THE DETERMINANTS OF FIRMS' INNOVATIVENESS ON CONSTRUCTION TECHNOLOGY IN MALAYSIAN HEAVY CONSTRUCTION SECTOR

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ABSTRACT

The peculiar characteristics of constructed products significantly differentiate construction from manufacturing. Past researches seem have been given greatest attention and concentration to the innovation in manufacturing sector. This research assesses the determinants of firm's innovativeness in construction sector, which has been neglected by researchers despite its immense importance to the technological advancement in affecting the degree of innovation implementation and adoption. A total of fourteen hypothesises were developed and tested. These hypotheses are established within the context of heavy construction sector characteristics that are consistently suggested to be significant determinants of firm innovativeness. These characteristics include (1) market structure characteristics, (2) organisation and task characteristics, (3) adopter industry competitive environment, and (4) external cooperation linkage. This study has reviewed the problem of determinants of firms' innovativeness in technological innovation the Malaysian heavy construction sector to meet the three outlined objectives. Hypotheses were tested utilising survey data collect from Malaysia Construction Industry Development Board, CIDB Grade 7 construction firms throughout the Malaysia. The relationships of the identified four domains were discussed in this research. The results indicate that adopter industry competitive environment and external cooperation linkage are among the variables that significantly affect the degree of innovation implementation and adoption. Results also indicate that 13 out of 14 hypothesises are supported and positively affecting the degree of innovation implementation and adoption. Lastly, a new model closely reflects the essence of the determinants of firm's innovativeness in heavy construction sector was formulated. Therefore, the results suggest that increasing the rate of innovation implementation and adoption may be enhanced to a greater degree by increasing adopter industry competitive environment and external linkage rather than implementing market structure environment characteristics or organisation and task characteristics. This research has value and has advanced knowledge in construction industry, especially, and hence the aim has successfully attained.

Keywords: Innovation, Construction Technological Innovation, Determinants of Firms' Innovativeness, Heavy Construction Sectors, Modeling

ABSTRAK

Perbezaan yang ketara antara pembinaan dengan pembuatan dapat diperlihat melalui ciri-ciri istimewa pada produk yang terhasil. Melalui penyelidikan sebelum ini, pengamatan dan pemerhatian terhadap inovasi hanya diberi pengkhususan pada sektor pembuatan.Tujuan kajian ini adalah untuk menilai penentu tahap inovasi sesuatu firma dalam sektor pembinaan, dimana ianya sering diabaikan oleh para penyelidik walaupun terdapat kepentingan ketara terhadap pembangunan kemajuan teknologi dalam mempengaruhi tahap implimentasi dan adaptasi sesuatu inovasi. Sebanyak 14 hipotesis telah dimajukan dan diuji. Hipotesis-hipotesis ini dikenalpasti dalam konteks sektor pembinaan berat yang konsisten untuk dijadikan sebagai penentu inovasi yang penting bagi sesuatu firma. Ciri-ciri kajian ini merangkumi (1) ciri-ciri struktur pasaran, (2) ciri-ciri organisasi dan tugas, (3) adaptasi industri terhadap persaingan persekitaran, dan (4) rangkaian kerjasama luar. Hipotesis ini telah diuji dengan menggunakan data terkumpul dari firma-firma pembinaan di seluruh Malaysia yang berdaftar dengan Lembaga Pembinaan dan Pembangunan Industri Malaysia (CIDB) sebagai kontraktor Gred 7. Penyelidikan ini mengkaji masalah penentuan inovasi sesuatu firma dalam pengunaan inovasi teknologi bagi sektor pembinaan berat di Malaysia untuk memenuhi tiga objektif yang telah digariskan. Hubungan diantara empat faktor yang dikenalpasti telah dibincangkan dalam kajian ini. Keputusan kajian menunjukkan bahawa adaptasi industri terhadap persekitaran yang kompetitif dan rantaian kerjasama dengan agensi luar adalah antara pembolehubah yang mempengaruhi tahap pelaksanaan inovasi secara signifikan. Keputusan-keputusan dari kajian juga menunjukkan bahawa 13 daripada 14 keseluruhan hipotesis-hipotesis disokong dan mempengaruhi tahap pelaksanaan and adaptasi inovasi dengan positif. Akhir sekali, kajian ini telah dapat penemuan model baru yang paling tepat mencerminkan intipati penentu inovasi sesuatu firma dalam sektor pembinaan berat. Oleh yang demikian, hasil kajian mencadangkan bahawa peningkatan kadar perlaksanaan dan adaptasi boleh ditambahbaik ke tahap yang lebih tinggi dengan meningkatkan adaptasi industri persekitaran persaingan yang kompetitif dan rangkaian luar berbanding melaksanakan ciri-ciri persekitaran pasaran struktur atau ciri-ciri organisasi dan sifat sesuatu tugas. Kajian ini memperlihatkan nilai dan memberi pengetahuan yang lebih lanjut dalam industri pembinaan. Dengan itu, tujuan kajian ini telah tercapai dengan jaya dan sempurna.

Katakunci: Inovasi, Inovasi Teknologi Pembinaan, Penentu Kadar Inovasi Firma-firma, Sektor Pembinaan Berat, Model

PUBLICATIONS FROM THIS RESEARCH

The following papers have been produced from the research reported in this dissertation:

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DEDICATION

*I dedicated this dissertation to my **Mum** and **Dad** for nursing me with affections and their dedicated partnership for success in my life.*

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LIST OF EQUATION

LIST OF ABBREVIATIONS

AICE	Adopter Industry Competitive Environment
CFI	Construction Firms' Innovativeness
CIDB	Construction Industry Development Board
Comp	Complexity in Purchase and Use
CR	Competitive Rivalry
ECL	External Cooperation Linkage
EIC	Experience in Construction
FGC	Firm-Government Cooperation
FRCC	Firm-Research Center Cooperation
FS	Firm Size
FUC	Firm-University Cooperation
IF	Industrial Fragmentation
MI	Management Intensity
MRA	Multiple Regression Analysis
MSC	Market Structure Characteristics
OL	Operation Location
OTC	Organisation and Task Characteristics
PCA	Principal Component Analysis
PEU	Perceived Environmental Uncertainties
PTA	Professional and Trade Association Affiliation
PTU	Presence of Trade Unions
R&D	Research and Development
SPSS	Statistical Package for Social Science
TOC	Types of Construction

LIST OF APPENDICES

CHAPTER ONE: INTRODUCTION

1.1 INTRODUCTION

This chapter provides an overview of the background of the study, problem statement, research question, research objective, scope of work, definition of terms used in this study and organisation of the dissertation.

1.2 BACKGRUND OF THE STUDY

Malaysia has been experiencing a massive surge of construction activity with the construction boom reaching its climax at the turn of the 2010s. Examples of heavy construction projects delivered includes, but not limited to, North-South Highway, Kuala Lumpur International Airport (KLIA), Malaysia-Singapore Second Link, Electrified Double Tracking Project (EDTP), Second Penang Bridge, Mechanical Railway Transit Project (MRT), Light Railway Transit Project (LRT) and many more. The Malaysian construction industry has been one of the greatest contributors to the Gross Domestic Product (GDP). Advancement in technology is an integral part of Malaysia's growth as an industrialised country. However, the firms' innovativeness in technological innovation in construction has virtually been given relatively less attention and neglected as a viable area for investigation and research in most of the countries (Holt, 2010). In contrast, the firms' innovativeness in technological change in manufacturing industries has received more attention from the industry and the research communities.

Budiawan & Sidwell (2004), Manley (2006), Brochner (2008), Kristian (2010), Hardie (2010), and Aouad, Ozorhon, & Abbott. (2010) are few examples of the

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