REPORT

NOTE ON OPEN INFORMATION ENVIRONMENT

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May 2007

The InPro project is an Integrated Project co-funded by the European Commission within the Sixth Framework Programme. More information about the project can be found at the web site: http://www.inpro-project.eu

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1 INTRODUCTION

InPro stands for "Open **In**formation Environment for knowledge-based collaborative **Pro**cesses throughout the life-cycle of a building".

The claimed breakthrough of the **InPro** research project is to deliver a way to implement successfully in the building industry the Virtual Construction[1] approach developed in manufacturing industries such as aeronautics or automotive.

In order to cope with the ambition of such a breakthrough, **InPro** focuses on **early design of buildings**. The **early design** phase starts with the first client contact, and ends with a design including recognisable functions, visualised for easy understanding and with a cost calculation to support the client's go/no go decision[2].

The two main phases of Early Design are: Brief Design[3] and Concept Design.

During the Brief Design, end-user needs, wishes and limitations (like available total budget) are translated into building requirement specifications, especially taking into account the client's processes and related regulations.

Based on these requirement specifications, the Concept Design produces a design of the building that is sufficiently detailed to predict[4] performance, cost and time aspects.

With reference to **InPro** Description of Work, the main output of the research project will be a so-called "***Open Information Environment***" – an advanced system that supports and integrates four different aspects of Early Design:

- Open and flexible collaboration between all stakeholders of the building value chain,
- Design from a lifecycle perspective, based on 3 dimensional building information models,
- Decision support to make "informed choices" based on knowledge of each decision's consequences on the building lifecycle,
- Early planning of build and operation processes based on computer enabled simulation of smart digital prototypes.

[1] Virtual Construction is a process by which the building problems arising during the whole lifecycle are visualised and solved using the capabilities of computer simulation. This approach allows exploring and assessing alternative solutions more easily, quickly than conventional practice.

[2] For instance property developers bring together and orchestrate the skills needed to develop, then build, even operate and maintain a complex real estate project. Relevant disciplines include property development, project management, architecture, structure, energy and other environmental issues, cost estimation and time scheduling. Involved stakeholder roles include property developer, project manager, architect, engineer, estimator and scheduler.

3 or Feasibility

4 within margins according to the level of information available during this phase.

2 STATE OF THE ART

Construction is from the beginning a collaborative activity involving various skills, expertises and trades. Due to the fragmentation of the construction sector, stakeholders are often employed by different companies of various sizes, including large contractors and engineering companies as well as small and medium enterprises or craftsmen. Therefore, for each project, collaboration is driven by contracts.

Collaboration means exchange of data and information sharing within the scope of specific contracts.

Traditionally a construction project is defined by a set of documents including 2D drawings and descriptions. All the art of the designer is to provide a complete description of the project with a minimum number of documents, without neglect or allusion, with a minimum of redundancy in order to facilitate the reading. The complete 3D model is only in the brain of each stakeholder, assuming that all have the same vision.

Today, due to the job site organisation, 2D drawings are the **only** documents used by workers.

In conventional practice, information sharing is paper-based or digital-based without interoperability, transmitted through post, e-mail or collaborative work spaces. Coordination between project disciplines is based on 2D drawing information which is updated manually. Exchange tracking is monitored thanks to procedures describing document numbering, dispatch and validation. The coordination process is a key process in order to maintain information consistency and to guarantee that the construction will be erected according to the owner specifications.

All disciplines work in parallel in a so-called concurrent engineering process, using data that are updated regularly to take into account clashes, coordination actions and increasing level of detail. Cost and time are key constraints.

Due to the difficulty to maintain an adequate geometry for each design aspect, buildings are mainly designed according to code requirements, personal experiences and rules of thumb. Each discipline constraint is addressed at trade level. In general, there is no global approach and optimisation. Consequently, a lot of errors are only identified on the job site and therefore corrected lately with a consequence on quality, time and cost.

Nevertheless, this description of the traditional approach shall not imply that 3D models are not used. A lot of dedicated and efficient tools are available on the market, mainly addressing the architectural point of view. The expected 2D-drawings are specific points of view of the 3D-model which therefore maintains the global consistency. As long as the project – that means the 3D-model- can be managed by one designer, it works and results are huge. But, as soon as more than one designer is needed, due to the project size or the necessary skill range or the time frame, it does not work properly. The problem is clearly at collaboration level.

3 INPRO OBJECTIVE

Such a problem has to be addressed globally, that means that the five following axes have to be analysed. What **tools** are needed? What **methods** have to be applied to use these tools efficiently? What business **processes** have to be revisited? What **organisation** is mandatory to support the revisited processes? How is the **enterprise** concerned? The business processes have to be revisited in front of the new technological capabilities. This is applied in the **InPro** project through a dual approach: business and technology

A Building Information Model (BIM) – that is the implementation foreseen in the frame of the **InPro** project – means 3D global approach. Object oriented project modelling facilitates interoperability. Complete coordinated and up-to-date 2D-drawings are specific views of the global digital model. Up-to-date information can be extracted to feed up the geometry needs of the simulation tools.

Smart and friendly software packages addressing BIM's needs become more and more available on the market. But up to now the model is updated only by one person. There is no model sharing, i.e. concurrent access on the same model. This mono end-user approach is sufficient as long as the model can be managed by a single person according to the level of detail, the size of the project, the project development schedule.

Organisation and software package capabilities are mandatory for model sharing.

A Building Information Model is a collection of objects organised by sets. In case of a collaborative work, a common and shared object breakdown has to be defined. The information related to each object has to be managed only by the person responsible of this update. The other users can read but not update this information. The object breakdown and information responsibility has to be described in an organisation procedure specific to each project. In addition, the Building Information Model has to be able to cope with that access policy.

In conventional practice, the drawing list takes into account these various point of views: functional, geographical, trade and schedule. In conventional practise, the components of the building, the so-called "parts" in manufacturing industries, are not explicitly detailed on the drawings. But this part list becomes mandatory for exchanging objects on a common basis. A product data management (PDM) addresses this in manufacturing industries. Are our actual difficulties in sharing BIMs due to the lack of a specific PDM?

Sharing models does not necessary mean implementation on a unique server. For organisational purpose, companies involved in a project are not necessary located in the same building. This implies that parts of the model can be exchanged. Actually there is no software editor that is leading the market. Consequently, it happens often that different stakeholders acting on the same project don't use the same software packages. This implies a neutral exchange format, which means open and flexible collaboration.

Exchange implies the ability to track and check the exchanged information, i.e. the availability of adequate tools.

2D drawings are still the main form of contract documentation used in the construction industry. Blue collars –the end users on the construction site- use drawings. The validation process is based on red lining of drawings. Consequently, even if a global 3D approach offers significant improvements to conventional drawing production, the validation process has to be addressed as a process based on 2D drawings issued. In particular, a set of 2D drawings describing completely the project is associated to the global 3D model and extracted directly. As a result, drawings have a higher level of coordination and always reflect the most current information, assuming that comments reported on the drawings, for instance by red lining, will be updated directly in the global 3D model.

4 CONCLUSION

The Open Information Environment is a set of results due to the junction of two approaches: on one hand business processes and the required organisation and on the other hand the underlying technologies supporting the business processes.

Detailed definition, selection or development of methods, tools and application should be done in several InPro tasks.

Expected results should include:

Business processes

- Statements describing the object breakdown of the 3D model (Tasks 1.2 and 2.2),
- Statements describing the associated 2D drawings used for validation, including management and consistency, e.g. versioning of the 3D model (Tasks 1.2 and 2.2),
- Statements defining the responsibility of each stakeholder regarding information management (Tasks 1.2 and 2.3),
- Impact on contracts (Tasks 1.2 and 1.4),

Technologies

- Description of the object breakdown of the 3D model (Tasks 4.2 and 3.3),
- Open exchange standards (Tasks 4.2 and 3.3),
- Software packages for checking and tracking the model updates (Task 3.2),

Software packages for managing 3D global models with respect to information access rules (Tasks 4.2, 4.3, 3.3 and 3.4).