MONITORING USE OF COMMUNICATIONS ON A PARTNERING PROJECT

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Summary

The 'Process and product development in the building industry' (PPB) project in Denmark has acted as a test bed for various types of innovation in building social housing since 1995. Four consortia developed methods of design and construction that were tested on a series of similar housing projects. The development project was supported by the Ministries of Industry and Housing, who commissioned the ITbyg group to monitor use of information technology.

Partnering between the designers and constructors, should have been very suitable for electronic communication. DTU studied various media used during both design and construction stages. It carried out Social Network Analysis of the number of messages, and partners involved, in different methods of sharing data. This is a case study of one consortium and describes its communications over a two-week period and their use to solve a design problem. It found that electronic communication was little used to solve the problem, but Email was generally used and Project Webs were being tried. However even 5 years of partnering is too short for a project team to change its methods of working.

Keywords: Partnering, Communications, Project Web, Social Network Analysis, Housing

1. Introduction

Although the research studied and compared four consortia, this paper can only present the results from one of them. The Comfort House consortium started its first project using steel construction but changed to concrete with prefabricated elements such as bathrooms. This resulted in a gap of 3 years before the start of the project studied, and the contractor used a different project manager. The consortium emphasised energy aspects and used special glass on the facades, and they are pioneers in sharing data using Project Web. The partners are: NCC, contractors, Boje Lundgaard & Lene Tranberg, architects and Carl Bro, engineers. IT is not the only area in which the PPB development project was to explore new ways of

working [1]. Other innovations were: industrialisation, logistics, flexible building systems, intelligent housing and low energy and environment-friendly building.
The objective of the research was to study the pattern of, and media used for, communication both in typical stages of building and when fast communication is required to solve problems [2]. It was hoped to compare how fast and effectively different consortia, using different technologies, solved similar types of problem. In fact there were very few incidents reported and little comparison was possible, although the Social Network diagrams, produced for two-week periods of projects by each consortium, allow comparison of the type and pattern of communications and numerical analysis of their density, centralisation and centrality. Two projects were monitored at the design stage and two during construction. Comfort House was studied at the construction stage.

2. The research method

Social Network Analysis [3] is a technique normally used to determine patterns of communication in social groups. The UCINET [4] software was used to analyse two weeks of communications, and Krackplot presented this data in diagram form showing numbers of messages between each partner. Types of communication were: meetings, post, telephone, fax, email, database, project web & other.

2.1 Monitoring communications

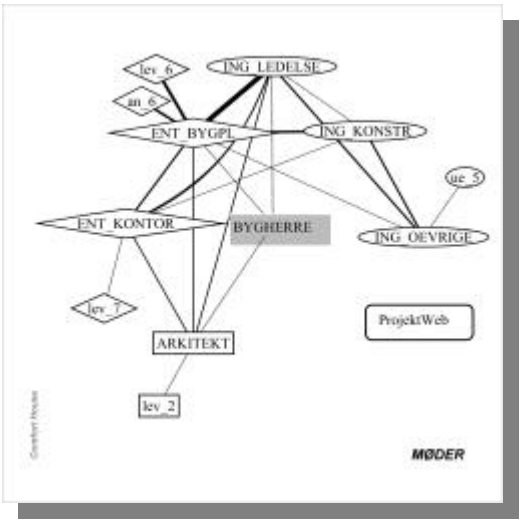
It was hoped that some forms of communication, such as Email, could be monitored by looking at electronic records, but it was decided to collect information on all forms of communication in the same way. A period of two weeks was selected for all project participants to record, on data collection forms, all the messages received and sent, relating to the selected housing project. The forms were designed to make this as easy as possible, and they were explained to each team

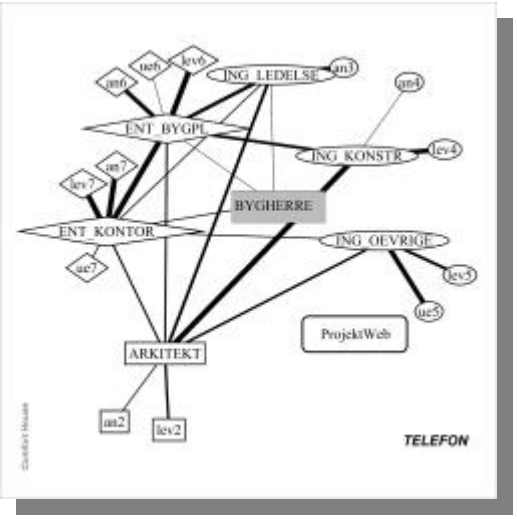
The incidents would inevitably arise spontaneously, and forms were provided for all those involved to record the messages they sent or received to help solve the problem. It was impossible to plan for similar incidents to arise, but teams were asked to select ones that were significant, needed to be solved quickly, and involved communication with several members of the team.

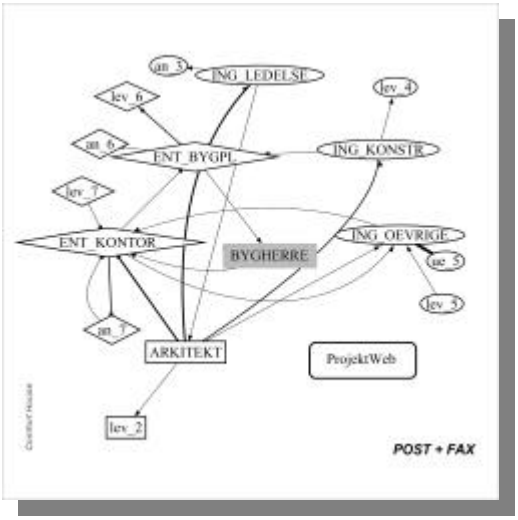
2.2 Sociograms based on the two week study

The presentation of the communications between the main participants on the project studied is designed for quick understanding of the types and volumes of messages sent and received. The sociograms for Comfort House are shown in Figure 1. The weight of each line represents the number of messages exchanged, up to 9 during, the two-week period. Numbers indicate where the messages exceeded 9. Where the messages are directional, arrows are added to show how many were sent in each direction, and whether the Project Web was being uploaded or downloaded

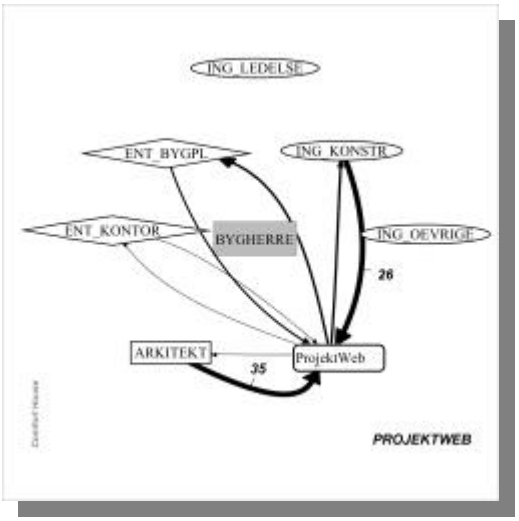
The table giving the average number of messages sent between each of the main parties to the project, over the two weeks studied, is in Table 1.
Rank is the frequency of use of each medium ranked in order of level of usage.
Density is the average number of messages between each main project partner in the two weeks.
Standard Deviation indicates how much variation there was in usage by each partner with the lower figures representing more evenly distributed levels of usage.
All non-IT is the total for meetings, telephone and fax and post. **All IT** is E-mail and Project Web







Møder	Meetings
Bygherre	Client
Ing konstr	Engineer construction
Ing oevrige	Engineer, services
Ing ledelse	Engineer manager
Ent kontor	Contractor office
Ent bygpl	Contractor site
Lev	Supplier
Ue	Sub-contractor
An	Other



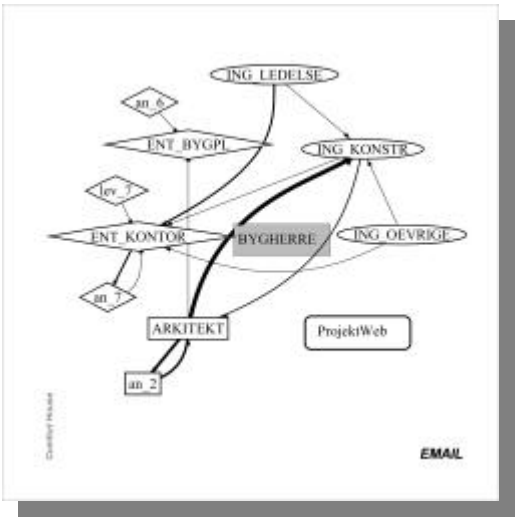


Figure 1. Sociograms showing messages sent and received over two weeks during construction

3. COMFORT HOUSE AALBORG HAVN CONSTRUCTION STAGE

The project studied was Comfort at Aalborg and was only the second by this consortium. The original steel based construction had to be changed to traditional concrete after the first project so there was a gap of over 3 years before starting this one. It used the same partners and the individual architect was the same for both these projects, but the project manager from the Contractors, NCC, was different. They used the same façade system on both. The study project was the one on which NCC used a Project Web first and they gained much experience from this. They use CAD widely but on most projects they send drawings as attached Email files. The communications available on site were not adequate to handle Project Web data.

During the period studied there were relatively few meetings and these mainly involved the Engineer management and the Site but most of the team took part in some. The telephone was also used by all team members, particularly with the site, but was the second form of communication after project web. Post and Fax were used very little, except by the Architect. Data was being uploaded to the Project Web at this stage with the Site downloading it. The Email traffic was mainly from the Architect to the Construction Engineer. There was a high volume of communication at the initial construction stage and it involved mainly telephone and uploading data to the Project Web. This was a project involving a consulting engineer with previous experience of Project Web.

Rank	Medium	No of messages	No of groups	Density
1	Telephone	94	7	4,48
2	Meetings	36	7	1,71
3	Project Web	65	7	1,55
4	E-mail	17	7	0,40
5	Post + Fax	16	7	0,38
	All non-IT	146	7	3,48
	All IT	82	7	1,95

Table 1. UCINET analysis. Density = $\frac{\text{No of messages}}{n(n-1)}$ where n = no of groups. Meetings and telephones are two-directional and are multiplied by 2.

The total number of communications with the Project Web, for example, is divided by 42 according to the formula above, to give the density of communications between each of the main groups compared with each contacting the other once over the two week period. It is therefore more generally used then E-mail or Post+Fax but the telephone is still the most widely used. All non-IT communications exceeds the density of IT communications by a factor of about 1,8.

4. COMMUNICATIONS USED DURING THE INCIDENT

It was the intention to study incidents where change was required as they arose, and the means of communication used to solve them. This is only meaningful at the construction stage when changes become expensive and decisions have to be taken quickly. In the event only the Comfort House project was fully studied at this stage and it provided data on one incident reported in detail by all those involved. The chart in Figure 2 shows the first and the last groups of messages, what methods of communication were used and how long it took to solve the problem.

The total sequence involved 15 groups of messages that were reported on data collection forms, to show how the problem, involving increased separation of windows to meet fire regulations, was solved. It took 89 days to find and agree a solution and most members of the project team were involved in, or informed about, the eventual solution. Each group of messages occupies a separate box. Arrows indicate the direction of the message, and letters the medium used: **M**eeting, **P**ost, **T**elephone and **F**ax. Eksterne Faktorer include those outside the consortium such as fire authorities.

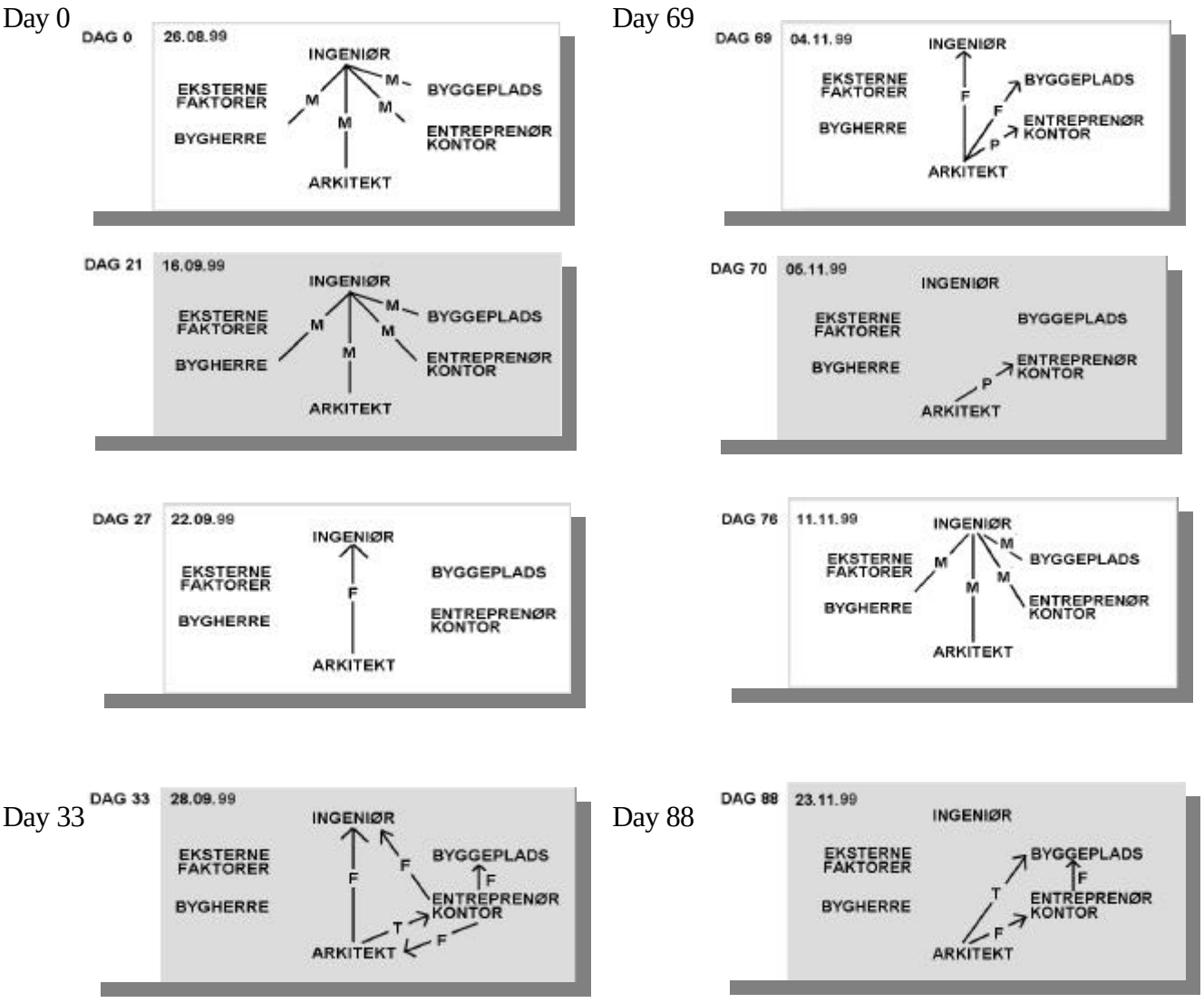


Figure 2. Communication events at beginning and end of sequence of 15 to solve redesign incident

The objective of studying incidents was to see what means of communication are used when quick decisions involving several members of the team are needed. Two meetings were held first, about 3 weeks apart. They may have discussed other matters as well, but there is always a delay in gathering 6 – 10 people together. Reference to design information over the Internet might have been a substitute for this and could have saved some time. The rest of the solution progressed very steadily.

An interesting observation is that, for a consortium with a high level of IT use for communication, there were no IT means used for solving the problem. All messages were by Fax, Telephone and Post.

Elsewhere Fax was used very little, but it still has a role for exchanging quick sketches. It seems that, when a problem arises, unless all the relevant information has been modelled and is accessible through a Project Web, the traditional way of solving problems is turned to. This was a significant problem and took an elapsed period of 89 days to solve and some time from most of the partners. The Snublesten database from Carl Bro shows that it was the second most costly variation but was only estimated to cost the engineers about $ 8,000 to solve. There were also delays to the project that would have cost much more. Had there been greater use of electronic communications, such as email which was in general use, the problem could have been solved more quickly. However project managers tend to revert to traditional means when problems arise.

5. Conclusions

5.1 Significance of communications for partnering – many of the problems experienced by the construction industry in trying to increase productivity are due to the complexity of project teams and the changes that take place in them from project to project. The PPB Project with its continuity for 5-7 years, was therefore an opportunity to improve understanding between partners.

5.2 Conclusions on new technologies - generally these do not replace older ones but continue to exist alongside them. One exception is the wide use of Email and this seems to be replacing Post and Fax. Meetings are still needed for shared understanding of a project, and the telephone, now usable from anywhere on the site, is still the most widely used form of communication. Project webs were the major development during the period studied and the partners gained much experience of their use, but the research showed they were little used by only a few partners.

5.3 Solving problems reverts to traditional methods – although there was only one incident involving design changes during construction that was fully reported, this shows that, when a problem needs to be resolved quickly, people turn to the traditional methods – telephone, meetings and fax. Meetings to initiate a solution are understandable since problems often require input from several partners, but they do take time to arrange and more use of Email would have been expected.

5.4 Level of IT use disappointing – compared with the original proposals for IT use, all the consortia achieved much less, but new technologies have emerged since 1995 and several companies used their housing projects to test out Project Webs. Generally the large firms that are partners used the technology they introduced elsewhere. Levels of IT use in communication in all the consortia, compared with traditional means, varied from 1,8 times less in Comfort House, to 4,6 times less for another consortium, but a third consortium used IT more than non-IT by about 23% Even 6 years is a short time to change human attitudes to means of communication, in spite of theimpressive new technologies available.

6. References

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