UNIVERSITI PUTRA MALAYSIA

LABOUR PRODUCTIVITY MEASUREMENT METHOD FOR MALAYSIAN HOUSING INDUSTRY

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By

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Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of Requirement for the Degree of Doctor of Philosophy

March 2005

DEDICATION

TO:

My FATHER and My MOTHER

Abstract of thesis presented to Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

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March 2005

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The industrialised building system (IBS) was introduced in Malaysia in 1966, but it failed to establish itself though there is a sustained large market for residential projects. One of the main reasons behind this failure is a lack of scientific data on labour productivity in the construction industry. Hence, the objective of this study is to establish a labour productivity measurement method for the Malaysian housing construction industry. Labour productivity (manhours/m^2) is defined as the manhours (the multiplication of number of workers and work time) required to complete a structural element of a house. Two data collection methods were used to collect the labour productivity data, namely time study on-site observation (ideal labour productivity) and survey questionnaire (actual and pre-planned labour productivity).

For the time study on-site observation method, a total of 499 ideal labour productivity data were obtained from seven residential projects constructed between January 2003 and April 2004. Results indicated that the mean ideal labour productivity for conventional building system was 4.20 manhours/m^2 followed by cast *in-situ* table form

(2.70 manhours/m^2), cast *in-situ* tunnel form (1.88 manhours/m^2) and precast concrete system (1.33 manhours/m^2). The mean cycle time measured in days for conventional building system, cast *in-situ* table form system, cast *in-situ* tunnel form and precast concrete systems were 4.93, 3.91, 2.90 and 2.31 days respectively. The mean crew size for conventional building system was 24 workers while for IBS was 22 workers. The subsequent analysis developed the ideal labour productivity measurement method using multiple regression analysis. The results indicated that the independent variables, namely type of building system, crew size, gross building floor area and floor level have significant impact on ideal labour productivity with coefficient of determination, R^2 of 82.1%.

A total of 102 respondents which included 72 contractors, 19 consultants and 11 developers responded to the survey questionnaire. The data obtained from the questionnaire were actual labour productivity data from actual residential projects and pre-planned labour productivity from hypothetical projects. The results indicated that the mean actual labour productivity for conventional building system was 7.00 manhours/m^2 compared to IBS of 2.10 manhours/m^2 while the mean pre-planned labour productivity for conventional building system was 7.40 manhours/m^2 compared to IBS of 2.13 manhours/m^2. Finally, the factors causing the gaps between actual and ideal labour productivity were established and ranked.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah doktor falsafah

KAEDAH PENGUKURAN PRODUKTIVITI BURUH UNTUK INDUSTRI PERUMAHAN DI MALAYSIA

Oleh

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Sistem binaan berindustri (IBS) telah dilaksanakan pada 1966, tetapi ia gagal berkembang walaupun terdapat pasaran luas untuk sektor pembinaan perumahan. Salah satu sebab utama kegagalan ini adalah kekurangan sainstifik data di dalam produktiviti buruh industri pembinaan. Oleh itu, matlamat utama kajian ini adalah untuk membangunkan satu kaedah standard untuk mengukur produktiviti buruh bagi sektor pembinaan perumahan di Malaysia. Produktiviti buruh (pekerja-masa/m^2) ditaksirkan daripada jumlah pekerja dan masa yang diperlukan untuk menyiapkan struktur elemen bagi sebuah rumah. Dua kaedah pengumpulan data yang digunakan adalah penyelidikan masa di tapak (produktiviti buruh ideal) dan soal selidik (produktiviti buruh sebenar dan terancang).

Bagi kaedah penyelidikan data di tapak, sebanyak 499 data telah diperolehi daripada tujuh tapak pembinaan perumahan yang dibina pada Januari 2004 sehingga April 2004. Keputusan menunjukkan bahawa min produktiviti buruh ideal bagi sistem bangunan konvensional adalah 4.2 pekerja-masa/m^2 diikuti oleh sistem konkrit meja di-situ (2.7

pekerja-masa/m^2), sistem konkrit terowong di-situ (1.88 pekerja-masa/m^2) dan sistem konkrit pra-tuang (1.33 pekerja-masa/m^2). Min masa kitar untuk menyiapkan sebuah rumah bagi sistem bangunan konvensional, sistem konkrit meja di-situ, sistem konkrit terowong di-situ and sistem konkrit pra-tuang adalah 4.93, 3.91, 2.90 dan 2.31 hari masing-masing. Jumlah min pekerja yang diperlukan untuk sistem bangunan konvensional adalah 24 orang manakala untuk IBS adalah 22 orang. Analisis seterusnya adalah membangunkan kaedah standard untuk mengukur produktiviti buruh ideal dengan menggunakan model analisis regresi. Keputusan menunjukkan bahawa pembolehubah-pembolehubah jenis bangunan bersktruktur, saiz pekerja, keluasan rumah dan ketinggian bangunan adalah signikans dengan pekali penentuan model regresi, R^2 (82.1%).

Sebanyak 102 responden yang mengandungi 72 kontraktor, 19 perunding dan 11 pemaju telah menjawab soalon-soalon soal selidik. Data yang diperolehi daripada soal selidik adalah produktiviti buruh sebenar and produktiviti buruh terancang. Keputusan menunjukkan bahawa min produktiviti buruh sebenar bagi sistem bangunan konvensional adalah 7.00 pekerja-masa/m^2 berbanding dengan 2.10 pekerja-masa/m^2 bagi IBS sementara min produktiviti buruh terancang bagi sistem bangunan konvensional adalah 7.40 pekerja-masa/m^2 berbanding dengan 2.13 pekerja-masa/m^2 bagi IBS. Akhir sekali, analisis faktor-faktor yang menyebabkan jurang diantara produktiviti buruh ideal dan sebenar telah dibangunkan dan dirank.

ACKNOWLEDGEMENTS

I would like to express my utmost gratitude to Associate Professor Ir. Dr. Mohd Razali Abdul Kadir, Associate Professor Ir. Dr. Mohd Saleh Jaafar and Associate Professor Ir. Dr. Mohd Sapuan Salit for their guidances, suggestions, advices, supportive encouragement and time spent throughout this study.

Valuable appreciation are also extended to all the contractors, consultants, developers and friends for their co-operation in answering the survey questionnaire and allowing me to access to their construction sites for data collection.

Last but not least, I wish to express my deepest appreciation to my parent, brother and sister for their continuous support, motivation and encouragement.

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P_i	labour productivity for the structural enclosure of one unit house (manhours/m^2);
β_i	the slope of the regression line;
α	indicate the mean value of labour productivity when all $X_i = 0$;
X_i	independent variables;
e_i	error (residual);
R^2	coefficient of determination;
SSR	sum of square regression;
TSS	total sum of squares;
SSE	sum of squares error;
Y_i	i the value of the dependent variable;
Y_a	predicted value for the average of Y for each given X value;
Y_b	average value of the dependent value;
S_e	standard error of estimate;
n	sample;
k	number of independent variable; and
R_A	adjusted coefficient of determination
IBS	Industrialised building system

CHAPTER ONE

INTRODUCTION

1.1 Introduction

Labour usage is paramount in the Malaysian construction industry because the industry relies heavily on both legal and illegal foreign workers especially in the structural construction trades such as carpenter, barbender, concretor, precast concrete panel installer and system formwork installer. The number of foreign workers had increased to 1.36 million peoples in July 2004 compared to the 1.1 million in 2000 and 136,000 during the early 1980s. Out of the latest figure, 66.5% were from Indonesia followed by Nepal (9.2%), Bangladesh (8%), India (4.5%) and Myanmar (4.2%). The manufacturing sector employed 30.5% of foreign workers followed by service sector (25%), agriculture (24.7%) and construction sector (19.8%) (Anon, 2004).

Albeit, foreign workers had contributed to economy by alleviating labour shortages in the construction sector, it had also resulted in illegal occupation of land and housing. They were competing with the poor local peoples for low cost accommodations in squatter settlements and in the Malay reservation areas. The congested living conditions were detrimental to social and environmental problems. Total medical fees obtained from foreign workers had risen by 7.5% annually since 1994 (RM13.8 million) to RM23.2 million in 2003. Remittances by foreign workers has also increased to RM11.23 billion in 2003 from RM6.96 billion in 1997 (Anon, 2004).