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Health and safety in early phases of project management in construction

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Abstract

Serious and fatal accidents happen on construction sites every year. However, earlier research indicate that the root of the accidents can often be found in the early phases of the project process. In this paper, we examine what occurs in the early phases of project management in construction that can be harmful to health and safety in the construction phase. The investigation focuses on two main research questions: 1) can health and safety in the construction phase be improved during the early phases of project management, and, if so, 2) what are the main challenges of health and safety in the early phases of project management that need to be addressed in order to do so? The data presented is collected by interviewing regional safety representatives in Norway. They point to three main challenges to health and safety in the early phases of construction projects: 1) lack of competence, 2) lack of prioritization, and 3) lack of consequence. In conclusion, we suggest that educational institutions, construction clients and public authorities all need to play their part to improve the situation.

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Keywords: construction industry; design phase, health and safety; planning phase; project management.

1. Introduction

The construction industry is regarded as a risky business, worldwide [1-4]. Serious and fatal accidents happen on construction sites every year. Historically, different efforts have been made to improve the situation through three overlapping stages [4]. In what is called the *technical stage*, the main focus was to adopt technical measures to reduce risks in the construction project environment. In the *human error age*, accidents were often blamed on the victims themselves and their malpractices [5, 6]. Lately, we have been in the *socio-technical age*, and the focus has been on person-environment interactions, thus joining the two earlier perspectives.

In accordance with the socio-technical view, earlier studies have found that in the construction industry the early project phases are crucial to safety in the construction phase [2, 6], hence emphasizing the importance of person-environment relations. Despite these scientific contributions pointing to the importance of the early phases of decision making as the root causes of accidents at construction sites, a review of earlier studies on construction safety, found that the vast majority of studies focus on the construction

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phase of the projects [7]. Hence, we need more studies that can add to the knowledge of what happens in the early project life cycle and how these decisions reveal themselves as promoters of unsafe behavior and accidents at the construction sites. We also need to identify possible ways to handle this issue in the early phases of project management in construction. This paper aims to fill some of this gap by providing inputs and insights from regional safety representatives (RSRs) in Norway. The RSRs' unique competence on health & safety (H&S) in the Norwegian construction industry can help pinpointing what needs to improve at the early stages of project management in the industry to help improve H&S during the construction stage.

In this paper we will first look into the different phases of a construction project and how decisions made in early phases influence what happens at the later stages. We will also introduce some theoretical perspectives that can be applied to understand this process. Then we go on to present the methodology of our research and the role of RSRs in the Norwegian construction industry. Finally, our findings will be presented and discussed, conclusions are drawn and some thoughts on further research are presented.

2. Theoretical background

All projects have certain characteristics in common. According to Larson and Gray [8], the major characteristics of projects are as follows:

1. An established objective.
2. A defined life span with a beginning and an end.
3. Usually, the involvement of several departments and professionals.
4. Typically, doing something that has never been done before.
5. Specific time, cost, and performance requirements.

In the construction industry, the success of a project will usually be measured by its timely completion, whether the project is completed under budget, if the project meets the quality criteria, that the work is safely executed, and finally client satisfaction [9, 10]. Hence, safety is regarded as a success criteria in construction projects, though it can conflict with other project goals [6, 10]. However, the industry suffers from poor project performance, partly because the project work involves a complex mix of different actors, stakeholders and sub-processes [9]. This is also reflected in the project life cycle.

Every project goes through different stages. Normally a project starts with a *defining stage* in which project objectives are established. Then the execution of the project is planned as timeframes, the allocation of resources, acceptance levels of risks, staffing and so forth are decided in the *planning stage*. The project will then enter the *executing stage*, where the actual construction takes place. This is the phase in which accidents tend to occur. Finally, the project is finished by delivering the result to the client in the *closing stage*. The different stages in the project life cycle partly overlap, as illustrated in Fig. 1. In the construction industry, different actors are involved at the different stages, which adds to the complexity of the project life cycle.

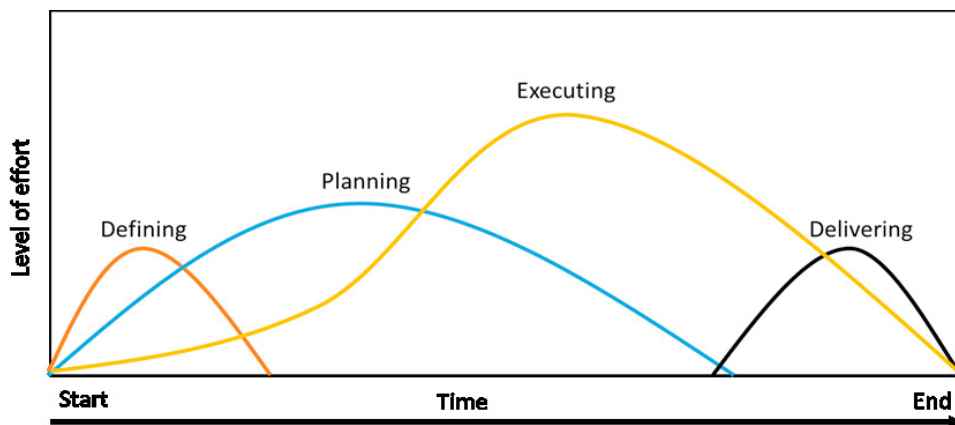


Fig. 1. Project Life Cycle (based on Larson & Gray, 2011)

Although the accidents in the construction industry mainly occur in the execution stage, earlier research has found that the possibility to influence H&S diminishes gradually during the project life cycle, and that decisions made at the design and defining stage have a major impact on site safety during the construction or executing stage [6]. This is illustrated in Fig. 2 [11].

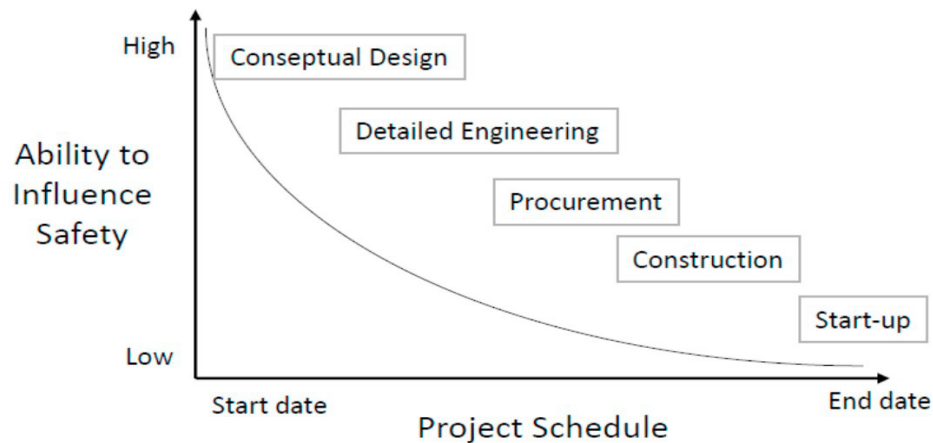


Fig. 2 Potential opportunities to influence safety in construction projects (based on Szymberski, 1997)

This also corresponds well with the thinking of Reason [12] who divides organizational accidents into stages and claims that organizational accidents have a time-line that starts with organizational factors such as strategic decisions, budgeting, allocating resources, planning, scheduling, managing, and so forth. These processes will be influenced by the corporate culture, or the unspoken attitudes and unwritten rules concerning the way an organization carries out its business. The consequences of these activities are then communicated to the next level and, in our case, to the individual construction site where they “reveal themselves as factors likely to promote unsafe acts” [12, p. 16]. According to Reason these organizational factors include “time pressure, inadequate tools and equipment, poor human-machine interfaces, insufficient training, under-manning, poor supervisor-worker ratios, low pay, low status, macho culture, unworkable or ambiguous procedures, poor communications”. The organizational factors are regarded as the ‘root causes’ of unsafe acts as illustrated in Fig. 3. Failures on other levels may change form, but will continue to reappear as long as the root causes are not addressed.

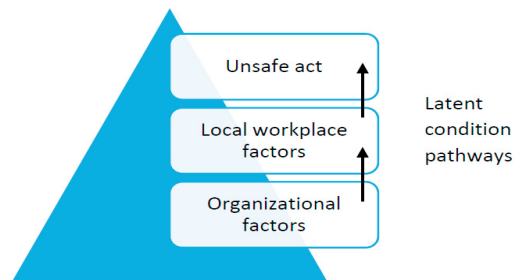


Fig. 3: A system of factors creating latent conditions (builds on Reason, 1997)

Translated into a project management context in the construction industry, the structural and cultural systems for planning projects at the organizational level in the early stages of the construction process will influence the local work place, in this case the construction site. More specifically, structural and cultural regulation and practices will influence which actors are included in the project team in what phase, which factors are mostly emphasized, what issues are considered as risks in the project, and so on. These local workplace factors then act as latent conditions that might influence the next stage in the project, and may cause an unwanted incident or accident.

Theory of path dependency is another theoretical contribution pointing in the same direction. Path dependency means that early decisions will influence the range of possibilities and choices at the later stages in the project process [13-15]. At an early stage all options are open. As actors start making decisions – such as who will be part of the project team, what are the most important criteria in decision making, what is the timeline for the project as a whole and the different milestones, and so on – the range of future options becomes more limited. More precision narrows down the different windows of opportunities. The project development process moves ahead and eventually you find yourself in a ‘lock-in situation’, unable to break free of the line of decisions already taken, as illustrated in Fig. 4 [15].

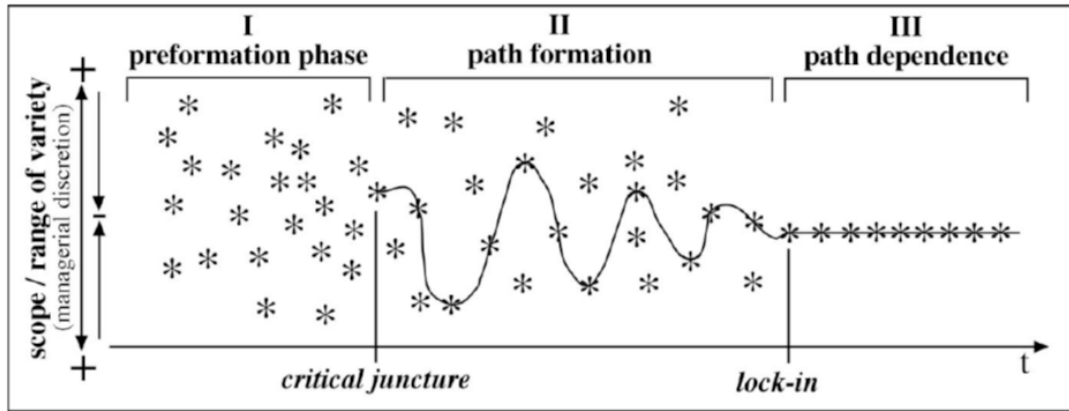


Fig. 4 Path dependency (Sydow et al., 2009)

In this paper, we aim to shed some light on how H&S on construction sites are influenced by the early project stages in the construction process, and what can be done to improve the current situation.

3. Methodology

The findings in this paper are part of a larger research project aimed at ensuring sufficient H&S competence among construction engineers in Norway. A literature search was conducted as described by Arksey and O'Malley [16] to get an overview of earlier research. Due to the fact that the studied area has not been subject to much earlier research, the research questions have a qualitative design and semi-structured interviews with key stakeholders in the construction industry was considered a preferred method to gather the data needed. Though there are many different stakeholders in the industry that could provide data relevant for this study, the key stakeholders chosen for the purposes of the part of the study presented in this particular paper, are the regional safety representatives (RSRs) in the Norwegian construction industry.

The safety representatives are regarded essential to ensure H&S in the Norwegian labour market [17]. According to the Norwegian Working Environment Act all enterprises should have a safety representative elected by and among their employees to ensure their safety, health and welfare. However, enterprises that employ less than 10 employees, are not required to elect a safety representative. As the Norwegian construction industry is dominated by small companies and therefore lack their own safety representative, the arrangement of having *regional* safety representatives (RSRs) in the construction industry was established in 1981.

The RSRs work within a specific geographical area across company borders. They visit construction sites, inform workers and managers on issues concerning health, safety and environment (HSE), and cooperate closely with the Labour Inspection Authority [18]. The RSRs have important insights into the H&S challenges of the industry as they gain first-hand experience with various construction sites. The RSRs are mainly involved in the construction phase of the construction projects. This is an important limitation to consider when it comes to their knowledge about the earlier phases of construction projects. However, in the construction phase the RSRs gain first-hand experience with the H&R consequences of decisions made in the earlier phases of the projects. In addition, many of the RSRs are involved in teaching at H&S training courses for major enterprises in the construction sector. On these occasions, designers and planners attend such courses as students, and the RSRs interact with them on H&S issues. These are some of the reasons why the RSRs can provide valuable inputs to the research questions of this paper.

In the Norwegian construction industry, there are 29 RSRs in total. All were invited by e-mail to participate in the study, and 15 were interviewed. Semi-structured interviews provide the informants with the opportunity to talk more freely and give unanticipated answers. The study follows a discourse of empowerment by conducting symmetrical interviews where both interviewer and informant are viewed as participants in the production of meaning [19].

12 interviews were conducted face-to-face, while two were done by telephone. One interview was organized as a group interview with two informants present, while 13 were one-on-one conversations between interviewer and one single informant. All interviews were performed according to the prescription for semi-structured interviews made by Blumberg *et al.* [20], and were audio recorded, transcribed and analyzed. Interview statements from the informants are presented and discussed in the following to shed some light on our research questions. The RSRs have been given different numbers to help avoid their identification.

4. Findings and discussion

Turning our attention to the first research question of whether health and safety can be improved during the early phases of project management, our informants firmly believe that this is the case. The RSRs interviewed for this study underline the need to include H&S safety already at the early stages in the project process to avoid unsafe behavior and accidents in the construction phase. The importance of planning is strongly emphasized by the informants. Without proper planning, the workers have little opportunity to act safely. Some statements from interviews with RSRs illustrate this point:

No. 1: “There are problems out there because they rush and nag due to bad logistics and bad planning. (...) Then you have the planning by those who manage and facilitate for these workers. So including the importance of planning and follow-up have concrete effects on construction sites all around.”

No. 11: “Another thing that I believe could have prevented some accidents is to start already in the planning phase. Planning every hazard, right? (...) If they start by taking some steps already in the planning phase, I believe they could prevent a lot of injuries.”

No. 12: “The earlier in the phases of the building project you can come in to influence the HSE responsibility and safety, the more likely it is that there will be no injuries on the construction site.”

No. 13: “HSE measures must come early in the engineering phase. If not, then the race is run!”

Our informants strongly believe that planning for safety must happen early in the construction projects. If safety is not considered in the phases involving designing and detailed engineering, this will have a ‘trickle down’ effect on the construction phase creating the potential for unsafe acts, in accordance with Reason’s argument and other earlier research [6, 12]. Informant no. 1 clearly underlines the path dependency of bad planning resulting in the need to rush the work in the construction phase. As mentioned above, time pressure is one of the organizational factors that is likely to promote unsafe acts [12]. In addition, informant no. 13 clearly points to the experience of reaching a lock-in situation.

Many of the regional safety representatives elaborate on how this ‘trickle down’ effect occurs. They mention inadequate health and safety requirements from construction clients as a major obstacle when it comes to preventing accidents and health problems affecting workers in the construction industry. Here is one example of what they say:

No. 3: “The construction client is responsible. The construction client hire sub-contractors and should determine many requirements [regarding H&S] already at the planning stage stating that “this is what you should work according to”. And bids are calculated according to these requirements. When the construction client hasn’t specified any criteria they should be concerned about, their primary concern it to build as fast and cheap as possible. And then what happens is that such semi-serious firms come in. (...) And I’m not very impressed, if I can put it like that. So HSE should be at the top of the construction client’s list. (...) It is stated in the regulations that it [HSE] should be planned in detail. (...) “This is the plan for safety, health and working environment – this is what you should base your calculation of bid upon.” There are great deficiencies there.”

According to our informants, the construction clients are responsible for planning for health and safety. When they fail to do so, the semi-serious sub-contractors win the bids because they take shortcuts on safety and do nothing more than what the construction client has specified. This way, the lack of H&S concerns from the construction clients is reflected in the actions of the next actor that try to win contracts in a highly competitive market. Whoever wins the contract now has to deliver according to the bid, and can no longer go back to raise the bar for H&S. They now find themselves in a lock-in situation. Safety measures that has not been planned and calculated at this point, will usually not be implemented.

The question is then why the actors involved at the early stages of project management fail to take necessary H&S precautions, as we look into the second research questions of identifying the main challenges to H&S in these early phases. According to our informants, the lacking ability of construction clients to act according to their regulated H&S responsibilities is rooted in three main causes. The first is lack of competence. To make sound decisions in the design phase of a project, the actors involved in this project phase need to be competent about H&S issues. Many of the RSRs interviewed in this study, point to lack of competence on H&S as a problem that needs to be addressed. A construction project normally starts with designing and detailed engineering. However, according to our informants the architects and planners have little knowledge on H&S, as these examples show:

No. 6: “I have only met one architect who knew what he was doing, and he was a skilled carpenter. So he knew what was possible to build, unlike other architects that have no fucking clue. (...) The architects have been the major obstacle, they have designed things that are hopeless not only to build, but also to secure.”

No. 13: “I notice that people that have worked on detailed engineering and architects and the like, they have no clue regarding the minimum requirements [on H&S] in laws and regulations. (...) It is so easy to draw a line for an architect, but it is so hard for the workers to secure. And that is where I think the mistake is done: between engineering and execution.”

Without competence on H&S among actors involved in the early project stages of designing and detailed engineering, the consequences of the decisions made will be left for other actors to handle down the line. As informant no. 6 points out, when the chosen design is difficult to build it is also difficult to implement sufficient safety measures in the construction phase of the project. This point corresponds well with the theory of path dependency as it shows that it is impossible in some cases to break free from earlier decisions and you are left with only bad options to try to ensure safety.

Another reason why the construction client does not comply with their formal H&S responsibility is, according to the RSRs, the problem of finding the root causes of accidents. They believe that the actors responsible for root causes seldom is held accountable for accidents. If something happens, it rarely has any consequences for actors involved in the project phases leading up to construction. Two of the informants put it like this:

No. 3: "There are no consequences if you don't make a proper plan for safety, health and working environment other than that the building process becomes poorer. But it's like... then all the responsibility is left to the entrepreneur."

No. 6: "If an accident happens, the main contractor always gets away."

The quotes illustrate some of the challenges when many different actors are involved in the different phases of the project life cycle. When different actors relieve one another of H&S responsibility when moving on to the next project phase, it is harder to determine who is at fault when accidents occur. This results in a diffusion of responsibility and few real incentives to safeguard health and safety in decision making at the early stages of the project process. Why bother when no one will blame you if anything goes wrong and you can even save some money in the process?

According to the RSRs the laws and regulations regarding H&S are accurate and sufficient. When H&S is not taken into consideration in the early phases of construction projects it is mainly because of 1) lack of competence on H&S among designers and planners, 2) the failure of construction clients to include H&S requirements when inviting contractors to make their bids on the construction job because of lack of competence or lack of prioritization, and 3) the lack of consequence on the part of the construction client if accidents happen during the construction phase.

The lack of H&S competence among designers and planners should be taken seriously. The educators of architects and engineers have an obligation to make sure that their graduates gain the knowledge and skills that they need to become competent practitioners knowledgeable of their responsibilities. This is part of enabling the students to act as professionals according to the standards of excellence of their profession [10]. The findings in this study suggest that educational institutions need to be more aware of what they teach their students regarding H&S. As earlier research has also found that educational institutions focus mainly on the executing stage when teaching their students project management [21], this indicates that there are improvements to be made in education.

The construction clients also need to be more aware of their H&S responsibilities and policies. When planning to hire partners to execute the construction phase of the project, they need to make it a priority to ensure that H&S measures are valued in their contracts in such a way that unserious actors are excluded from winning the contracts. This approach is strongly needed in an industry which over time has been haunted by dubious and even criminal actors [22].

Finally, public authorities need to pay more attention to the root causes of accidents. It is easy to blame a worker for acting unsafely, but when investigating accidents we have to dig deeper and look further than the workers and entrepreneurs. As many theoretical contributions have shown, the possibility of influencing safety gradually decreases during the project life cycle [6]. If we want the designers and construction clients to make the right decisions for H&S in the early project phases, it must have consequences for them when accidents occur. If their actions are only measured by the time and money spent and client satisfaction in the end, H&S will loose if conflicting with other project goals.

5. Conclusions and further research

In this paper we have looked at H&S in the early phases of construction projects. We have investigated if health and safety in the construction phase can be improved during the early phases of project management, and identified some main challenges in the early phases of project management that need to be addressed in order to do so. A stakeholder perspective was applied by collecting input from regional safety representatives (RSRs) on how decisions at early stages in the construction process are reflected in the construction phase, and what can be done to improve the H&S in the industry by focusing on the early stages of designing and planning. The RSRs have provided information that confirm that decisions at early stages is indeed reflected in safe and unsafe behavior in the construction phase. Lack of competence, lack of prioritization and lack of consequence for the actors involved in the early project phases, are the main issues that need to be addressed to improve H&S in the construction phase, according to the RSRs. Educational institutions, construction clients and public authorities all need to play their part to improve the situation. We seem to get what we ask for, also when H&S in the construction industry is concerned.

However, more research is definitely needed in this area in order to find possible ways to improve H&S in construction. The preliminary research presented in this paper should therefore be continued. Collecting data from other stakeholders besides RSRs could be a natural starting point for further investigation of the research questions. Other stakeholders will be able to provide a different perspective that is needed in order to get a more complete picture of the situation and possible solutions.

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