STRUCTURING COMMUNICATION WITHIN CONSTRUCTION PROJECTS: A COMMUNICATION BREAKDOWN STRUCTURE

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Most construction projects are complex, collaboration-intensive phenomena. Therefore, structuring and coordinating communication within projects is a serious challenge. The Construction Process Protocol is a plan of work that creates a division of activities into sub-processes in three levels. The main idea of this paper is to use a set of IT-based patterns and techniques complementary to business process management to develop a model of collaboration breakdown, integrating Business Process Management techniques with the Process Protocol. According to this idea, the structuring of collaboration within a project relies upon the premise that sets of Process Protocol sub-processes can be represented by corresponding sets of collaborative tasks carried out between various project participants. These collaborative tasks are defined by their participants with corresponding roles, deadlines, statuses, and other collaboration variables. A communication model originating from the presented idea is based on the fact that major part of communication on projects can be conducted in various digital forms and, therefore, easily stored and audited.

Keywords: collaboration, communication, information technology, process protocol, project management.

INTRODUCTION

This paper conceptually demonstrates the possibility of structuring collaborative processes around a formal process-driven project plan of work. For this purpose, the Process Protocol plan of work is used, but the concept can be adapted to other formal plans of work, such as RIBA. The actual concept is based upon collaborative tasks, introduced as central entities for discussing communication aspects within formal plans of work for construction projects.

If minor changes were implemented in the proposed concept, it could relatively easily be used for other types of projects, under the assumption that the level of its complexity is high enough so that the implementation of the formally structured collaboration approach makes sense. By contrast, if the project is of a reasonably small size, it might make more sense to use traditional ad-hoc collaboration methods for it.

Every project can be divided into discrete phases, each of which has its purpose, duration and scope of work. The end of every phase is a decision point where past progress is revised and all key decisions are made for the continuation of the project.

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Thus the division of the project into phases, i.e. the plan of work, is an important part of every process. The division of the project into phases resulted from the desire to find a set of activities that should be carried out in the realisation of every construction project. These activities are communication oriented as they heavily rely upon information flows governed by their participants.

CONSTRUCTION COMMUNICATION

Theoretical Context

Theoretical background on the topic of Communication in Construction spans across a variety of disciplines, putting emphasis on sociological, managerial or technology related issues. The high level of complexity in most communication-related issues in the construction sector has been continually drawing researchers' attention, resulting in a number of publications discussing the topic's various aspects.

The existing literature often makes references to one particular study that has apparently set the foundations for a large volume of subsequent work in the field of construction communication. This study, Communications in the building industry: the report of a pilot study (Higgin and Jessop 1966), highlighted several main issues in construction communication including co-ordination of fragmented teams and discrete portions of work, and the alignment of multiple points of responsibilities within these complex organisational environments (Emmitt and Gorse 2003). Given the fragmentation that to a large extent exists even today in the construction industry, and due to ever more complex projects, the conclusions of that study are still largely applicable to the construction sector of the twenty-first century.

In more recent times, the topic of construction communication continues to be extensively discussed among academics and professionals in the field of Construction Management. Therefore, after more than three decades since the Higgin and Jessop report, the topic of Construction Communication has been extensively revisited by Emmit and Gorse, and even more recently - Dainty. It was found that, in terms of communication, the industry keeps repeating very similar practices to what Higgin and Jessop discovered, while professionals and academics need a better theoretical overview on the complexity of the issue of communication in construction projects. It has finally been made clear that communication within construction projects is a multifaceted phenomenon spanning multiple disciplinary levels, multiple organisational levels and multiple perspectives of interpretation (Emmitt and Gorse 2003, Dainty *et al.* 2005, Emmitt and Gorse 2006).

Therefore, we are seeing a shift in theory from a pragmatist standpoint of trying to increase productivity on projects, to a broad academic insight into the complexities of the subject. In terms of supporting technologies and processes, a similar transition can be seen – one from a formalistic, concept producing, and software development approach to a more integrated view on such a multidisciplinary phenomenon (Alshawi and Ingirige 2003, Charoenngam *et al.* 2004, Lou and Alshawi 2009, Peña-mora, Vadhavkar and Aziz 2009).

However, a large gap still exists between these academic insights and the actual practice on projects.

Practical Context

Most construction professionals are aware that communication in construction projects is reasonably inefficient in comparison to other industries. This is the main

reason why companies and professional organisations are putting substantial effort into improving that practice. During the last decades there have been numerous attempts to advance industry practices with respect to their efficiency, and some results of those efforts are innovative contractual approaches that are increasingly being implemented on projects. However, the industry is still identified as inefficient and in need of significant improvements (Latham 1994, Egan 1998).

A project participant's role is a very important aspect of the Construction Management discipline. Project participants communicate according to their roles during the project lifecycle. A set of communication interactions and corresponding roles is formally given by contractual relationships between the project participants.

When it comes down to an operative level, communication is not only a function of formalised contractual relationships between project participants, but it also significantly depends on local business practices, informal channels of interaction between project participants such as building trust and maintaining control in organisational hierarchies, technologies employed for that purpose, and many other factors.

Given those issues of broadness and complexity, many companies adopt various formal frameworks to establish certain roles and responsibilities in their projects to achieve more efficient mechanisms of communication (Murdoch and Hughes 2007). Furthermore, numerous professional organisations have established their own formal frameworks for the same purpose. One of such frameworks is AIA's Guide for Integrated Project Delivery, which suggests a collaboration intensive approach and early involvement of all project stakeholders to significantly improve efficiency on projects (AIA 2007) and reduce the number of painful legal disputes after projects are terminated.

To be able to use the collaborative concept however, companies need a large amount of IT driven processes. These processes involve careful balancing between technologies employed, people issues and organisational strategies which are very difficult to implement and use consistently (Shelbourn *et al.* 2007). A recent study, for example, demonstrated that when using different collaborative concepts and technologies, virtual design teams operate significantly different than traditional collocated teams (Sher *et al.* 2009), and there are a number of criteria to support that statement.

Similar to the theoretical mainstream, a shift can be identified here from more formal and hard problem solving-concepts to more integrated frameworks including, for example, organisational and human resource issues.

The professionals therefore need new approaches for communicating within construction projects. Those approaches should be based on paradigms of improved efficiency, collaborative work, and should fully take into account the complex nature of communication processes within construction projects. They should include different levels of their several underlying aspects: technology, human aspects and organisational aspects. And finally, they should also be complementary to existing formal plans of work in construction and they should be easy to implement and use.

So far, the authors are not aware of any work undertaken in a similar fashion and this motivated them to propose a simple conceptual model compatible with the Process Protocol plan of work, and with main concepts in construction communication processes.

CONCEPTUAL FRAMEWORKS AND PLANS OF WORK IN CONSTRUCTION

The main idea behind this paper is to ground the concept of communication into a consistent plan of work in construction. Therefore, the main question this paper addresses is:

How can existing plans of work be extended to capture collaborative aspects of projects?

In trying to provide an answer to this question, the Process Protocol was chosen as a certain point of reference, although the authors are familiar with the existence of several other formal plans of work in construction.

The Process Protocol

Process Protocol is a plan of work developed at Salford University (2000). According to the Process Protocol, the construction process can be divided into 4 stages that comprise 10 phases and corresponding processes (Cooper and Aouad 2004). The stages are: Pre-Project Stage, Pre-Construction Stage, Construction Stage, and Post-Construction Stage.

Every stage is further subdivided into several phases, showing the process in more details.

Activity Zones
The Process Protocol classifies project participants in Activity Zones. Each project participant is determined by his responsibility for executing the project. The zones are multifunctional, overlapping and are a structured set of tasks and processes. They cover the whole spectrum of skills needed for a construction project. The Process Protocol contains 9 activity zones (Kagioglou, Cooper and Aouad 1998):

1. Development Management
2. Project Management
3. Resources Management
4. Design Management
5. Production Management
6. Facilities Management
7. Health and Safety, Statutory and Legal Management
8. Process Management
9. Change Management

Limitations
Researchers have been repeatedly reaching the conclusion that the Process Protocol and most other formal plans of work in construction do not sufficiently support the communication process throughout the projects (Hughes 2003). Efficient communication is one of the main risks in this generic division of work (Cerić 2003), and this has proven to be a major drawback for accepting this type of approach in projects.

The main reason for this is that assigning responsibilities within a project in terms of activity zones defined by the generic Process Protocol remains a serious challenge.

Eventually, responsibilities and tasks have to be assigned to a specific person who oftentimes overlaps different activity zones or even includes different roles than generically defined in PP.

Other formal process driven plans of work suffer from similar drawbacks. For example, RIBA plan of work does not control the output of individuals (Hughes 2003) which is a similar problem.

THE MODELLING CONCEPT

Assumptions

This paper will use the terms collaboration and communication interchangeably. However, for the purposes of this paper the authors would like to make a distinction between these two phenomena. In terms of this paper, collaboration is a concept that relates to everyday practical work, while communication is a more abstract term concerning the supporting process that must be maintained for efficient collaborative work to take place. In that sense, collaboration in construction projects takes various forms, depending on the project phase, involved stakeholders, and other factors. This paper makes the sensible assumption that the majority of communication in projects is conducted in digital form.

Frameworks for Construction Communications

Several frameworks have been developed in the past to support communication processes within construction projects. Although most of these frameworks are on a fairly abstract and conceptual level, virtually all of them are based on identifying a series of project phases in terms of communication's form and content that is taking place during a particular phase. According to the authors' literature review, the first of such concepts to be introduced was RIBA Plan of Work (RIBA 1964). Another framework was introduced by Higgin and Jessop and was based on eight stages of building model: (Emmitt and Gorse 2003)

0. Client deciding to build
1. Client consulting with team members
2. Investigating and preparing the brief
3. Sketch plans, obtaining outline approvals
4. Preparing contract documentation and obtaining final approval
5. Agreeing contract and setting up construction team
6. Construction to completion
7. Handing over and setting final account

Designing the Process Protocol was similarly motivated, but the final framework that was produced is extended and innovated so it captures a more integrated view on a construction project (Kagioglou *et al.* 2000).

Although all of the proposed conceptual models were somehow derived from communication processes taking place during the lifecycle of a generic construction project, grounding the communication process from a practical project back into a formal plan of work is not a simple task.

Collaborative Tasks as Basic Functional Elements

In order to incorporate the communication process into the Process Protocol, the centre of the process must be identified. According to common logic, collaboration should revolve around a set of tasks possessing such key characteristics as: participants with corresponding roles, deadlines, status, etc.

Moreover, every sub-process in the Process Protocol comprises its several generic features, according to the framework itself. The level of detail is, however, limited in the model with the consequence that it must be adapted for each specific project if it is to be used in practice.

A relatively smooth transition could be made from the PP defined generic to project-specific tasks, by defining a package of collaborative tasks for every project stage. These tasks must be deliverable oriented and they do not necessarily match the sub-processes as defined in the generic PP. The idea was to translate sets of PP sub-processes into sets of collaborative tasks based on deliverables which conclude project stages. If a matching technology was put into place to support that breakdown structure, collaboration would be defined in details within the framework of PP.

Designing the Model

The Concept

The basic proposition of the conceptual model is as follows:

If project teams worked collaboratively, the collaboration workflow would be supported by the Process Protocol concept. Available collaboration technologies can be used for integrating this communication process into the PP framework.

The flow of communication is shown in the following figure (Figure 1) and summarised in the following passages.

Project participants grouped into activity zones are continually communicating while collaboratively working on a series of collaborative tasks. This set of specific collaborative tasks is specifically tailored for the project it is employed for and for the stakeholders employed by this specific project. This personalised and project oriented communication framework works within the generic Process Protocol because the result of the collaborative task set is a generic deliverable, as defined by the Process Protocol.

That way, communication is structured in one-of-a-kind construction projects to meet key deliverables defined through a formal, process-driven plan of work.

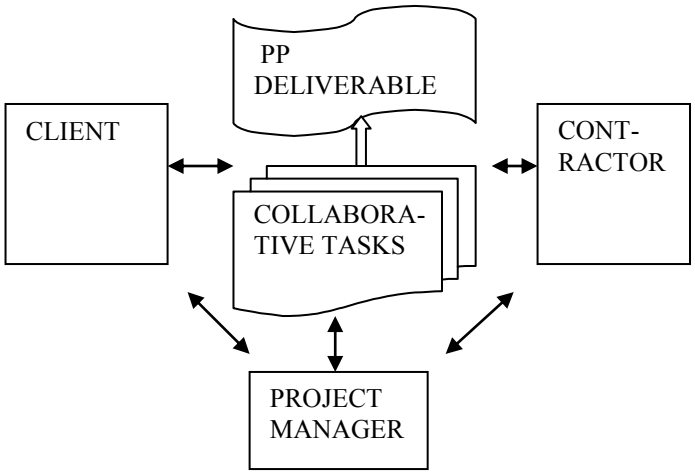

Figure 1 Collaboration flow within the Process Protocol.

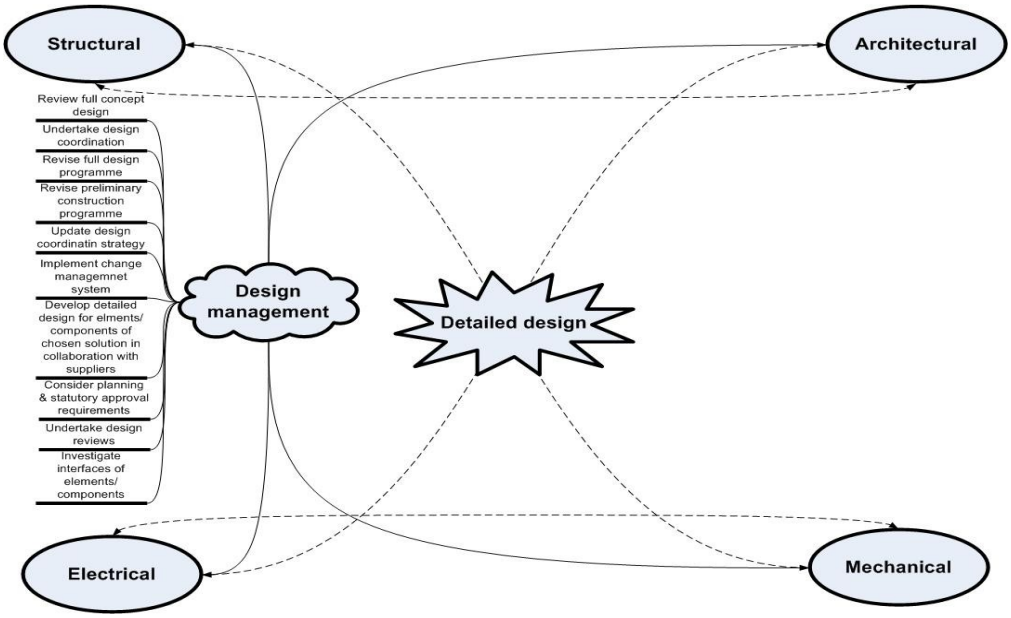

Figure 2 – Summarised communication breakdown within one process of the Process Protocol.

Figure 2 demonstrates an example of two sets of processes that occur simultaneously in projects. This is illustrated in the process of Producing Detailed Design as part of stage 6 of the generic Process Protocol. The first process corresponds to the activity zone of Design Management. The communication process is central to the observed project phase and this is shown on this diagram. The background process that enables producing detailed design is a collaborative task undertaken through communication between an architect, a structural engineer, a mechanical engineer and an electrical engineer. The physical deliverable concluding this stage (Detailed design) is a direct product of the collaborative process between the involved parties.

Similar diagrams can be put together for any other phase of the formal Process Protocol or other plans of work for construction. Underlying collaborative tasks are executed through communication processes that must be aligned with corresponding deliverables. The particular stakeholders involved may vary, depending on a specific project and circumstances of its environment.

RIBA plan of work makes a similar description of its work stage Detailed Design where following stakeholders are involved: Architect (Management and Design), Quantity surveyor, Engineer (Civil and Structural), Engineer (Mechanical and Electrical) and Planning Supervisor. In that case, the concept in Figure 2 can simply be translated into corresponding terms.

Making it work

To be able to use this concept in daily practice, it must be customised to meet the standards of available IT tools. With this in mind, a series of collaborative tasks is set up corresponding to sets of PP sub-processes. These tasks do not necessarily match every specific sub-process defined by the PP, but they should certainly produce the same result (in terms of PP deliverables) and they should include participation of all relevant project stakeholders in person.

Similarly, the concept needs to link to current standards of professional practice in construction projects to be adopted by the professionals. Since a large amount of communication in construction projects takes the form of digital drawings and text, a formal structure similar to the one this paper presents could be theoretically employed in projects.

There are many tools to support collaboration around such tasks so the operational part below this level is relatively simple for most construction professionals.

This explanation is, of course, very generic, but a simple case can easily be reconstructed from Figure 2, where task packages and project participants are shown according to a particular case they are used for. These tasks are represented by task ID, the involved participants, deadlines and data flow between participants. Only then is the collaboration process fully defined and can be put into work by a technology solution.

Different collaborative platforms exist for supporting collaboration of virtual teams and the construction sector is taking advantage of some of these technologies (Nitithamyong and Skibniewski 2004, Wilkinson 2005). These tools employ different technologies for integrating collaboration within a single platform to deliver effective communication by higher data security, greater transparency of the processes and better project results (or deliverables in terms of the PP).

The described process of defining a collaborative model for a project can be conceptually summarised with the following two-step sequence:

1. Defining collaborative tasks with assigned responsibilities by reaching consensus between the project participants and by respecting the contractual relationships given in the project.

2. Defining a project-specific set of collaboration channels and assigning a correspondent set of responsible roles, based on the project structure and process tasks, by employing a convenient tool based on available information technologies.

It can be noted that this approach can be applied not only to communication in construction projects, but to any other complex project structure. The only prerequisite that must be fulfilled is the elaboration of project content through Work Breakdown Structures and Project Schedules.

CONCLUSIONS

Next Steps and Issues

This conceptual framework should be further elaborated and validated in realistic projects and upgraded into a detailed formal model for daily use in construction projects. To accomplish this, formal research methodologies of Sociological Research and Organisational Design should be properly employed to find a concept that works best in realistic projects. The authors, however, think that this concept suggests a useful way of using collaborative technologies in process driven plans of work in construction.

The proposed concept is constrained not only by distinctive features of every particular project; it is also limited by other local conditions. Communication channels and roles for each construction project are more often than not defined by state regulatory systems and project contracts. It is therefore necessary to carefully study these limitations before putting in place any collaboration model for the project.

It is expected that a number of issues would eventually emerge before and during the implementation process of such a concept in construction companies. One of such issues relates to motivating management to use such concepts. Given the traditional resistance to change within the industry, and its oftentimes technologically non-savvy leaders, this might be a significant problem to overcome. Another issue relates to aligning the model with specific company practices and its staff.

The authors are aware that the model is very general and contains many imperfections that would emerge before and during its implementation, but they also think that it captures an interesting idea that the academics and professionals might benefit from and that, as such, it is worthwhile for further investigation.

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