MATRIX REPRESENTATIONAL METHOD FOR IDENTIFYING PROMINENT FEATURES OF ARCHITECTURAL DESIGN PROCESS

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To my beloved mother and my family

To my respected supervisor

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All praises and thanks be to Allah (S.W.T), who has guided us to this, never could we have found guidance, were it not that Allah had guided us! (Q7:43)

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ABSTRACT

Understanding design processes from the standpoint of information-based interactions that transpire between stages of activities is acknowledged to be a time consuming and painstaking task. This is due to the need to consider all possible links and dependencies between stages of design activities. Such conditions signify design as a complex process, of which activities are crucially driven by information exchange between stages of design. Despite the important role that information dependency play in enabling us to comprehend the nature of design, there is still a lack of emphasis on this dimension of research in the study of architectural design processes. In order to understand the complexity of design activities, the current research pays attention to a salient characteristic of the design process that is the iterative behavior/behaviour of designing. In order to propose a suitable method for depicting the information flow of design activities, this study further advocates the use of the Design Structure Matrix (DSM) as a powerful information modeling tool in providing a better understanding of complex processes in design. This study uses case study methods for data collection purposes where both qualitative (observation and interview) and quantitative (experimentation) data complement existing data. This was done to explore as well as to explicate the influence of human behavior/behaviour in the design process. The research concluded that DSM provides designers with a simple way of simulating a complex process through which we gain greater insights about the architectural design process. This sets the stage for the development of more practical tools in capturing and analyzing relationships between iterative activities in design and information flows that represent them.

ABSTRAK

Memahami proses rekabentuk dari aspek interaksi maklumat yang berlaku diantara peringkat aktiviti-aktiviti rekabentuk sememangnya memakan masa dan merupakan tugas yang rumit. Ini adalah kerana perlunya untuk mempertimbangkan semua hubungan dan kebergantungan yang mungkin wujud antara peringkat-peringkat aktiviti rekabentuk. Ini menunjukkan bahawa rekabentuk adalah satu proses yang kompleks, dimana aktiviti-aktiviti penting didorong oleh pertukaran maklumat di antara peringkat rekabentuk. Walaupun kebergantungan maklumat memainkan peranan yang penting dalam membolehkan kita memahami ciri-ciri rekabentuk, masih terdapat kurang penekanan terhadap dimensi penyelidikan ini dalam kajian proses rekabentuk seni bina. Untuk memahami kerumitan aktiviti rekabentuk, kajian ini tumpuan perhatian kepada ciri-ciri penting proses rekabentuk iaitu kelakuan iteratif dalam aktiviti-aktiviti merekabentuk. Bagi mencadangkan satu kaedah yang sesuai untuk menggambarkan aliran maklumat aktiviti-aktiviti rekabentuk, kajian ini menyokong penggunaan Matrik Rekabentuk Struktur (DSM) sebagai alat pemodelan maklumat yang berkesan dalam memberikan pemahaman yang lebih baik mengenai proses rekabentuk yang kompleks. Kajian ini mengguna pakai kaedah kajian kes untuk tujuan pengumpulan data di mana kedua-dua data kualitatif (pemerhatian dan temu bual) dan kuantitatif (uji kaji) melengkapkan data yang sedia ada. Ini dilakukan bagi meneliti serta menghuraikan pengaruh tingkah laku manusia dalam proses rekabentuk. Penyelidikan ini memperolehi kesimpulan bahawa DSM memberikan satu kaedah yang mudah bagi para perekabentuk untuk mengadakan simulasi terhadap proses yang kompleks dimana melaluinya kita akan lebih mengetahui hakikat proses rekabentuk seni bina. Ianya juga menyediakan cara-cara yang lebih praktikal dalam memapar dan menganalisis hubungan antara aktiviti-aktiviti iteratif dalam rekabentuk dan aliran maklumat yang mewakili mereka.

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LIST OF ABBREVIATIONS

IGM	Interdependencies Graphical Model
DSM	Design Structure Matrix
UTM	Universiti Teknologi Malaysia
AC.1	Activity.1
AC.2	Activity.2
AC.3	Activity.3
AC.4	Activity.4
AC.5	Activity.5
AC.6	Activity.6
AC.7	Activity.7
AC.8	Activity.8
AC.9	Activity.9
AC.10	Activity.10
AC.11	Activity.11
PERT	Project Evaluation Review Technique
CPM	Critical Path Method

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Iteration as an essential feature, which is common in complex processes such as in architectural design, has the key role in the way on how such complex process works. In the Architectural Design domain the phases of defining and understanding the process known as the most painstaking task as it is always so confusing which makes the it the toughest to complete on time.

An architectural design process is considered as a process that design process' activities which including constructs its stages. It begin with identifying what had happened among the stages of the process involved and exploration of the interactions between activities is considered as the most important function in a modelling process.

This shows that an architectural design processes are ill-defined structure, because the problem was not well defined in the early stages of the process itself.

Hence, an architect needs to refer to his knowledge to understand the problem, and also still needs to improve the understanding of a problem to reach better definition of the process at each phases. Therefore, he begins the process with an initial basic understanding of the problem, and continued with the process stages.

Moreover, this will also guide the designer when upgrading at each stage and enhancing the process to the next level increases the amount of information and offer the designer with better understanding towards the designing process. However, by changing or increasing the information it causes them to move back from later steps to the prior steps. So that, interdependencies in terms of iteration loops or feedbacks will reveal and errors can be avoided.

This process of design indirectly, is influenced by iterative behaviour, because it presents three important factors relevant to every productive process such as time, cost, and quality. Therefore, in this content, controlling the iterative behaviour has a vital role to assist a designer to deliver the optimum design on the scheduled time manner.

Another common issue is on the ill-structured problems which makes an architectural design process to be so complex and ambiguous that a designer unable to identify the exact point as the stop point of the process. It means that, because an architect unlike an engineer cannot follow the process based on fixed formulations to achieve the unique final solution. However, there are more solutions in response to the design problem, as designers can always stop the process when they recognize solutions and found it is satisfied in contrast to the process constraints and criteria involved.

As explained, understanding the process is the foundation to the problem solving process because as it can be improved in a parallel manner during the process of each stages.

This study aims to capture the perfect modelling method that assist architects to enable a better defining the process, including on finding the iteration loops. Nevertheless, this method will provide architects with an advantage of identifying the reasons of the iterations, and to control this salient feature of the architectural design process.

1.2 Background to the Problem

Identifying the informational dependencies among the process' activities affects strongly the way of presenting the definition of the process, as without considering it, providing an accurate definition is impossible. This causes architects to face with a major obstacle such as, lack of systematic method to define the process, and conducting the process toward acquiring the satisfied solution.

Accordingly, there are no efficient studies been done in this content particularly focuses on informational relationships. Although, some previous studies in other design domains attempted to help a designer to reach a better definition, even control the process by using the matrix-based methods, anyhow was not any useful method/model for architectural design process been identified as essential (Braha and Maimon, 1997, Safoutin, 2003).

Therefore, exploring the iterative nature of the architectural design process prompted this study to find the informational based method in order to facilitate the way of identifying the prominent features of design processes.

1.3 Statement of the Problem

The informational dependencies are the main reasons for occurrence of iteration loops within a complex process. As exploring the information relationships among the process activities can guide to find iterations, and also identify where and when it occur. Nevertheless, modelling a process based on information exchange provide a distinguish reasons on why iteration occurs.

However, the informational modelling of a process is required to make a discussion about this salient feature of an architectural design process clearer.

The research questions in this research are as following:

1- How can we model the architectural design process to illustrate the iterative behaviour as an integration part of the process?

2- What is the suitable method to represent the architectural design process with regards to informational flows among its stages?

1.4 Research Objectives

The following objectives initiated us to do this research:

1- Prescribing the architectural design framework

2- Simulating the process in such a manner that helps an architect to understand the interactions among the stages of a process and then understanding the iterative feature of the process.

3- Capturing a matrix-based method as the powerful and simple model to facilitate the way of looking for iterative nature.

1.5 Scope

The boundaries of this study are defined based on the following:

i) The Architectural Design Process will be considered in this study.

ii) The design process will be discussed through sketching that will be done by five architecture students.

iii) The modelling of the design process will be done based on the information dependencies.

1.6 Importance of the Research

On understanding the complexity of the process by focusing on the prominent feature in the process; iteration is considered as one of the main advantages of this study in the architectural design domain. Nevertheless, there are also other reasons that indicated the importance of this research:

- It helps to understand the dependencies among the process' activities by focusing on information flows among them.
- It presents the simple and perfect method to identify the iterative behaviour, whether the causes of iterations, the place or the time of iteration loops.

- It facilitates the way of representing the complex process like architectural design process.

1.7 Summary

This chapter discusses on the aims and objectives of this study. Research on architectural design process is developed based on the scope along with the information on importance of the study are discussed as well.

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