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A Conceptual Idea of Participatory Design with BIM

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Abstract

This study aims to investigate the participatory design by using BIM concept and how to increase the quality of life through BIM during the design and usage process. For this purpose, user participation and BIM relationship examined through examples from the world. This paper describes a BIM framework which enables designers to involve users by using information technology. It demonstrates that participatory design approach combined with BIM can make a significant contribution towards an increase in performance in building and in the quality of life.

Keywords: BIM; participatory design; collaboration; user needs

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1.0 Introduction

In reality, architecture has become too important to be left to architects. A real metamorphosis is necessary to develop new characteristics in the practice of architecture and new behavior patterns in its authors: therefore, all barriers between builders and users must abolish, so that building and using become two different parts of the same planning process. Therefore, the intrinsic aggressiveness of architecture and the forced passivity of the user must dissolve in a condition of creative and decisional equivalence where each-with a different specific impact-is the architect, and every architectural event-regardless of who conceives it and carries it out-is considered architecture."

Giancarlo de Carlo

Participatory design is a change proposed by De Carlo in the early 1970s to remove the limits between the designer and the user. De Carlo suggested challenging the architect or planner's authority by making the process healthier with the participant or the user in the design and by saying the user's desires and needs for the urban space. The main idea is to create an environment which is more livable, economical, and supply-demand relationship by providing a contribution of users besides the architect or designer. With the participation of users, comfort requirements in the building met in a healthier way (Uzer, 2017).

A common opinion should meet so that the conscious user wants to take part in the design and to cooperate with the designer. A shared dialogue environment is required for the user and the designer to meet the same opinion. In the mid-90s, software that supports the new design approaches that allow the creation of this dialogue environment has begun to develop. Building Information Modeling (BIM) creates a common dialogue environment for the user to share information with the designer. The user and the designer can make all kinds of arrangements in cooperation with the three-dimensional information model of the building (Atay, 2011).

In participatory design, it recommended that the user or designer focus on requirements rather than prioritizing their agenda. In the participatory design process, where participants should be aware of their duties and responsibilities, it is an essential issue that participants should be involved in the design process within the boundaries. More reliable communication can achieve between users and design experts in participatory design using BIM. BIM enhances the interaction between the actors in the participatory design, helping to produce realistic design solutions.

Today, the projects characterize by collaboration between multidisciplinary parties and are highly dependent on the communication between them. Building Information Modeling (BIM) is the use of the computer-generated model to simulate the planning, design,

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construction, and operation of a facility; a technology that allows users to create a visual simulation of a project with a digital prototype of a building before construction. The computational model of BIM forms an environment that serving the various disciplines of the design process to work together. The concept of BIM aims to minimize concerns arising from the time, cost, and quality of the changes in the design, and implementation of construction projects.

This study aims to investigate how the concept of BIM can contribute to participatory design. After briefly mentioning the concept of BIM, the idea of participatory design explained. Although there are several research studies on participatory design, few studies are examining the use of BIM in participatory design. For this reason, the concepts of BIM and participatory design discussed separately, and the proposed framework shows how these two concepts can be related. BIM supported the participatory design, and participatory design processes examined by investigating two specific examples.

2.0 The Concept of BIM

In most new building projects, design teams work collectively in a shared BIM (Building Information Modelling) model. This offers many opportunities to use BIM technologies as a platform to exchange and record design preferences and decision criteria. This is particularly useful during the early design stages when different design options are investigated.

BIM for Building Information Modelling is a concept that appeared in the middle of '90s. The idea of BIM is to integrate all building information in one only theory. Although the name initially found by Autodesk, it used by other software developers such as Graphisoft and Nemetschek.

BIM is defined by IAI (International Alliance for Interoperability) in three different ways:

- Interoperable digital presentation of physical and functional characteristics of a building based on open standards
- A shared database of the building that uses during the whole building lifecycle by different areas and professionals.
- The collaboration between different areas and professionals that aim to add, change and renew building information during the entire building lifecycle.

Many countries, particularly Northern European countries, have developed their own standards of BIM. “National BIM Standards” (NBIMS, 2008) in the USA, “building SMART” (NO 2008) in Norway, “CRC Construction Innovation” (CRC CI 2008) in Norway, DK (DK 2008) in Denmark are among the best- known national BIM standards.

It is defining BIM as software type reduces its importance for design and construction processes. Eastman et al. (2011) state that it is necessary to understand BIM as a wide range of concepts, activities, techniques, tools, and subjects united in complex relationships and distributed in all activities related to the construction industry.

By using BIM technology, the designer, "build" virtually a building model through objects that simulate the behavior and shape of constructive elements. The virtual models can understand as databases, where stored both geometric data and text information of each construction element used in the design. The combination of this data enables the automatic extraction of documents such as plans, sections, perspectives, and quantities to take off (Brix, 2006).

The usage of BIM in Architecture, Engineering, and Construction (AEC) sector has been increasing rapidly. The concept of BIM contains the formation and the usage of the design, construction, and management knowledge of buildings. The computational model of BIM forms an environment that serving the various disciplines of the design process to work together (Turkyilmaz, 2013).

BIM is the use of the computer-generated model to simulate the planning, design, construction, and operation of a facility. It is a technology that allows users to create a visual simulation of a project with a digital prototype of a building before construction. The deployment of BIM in construction can make the industry more efficient, effective, flexible, and innovative (Takim et al., 2013).

BIM is a digital database that contains physical and functional data of the project (Reddy, 2012). BIM provides effective cooperation, visual representation and data management, enabling a smooth flow of information throughout the life cycle of the project (Georgiadou, 2016). BIM creates a new paradigm and work environment by integrating whole stakeholders of construction sector. This integration has the potential to achieve greater efficiency and interoperability between stakeholders who see themselves as adversaries in traditional ways of working (Azhar, 2011).

BIM foresees that the information retrieved from paper documentation that can be easily lost passed through a standardized, sustainable and developed a common digital model (Building Information Model), stored and used throughout the life of the building. According to Eastman (2011), BIM is one of the most promising developments that allow the creation of one or more virtual digitally generated models of a building to support the design, construction, manufacturing and purchasing activities of the building.

BIM applications have gained a lot of attention in various structural engineering operations (program improvements, cost estimations, data documentation and interoperability, design team communication), as reported in an extensive review by Eleftheriadis et al.(2017). Today, the construction sector is experiencing rapid change and development. Complex structures require a consistent and sustainable flow of information during both design and application. The importance of collaboration with cost and time factor increases in the implementation of these buildings. Disruptions in the flow of information prevent the formation of collaboration and cause a decrease in productivity.

3.0 Participatory Design

When we examine the problem of participation in the architectural profession in the design process as two different situations; the first one is the perspective that protects the traditional attitude and that design is a field of expertise and the only actor in this process is the

architect. The second case proposes a method and point of view in which the user may be involved in the design process without losing the control of the professional knowledge and experience of the designer.

Current design discourses is based on some principals such as "focusing on the user, acting together", "paying attention to group identities and preferences", "proposing spatial diversification by establishing intimacy, "evaluating the perceptions, experiences and satisfaction of the subject" and "being involved in design and decision processes" (Ersoy, 2010). With the increasing communication possibilities, the exchange of ideas increases, and the concept of participation in design as it is in every subject is a demand of society now. User participation design in space and environment issues gains importance today.

John Turner defines designers as the "facility server." Turner's discourse goes beyond the idea that residents should build their own houses and neighborhoods, and in their book "Freedom to Build," he says that people should take control of finance and administration. In his book "Little Change" Nabeel Hamdi argues that the systematic effects of organized systems in urban life on the bottom-up rather than ceiling-to-ceiling would be more effective in carrying out significant changes with meaningful results within communities.

In participatory design, stakeholders in the design process often involve future users. Designers can shape their plans within the framework of the information they have acquired by observing the lifestyles of the users, or they directly require the users in the design. In this process, designers; sees attitudes towards social networks, behavior patterns, and existing areas, and asks users for their preferences and receives feedback. Participation at the highest level is where users directly influence the design by collaborating with the designer.

Collaboration in participatory design sometimes misinterpreted. In large-scale projects, participatory design can be more complicated than small-scale projects. In cases where the user misled, manipulations occur, and instead of taking advantage of the knowledge and experience of the designer, practices such as trying to push him out of the process by reducing his responsibilities can realize.

The positive aspects of participatory design can be listed as follows:

- It improves the quality of the design.
- It considers the rights and freedoms of the user.
- It reduces unnecessary costs.
- It helps to create understanding architectural products.

Negative aspects of participatory design are:

- The possibility of future use problems is high.
- Profits can be kept in the forefront.
- Excessive demands can prevent designers from managing project processes.
- During the design process, the user can take under the control of designers.
- Unplanned participant design processes can damage the built environment.

4.0 Examples of Participatory Design

4.1 İstanbul, Sulukule Urban Transformation and Renovation Project

Figure 1. Several views from Sulukule before demolition (http://www.fatih.bel.tr/icerik/1155)

The urban transformation in Sulukule, located in Fatih district of Istanbul, is a transformation and renovation project in which the participatory design failed. It is one of the most critical urban transformation projects in Istanbul. About 5500 people, 3500 of whom are Romany, lived together in the region for many years (Kıyak, 2007). In Sulukule, 48% of the total population is the owners, 42% is the tenants and 10% of the illegal occupiers. For Sulukule urban transformation, the expression "no one will not damage by the results of transformation projects," said many times. On the official website of Fatih Municipality, the primary purpose of the project stated as "enabling all resident families to live in the neighborhood" (Unsal, 2013).

When the design processes of the Sulukule project monitored, three stakeholders found; invitations to participation (local authorities), participants (Romany) and architects, planners, and voluntary organizations participating in events and platforms. The Sulukule project has gradually lost its claim of being a social project from, leading to manipulation in the region under the name of participant design. (Figure 1.)

Almost complete exclusion of residents from decision-making processes is a significant problem. There has been much speculation in the region. Because accurate and comprehensive information has not passed on the residents. As a result, as the real estate values increase, the residents of Sulukule, who are generally low-income, have to migrate to other areas. They cannot pay the monthly installments or rents of the new buildings (Ökem & Bavilolyaei, 2018).

The size and strength of the community organization in all kinds of projects carried out with participatory design is a crucial factor in determining how the projects will implement and what their socio-economic consequences will be. Active and continuous organization movements, especially when combined with the organizations in the society, will challenge the hierarchical social structure and provide significant gains in social participation (Eckstein, 1990)

Figure 2: New building in Sulukule after urban transformation (http://www.fatih.bel.tr/icerik/1155)

4.1 Norwegian Railway Project with BIM supported Participatory Design

Figure 3. Several virtual reality views from Norwegian Railway Project (https://www.archdaily.com/882527/how-a-norwegian-infrastructure-project-is-using-virtual-reality-to-improve-public-buy-in)

The design process of a 10-kilometer railway project in the south of Oslo, Norway, which started in 2019 and is scheduled completed in 2024, is one of the successful contemporary examples of participatory design (Rob McManamy, 2017). The Norwegian Railways (Bane

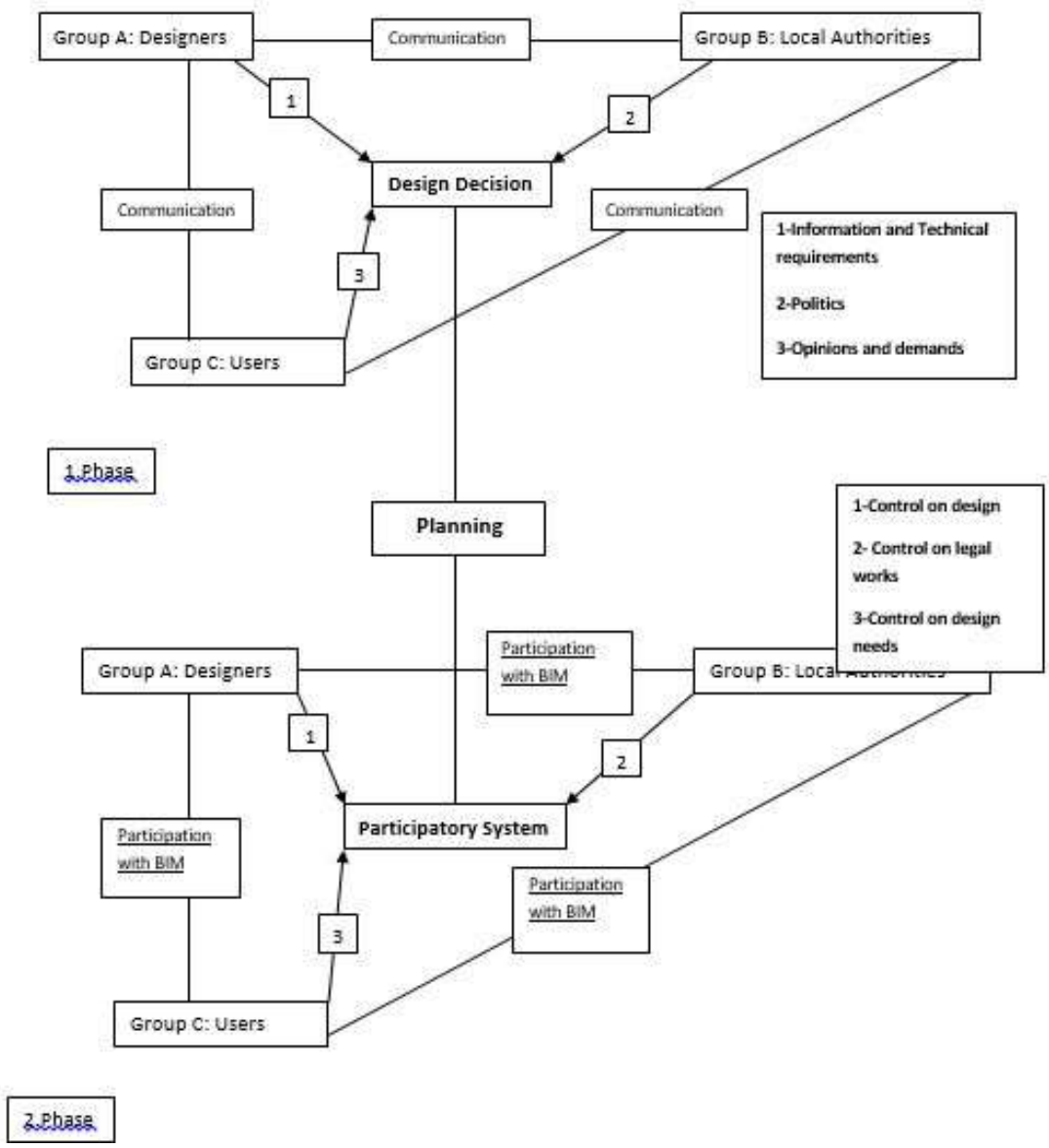
NOR) and the Ramboll Sweco design team and users of the railway have worked together as stakeholders from the first phase of the project.

The animations prepared by the design team first watched to users, and the design process re-designed according to the feedback received. Participants stated that they could make a more comfortable criticism and add value after watching the animation like watching a movie. The design team noted that the use of BIM in the process helped to produce solutions to complex problems, make realistic visualizations and communicate with other participants, and use the tools of BIM as a central dialogue platform. With the help of the Naviswork Simulate program and the model prepared with the BIM Track Building Information Modeling program, a dialogue established between all stakeholders, and real-time project evaluation has been possible (Figure 3).

The benefits of the BIM-supported participatory design process for all stakeholders can be summarized as follows:

- More efficient and fast design
- Good collaboration between stakeholders
- Easier to overcome design problems
- Faster recognition and correction of errors
- Saving time and money

5.0 BIM Framework for Participatory Design



Designers (group A) local authorities (group B) and users (group C) works together to make design decisions. All groups can have different ideas and requirements about design process. Communication is the most important aspect of working together and helps all

parts to meet in a common language. Information and technical documents, politics, opinions and demands are also crucial for design process. BIM helps the stakeholders to explain their ideas. Designers can control the process more easily and effectively. Local authorities can control legal issues and documentation more quickly and effectively and users can control design needs more comfortably.

The phenomenon of design has a complex structure that includes different dimensions and disciplines. A multi-dimensional design process should be able to guide the designer, the user, and people from different disciplines to work together. The participant should be in dialogue with the designer in a user participation design environment that can be provided by the local administration in this process. The continuity of communication between the participant and the designer should maintain in the planning phase after the design decision given after healthy communication. BIM-based projects are the best way for the designer and the user to meet in a common language.

6.0 Conclusion

The most problematic part of the participatory design is the difficulty of understanding abstract planning data by users. By incorporating the user through the design process through BIM, the users can more involve in the design decision process to achieve better satisfaction. The identification of user-specific attributes can facilitate, and the creation of spatial comfort conditions can accelerate with participatory design through BIM. Because of this relationship, while the spatial comfort and quality of life of increases, it is possible to save cost in the design process. The design integration opportunities are the main advantage of the BIM-based participatory decision process against conventional practices. Integrating BIM applications to decision-making processes can enhance the communication especially during early phases of design.

Considering the understanding of user participation in the design process, clearly observed that the most prominent idea is the strengthening of the relationship between the designer and the user. This idea realizes with the search for potential users' inclusion in the design process at various levels and different stages from the beginning of the design process. These searches show that users of design can evolve to active participation over time. In this case, it is necessary to create new forms of relations and environments by interpreting the tools, techniques, and communication languages used. It is possible to produce consistent and quality ideas with the use of BIM in participatory design and thus to improve the quality of life. More reliable communication between users and design experts can be achieved in the participatory design using BIM. The BIM enhances the communication between the actors in the participatory design, helping to produce realistic design solutions.

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