The Application of BIM as Collaborative Design Technology for Collective Self-Organised Housing

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ABSTRACT

Collective Self-Organised (CSO) housing projects are an emerging trend in Europe. In these projects communities engage in co-design throughout the process. Little knowledge exists that can support CSOs with the process of managing their projects by using state-of-the-art building information (BI) technologies. The authors introduce a BI supported CSO housing design process that can support CSOs through all stages in the design process, from early conceptual location planning through to selection of interior finishing. They illustrate the project using a demonstrative illustration of a CSO housing design process. The paper will concentrate on the development of innovative Collaborative Design Technology (CDT) solutions. The tools will be demonstrated on the basis of an illustrative demonstration case in which the CSO-process is combined with an IFD (Industrial, Flexible and Durable) building system. The particular advantages for architectural design practice will be highlighted throughout and gaps in the literature addressed.

Keywords: Augmented Reality, Building Information Modelling, Collaborative Design Technology, Concept Modelling, CSO Housing, Participatory Design, Virtual Reality

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1. INTRODUCTION

1.1. The State of the Art of CSO in Europe

This paper refers to the ongoing EU Framework 7 project PROFICIENT, that deals the development and validation of new processes and business models for the next generation of performance based energy-efficient buildings, which will create business opportunities for SMEs in the construction sector by exploiting the emerging process of Collective Self-Organised (CSO) housing for the constructing and retrofitting of energy-efficient residential districts. The project addresses the emerging and rapidly increasing trend in Europe of CSO housing.

In a CSO housing process a group of homeowners purchases a piece of land or existing properties; procure professional companies for design, construction and maintenance, and directly manage the project from planning until delivery and use. CSO Housing is a growing market. Recently launched policies and action plans by governments in a number of EU countries indicate a doubling of the current market over the next decade. The demonstration and experimental phase of CSO housing development has proven the value of this concept. For instance, in the Netherlands, in the past 10 years, successful pilot projects in various municipalities across the country have been carried out under the SEV subsidy and supervision programme (SEV, 2010). The UK government claims that “self-build homes are often cheaper, greener, more affordable and more innovatively designed than standard market housing” (DCLG, 2014), and plans for an extra 25,000 self-built homes each year.

1.2. Problems with CSO Design Processes

A number of barriers and constraints to successful implementation of CSOs have been identified (Gerohazi et al., 2014). As Sebastian et al. (2009) argue, the traditional design and implementation process for housing is fragmented, inefficient and can lead to “10%-25% loss of efficiency in each project due to unplanned redesigns and ad hoc modifications during the construction. This inefficiency results in delays in the delivery, suboptimal end-product quality, a higher price for the client, and lower revenue for the building participants” (p. 2).

The CSO housing process, however, inserts the client at all stages of design and implementation, not just at initial briefing stages. A further complicating factor is the collective nature of CSO communities and the need for joint decision making between members of a group that may include different members at different stages of the process, as new members join and others leave (Gerohazi et al., 2014). It is to address these difficulties that the particular Collaborative Design Technology (CDT) model presented in this paper is proposed.

From the SME perspective, as a sector they have the power of knowledge, design, construction and product expertise that ensure the contractor is the gate keeper to successful CSO implementation and the adoption of energy efficiency building (EeB) measures within CSO projects. Adopting Roger’s Diffusion of Innovation model (2003), it can be seen that, with the exception of the first adopters and innovators, the other adoption groups cannot be expected to delve into the unknown world of EeB technology without the guidance and expertise of qualified contractors. The first adopters, the innovators, are the only group that could be expected to implement new EeB technologies without the support of government and contractor’s expertise. Without the contractors knowledge EeB technology would never be more than a niche market, the majority of the public will find the process too daunting to start alone (Olsson et al., 2004). Further barriers arise due to the iterative nature of the CSO planning process. Time scales of CSO projects can easily outstrip more ‘normal’ planning and construction processes, as designs are negotiated with community end-users (Gerohazi et al., 2014).

CSO communities, on the other hand, have the power of choice. CSOs often have more
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