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Concurrent Design Applications in Construction, Offshore Industry and Engineering Education

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InPro

InPro is a European Integrated Project (under FP6, running from August 2006 to November 2010), in which TNO is highly involved as a Dutch partner. The partners further include several large European construction companies such as NCC, Hochtief and Bouygues and universities such as Bauhaus University Weimar and Lulea and various other institutions and companies. The goal of this research project is to create an Open Information Environment for knowledge-based collaborative processes throughout the lifecycle of a building. Aiming on improvements in the Early Design phase in the construction sector, this project consists of three focus areas [1]:

- Business pull - Business concepts and processes that provide incentives for model-based working and open collaboration between all stakeholders
- Technology push - Smart, fully semantic ICT enabling and exchange, sharing and reuse of information throughout the building lifecycle
- Industrial transformation - Support actions for direct implementation in the European construction sector

Following the positive experience using CD within the Omnium project, J-CDS was invited by TNO to participate in the already running project of InPro to bring in its knowledge of CD as a method that is very well suited to be applied in the Early Design phase in the construction sector.

After inclusion as a project partner in the second year, J-CDS is involved in several tasks within different work packages, corresponding to these three tasks. The main focus is to bring knowledge from a Concurrent Design perspective into developing new business processes.

Business pull: Concurrent Design in early design

One of these tasks was Task 2.3 'Capturing stakeholder values', within the work package 'Early Design Processes' for development of new business processes. The objective of this task was to create a framework of formalised early design methods for capturing the needs and preferences that add value to society and citizens, clients and users and the construction sector over the life cycle of a building. These values should be translated into functional requirements and attributes for the specific business case to give a clear set of design targets for the lifecycle design process [2].

As part of this task work a Concurrent Design activity was performed, taking the Swedish Post head office as a case. The intention of this activity was not the parametric design itself, but using CD to capture stakeholder values. Each stakeholder needed to model their part of the design, asking input parameters from other disciplines and generating output parameters. These parameters were subsequently analysed and

discussed to identify the underlying stakeholder values connected to these parameters, clearly bringing forward the influence of each individual stakeholder on the others.

As a result of this task a formal InPro framework for capturing stakeholder values was developed to establish project goals, capture stakeholder values, translate these to requirements for the design and connect these with performance parameters that ultimately need to be fulfilled by the resulting design. From the results of the case study a generalised list of value groups, stakeholder values, requirements and parameters was developed as the InPro template that can serve as input in this process. Within this framework, CD is recommended as a suitable enabling method to capture the goals, stakeholder values and corresponding requirements and parameters in a project [2].

Technology push: Requirements Mapper

Work on the Requirements Mapper was initially started by J-CDS to have a more graphical tool available to make the analysis of the results from the CD sessions within Task 2.3 easier. Due to the positive results and the promising outlook of the work performed in the task of capturing stakeholder values this tool was subsequently developed further to be able to support a design process according to this InPro framework.

In CD sessions with all the relevant stakeholders present in the room, the participants can engage in discussions and interactions in a process that is structured by the team leader and the project (or model) manager, the role in the construction sector that takes on the role of the system engineer. In this process a project specific map of the goals, stakeholder values, requirements and parameters is created in the Requirements Mapper with contributions from and in consensus with the whole team.

The Requirements Mapper can be used as a self-standing tool or the set up can be used as a fully integrated part of the CDP when CD is applied to this process of capturing stakeholder values. In both cases it is possible to create a direct link between the performance parameters in the project specific requirements map and the design parameters coming from the integrated design in the CDP in the following CD sessions to create various design alternatives for the project. This tool is seen as a valuable addition to the CDP toolsuite in support of the Concurrent Design process.

Industrial transformation: training module 'Client Requirements'

The Requirements Mapper, after its initiation in Task 2.3, was further developed and used in support of a training module in Task 7.2 'Business courses' within the scope of InPro work package 7 'Training and education'. This workshop with the title of 'Client Requirements' has as a subject the InPro framework of capturing stakeholder values. In this workshop the framework is introduced and explained in several learning blocks. In one of these blocks the Concurrent Design process as enabling method is presented, accompanied by an exercise with the Requirements Mapper, linking the goals, value groups, values, requirements and parameters as brought forward by the participants in the workshop on an example project [3].

A Dutch InPro workshop was organised by J-CDS and TNO, in which a short version of this workshop was given as a 2 hour session in a parallel track. Emphasis was given on illustrating the concept by going through the process taking a real project provided by one of the participants as a subject, creating a project Requirements Map for it. The choice was made to start from scratch, keeping the InPro template available as a backup in case the process would get stuck.

The subject was a Dutch project 'Vlaardingen stationsgebied'. This project consists of a remodelling of the area around the central railway station in the city of Vlaardingen. This was done at the suggestion of the architect from HET Architecten, participant in the workshop and involved as architect in this project, which is commissioned by the municipality of Vlaardingen, NS Poort, Careyn and Domoflex.

One participant acted as client or sponsor for the project, the others were divided to represent the stakeholder groups of users, the construction sector and citizens/society. In the highly interactive 2 hour workshop session a project Requirements Map was created, having identified and discussed a total number of 7 goals, 11 value groups, 21 stakeholder values, 20 requirements and 4 parameters. The main overlap between the resulting map and the InPro template was in the value groups: 7 out of 11 are in the InPro template as well. Due to project specific characteristics slightly different aspects were covered in the further identification of stakeholder values, requirements and parameters, although a lot of items from the InPro template would very well fit in a more complete map for this particular project, showing its valuable contribution if applied as input to real projects [3].

The participants indicated that they found this a powerful approach to actually create the needed project information together that is often missing in other processes or methods. One of the most encouraging

remarks from one of the participants was that although he had the impression that issues were being discussed more and less as they came up during the session the resulting map was valid and surprisingly well structured. This is partly due to the ease with which the information put forward by the stakeholders during the process can be created, changed and linked in the Requirements Mapper.

REFERENCES

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[3] Dehlin et al, (2010), InPro Business Courses, Deliverable D37, The InPro project, unpublished.