

# NEW CONCEPTS OF COLLABORATION IN CONSTRUCTION: COULD THEY LEAD TO HEALTH AND SAFETY IMPROVEMENTS?

Tine Herreborg Jørgensen<sup>1</sup>, Marianne Forman<sup>2</sup>, Kresten Storgaard<sup>3</sup> and Susse Laustsen<sup>4</sup>

<sup>1</sup>Aalborg University, Fibigerstræde 13, 9220 Aalborg Øst, Denmark

<sup>2,3</sup>SBI, Dr. Neergaards Vej 15, 2970 Hørsholm, Denmark

<sup>4</sup>COWI, Parallevej 2, 2800 Kongens Lyngby, Denmark

This paper presents experiences with new forms of collaboration in the construction industry and their present impact on health and safety (H&S) at the building site. These experiences and suggestions for improvements were gathered through five focus group interviews with various actors in the construction sector. The interviews reveal that work with H&S and the new collaboration forms at the building site have meeting points in terms of planning, objectives, communication, community spirit, common facilities, coordination, conflict handling, competence needs, and evaluation. The new forms of collaboration in construction have the potential to influence the H&S work in a constructive way.

Keywords: collaboration, health and safety.

## INTRODUCTION

In Denmark, as in most countries, building and construction involves serious H&S problems and accidents. The concept of H&S organisation is regulated by the law and, furthermore, legal requirements are made to H&S activities. For example, an H&S plan must be made for each building site and the work processes must be assessed according to H&S conditions. The high level of accident and H&S problems in the sector has led to a strengthening of the law for instance in terms of placing and distributing responsibility between the different actors in a construction project; especially the client has been given an increased responsibility for H&S. All in all, the actors involved have showed an increased interest in finding ways to support and develop the H&S conditions and the following measures have especially been in focus: placing the responsibility for H&S, improving the planning and coordination of the H&S effort and developing the information tools required to support the H&S work (Forman, Laustsen and Jørgensen 2007).

In construction most activities are organised in projects - and introduction of repetitions and standard procedures are difficult to implement. A construction project

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<sup>1</sup> tine@plan.aau.dk

<sup>2</sup> maf@sbi.dk

<sup>3</sup> krs@sbi.dk

<sup>4</sup> sul@cowi.dk

involves several independent actors within a limited area and period of time, and these actors must be able to collaborate in order to carry through the production of the construction. It is obvious that a bettering of the collaborative processes will increase the productivity, reduce the failures in solutions - and create a potential for increase the H&S on the site. But often collaboration is low, conflict high - and even though the construction business is known to involve high H&S risks, the majority of the construction industry in Denmark has a weakly organised H&S work (Bach, et al 2003).

In the past 10-15 years, attention has been paid to human resources and organisational potentials. The ongoing critique of low productivity, a high number of failures, variable quality and cost overrun has led to the development of new concepts of collaboration with the aim of promoting learning and innovation through improved dialogue and collaboration between the stakeholders (By og Boligministeriet and Erhvervsministeriet 2000).

### **The new concepts of collaboration**

As mentioned the Building and Construction are characterised by a project organisation. This has given rise to a focus on how to transfer experiences from one project to another through an improved way of making knowledge sharing an integrated part of the organisation for instance through systematic gathering of experiences. In the past decade, new forms of collaboration like lean construction, partnering, strategic partnerships and self-managed teams have gained a foothold in the construction industry. These improvements have typically been made in terms of the distribution of tasks and responsibility, planning and coordination, relations across different companies, incentives and methods for conflict resolution. But so far the initiatives on better collaboration has not involved the potential for increase the H&S - In the next paragraphs the new concepts of collaboration are briefly described.

The aim of Lean Construction is to optimise the building process. In Denmark use of Lean Construction is concentrated around Last Planner system. Last Planner system is a planning with focus on flows and good activities. Flows are outer aspects, previous activities, materials, information, manpower, equipment and the next activity. The central actors are consultants and all the actors at the building sites. Until now focus has been on the activities at building site but recently also attempts to integrate the design phase in the concept have made. In Denmark the concept primarily has been developed and tried out in developing programmes and are implemented by some of the large contractors.

The aim of partnering is to shape a transparent business environment and optimize the building process and the product by establishing co-operation based on dialogue, confidence and openness and with early involvement of all partners' competencies. As a minimum the central actors are clients, consultants and contractors. Until now focus has been on the design phase but recently also attempts to integrate the building site have been made. In Denmark the concept has been tried in more than 100 projects. Partnering is part of Danish regulation and the public clients have to assess the possibility for using partnering in public building projects (Gøth 2005).

The aim of strategic partnership is to collect experiences and reuse the experiences through long-term cooperation across several projects. Strategic cooperation has been seen as cooperation between different actors. Several constellations have been identified: A supplier team offers the same product to clients, client and a supplier team work together for a longer period, cooperation between client and facility

manager, joint venture cooperation concerning system products and supplier chain management. Last but not least there exists horizontal strategic partnership between the same types of companies. Strategic partnership in Denmark has mostly character of being informal (Egebjerg and Storgaard 2006; Kristiansen 2006; Storgaard 2006).

The aim of self managed teams is to place responsible and task concerning the coordination together with or as close as possible at the work processes in order to improve the building process within and across the different trades. Concerning the design phase central actors have been counsellors and labour unions. Concerning the building process which is the central phase of self managed teams central actors have been counsellors, contractors, foremen and workmen. The concept of self managed teams at the building site is developed and tested through development programmes (By- og boligministeriet and Erhvervsministeriet 2000; Bertelsen 2005; Marton and Koch 2005).

### **AIM OF THE RESEARCH PROJECT**

However, it has not been systematically investigated how the new concepts of collaboration impact H&S in construction and if a synergy could be created by implementing the new concepts and, at the same time, improve H&S. The new concepts of collaboration could lead to (H&S) problems but could also be viewed as a new opportunity for strengthening the H&S effort. These new opportunities are in focus in a Danish project “Across new forms of collaboration – Development of H&S-friendly processes of construction”. The research project is funded by the Danish Working Environment Authority (Arbejdsmiljøforskningsfondet). The project is conducted by a team of researchers, H&S consultants and project managers. The project began in the spring of 2007 and will finish in December 2009. The thesis of this project assumes that there is a great potential to increase H&S if H&S is seen as a part of the new initiatives of collaboration. But hitherto the new concepts and initiatives on collaboration have as a rule not included H&S activities. If H&S issues are to be integrated into the new concepts of collaboration, the H&S work must meet the new challenges and focus on H&S in the collaboration between the actors involved.

The aim of the project is to investigate:

1. What kind of impact do new concepts of collaboration have on H&S in construction?
2. What impact do the new concepts of collaboration have on H&S work?
3. Could the development and implementation of the new concepts be planned in ways which also promote good H&S conditions?
4. What role could H&S play in the readjustment of construction?

The project is a qualitative development project designed as an iterative sequence, in which each phase is a precondition for the next phase, with ongoing adjustments and corrections of the field of study, methods and results. The project and method used consist of the following main phases:

1. Preparation, gathering and systematisation of existing experiences with the implementation and utilisation of new concepts of collaboration (Literature study)
2. Gathering of experiences with new collaboration concepts and H&S at the construction industry level (Focus group interviews with different actors in the construction industry)

3. Gathering of examples of practice with new collaboration concepts and H&S at the building site level (Interviews with different actors at building sites, observations and data collection in five ongoing construction projects)
4. Intervention at building sites; integration of H&S work in the new concepts of collaboration (Test at five construction project in a one year period)
5. Analysis of the experiences gathered and development of a guideline of recommendations

The aim of this paper is to present and discuss the results of phase 2 of the project, i.e. the five focus group interviews.

### **Focus group interviews**

In the fall of 2007, five focus group interviews were conducted. The aim of these interviews was to gather the experiences with the new concepts of collaboration in construction in the execution phase and the impact of these concepts on H&S and H&S work. Each focus group interview had a title:

1. Partnering and H&S
2. Lean Construction and H&S
3. Strategic partnerships and H&S
4. Self-managed teams and H&S
5. H&S and new concepts of collaboration

The participating actors were chosen on the basis of their experiences with the new concept of collaboration in question. The participants were also chosen in accordance with the objective to mix representatives of various actors in construction in each group and the actors were: Clients, developers, architects, consultants, contractors, foremen, and workmen. Also actors working with H&S issues participated, such as safety coordinators and employee representatives. In total, 30 participants were involved in the five focus group interviews, which each lasted about 2-3 hours.

The five focus group interviews resulted in clarification of barriers and suggestions on how to improve integration of H&S and the new collaborative forms. These suggestions are presented and discussed below.

## **EXPERIENCES WITH COLLABORATIVE INITIATIVES AND H&S WORK**

The objective of the new collaboration forms is to use better planning methods and new types of communication as a way of optimizing the construction process. The questions in focus are: Who shall make plans for what; how shall these plans be organised; which knowledge has to be present, and which types of communication are needed?

A central aspect of the new initiatives at the building site, concerning the implementation of new collaboration forms, is the question how the initiatives from the management can meet the initiatives from the workers? The different actors at the building site have different interpretations of the actual problems and different views on how to solve these problems. A successful meeting between a top-down and a bottom-up approach was seen by the focus groups as an important precondition for the problem-solving, and the challenge is to find the balance between these approaches.

In the following, some of such potential successful meeting points between the implementation of new collaboration forms and the H&S work at building sites are

presented, as they were identified during the focus group interviews. In the following, these points will be elaborated.

### **Framework conditions**

The building sites cannot be viewed as isolated from their framework conditions. Parallel with the development and implementation of new concepts of collaboration, framework conditions are also changed and developed; for instance change in division of H&S responsibility, new regulation of the responsibilities of the safety coordinator, and the use of partnering as a demand to public clients.

The different actors in construction play different roles and have different degrees of influence on the H&S conditions at the building site. In the focus group interviews it was especially stressed that the clients play a key role in strengthening the H&S work in relation with the new concepts of collaboration and H&S.

### **Dialogue concerning "Plan for safety and health" (PPS) and on Risk assessment**

The interview indicated clearly that very often the practical knowledge represented by the building contractors and the workmen is not integrated into the PPS. As a consequence, the plan is not used during the building work. By involving practical knowledge in the design of the plan, the plan would be more useful.

Risk assessment is relevant, both before the building site is established and during the building process. Often the knowledge related to working environment and practice is not taken into account in the risk assessment. On the one hand, it is important to integrate knowledge of practice, etc., into the risk assessment; on the other, circumstances can be of such complex nature that expert knowledge is needed. It is very important that advisers communicate the complex knowledge to the contractors and the workmen.

#### *Suggestion:*

The PPS must be made before the building site is established and actors involved in the practical work procedures should be involved. The quality of the risk assessment could be raised by involving the knowledge of working environment and practice both during the design and planning phase and during the building process at the building site. This could be done by involving contractors and H&S actors in the risk assessment.

### **Formulation of common objectives for H&S**

Partnering involves the development of tools to manage the process, the definition of common goals, the identification of incentives, and the entering of bonus agreements. The experiences presented during the focus group interviews show that this process often takes place without the involvement of sub-contractors, since they were not part of the partnering process. It is also found that the objectives concerning the building site, which are defined during partnering, tend to be a top-down approach. Often different actors will have different objectives and different parameters for success so sub optimisation may be a major barrier for optimization of the total project.

#### *Suggestion:*

Involvement of sub-contractors and workmen in the design of the objectives concerning production and H&S aspects at the building site might increase focus on H&S.

### **Information and communication strategies**

The access to information and the dissemination of information to all actors involved at the building site are preconditions for both the production and the shaping of an acceptable working environment. Firstly, the information channels have to be designed in such way that they reach the workmen, when they arrive at the building site at different hours. Secondly, it seems that the information passing through the different hierarchical organisational lines at the building sites, concerning continuous planning and decision-making, does not always provide the basis for coordination across the different businesses involved. Imparting information through other channels may therefore be a good idea. Different proposals were made by the members in the focus groups. A booklet prepared for the single building site may ensure that all actors at the building site receive information about rules, meetings, expectations of behaviour and performance, etc. Finally, joint information meetings during the building process can ensure that all actors are updated on future happenings and important changes. A general experience from this type of meetings is that they provide the basis for the discussion and solution of problems. Experience also shows that it is very important that the chairman of the meeting is a person with process competence and also that the duration of the meeting is short.

*Suggestion: A joint meeting in the beginning of the building process can contribute to the creation of a cultural framework at the building site and a common understanding of the building processes and the building product.*

### **Ongoing dialogue concerning production and safety**

Ongoing short and long-term planning is necessary during building processes. Lean Construction uses weekly plans and six-week plans to keep an overview and adjust the plans for changes, delays, etc. Foremen from the different businesses represented at the building site participate in the meetings and they coordinate all the activities that take place at the building site. Thus, tools are available to coordinate the activities at the building site, but the general experience is that the H&S perspective is often missing in this coordination. One example is the fact that working activities take place both on the ground and on scaffolds at the same time, and this involves the risk that workmen on the ground are hit by falling tools or materials. By introducing H&S perspectives in the planning process, both coordination problems and H&S aspects concerning the work process can be prevented. Different proposals to activate the H&S perspective were formulated during the focus group interviews. An active interplay between the production process and H&S assessment (APV) could also take place. The APV is required by law in Denmark, and therefore, the proposal is not to invent new activities but to integrate H&S activities into already existing activities.

*Suggestion:*

The H&S coordinator of the building site can participate in the planning meetings or the H&S meetings can take place just before or after a planning meeting.

### **Support of community spirit**

The dominating culture and understanding at the site guide the practices of the building site. Therefore, it is important to become aware of the circumstances which may maintain a "negative culture" and the circumstances which may promote a "positive culture". This is an aspect that interacts with everything described in this section.

*Suggestion:*

Joint activities, for example a party in the beginning of the building process, can support the development of common understanding and team spirit.

**Follow-up on and improvement of the visibility of H&S work**

H&S are often not visible at the building site and not a subject which people tend to talk about. It seems that pictures illustrating good and bad examples and graphs showing the status are effective ways of communication, as they often stimulate discussion among the workmen. During the interviews, it was also discussed who should measure the status, and different possibilities were mentioned: the H&S coordinator, the H&S representatives, the workmen or all of them in turn.

*Suggestion:*

In order to make H&S a visible subject for discussion, methods of measuring the H&S status at the building site and communicating the results to the workmen are very important.

**Common facilities**

To support the informal information flow and coordination between the workmen at the building site, common facilities such as canteen, changing room, etc., has been established. The experience shows that people have to get used to these facilities in the beginning, but after a while, the common facilities function as a meeting place where people can exchange information, etc. Another experience shows that it is important to keep the common facilities clean, not only for reasons of comfort but also due to the symbolic value which the workmen ascribe to dirty facilities. The general idea is that if the basic activities at the building site are not well organised, other parts of the organisation will not be so, either, and mistrust of the management will arise.

*Suggestion:*

Common facilities function as a meeting place and improve exchange of information. It is important to keep the facilities clean.

**Joint coordination of safety precautions**

If safety precautions are not coordinated, situations may occur in which precautions are missing or are only adequate for one of the businesses involved. It was reported that often the single sub-contractor sub-optimizes their precaution and this may result in missing investments in the precaution measures serving all businesses. For example, it is often seen in the renovation of buildings that a lift is missing and the different sub-contractors carry their building materials up the staircase of the building. This involves heavy lifts and bad working positions.

*Suggestion:*

It was discussed if a solution could be the introduction of an independent enterprise managing the safety precautions.

**Methods for handling conflicts**

As a part of the new collaboration forms conflicts are supposed to be handled at the building site between the involved parties in contrast to the traditional procedure, in which conflicts rapidly turn into legal and economic issues. The experience is that a lot of conflicts can be solved at the building sites, but this requires understanding and confidence between the companies and persons involved. If these are not present, the parties will quickly return to old conflict attitudes.

*Suggestion:*

Firstly, common agreements must be made on how to handle conflicts, for example at which level the conflict can be solved and when the conflict has to be lifted to higher levels in the organisations. Secondly, consequences must be defined for those individuals/companies who work against common goals and who do not fulfil the agreements made.

### **Competence needs and competence development**

Concerning the implementation of new collaboration forms and the improvement of the working environment, the necessary competences have to be available or have to be developed. If the competences needed are not present or are not developed as a part of the process introduced by the management, the foremen and the workmen, this process can lead to confusion and resignation. A problem mentioned during the focus group interviews is the fact that some building leaders are young and newly educated and therefore inexperienced. Often they do not have the practical experience required and they lack knowledge about the workmen's competences. It may result in reduced safety, irritation and confusion among workmen, and a stressed building leader, who has a responsibility which he does not have the competence to cope with.

*Suggestion:*

Let new building leaders follow an experienced building leader or have a mentor. Specific education for developing the workmen's competences at the building site was also suggested, concerning working environment, quality and production.

### **Evaluation**

As a last aspect, evaluation is mentioned. The focus groups pointed out the need for a more systematic practice of evaluation. When a building project is finished, all actors are scattered and work on different new projects. The experiences gained through the work are connected to the single actor instead of the organisations and this makes it difficult to apply the experiences from a single project to a general change of practice, etc.

*Suggestion:*

The interviewees find that a better synergy effect would be created between the new collaboration forms and the H&S work, if a systematic evaluation of the work was made in such way that the experiences could be reused.

## **DISCUSSION**

The results of the focus group interviews show that even when new forms of collaboration have been implemented there is still a great potential for improvement, both regarding collaboration between various actors and other activities in the planning and building phases.

The research project is, as earlier mentioned; an ongoing project and the experiences from the five focus group interviews described in this paper will be used in the next project phase, where the practical experiences gathered at the building site are in focus. In this sense, the results from the here reported phase concerning the focus groups does serve as a bed for fostering hypotheses, which we will test and explore further in the next phase of the research project. The hypotheses we have outlined in this analysis are:

Lean Construction can support and improve H&S through a concentrated focus on continuous planning, clean-up at the building site, preparation of activities, and a



better focus on ongoing improvements. On the other hand, Lean Construction can increase the negative impacts on H&S through shorter cycle periods and the reduction of small breaks.

With new incentive structures, Partnering can contribute to a larger focus on H&S among the workmen at the building site, but the success of the new structures depends on the design of these structures.

Strategic Partnership can contribute to the reuse of the experiences and agreements previously made. This can ensure that good solutions are reused, but it may also lead to the development of bad solutions into bad habits.

Workmen at building sites are to a large extent used to plan their own work and there is a risk that more outside planning and control can increase the amount of administration and work pressure on the individual worker. And hereby reduce the workmen's influence on their own work - as well as the motivation to focus on H&S.

If no particular effort is made to involve the actors of H&S in the new planning routines etc., these actors may be distanced from the production, the so-called "side car effect".

The change and implementation processes are central to the achievement of a good result concerning the introduction of new collaboration forms and improved H&S. In big companies, different actors work with production and H&S and new initiatives are often characterized by the lack of interplay and knowledge sharing between the actors involved. A missing connection between the efforts concerning the new collaborative forms and H&S may constitute an essential barrier to success in both areas.

## CONCLUSIONS

In practice, the different concepts of collaboration are not divided, instead they overlap each other. The question is how the new forms of collaboration could be fruitful to each other and how the links between them could be strengthened instead of understanding each concept separately.

Generally speaking, the results show that, in Denmark, the work of improving H&S at the building site has to find a balance between more efficient planning and maintenance of the local system at the building site, understood as norms and values, informal coordination and communications structures, competences and local knowledge sharing.

The focus group interviews resulted in a number of suggestions on how the new forms of collaboration in construction could influence the H&S work in a constructive way. For instance communication about H&S and other H&S activities could be integrated in activities related to the new forms of collaboration.

Lean Construction has a formal planning system which easily may include H&S seen from a rational point of view. In some firms, H&S is seen as the "eight stream" which is included at the weekly meeting. Other firms refuse to do this because it increases the administrative workload. But at the informal level, they do include it, especially when a reduced H&S is seen as a barrier to efficiency. In Lean Construction, precaution should be taken to improve informal systems in such way that they supplement the formal system.

In partnering, special focus is often placed on H&S and a special bonus is paid when no accidents happen. Often, specific H&S education is also seen. The weak points

may be, first, the missing integration of local goals into the efforts and, secondly, the lack of a formal planning system which ensures the focus on H&S work and integrates it into the daily routines.

In strategic partnerships, the same teams often work together on several projects. This gives an opportunity to stick to good norms and traditions – to learn if something failed – and to share the experiences. Also here, a formal system which could facilitate a continuous focus and the integration of experiences into daily routines could support the process.

In self-managed teams, shared norms are very high. Here, the task will be to have a focus on H&S – to let H&S form part of the job.

## REFERENCES

- Bach, E, Hasle, P, Limborg, H J and Roepstorff, C (2003) *Måling af fremdriften i arbejdsmiljøarbejdet: Det generelle arbejdsmiljøarbejde*. Arbejdsrapport. Arbejdsmiljøinstituttet, København.
- Bertelsen, N H (2005) *Den selvstyrende byggeplads: Visioner for mestres og bygningsarbejderes anvendelse og udvikling af tværfaglighed og selvstyring i dansk byggeri*. Statens Byggeforskningsinstitut, Hørsholm, SBi 2005:11.
- By og Boligministeriet and Erhvervsministeriet (2000) *Fra tradition til innovation*.
- Egebjerg, C K and Storgaard C (2006) *Strategiske Partnerskaber i Byggeriet. Modul 3: Case eksempler: Strategiske Partnerskaber i Danske Byggevirksomheder*. DTU.
- Forman, M, Laustsen, S and Jørgensen, T H (Ed.) (2007) *På tværs af nye samarbejdskoncepter: Udvikling af arbejdsmiljøvenlige byggeprocesser*. Delrapport 1. Statens Byggeforskningsinstitut, Hørsholm, SBi
- Gøth, S (2005) *Brug af partnering i Danmark — en dokumentation af byggebranchens brug af partnering*. Temagruppe Partnering, Byggeriets Evaluerings Center.
- Kristiansen, K (2006) *Strategiske Partnerskaber i Byggeriet. Modul 1. Viden om strategiske partnerskaber: generelt og i byggeriet*. DTU.
- Marton, J and Koch, C (2005) *Selvstyrende Byggeplads*. Evalueringsrapport, BYG.DTU, R-110.
- Storgaard, K (2006) *Strategiske partnerskaber i Byggeriet: Modul 2: Fleksible strategiske partnerskaber i byggeriet. Interview med nøglepersoner*. Virksomhedsundersøgelse. SBi.