UNIVERSITI PUTRA MALAYSIA

IT-INTEGRATED DESIGN COLLABORATION ENGAGEMENT MODEL IN SUPPORT OF MALAYSIAN BUILDING DESIGN PROFESSIONALS

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By

NAEIMEH DELAVARI

Thesis is Submitted to the School of Graduate Studies, University Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

December 2011

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DEDICATIONS

"This Doctor of Philosophy degree dissertation is the ultimate result of a twenty-two year study and it is my honour to dedicate it to my husband, my sister and my parents

MOHAMMAD REZA DELAVARI & SHAHLA ALIZADEGANI

Whom without their support, I wouldn't be standing here"

NAEIMEH DELAVARI

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2011

Abstract of thesis presented to the Senate of University Putra Malaysia, in Fulfilment of the Requirement for the Degree of Doctor of Philosophy

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By

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December 2011

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Faculty: Design and Architecture

Design collaboration is an activity that requires the participation of various individuals to accomplish an agreed design task or goal. Globalization is what has changed the character of this field, integrating geographically dispersed participants through the Internet or an intranet server. Professional design team members can now communicate via collaborative tools and utilize technologies beyond physical boundaries and time. However, many design team members fail to utilize these technological developments. This predicament is exacerbated by various issues, such as the misunderstanding that tends to occur when professionals switch from face-to-face to technological communication and limited professional education programs on the subject.

The purpose of this research was to find a way to engage Malaysian professional architects in IT-integrated collaborations and to improve their interaction with

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computing systems using the concept of Human Computer Interaction (HCI). It intended to understand how human factors (physical, cognitive, intrinsically or extrinsically motivated) can be used to facilitate and improve the interaction in professional building design and collaborative technologies to achieve a sustainable IT-integrated design collaboration process.

This study used Grounded Theory research methodology to develop an IT-engagement model to increase architects' motivation to collaborate using collaborative technologies. Firstly, this study identified current collaborative technologies and how design team members use them. They include Virtual Prototyping (VP) for producing realistic graphical simulations, collaborative Computer-Aided Design (CAD) and Computer Supported Collaborative Work (CSCW) tools such as video conferencing, and shared document management which facilitates the flow of data. In addition, using the existing parameters of engagement from theories of technology adoption and studies of IT-integrated design collaboration, this study determined feedback, control and functionality as the criteria for developing a model of engagement for design team members using IT-supported technology.

At the conclusion of this study, feedback was defined as the knowledge that is allocated to the appropriate design team members and the knowledge that is retrieved from other design team members for improving purpose. Meanwhile, control was defined as the control effect of behaviour on a user. Similarly, functionality was defined as the degree of user performance with the computing system and the degree of technological flexibility afforded to the user. Finally, the study identified that in

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Malaysian building projects, collaborations tend to occur in face-to-face meetings, where Architecture-Engineering-Construction (AEC) design team members communicate by exchanging paper documents, technical drawings and so on. This highlighted a working-culture deficiency with regards to IT-supported technologies in the design collaboration process.

Thus, this study contributes towards the development of an IT-integrated design collaboration (IT-DC) engagement model for Malaysian building design collaborations. It is expected to improve the acceptance of IT-integrated design project collaborations, increase the degree of engagement in collaborative team work projects and support future research to mitigate knowledge losses in complex project lifecycles. This in turn will encourage and facilitate more participation from Malaysian building stakeholders in global projects, thus fulfilling the country's desire to increase exports in the services industry.

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MODEL KEASYIKAN REKABENTUK KOLABORASI INTEGRASI-IT DALAM MENYOKONG PROFESIONAL REKABENTUK BANGUNAN MALAYSIA

Oleh

NAEIMEH DELAVARI

Disember 2011

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Kolaborasi rekabentuk adalah satu aktiviti yang memerlukan penglibatan beberapa individu bagi menyempurnakan sesuatu tugas atau matlamat yang dipersetujui secara bersama. Globalisasi telah menyebabkan berubahnya rupa bentuk bidang ini dengan mengintegrasikan penglibatan peserta yang dipisah melalui geografi melalui Internet atau server intranet. Ahli kumpulan rekabentuk profesional boleh sekarang ini berkomunikasi melalui peralatan kolaborasi dengan penggunaan teknlogi melampaui masa dan sempadan. Walau bagaimana pun ramai ahli kumpulan rekabentuk yang telah gagal menggunakan pembangunan teknologi ini. Kesulitan ini diburukkan lagi dengan beberapa isu, seperti, kesalahfahaman yang sering berlaku apabila profesional bertukar kaedah dari bersemuka kepada berkomunikasi secara teknologi terutama bagi mereka yang kurang pengetahuan tentang program profesional sesuatu bidang.

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Tujuan penyelidikan ini adalah untuk mengetahui cara bagaimana melibatkan Artitek Professional Malaysia dalam proses merekabentuk secara kolaborasi yang mengasyikkan melalui integrasi IT dan memperbaiki cara berinteraksi dengan sistem komputer dengan menggunakan konsep Interaksi Manusia dengan Komputer. Kajian ini bertujuan untuk memahami faktor manusia (fisikal, kognitif, motivasi secara intrinsik atau ekstrinsik) yang akan digunakan bagi memudahkan dan membaiki interaksi antara pembina profesional dan teknologi kolaborasi bagi mencapai proses rekabentuk kolaborasi secara integrasi IT.

Kajian ini menggunakan kaedah penyelidikan "Grounded Theory" dalam membentuk satu model IT yang mengasyikkan dalam meningkatkan motivasi artitekprofesional supaya bekerja secara kolaborasi dengan menggunakan teknologi kolaborasi. Pertama, penyelidikan ini telah mengenalpasti teknologi kolaborasi semasa dan bagaimana ia boleh digunakan oleh ahli kumpulan rekabentuk. Ini melibatkan Protototaip Secara Maya (Virtual Prototyping (VP) bagi menghasilkan simulasi grafik secara realistik, program CAD (Computer-Aided Design) dan peralatan CSCW (Computer Supported Collaborative Work) seperti sidang video, dan pengurusan pengkongsian dokumen yang boleh memudahkan pengaliran data. Selain daripada itu kajian ini, dengan menggunakan parameter yang sedia ada mengenai keasyikan daripada teori-teori teknologi yang dipilih dan kajian-kajian rekabentuk kolaborasi secara integrasi IT, telah menentukan bahawa tindakbalas, kawalan, dan fungsi adalah kriteria membina model keasyikan untuk ahli kumpulan rekabentuk yang menggunakan teknologi yang menyokong IT (IT-supported technology.)

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Kesimpulannya, kajian ini telah mentakrifkan tindakbalas sebagai ilmu yang perlu diperuntukan kepada ahli kumpulan rekabentuk yang sesuai dan ilmu yang perlu diperoleh dari ahli kumpulan rekabentuk yang lain bagi tujuan penambahbaikan. Sementara itu, kawalan boleh ditakrifkan sebagai kesan kawalan terhadap perlakuan pengguna. Fungsi pula ditakrifkan sebagai darjah prestasi pengguna dengan sistem komputer dan darjah fleksibiliti teknologi yang diberikan kepada pengguna. Akhirnya kajian ini telah mengenalpasti bahawa projek pembinaan di Malaysia lebih bersifat perjumpaan bersemuka, di mana ahli kumpulan AEC (Architecture-Engineering-Construction) berkomunikasi secara bertukar-tukar dokumen, lukisan teknikal dan lain-lain. Situasi ini menekankan kekurangan dalam budaya kerja yang melibatkan penggunaan teknologi sokongan IT dan proses rekabentuk secara kolaborasi.

Dengan itu kajian ini dapat menyumbang ke arah pembangunan Model Keasyikan Rekabentuk Kolaborasi Secara Integrasi IT (IT-integrated design collaboration (IT-DC) Engagement Model). Model ini akan dapat membaiki penerimaan Projek Rekabentuk Kolaborasi Secara Integrasi IT, meningkatkan darjah keasyikan dalam projek kolaborasi berpasukan, dan menyokong kajian akan datang mengenai mitigasi ilmu yang hilang dalam kitaran projek yang kompleks. Secara langsung dan tidak langsung kajian ini akan dapat menggalakkan dan memudahkan lebih banyak penyertaan dari golongan pembina Malaysia yang berkepentingan dalam projek-projek global, dalam mencapai inspirasi negara untuk menambah eksport dalam industri perkhidmatan.

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APPROVAL

I certify that a Thesis Examination Committee has met on 20/12/2011 **date of viva** to conduct the final examination of **Naeimeh Delavari** on her thesis entitled "**IT-integrated Design Collaboration Engagement Model in Support of Malaysian Building Design Professionals**" in accordance with the Universities and Universities Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U. (A) 106] 15 March 1998. The committee recommends that the student be awarded the degree of Doctor of Philosophy (Integrated Design Studies).

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DECLARATION

I declare that the thesis is based on my original work except for quotations and citations, which have been dully acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at University Putra Malaysia or at any other institution.

_____

NAEIMEH DELAVARI

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