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REVIEW

Critical analysis of key determinants and barriers to digital innovation adoption among architectural organizations

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Abstract
The development and use of design technology for architecture in the modern world have led to the emergence of various design methodologies. Current design research has focused on a computationally mediated design process. This method is essentially concerned with finding forms and building performance simulation, i.e., structural, environmental, constructional, and cost performance, by integrating physics and algorithms. From the emergence of this process, design practices have been increasingly aided by and dependent on the technology, which has resulted in a major paradigm shift. Advancement of the new technology has the potential to improve design and productivity dramatically. However, related literature shows that substantial technical and organizational barriers exist. These barriers inhibit the effective adoption of these technologies. The effect of these obstacles on architectural practice varies depending on the size of an architectural organization. To further understand the problem, we conducted an in-depth study on several small, medium, and large architectural organizations. This study involves in-depth evaluation of technological, financial, organizational, governmental, psychological, and process barriers encountered in the adoption of digital innovation. Results reveal relevant attributes and patterns of variables, which can be used to establish a framework for digital innovation adoption. Valuable findings of this study reveal that smaller architectural organizations present more barriers to digital innovation compared with their larger counterparts. This study is important because it contributes to the research on digital innovation in architecture and addresses the barriers faced by different sizes of architectural organizations.

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Contents

1. Introduction

Technological advancement of the new technology has the potential to improve design and productivity dramatically. However, related literature shows that substantial technical and organizational barriers exist, which inhibit the effective adoption of these technologies (Leach and Guo, 2007; Johnson and Laepple, 2004; Inchachoto, 2002). Despite the availability of digital technologies, innovation does not occur because limited knowledge and resources are transferred from one project to another. This concern occurs when projects have dissimilar objectives or exclude members of the previous team with relevant skills or knowledge. Cory and Bozell (2001) found that although architects and designers have acknowledged the advent of computers as an aid in architectural design, particularly in saving time and energy, these tools have not been fully utilized. The benefits of intelligent modeling to the design process are increased productivity, reduced cycle time, and better work flow and life cycle applications (Fallon, 2004).

Undeniably, the digitalization of design practices has not been trouble-free. Business profitability, one of the major goals of design practice, is at risk when digital innovation is implemented.

Innovation implies a new process or way of doing certain tasks, which exposes businesses to the risk of failure (Davila et al., 2006). Generally, innovation adds value, but it may have a negative or destructive effect because new developments eliminate or change old organizational forms and practices. The negative effect varies depending on the size of the organization (Davila et al., 2006). The need to fully explore this research area highlights the purpose of this paper.

To understand the problem, this study investigates the key determinants that impede the effective adoption of digital innovation in architectural practices that are computationally and digitally driven. Specifically, this study aims to answer the following research questions: (1) What

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