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The use of CIC in Construction Business

1. BACKGROUND

The construction industry makes up 15% of Finland's Gross National Product, which makes it a very important part of the Finnish economy. The total volume of construction related business (90/91) was 2 900 USD per capita, the highest in Europe.

90-95% of the Finnish designs (shopdrawings) are carried out by consultants, who are hired by the Owner of the building or the Main-Contractor, depending on the contractual arrangement. Even though the designs are carried out by outside firms there should be a very close working relationship to ensure that the information (CAD, DATA files,...) will be in a format which will be useful for the contractors and manufacturers. One downfall of this system is that the designers and the producers do not communicate. An example of this is that the consultant firm designs a certain type of frame at the beginning of the project and this design is taken to the manufacturers at a later time for pricing. The problem with this is that the producer is the most knowledgeable of the frame. By having the consultant complete the design at an early stage the project is locked into this type design and can not take advantage of the manufacturers know how.

2. TARGETS OF A CONSTRUCTION COMPANY

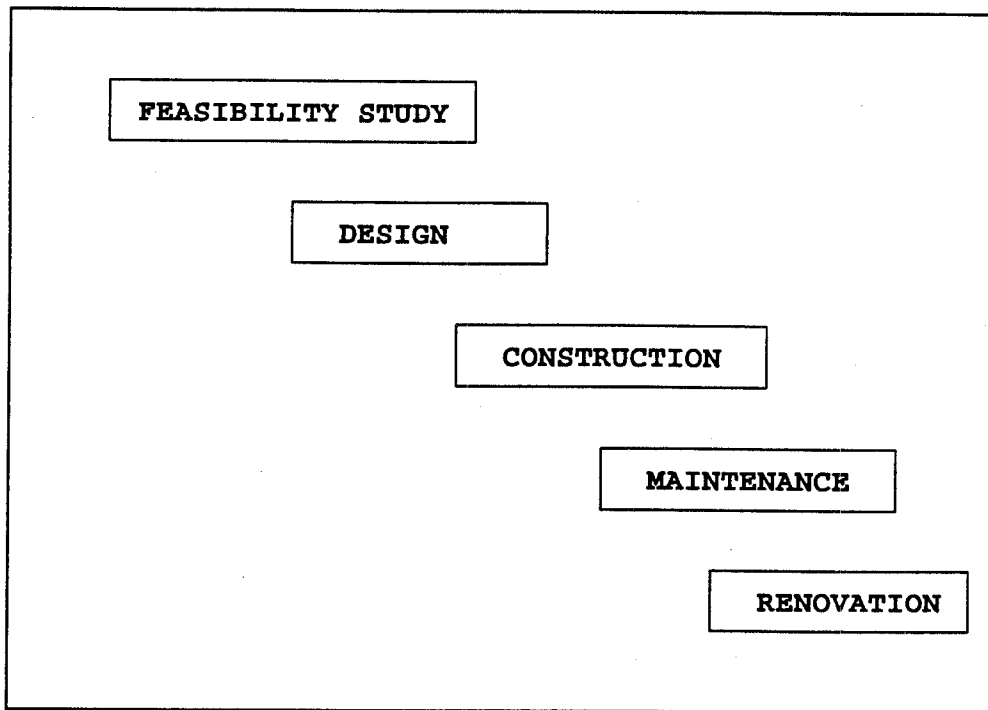
The targets in case Haka are following:

- To find the most efficient uses of computers from the earliest design phases of a project through renovation or demolition, the entire life cycle of a building.
- To manage the data transfer between parties.

-To manage materials/quantities in different design phases (material take off):

- Cost estimation
- Scheduling
- Production planning
- Logistics

-The usage of CAD and Project Data Bank (PDB) at site



(picture 1 building process and its entire life cycle)

Haka decided that the only way to achieve these targets is to use **product models** and the Finnish RATAS-model as a frame. As an initial phase we have concentrated on our own "Turn Key" projects to specify and implement these targets.

3. INFORMATION MANAGEMENT SYSTEM

The basic idea of the Information Management System (IMS) is:

Application interface to construction company's own applications

Information management

- Electronic mail
- Product/Production model
- Working methods
- System management

Standardized external interface

- File formats
- Protocols

The idea is to solve the problem, how we can take different viewpoints for our business applications through IMS where the external parties, especially designers transfer their data.

Typical **Business Applications** for construction company are:

- Marketing
- Tendering
- Cost Estimation
- Production Planning
- Scheduling
- Logistics
- Purchasing

External Parties are:

- Designers
- Site
- Subcontractors
- Workshops
- Manufacturers
- Suppliers
- Client (hopefully in the near future)
- Authorities

In the business applications the product model has also its own lifecycle, there are different phases according to design stages. That is also in the case of production model.

4. TARGETS FOR DESIGN

Haka has decided to concentrate its product model development on the design phase of their "turn key" projects. Cost estimation and scheduling will be follow ups in the near future.

There are four phases in which the design has been divided: Feasibility Studies, Draft 1 (several alternatives), Draft 2 (chosen alternative) and Main Drawings. In the first three of these phases 80% of the total cost of the project has to be decided. Therefore it is very important to have the use of product model to be able to better analyse the different options in these phases.

| Feasibility Study | Design | Construction |
|--------------------------|---|---------------------|
| Feasibility Studies | | |
| | Draft 1 Draft 2 Main Dwgs | |
| | | Additional Design |

In the Feasibility Study the first information is received from the Architect and Structural Designer for the purpose of investment analyses from our point of view and profit calculations from Client's point of view. It is very important that this initial information is the beginning of the Project Data Bank (PDB). The information in the PDB is integrated with the estimating and scheduling programs to create rough costs for the project. This phase is also the time when the analysis and selection of the foundations and frame are made, and the preliminary production schedules are created. It is a goal of Haka to be able to secure Product Contracts (foundations, frame & envelope) at this phase. The idea of product contracts is to purchase the design and final product together in the early phase of the design. In the near future we try to develop a simulation package for this phase using a knowledge based CAD-program to create the product model of the building.

In the phases Draft 1 and Draft 2 the Project Data Bank is becoming more knowledgeable because the Installations engineers have started their designs.

With in these two phases almost all the material and methods are being chosen using the PDB and the cost estimating systems to easily compare the cost alternatives of different products. Additional cost estimates are completed at the end of these phases to ensure that the project is still with in the budget. The production planning and scheduling are also becoming more detailed in these phases. Upon completion of the Draft 1 & 2 phases the project is ready to move into Main Drawings phase. This phase should be relatively easy if the PDB has been updated and maintained properly through the earlier phases.

5. COST ESTIMATION

The basis for planning activities is quick and reliable cost estimating. This leads us to the question of receiving accurate quantities, what are the quantities based on and who produces them (designers or contractors). The theory behind these quantities is that they are also a part of the PDB.

Earlier the designers produced drawings (CAD) and Bills of quantities. The tables are not so useful for construction company, because the need of different viewpoint (use). If the designers produce their output using product model there is the freedom for contractor to use that information their own way as mentioned earlier in the text.

Product model based on cost estimation development is now well underway in Haka and the results from pilot projects are promising. The basic problem/challenge is how to get that kind of design information from external parties?

6. LOGISTICS

Using the product model gives us the possibility to control the logistics of the construction. The goal is to create material specification and quantities for particular areas of building, such as the partition walls or electrical fixtures in a specific room. This type of information requires logistical systems which include information from production planning and scheduling. But it is again a new viewpoint/output from product model data bank. It is a big challenge to manage the logistical chain throughout the building process.

7. SUMMARY

The prerequisite for a construction companies CIM system is that the data transfer between Designers, Factories, Subcontractors and Suppliers is working. In Finland the problem of graphical data transfer has been solved by the development of programs which allow most types of CAD-systems to communicate. But there is a lack of standardisation of the product model-based data transfer. This is going to be one of the major questions in the future.

Visualisation is going to be very important area in the near future. It is useful for marketing but also for production planning. The easiest way to start is simply to use colors.