

# IN SEARCH OF SAFETY ON CONSTRUCTION SITES - IMPLICATIONS OF CULTURE, ORGANIZATIONAL STRUCTURES AND STRUCTURAL CHANGE ON SAFETY

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The Danish construction industry is presently confronted with societal and market challenges concerning cost reduction, productivity issues and quite high rates of occupational accidents. Conforming to changing project organizations and work strategies, construction standards and meeting owner specific safety requirements has become a divers challenge for contractor companies. How contractors' organizational structure relates to these features and what are their implications for safety and safety culture on the sites is the focus of this paper. Drawing on symbolic, interactionist conception of organizational and safety culture and sociological institutional theory the presented research covers two qualitative studies seeking to get a deeper understanding of these relations, barriers to and conditions under which safer work environments could be established. Whilst one investigation follows the implications of work strategy restructuring on the site and of the applied environmental management procedures for safety and safety behavior, the other case relates about safety implications of the integrated safety culture, safety practices and more or less explicit safety management policies of a progressive contractor company. The results point out, that centrally issued safety policies and systems may be conceived ambiguous or of limited effect when related to prioritizing goals of the built project and because of traditions in the daily work practices. Approaches, oriented at intensified site communication, learning and participative processes, sating emphasis on a greater horizontally integration of safety, seem to be more promising.

**Keywords:** construction sites, horizontal integration, safety culture, safety management policies, structural change.

## INTRODUCTION

Safety at construction sites alongside with issues concerning negative productivity growth with a yearly 0.5% average decrease (Governmental report 2003) has become major challenges to Danish contractor companies. Several explanatory factors concerning this condition have been suggested (ATV, 1999), one of which is the traditional work organizational structure at constructions projects. This produces limitations of cross-functional communication and exchange of experiences, demarcated horizontal boundaries and shop floor involvement in production and

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safety management planning. The present focus on occupational accidents in the construction industry stems from the Work Environment Authority's national accident rate statistics (2002), and is also supported by the labour market organizations. According to national statistics, accident rates within construction are well above labour market average, and the trend has not improved during the past decade. Occupational accidents and hazards in construction are rooted in projects' organizational, technical, physical and cultural environments, which compared to other settings, are indeed unique. In Europe, construction accounts for over 15% of workplace accidents, despite representing 10 % of the working population (Loosemore et al, 2003). Management prioritizing, economical goals and conditions, weather factors, working conditions and certainly safety culture could be mentioned as the most influential factors emanating from the task environment. The drive to reduce accidents and hazards in Denmark is currently related to economic costs of accidents at company level (Rikhardsson P. et al 2002), the societal level as well as costs and social consequences at the individual level. Efforts have been supported by state regulatory measures, controls and campaigns, initiated by the Authority and the organizations. However, these initiatives have not succeeded convincingly, hitherto. This does not mean, that efforts have been absent. Especially the larger construction companies have within the past 5-10 years sought to meet the challenge, for instance by implementing widely diffused and legitimated audited quality and environment management systems, such as ISO 9001 and the Occupational Safety and Health certification standard ISO 14 001. Aligning such standards as strategic functions is, however, a costly business, requiring resources for systematic management. Only "up-front" construction companies are capable of this, whereas the majority of small and medium sized companies allocate responsibilities of handling safety tasks informally to project planners, workers' representatives and safety officers.

Thus, site safety management vary in accordance with company size, the firms' safety strategy, project type and complexity, and in some cases merely consist of formal inspections and site condition assessments (Richter & Pedersen 2002). However, several authors (Kjellen & Hovden 1993, Turner 1992, Hale & Hovden 1998) have questioned the viability of traditional safety management systems. They point out that the systems, in practice, have a tendency to reproduce already existing conceptions of safety and accident prevention. Their suggestion is, therefore, to pay more attention to the impact of culture.

On this background the presentation initially outlines our theoretical approach, namely safety culture, which is then illustrated by experiences from two ongoing studies on organizational and cultural impacts on safety at construction sites. One case highlights the effects of a strategically aligned safety management system combined with particular safety procedures developed as part of a demonstration project infrastructure aimed at integrating work structural change on the site. The outcomes point out that operational safety management has to set focus on new safety critical aspects such as intensified communication and education processes, giving safety a learning orientation. The other case focuses on understandings and actions on safety among actors within a "modern" medium sized contractor company. This case illustrates impacts of safety culture, when facing safety policies and procedures. Finally, we discuss barriers to and conditions under which safer work environments could be established at construction sites. This serves to illuminate the main questions of this presentation, i.e. safety management dilemmas, such as autonomy and participation versus formalised safety procedures? Secondly, how alternative site

organization could set new meaning giving processes and actions on safety on the agenda?

## **INTERPRETING SAFETY AND SAFETY CULTURE**

Our approach to investigating safety related issues in construction is based on the interpretive paradigm of organisational phenomena, the theoretical methodology being particularly inspired by Alvessons (2002), Geertz (1998) and sociological institutionalists' views of organizational culture (Berger & Luckman 1967, Powell & DiMaggio 1991, Scott & Meyer, 1994). The focus is on safety culture, a conception that incorporates social and technical practices, norms, beliefs and actions oriented towards minimising individuals exposure to risk or danger in work (Gherardi & Nicolini 2000). Additionally, and in line with Pidgeon (1998), we conceive safety culture as the shared and learned meanings, experiences and interpretations on risks and work, which guide people's actions and have an impact on risk handling, accidents and prevention. The concept of safety culture draws on the symbolic conceptualization of culture in organizations, which recognizes, that culture is created and recreated as people interact socially and with the physical world, i.e. when performing work tasks in a specific organizational frame. In meaning giving processes of interpretation and negotiation, guidelines on how to act are created by the individual actors. This is expressed in partly symbolic forms especially via language, using metaphors, stories and perhaps also myths. A central observation is, that culture in an organization consists of integrative elements, which most members of the organization adhere to. However, culture may also be differentiated, in so far as members interpret and share some features, which are distinct from other groupings in the organization. Furthermore, culture is context bound and may appear ambiguous, insofar as people orient themselves differently at different times. But we agree with Alvesson, and Parker (2000), who warn against too easily assigning cultural phenomena to ambiguity. Ambiguity might originate from social structures and practices, as for example groupings with own rules of success, and own structure of positions and economic and symbolic rewards. This means, that organizational structure and culture are intermeshed, but without the one being directly derived from the other.

Another central point is, that culture differentiation may not follow the lines of organizational structure. First of all, people interact across organizational boundaries, and are thus confronted with cultures of other groupings, which may set new interpretations on the agenda, and challenge existing conceptions. This is especially so in the course of organisational change processes. Secondly, organizations are not isolated. They function in a broader societal connection, where market conditions, competition, state regulation and so on are at play. Thirdly the members of the organization are in interaction with external networks and groups, such as family, profession, organizations and regulatory bodies. These interactions may tone members' conceptions and actions – i.e. the cultures - within the organization.

The core argument of symbolist culture theory and sociological institutionalism is that actors, symbols and actions are taken for granted social constructs. The way in which individual and collective identities, cultures, boundaries and practices are

(re)constituted in institutionalized processes of interpretation (Scott 2001, Berger & Luckman 1967, Powell & DiMaggio 1991, Scott & Meyer, 1994) is in the actual change and exchange conditions across settings a pertinent issue to understand. According to institutionalists, choice of organizational structure, strategy or

managerial procedures and systems is not an expression of a more or less constrained instrumental rationality, but rather the expression of conceptions of rationality that have been institutionalized as rationalized myths in a larger scale organizational environment. This means that organizational practices and constituents, including safety culture, are increasingly subjected to normative pressures of institutionalized environments that are becoming more dominated by means-ends oriented rationales. The outcome is typically representational conformity, decoupling of organisational practice and official representations, ceremonials or ritualized behaviour (Meyer J. & Rowan 1991, Meyer & Scott 1983).

Summing up, safety culture is conceived as historically and socially constructed among members of an organization, and is influenced as well by the dynamics of a larger scale of environment. The implications of the persistence - or change - of these constituents for the social environment and economical performance in construction, from a safety viewpoint, are considered pertinent to understand and analyse.

## **ETHNOGRAPHIC FIELDWORK AND ANALYSIS**

The methodological selection combines elements of culture theory, organisational sociology, and institutional theory. The studies have encompassed ethnography on work processes, safety issues, company organisation and work structural change.

The first case reveals implications of work organisational change for safety and safety behaviour on the sites. It is also formally attached to a process assessment required and funded by the Ministry of Housing, as part of a larger best practice program called "The Tool Box" developed by a municipal renewal company. A report on this process is underway (Marton 2004), and will serve as best practice sheet comprising process, work performance and safety implications, overall failings and outcomes, and recommendations for alternative solutions for future efforts. The ethnography comprised: participation at various meetings during the initiation, design and implementing process such as: project steering, pay bargaining, educational support planning, site meetings and evaluation sessions; qualitative interviews with direct involved actors on all project levels; study of project documents; field study observations, informal discussions and notes. Core interest of the investigation was the study of the way in which structural change was enacted and perceived by its contributors and how did it impact work performance, safety and safety behaviour on the side.

The second case presented is documented in Richter & Pedersen (2004), and is part of a study carried out in three small to medium sized companies, specialized in carpentry work. The study was funded by the state and administered by the Danish Work Environment Authority. The fieldwork comprised semi-structured interviews with managers, operatives and their representatives; participant observation at five construction sites in the greater Copenhagen area, participation at site and company safety meetings and at the weekly site meetings. This was supplemented by written documentation on organizational structure, mission of the company, referendums, safety procedures and policies, accident statistics, risk assessment methods, etc.

Central to the safety culture analysis was the meaning each actor associated to the following themes: risks and risk handling; causes of accidents; preventive actions; safety work and procedures; problem and conflict solving; participation; own job and tasks - mission and satisfaction; and finally, social relations. The analysis was further

supported by field observations of safety conditions, actions to handle risks and prevent accidents, and communication on safety management.

Analytically we looked for integrative, differentiated and ambiguous elements in the actors' interpretations and actions on the safety themes. Logically coherent themes were then organized into one system of meaning, constituting a culture. Each differentiated culture is given a name, which pictures the overall content. The safety culture analysis was conducted in several steps, - for each work gang, managers, and company separately and, ultimately, regarding the total material.

## **THE CASES**

The first case below represents a contractor with about 2800 employees, representing all traditional construction trades except plumbers. The case concerns a demonstration project on the implications of work organizational change for work performance and safety. The second case represents a contractor employing about 200 people, whereof about 150 are carpenters. This company operates traditionally within construction, but is a "fore-runner" regarding management style and strategic views on enhancing workers competences, and health and safety.

### **"The self-governed construction site"**

The case analyses industrial players' efforts to remediate one of the core factors assumed to be causing project efficiency decline, namely the traditional organisational structure on the sites. The extremely fragmentary structure and articulated specialist authority among the trades, fostering adversary collaboration culture are seen as overall failing features of site work strategy, which create numerous horizontal and vertical interfaces in work operations. Limitations on autonomy and involvement in production and management planning are additional factors assumed to constrain project efficiency and foster adverse implications for health and safety. Accordingly, the need of applying more collaborative coalition strategies, which to a higher extent enable integration of the site operatives' skills, and develop a different perception of safety and health management, becomes evident. Implications of organizational change for work performance and site safety and behaviour are the central empirical findings of the case.

The overall scope of initiating the demonstration project was process improvement in urban refurbishment. More specific project objectives varied from social, such as personnel motivation, job satisfaction, improved work environment and safety - to technical, such as functional flexibility - and to economical, concerned with outcomes like improved work productivity. The strategy proposed was the use of self-governed teamwork as an alternative work strategy for operations management on the site. The main assumption was that vertical and horizontal integration would reduce trade boundary constraints and functional partitions, and assure a more coherent workflow and improved safety on the site.

The new work organising structure consisted of four multiskilled crews and one logistic crew, supposed to interact in an extensively decentralised site governance structure, where middle managers' decision rights for production and staffing planning was granted to the five foremen. The central function of the logistic team was to keep the site clean and easily accessible by a systematic control of hazardously placed work material, and a methodically vacuum cleaning of the facility. The new governance strategy incorporated weakly foremen meetings, which were replacing the usual site meetings, and were attended by foremen, the architect and two site leaders. Higher

extent of participation in work planning and co-ordinating allocated a different emphasis on operatives' responsibility for safety. An interesting issue in this context was to analyse the effect of the normative and self-emergent devices deployed for enforcing safety improvement, and more particularly, how site operatives and managers perceived them, and how they interacted with the new work structure.

Formal safety management procedures were part of the contractor firm's strategically aligned safety policy, based on the recently integrated standard, ISO 14 001. The operational safety management system consisted of a set of monitoring and inspection elements including the conventional site safety plan, meetings, records, and internal and external surveillance. The main control device, called "Qualified working place", consisted of weekly assessment and recordings of the safety condition, which after each session, was registered in colored schemes and hanged in the sheds, illustrating periodical states of safety on the site.

The support functions devised to implement structural change incorporated a developmental program consisting of work performance assessment and teambuilding training sessions, which required active attendance of all operatives, site leaders, the engineers, construction union representatives and the client advisor. The main objective of the program was to achieve enhanced interaction and communication crossing the horizontal and vertical work boundaries. The assessment and training sessions consisted of collaborative evaluations of work performance and environmental indicators, the outcomes of which were registered and attached to detailed meeting accounts, serving as project experience sheets. Most frequently discussed indicators were those related to aspects of site management, safety and work environment, and uncertain work boundaries, as these factors seemed to exert an ill influence on the daily work performance. During the first month site activities, work co-ordination and health and safety difficulties intensified, which was seemingly an effect of several disturbances occurring during the change process. In order to overcome these problems, the foremen proposed integration of an additional set of short daily interaction sessions.

As an effect of the project's extensive focus on safety, including the operatives' informal engagements with this issue, site safety difficulties regressed visibly. Untraditionally safe and clean work environment has been registered. After an interview with union representatives and site operatives the press has published an article in the carpenter union's periodical, attributing the safety management an overwhelmingly positive assessment. This act seemed to a considerable degree to benefit the work performance on the site. Although the attempt at integrating multiskilled teamwork has failed, due to technical design failures, a certain vertical and horizontal job integration has been achieved, which to a high extent incorporated safety focus. It appeared that the assessment and training sessions displaying a more intensive communication and sharing of production and safety problems, induced a reflection and learning dimension into the daily work practice, making the operational management of safety an integral part of the overall production management.

#### **“Hand & Spirit Ltd.”**

“Hand & Spirit” predominately operates as subcontractor at larger construction sites, at both refurbishments and new constructions. The pseudonym given to this company refers to a metaphor, used in a Danish study (Alsted Research A/S 2003) to sum up characteristics of certain construction enterprises. Companies aligned to this metaphor are oriented towards both the future and the past, are relatively proactive in regard to

surroundings, focus on quality, apply a modern management style, view the building process as a common task, and so on.

Specifically, the company strategy is to delegate responsibility to the gangs of carpenters and to enhance their broad competences. And contrary to a general practice in most construction companies, almost half of the carpenters are employed within a system of employment and wages similar to the white-collar workers. This implicates greater job security, monthly pay instead of piece rates or payment by the hour. Although there is much focus on economy in bids, the company also gives priority to the so-called “soft values”, and the ability to document having a stable workforce, good local management and sound health and safety procedures. The latter could be seen in the light of larger clients’ – especially in the public sector - emerging emphasis on contractors’ ability to meet the challenge of keeping safety standards.

Formally the company complies with rules and regulations according to the Work Environment Act. The owner and director, who heads the company safety committee, in this forum underlines the need to prevent accidents, and also allocates resources to campaigns, prescriptive methods and procedures concerning risk reduction on the sites. Although safety is perceived as one of several competitive parameters, dependency on falling or rising market conditions is also acknowledged.

Correspondingly, the single project focus is on economy, for which the company site manager is responsible. The directors’ and the company site managers’ interpretations of whether or not economy and safety are contradictory, differentiate and are in some instances ambiguous. Some middle managers are, however, solely oriented towards economical issues, which is regretted by the director. Among the site gangs these ambiguities are less manifested.

The overall integrative elements of safety culture, which nearly everyone, regardless of position, adheres to is, first of all, the recognition of a construction site as a risky working place. Secondly, the autonomy of the construction workers concerning their practices and daily planning is much valued. However, when it comes to opinions on how to handle risks, prevent accidents and on procedures and safety work, understandings and practices differentiate across and within groups in the organization. We have labelled the cultures, which the actors could be aligned to as: “Mastery”, “Frames & Rules”, and “Drawing board & Plan”. The cultures cover different risk reducing strategies. Whereas the culture Mastery underlines the need of being alert and taking precautions in the way of working, the culture Frames & Rules stresses a demand to eliminate risky conditions and effectuate rules and regulation. And finally, the culture Drawing board & Plan prioritises effects of own and others’ planning on safety, combined with notions of a need to consider safety in the design phase.

Interpretations concerning safety work at site level differ correspondingly. Members of Mastery find it unnecessary, since they themselves handle risky situations, whereas members of the other cultures – from various perspectives – value this activity. When it comes to company issued risk assessment procedures and methods, they are considered of limited value – across cultures. Procedures are either conceived as mere “paperwork” of no practical significance, or as alien elements in confrontation with autonomous groups. Nonetheless, when comparing different management strategies and styles in the three cases of this study, indications point out, that a management strategy and style as depicted in “Hand & Spirit” has some influence on actions taken on the part of foremen and safety representatives towards other actors of the site

organization. At site meetings these actors more explicitly argue and demand corrections to be taken on unsafe or unlawful conditions, in comparison to the two other cases, which are not described here.

## **DISCUSSION**

Due to an extensive monitoring of process and outcomes of the structural change in the first presented case, all parties had a great interest in achieving positive results. The two sets of safety management devices seemed to gain different interpretations during the work process, and consequently created different effects.

Although systematically applied, the contractor's formal safety management system was by operatives interpreted as merely a top down normative tool for control and registering safety data at the company level, and not in order to provide safety improvements. Moreover, in some occasions of more complex safety problems, the site leader referring to the contractor's audited system as "the good image of the company, which must not be left down, but protected", used the firm's safety policy as a disciplinary means of control. In effect this device, albeit resource consuming, did not exert much visible influence on safety behavior.

Decentralized operational decision-making urged a greater horizontal integration of safety, nonetheless seeming to benefit safety behavior. The new interaction and communication structure represented a medium where the actors in a collaborative manner took ownership of both positive and negative effects of the work performance, including safety, and progressively constructed new meanings. The participative sessions, both production management, work performance and training meetings have as social processes reinforced a sense of interdependence, creating a different platform for autonomy, engagement and sense making. Thus, operational safety management in this case has set focus on new safety critical aspects such as communication and education processes, giving safety a learning orientation. These empirical findings point at that alternative working structures on the site might have a noteworthy potential of setting new meaning giving processes and actions on the safety agenda.

In the case of "Hand & Spirit Ltd." both barriers to and promises of improved site safety could be detected. This aligns to the macro level of society and market and to the company level in relations between management and workers and internally among each functional group, which points out some safety management dilemmas. On the one hand state safety regulation EU Directive 95/57, 24.6.1992) on clients' safety responsibilities combined with some clients' focus on companies' accident rates supported perceiving safety as a competitive factor. This was clearly recognized by company top management, and served to motivate the development of general safety procedures and methods. But among some local site managers and workers, intentions ran into barriers for different reasons.

Site managers often gave priority to project economy, whereas safety concerns were either absent or considered of much less importance. This we ascribe to ambiguity of culture, where two competing rationales were at play. Although company's safety policy was forwarded, the site managers were also measured by their ability to meet budget ends. And top management related to two possibly contradictory and powerful agendas; increased market competition on costs versus safety as a competitive element. However, is it a myth, that high health and safety standards at construction sites are merely expenditures? Recent studies on the effects of lean construction in Denmark (Thomassen et al 2003) on safety and accident rates indicate, that profits of



design and build contractors as well as subcontractors increased, and simultaneously site workforce experienced improved work environment. This was ascribed to the lean concept's more systematic planning and structuring of ordering and deliveries, in combination with the "last planner" functions, delegated to site foremen.

Several meanings on risk causes and correspondingly different action strategies towards accident prevention existed among site work gangs. But sovereignty in handling the daily work tasks was an integrative element, much valued among the carpenters and management as well. Notions of autonomy were, among the workers, replicated in the safety cultures, as manifested in each of the different preventive strategies. In some cases this could explain management's reluctance to impose centrally developed safety procedures on the workers. Furthermore, since they had not been involved in developing the procedures, opportunities of reflecting on the varied conceptions and strategies of risk handling - embedded in the safety cultures - were missed. This also meant, that the workers felt no ownership to safety policies and procedures. Rather, it was perhaps conceived partly as the company's legitimising a safety profile. If the company's strategy of workers' participation and enhancement of competences related to the processes of work is combined with the abovementioned reactions to "official" safety procedures, this could be seen as a possibility of improving safety by more involvement of the site operators.

## **CONCLUSION**

The empirical findings showed that more flattened organizational structures, promoting engagement and participation, either as an integrated company policy or issued through attempts on decentralizing operational decision-making, allocate a different emphasis on safety, setting new meaning giving processes and actions on the safety agenda. A greater horizontal integration of safety seemed to benefit safety behavior. Collaborative interactions on the sites as social processes showed to have the potential of reinforcing a sense of interdependence, creating a different platform for the operative's involvement and commitment in all aspects of site operation processes. Moreover, operational safety management in the cases presented has set focus on new safety critical aspects such as need of more safety communication- and educational processes, giving safety a learning orientation. A notorious barrier in providing a safe site seems, thus, to have sources in the segregation of safety management from operational management, thus attributing it a fairly formalistic status. Both cases have illustrated that formal safety management systems, even audited ones, albeit resource consuming, do not exert much visible influence on safety or safety behavior on the site. They seem to display a symbolic role, employed to strengthening or providing market legitimacy rather than safety on the sites.

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