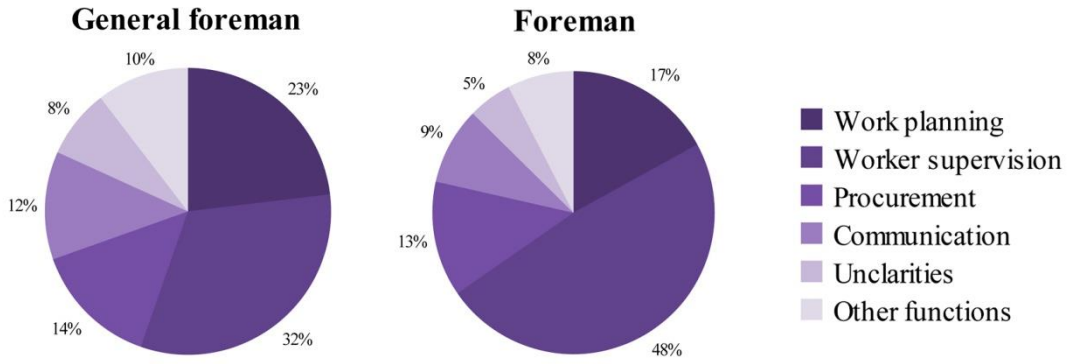

Figure 2: A summary of the time allocation of the site management

Most of the general foremen with less than six years of working experience spent less than an hour a day on work planning and preparation whereas the general foremen with over 20 years of experience spent approximately an hour and a half on this function daily. The results of the foremen had the same trend. The projects the younger general foremen managed, were in most cases slightly smaller than average in both volume and construction time. However, the more experienced general superintendents had an average of 1.6 foremen assisting them, whereas the younger ones only had 0.5 foremen on average the same site.

In terms of background data, the participants were asked for the number of workers under their supervision. We divided the total amount of time spent on supervision of work with the number of the reported workers. The general foremen reported all of the workers on site to be under their supervision, on average 5 contractor workers and 32 subcontractor workers (employed by 12 subcontractors). The foremen reported to supervise an average of 4 workers, and 9 subcontractor workers (employed by 5 subcontractors). On average a general foreman daily spent 20 minutes supervising each contractor worker and 3.5 minutes each subcontractor worker. The corresponding numbers for the foremen were 30 minutes and 9 minutes.

The amount of time spent on the IT systems and paper work varied from a half an hour to 3.4 hours daily. On average the general foremen spend a total of 2 hours and 22 minutes (28%) and the foremen one hour and 21 minutes (17%) on these activities.

DISCUSSION

Breaks and any possible time spent on personal purposes are included in the total data. Since we did not give any instructions on where to allocate these hours, they can be presumed equally distributed among the different functions. Although only three of the functions were considered non-value adding, they are not the only waste in a site manager's day. Presumably all the functions include some amount of waste; this research method just did not allow to us to study how much.

The general foremen spend one fourth of their time on functions included in the "work planning" set and one third on "worker supervision" set. A foreman spends almost half of his time on worker supervision and less than one fifth on work planning. Both the general superintendents and the superintendents spend an even amount of time on procurement.

By the law, one of the most important tasks of a general foreman is attending to occupational safety. This took up 2% of their time. There is a considerable amount of

obligations imposed to the general foreman by the law, regulations, instructions etc. However, these obligations are not visible in the time usage; they are built into the management systems and practices. Often the requirements of a company's management system require more than the quality requirements in place in the industry or the safety requirements set by the law.

The time general foremen spend on alterations and additional work, unclarities in drawings and sorting out unexpected problems (11 %) is significant when compared to the time spent on planning and preparations (16 %). Not only is the time spent on former functions non-value adding for the site management, it will possibly involve the waste of workers waiting. Waste on the management level is especially disadvantageous because of its potential to multiply when influencing the worker level.

Direct comparisons to the previous studies are difficult to make because of the different division into functions and the different job descriptions of the respondents. The areas of special interest, the work planning (16%/14%, Figure 1) could be compared to the project planning time (approx. 9%) in the study by Alarcón and Pavez (2006) and the worker control and supervision (25%/40%) with the total time spent on task supervision and reception, quality assurance meetings and on-site work coordination, approximately 16% in total. However, the respondents of the Chilean study were project managers, which explains their lower involvement in worker supervision. In the Korean study, the construction work manager, who spends 12% on planning and 52% on work at site, seems by job description comparable to a Finnish site manager. These results are similar to the ones we got, especially when considering, that the work at site corresponds approximately to the worker supervision set (32%/48%) of this study.

It is possible, that the companies nominated such foremen into the survey, who are more systematic in their work than average. Also the participants possibly, took special interest in the research area. However, this can be considered a representative group of superintendents; the results should apply in a larger group as well.

CONCLUSIONS

External factors, such as the economic situation, can increase or decrease the labour productivity, but internal development in management practices, technology and labour skills and training are needed to make real changes (Koskenvesa et al., 2010). To build productively requires that the building sites are managed productively. According to Ballard (1994), one of the most effective ways to increase productivity is to plan more efficiently.

The findings of this study show that at the moment we rather supervise than plan and make pre-requisites ready. When a task is planned insufficiently and started without all its standard inputs or the execution of a task is continued although the availability of at least one standard input has ceased, we have waste (Koskela, 2004). Term input refers here not only to material, but also to all other inputs such as machinery, tools, personnel, external conditions, drawings, instructions etc. Making-do as a waste has a great impact on the performance and labour productivity of activities.

One reason why making-do waste occurs is the so called "hurry". In Finland, construction on site and tasks in different phases are often started with unfinished

design, which is also visible here in the amount of time required by the unclarities in drawings. Furthermore, various alterations and additional works can make it nearly impossible for the site management to plan work in advance. This generates a rolling effect of "not producing according to plan", that changes the scope of managing the site from planning-ahead to fire fighting type of management. This can be seen in the results of this study in the ratio of time spent on work planning and on supervision, and also in the results of Lee and Kano's (2004) study. Based on these results, we can open a conversation of what the percentages of different functions should be and could some functions possibly be taken away. As Bell and Orzen (2011) stated, lean should be used to remove non-value adding work from project management. Arguably, the implementation of lean construction will require a new time allocation in site management.

Another noteworthy fact from the study is that the younger general foremen spent less time on work planning and preparation than the experienced. Also the foremen had the same trend. When a general foreman works without other foremen, he is covering for both roles, and as a result, spending less time on work planning. This may contribute to the cycle fire fighting type of management. Nevertheless, to confirm these findings, further research could be done on whether general foremen with a certain education or experience plan work more systematically than others.

Much of the non-value adding time could be eliminated by improving project management and designer cooperation and putting more emphasis on work planning and preparation.

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