

UNIVERSITI PUTRA MALAYSIA

LABOUR PRODUCTIVITY MEASUREMENT METHOD FOR MALAYSIAN HOUSING INDUSTRY

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LABOUR PRODUCTIVITY MEASUREMENT METHOD FOR MALAYSIAN HOUSING INDUSTRY

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

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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/m²) 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/m² followed by cast *in-situ* table form



(2.70 manhours/m²), cast *in-situ* tunnel form (1.88 manhours/m²) and precast concrete system (1.33 manhours/m²). 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/m² compared to IBS of 2.10 manhours/m² while the mean pre-planned labour productivity for conventional building system was 7.40 manhours/m² compared to IBS of 2.13 manhours/m². 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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Mac 2005

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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/m²) 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/m² diikuti oleh sistem konkrit meja di-situ (2.7



pekerja-masa/m²), sistem konkrit terowong di-situ (1.88 pekerja-masa/m²) dan sistem konkrit pra-tuang (1.33 pekerja-masa/m²). 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, R² (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/m² berbanding dengan 2.10 pekerja-masa/m² bagi IBS sementara min produktiviti buruh terancang bagi sistem bangunan konvensional adalah 7.40 pekerja-masa/m² berbanding dengan 2.13 pekerja-masa/m² bagi IBS. Akhir sekali, analisis faktor-faktor yang menyebabkan jurang diantara produktiviti buruh ideal dan sebenar telah dibangunkan dan dirank.



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TABLE OF CONTENTS

DEDICATION	ii
ABSTRACT	iii
ABSTRAK	v
ACKNOWLEDGEMENTS	vii
APPROVAL	viii
DECLARATION	х
LIST OF TABLES	xv
LIST OF FIGURES	xx
LIST OF ABBREVIATIONS	xxiii

CHAPTER

1	INTR	RODUCTION	
	1.1	Introduction	1
	1.2	Potential areas of productivity improvement	2
		1.2.1 Structural work	3
		1.2.2 Architectural and finishing work	5
		1.2.3 Mechanical and electrical work	7
	1.3	Malaysian housing needs	8
	1.4	Problem statement	12
	1.5	Justification	14
	1.6	Conceptual framework	17
	1.7	Research objectives	21
	1.8	Scope and limitation	22
	1.9	Layout of thesis	24
	1.10	Conclusion	25
2	LITE	CRATURE REVIEW	
	2.1	Introduction	26
	2.2	Type of building systems in Malaysia	27
	2.3	Classification of IBS	29
	2.4	Elements of IBS	33
		2.4.1 Frame systems	33
		2.4.2 Panel systems	36
		2.4.3 Box systems	39
		2.4.4 Formwork systems	41
		2.4.5 Block systems	46
	2.5	Essential characteristics of IBS	47
		2.5.1 Closed system	47
		2.5.2 Open system	48
		2.5.3 Modular coordination	49
		2.5.4 Standardisation and tolerances	50

Page



	2.5.5 Mass Production	51
	2.5.6 Specialisation	51
	2.5.7 Good organisation	51
	2.5.8 Integration	52
	2.5.9 Production facility	52
	2.5.10 Transportation	52
	2.5.11 Equipment at site	53
2.6	Benefits of IBS	53
2.7	Shortcomings of IBS	55
2.8	Malaysian experience in IBS	58
2.9	Experience of other countries in IBS	60
	2.9.1 Japan	60
	2.9.2 Argentina	61
	2.9.3 Singapore	62
	2.9.4 The U.K.	65
	2.9.5 Germany	65
	2.9.6 The Netherlands	66
	2.9.7 The U.S.A	66
	2.9.8 Canada	67
2.10	The definition of productivity	68
2.11	Hierarchical of productivity	72
2.12	Scientific model for construction productivity	77
	2.12.1 Work study	77
	2.12.2 Work sampling	79
	2.12.3 Time study	83
	2.12.4 Delay model	87
	2.12.5 Factor model of construction productivity	89
2.13	Scientific data collection methods	92
	2.13.1 Video camera technique	94
	2.13.2 Questionnaire	99
	2.13.3 Foreman delay survey	101
	2.13.4 Arranged interview	103
	2.13.5 Stopwatch time study	103
	2.13.6 Still photograph	107
2.14	Comparison of construction productivity	108
2.15	Determinants of labour productivity	127
2.16	Conclusion	135
MET	HODOLOGY	10.6
3.1	Introduction	136
3.2	Questionnaire	139
5.5	Observational study	142
	3.3.1 Time Study on-site observation	145
	3.3.2 Sample size	145
	3.3.3 Productivity comparison methodology	148
3.4	Analytical methodology	157

3



	3.4.1 D	ata identification and correlational technique	159
	3.4.2 A	nalysis of variance	160
	3.4.3 M	Iultiple regression analysis	163
3.5	Conclusio	on line line line line line line line lin	168
RE	SULTS A	ND DISCUSSIONS	
4.1	Introdu	iction	169
4.2	Result	of time study on-site observation	169
	4.2.1	The impact of types of structural building systems on	
		ideal labour productivity	172
	4.2.2	The impact of crew size on ideal labour productivity	
		between structural building systems	176
	4.2.3	The impact of cycle time on ideal labour productivity	
		between structural building systems	182
	4.2.4	The impact of floor level on ideal labour productivity	
		between structural building systems	187
	4.2.5	The impact gross floor area on ideal labour productivity	
		between structural building systems	189
	4.2.6	The impact of worker daily salary on ideal labour	
		productivity between structural building systems	190
	4.2.7	The impact of types of project contracts on ideal labour	
		productivity between structural building systems	191
	4.2.8	The development of ideal labour productivity	
		forecasting measurement method	194
4.3	Result	s of Survey Questionnaire	210
	4.3.1	Respondents' demographics	210
	4.3.2	Project characteristics of the actual housing projects	215
	4.3.3	The impact of types of structural building systems on	
		actual labour productivity	220
	4.3.4	The impact of structural cost on actual labour productivity	
		between structural building systems	223
	4.3.5	The impact of crew size on actual labour productivity	
		between structural building systems	226
	4.3.6	The impact of cycle time on actual labour productivity	
		between structural building systems	229
	4.3.7	The impact of worker daily salary on actual labour	
		productivity	232
	4.3.8	The impact of quantity completed on actual labour	
		productivity between structural building systems	233
	4.3.9	Relationship between structural cost and actual labour	
		productivity	234
	4.3.10	Relationship between structural cost and cycle time	235
	4.3.11	The impact of hypothetical projects on pre-planned labour	
		productivity between structural building systems	236
	4.3.12	Comparison between ideal, actual and pre-planned labour	
		productivity	238

xiii



		4.3.13 Factors causing gaps between actual and ideal labour productivity	243
	4.4	Conclusion	259
5	CON	ICLUSION	
	5.1	Introduction	263
	5.2	The Impact of Types of Structural Building Systems, Crew Size,	
		Cycle Time, Floor Level, Gross Floor Area, Worker Daily Salary,	
		Types of Contracts on Ideal Labour Productivity	
		(Time Study On-site Observation)	263
	5.3	Ideal Labour Productivity Measurement Method	
		(Time Study On-site Observation)	266
	5.4	The Impact of Types of Structural Building Systems,	
		Structural Cost, Crew Size, Cycle Time, Worker Daily Salary,	
		Quantity Completed on Actual Labour Productivity	
		(Survey Questionnaire)	266
	5.5	The Impact of Hypothetical Projects on Pre-planned Labour	
		Productivity (Survey Questionnaire)	269
	5.6	Factors Causing Gaps Between Actual and Ideal Labour	
		Productivity (Survey Questionnaire)	270
	5.7	Recommendation	271
	5.8	Summary	274
RE	FERENG	CES	275
API	PENDIC	ES	285
BIC	DATA	OF THE AUTHOR	299



LIST OF TABLES

Tables		Page
1.1	Usage of workers and potential for productivity improvement in building work	3
1.2	Productivity improvement for structural work	5
1.3	Productivity improvement for architectural work	7
1.4	Categories of housing during seventh Malaysia Plan	11
2.1	Building system classification according to relative weight of components	32
2.2	Prefabricated housing market share in Japanese Fiscal Year 1999	60
2.3	Argentina market for industrialised housing system	62
2.4	Characteristics of construction industry versus manufacturing industry	78
2.5	Sample sizes for selected confidence limits and category proportions	81
2.6	Results of work sampling studies in percentage	82
2.7	Time study data for placing formwork	86
2.8	Typical MPDM data collection form	88
2.9	Typical foreman delay survey	102
2.10	Main features of analysed construction methods	109
2.11	Labour requirement	110
2.12	Labour requirement on-site in different construction alternatives	112
2.13	Characteristics of building A and building B	113
2.14	Productivity rates for structural beam formwork	114
2.15	Mean national productivity rates for each type of formwork system	115
2.16	Labour adjustment factors for Northern Europe	116
2.17	Labour adjustment factors for Central and Southern Europe	117

xv



2.18	Labour adjustment factors for Near and Far East	117
2.19	Labur adjustment factors for Central America	118
2.20	Labour adjustment for Northern Europe	118
2.21	Management, site and environmental factors for vertical concrete formwork	119
2.22	Formwork system productivity	120
2.23	Productivity comparison between various types of industrialised building system	122
2.24	Comparison of pre-planned construction time between countries	126
3.1	Sample size for selected confidence limits and category proportion	148
3.2	Project characteristics	152
3.3	The proposed statistical technique used in the present study	157
3.4	The strength of association between two variables	159
4.1	Project characteristic for seven residential projects	170
4.2	Ideal labour productivity comparison between projects	173
4.3	Ideal labour productivity comparison between structural building systems	174
4.4	ANOVA output for ideal labour productivity comparison between structural building systems	175
4.5	Crew size comparison between projects	178
4.6	Crew size comparison between structural building systems	179
4.7	ANOVA output for crew size comparison between structural building systems	180
4.8	Scheffe's method of multiple comparison between structural building systems for crew size	180
4.9	Crew size distribution according to trades	180
4.10	Pearson's correlation between ideal labour productivity and crew size	181



4.11	Cycle time (days) comparison between projects	183
4.12	Cycle time (days) per house comparison between structural building systems	184
4.13	ANOVA output for cycle time comparison between structural building systems	185
4.14	Pearson's correlation between ideal labour productivity and cycle time	186
4.15	Pearson's correlation between ideal labour productivity and floor level	189
4.16	Gross floor area comparison between structural building systems	189
4.17	Daily worker salary comparison between projects	191
4.18	Types of project contracts comparison between projects	192
4.19	ANOVA statistics output for final regression model	200
4.20	Variables coefficients	202
4.21	Correlation matrix between variables	205
4.22	Frequency distribution on the respondents' working experiences	210
4.23	Frequency distribution on the respondents' academic qualification	211
4.24	Frequency distribution on the respondents' company nature of business	213
4.25	Frequency distribution on the respondents' race	214
4.26	Frequency distribution on the types of structural building systems	216
4.27	Distribution of project total construction cost	217
4.28	Distribution of types of housing projects	219
4.29	Actual labour productivity comparison between structural building systems	221
4.30	ANOVA output for actual labour productivity comparison between structural building systems	222
4.31	Structural cost comparison between structural building systems	224



4.32	ANOVA output for structural cost comparison between structural building systems	225
4.33	Crew size comparison between structural building systems	227
4.34	ANOVA output for crew size comparison between structural building systems	228
4.35	Cycle time comparison between structural building systems	230
4.36	ANOVA output for cycle time comparison between structural building systems	230
4.37	Worker daily salary for all types of skill	232
4.38	Average number of house per project comparison between structural building systems	233
4.39	Pre-planned labour productivity comparison between structural building systems	237
4.40	ANOVA output for pre-planned labour productivity comparison between structural building systems	238
4.41	Labour productivity comparison between survey questionnaire and time study on-site observation for conventional building system	240
4.42	Labour productivity comparison between survey questionnaire and time study on-site observation for cast <i>in-situ</i> table form system	241
4.43	Labour productivity comparison between survey questionnaire and time study on-site observation for cast <i>in-situ</i> tunnel form system	241
4.44	Labour productivity comparison between survey questionnaire and time study on-site observation for full precast concrete system	241
4.45	Labour productivity comparison between survey questionnaire and time study on-site observation for composite system	241
4.46	Labour productivity comparison between survey questionnaire and time study on-site observation for block system	242
4.47	Ranking of importance of project delay factors on labour productivity	245
4.48	Ranking of frequency of project delay factors on labour productivity	254

xviii



xix



LIST OF FIGURES

Figur	igures	
1.1	Badir-Razali Building System Classification	19
1.2	Conceptual framework adopted from factor model	20
2.1	Examples of linear systems for public buildings	35
2.2	Different systems of panel elements	38
2.3	Different arrangement of box systems	40
2.4	Cast in-situ tunnel form system	43
2.5	Cast in-situ table form systems	45
2.6	HDB precast concrete implementation	64
2.7	The hierarchy of productivity measurement indicators	76
2.8	Factor model of construction productivity	90
2.9	Percentage use of productivity monitoring methods	93
2.10	(a) Digital deck stopwatch, (b) digital handheld stopwatch, and (c) analogue stopwatch	105
2.11	Details of multi-story concrete frame	125
2.12	Distribution of worker time utilisation for a task	129
3.1	Schematic diagram of data collection methodology	137
3.2	The advantages and disadvantages between time study on-site observation and survey questionnaire	138
3.3	Prerequisites condition for observational study	144
3.4	Structural element of a house	151
3.5	Project A – conventional building system	153
3.6	Project B – conventional building system	153



3.7	Project C – cast in-situ table form system	154
3.8	Project D – cast <i>in-situ</i> table form system	154
3.9	Project E – cast in-situ tunnel form system	155
3.10	Project F – cast in-situ tunnel form system	155
3.11	Project G – precast concrete wall and precast half slab system	156
3.12	Proposed research methodology flow chart	158
3.13	Multiple regression analysis flow diagrams	167
4.1	Ideal labour productivity for seven residential projects	171
4.2	Ideal labour productivity comparison between projects	174
4.3	Ideal labour productivity comparison between structural building systems	175
4.4	Crew size comparison between projects	178
4.5	Crew size comparison between structural building systems	179
4.6	Distribution of crew size according to trades	179
4.7	Cycle time (days) comparison between projects	184
4.8	Cycle time (days) comparison between structural building system	185
4.9	Hypotheses testing for overall regression model	201
4.10	Hypotheses testing for individual variables	203
4.11	Residuals plotted against predicted labour productivity	207
4.12	Ideal labour productivity plotted against predicted labour productivity	208
4.13	Respondents' working experiences in construction industry	211
4.14	Respondents' academic qualification	212
4.15	Respondents' company nature of business	213
4.16	Respondents' race	214

xxi



4.17	Distribution of projects according to structural building systems	216
4.18	Distribution of projects total construction costs	218
4.19	Classification of projects according to types of housing projects	219
4.20	Actual labour productivity comparison between structural building systems	222
4.21	Structural cost comparison between structural building systems	225
4.22	Crew size comparison between structural building systems	228
4.23	Cycle time (days) comparison between structural building systems	231
4.24	Typical structural layout plan	236
4.25	Labour productivity comparison between ideal, actual and pre-planned labour productivity	240





LIST OF ABBREVIATIONS

- P_i labour productivity for the structural enclosure of one unit house (manhours/m²);
- 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

xxiii



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).

