PREFABRICATED BUILDING METHOD IN SRI LANKA AND USER ATTITUDE

Colombage Sudesh Ranga De Silva

128256v

Master of Business Administration in Project Management

Department of Civil Engineering

University of Moratuwa Sri Lanka

December 2017

PREFABRICATED BUILDING METHOD IN SRI LANKA AND USER ATTITUDE

Colombage Sudesh Ranga De Silva

128256v

Dissertation submitted in partial fulfillment of the requirements for the Master of Business Administration in Project Management

Department of Civil Engineering

University of Moratuwa Sri Lanka

December 2017

DECLARATION OF THE CANDIDATE AND SUPERVISOR

"I declare that this is my own work and this thesis/dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Also, I hereby grant to University of Moratuwa the non-exclusive right to reproduce and distribute my thesis/dissertation, in whole or in part in print, electronic or other medium. I retain the right to use this content in whole or part in future works (such as articles or books).

Signature:	Date:
The above candidate has carried out research	ch for the masters under my supervision.

Dr. L.L.Ekanayake
Senior Lecturer
Department of Civil Engineering
University of Moratuwa.

Date:

ABSTRACT

During the development of construction industry, people looked forward on building their

houses by using less time and cost consuming methods. Prefabricated building methods

were introduced as the outcome of this developmental process.

In conventional building method, both total fabrication and erection were carried out in the

site, which was a highly labour intensive work and also it was difficult to control the

wastages and quality. In such rough working environment, labours refused working, where

it became very difficult to arrange skill labours to these work sites. High scarcity of

resources, daily rising cost of raw materials, controlling of wastage become much more

important.

Prefabricated building method grab considerable market share in developed countries like

United States, Japan, china and United Kingdom. From early 1960s prefabricated housing

projects were lunched in Sri Lanka. But this method could not grab significant market

share in Housing industry of Sri Lanka.

Prefabricated housing projects that previously carried out in various parts of Sri Lanka,

selected as the case study and carried out user responsive survey and using personal

observation prepare the conclusion and recommendations. Visiting the prefabricated model

manufactures and analysis the pros and cons of their models and found out the reasons

behind their models, why that those poorly attract the market.

After analysis of all the information, found that major reasons for not grabbing

considerable market share as that this prefabricated housing method did not considering the

local customs and believes, local climatic conditions, lack of space and expandable ability

within these housing units and poor marketing of model manufactures. Then considering

these conclusion and prepare the recommendation as the guide line on launching of

prefabricated housing projects, where these steps will give good opportunity to grab

considerable market shear for prefabricated housing in housing industry.

Key words: Prefabricated building, Conventional building

ii

ACKNOWLEDGMENT

Many have helped me in making this research a success. Guidance and assistance given by

my research supervisor Dr.L.L.Ekanayake is highly appreciated and I am sincerely grateful

for the support given by him during the research and academic period. I would like to

express my gratitude to all the lecturers, the academic and non-academic staff of the

University of Moratuwa who helped me in numerous ways during the academic period.

I would like to thank specially to the people who live in colony houses in Ambilipitiya and

Udawalawe area, Tsunami Kit houses, Rukmalgama housing scheme Athurugiriya for

giving their valuable ideas.

I am also thankful to the officers of NERD Centre, NHDA Centre, ICC precast Centre and

other organizations for giving relevant details and share their experience.

Finally, I would like to thank my family members and friends for their patience,

encouragement, and assistance in making this research a success.

Thank You.

C.S.R. De Silva.

iii

Table of Contents

	ation of Candidate and supervisor	
	wledgment	
	Abbreviations	
	TRODUCTION	
1.1.	Background	
1.2.	Research Questions	
1.3.	Objectives	
1.4.	Research Justification	
1.5.	Research Methodology	
1.6.	Scope and Limitations of the Research	
1.7.	Structure of the Dissertation	
2. LIT	ΓERATURE REVIEW	
2.1.	Building Construction and the Need of Shelter	
2.2.	Historical Development of Building Constructions	6
2.3.	Socio-economic Context of Contemporary Building Methods	8
2.4.	Development of Building Constructions	
2.4	.1. Traditional buildings	10
2.4	.2. Post-traditional (Conventional) building	11
2.4	.3. Rationalized building	12
2.4	.4. System building	14
2.4	.5. Component building	15
2.5.	Introduction to 'Element Building' Methods	15
2.6.	Present Situation of Building Constructions in Sri Lanka	
2.7.	Concept of Housing	
2.8.	Main Determinant and Modifying Factors	21
2.8	.1. Climatic conditions	
2.8	.2. Socio-cultural settings	23
	.3. Material, construction and technology	
	.4. Economic conditions	
	SEARCH METHODOLOGY	
3.1.	Case study	
3.2.	Preparation of Questionnaire	
3.3.	Interview and personal observations	
5.5.	meet the training personal observations	

3.4.	Ways of Carrying out Data Analysis	32
3.5.	Ways of Preparing Conclusions	322
4. DA	TA ANALYSIS	34
4.1.	Introduction to Data Analysis	34
4.2. Lanka	Application of the Prefabricated Building Method for Housing in Sri	34
	1. The colony houses erected by the River Valley Development Board a awalawe and Embilipitiya	
4.2.	2. Rukmalgama housing scheme at Athurugiriya (Colombo District)	38
4.2.	3. Tsunami kit-houses at Thelwatta (Galle District)	39
4.2.	4. The prefabricated model houses built by the NERD Center at Ekala	42
4.2.	5. The prefabricated prototype house done by the NHDA at Maligawatta	ı: 44
4.2.	6. Involvement of local building product manufacturers and developers.	46
4.3.	Result of User Response Surveys	48
4.4.	Impacts of Users' Attitudes	49
4.5.	Visual Impression of housing units	49
4.6.	Use of materials and technology in housing units	53
4.7.	Flexibility to spaces and changes in housing units.	56
4.8.	Economic Value of the Investment of housing units	58
4.9.	Traditional Local Customs and Beliefs of housing units	60
4.10.	The Physical Comfort Level of housing units.	61
4.11.	Lack of Quality Local Models and Prototypes	63
5. CO	NCLUSION	67
5.1.	Introduction to Conclusion	67
5.2.	Findings	67
5.3.	Conclusion	68
5.4.	Constraints	69
5.5.	Recommendations	69
5.6.	Future works	70
6. Ref	erences	72
Δne	endices	74

List of Tables

Table 4-1: Result of user responsive survey	48
List of Figures	
Figure 2-1: An ancient Iron–Age hut made of clay and wood	6
Figure 2-2: The Parthenon at Greece constructed in 5th century BC	7
Figure 2-3: Disney Concert hall	8
Figure 2-4: Beijing National stadium– Bird nest	9
Figure 2-5: Taj Mahal at Agra, India	10
Figure 2-6: Royal palace of Polonnarwa	11
Figure 2-7: Usage of ready mix concret.	.12
Figure 2-8 : Steel structure for long spans	12
Figure 2-9: Beginning stage of Alatir twin tower	13
Figure 2-10: Assembling of prefabricated wall panel	
Figure 2-11: Fully factory produced residential unit at a rural area	15
Figure 2-12: Assembling of wholly factory produced modular houses for returnin	g
soldiers in USA in1960s	16
Figure 2-13: Nakagin capsule tower at Tokyo, Japan.	17
Figure 2-14: Future view of Port City project	18
Figure 2-15: Temporary huts in a Tsunami refugee camp at Ulle, Sri Lanka	19
Figure 2-16: Housing – As a basic need of the society	20
Figure 2-17: Eskimo House at Alaska	21
Figure 2-18: A typical house at Galle, Sri Lanka	22
Figure 2-19: A typical open house at Iquitos, Peru.	
Figure 2-20: The traditional African house at Mali	23
Figure 2-21: "Tatami" mat used traditional Japanese house	
Figure 2-22:Religious activities and rituals for digging foundation for a new house	
Figure 2-23: Turf roof houses at south of Island, Iceland	
Figure 2-24: ABedouin tent at Arab desert areas	
Figure 2-25: Traditional Sri Lankan house constructed using natural materials	
Figure 2-26: Low income houses at the Colombo municipal region	28
Figure 2-27: Most developers considered only the number of houses, without	
thinking about the user.	
Figure 4-1: External view of RVDB workers' house at Udawalawe	
Figure 4-2: Front view of RVDB workers' houses At Udawalawe	
Figure 4-3: External view of a RVDB house at Morakatiya.	
Figure 4-4: Frame structure of RVDB house at Morakatiya	
Figure 4-5: only the frame structure prefabricated, RVDB house-Morakatiya	37

Figure 4-6: The smallest and the simple house type of Rukmalgama housing	
community (Type A)	.38
Figure 4-7: External view of the largest house type of Rukmalgama housing	
community (Type C)	.38
Figure 4-8: Repetitive layout of the house type A and the twin type house (type B))39
Figure 4-9: Internal layout of the prefabricated kit-house unit at Thelwatha	
Figure 4-10: External view of the kit-house unit at Thelwatha	.40
Figure 4-11: Placement of the prefabricated kit-house on the foundation of destroy	yed
house	.41
Figure 4-12: Assembling of the prefabricated model house, NERD center - Ekala.	. 42
Figure 4-13: External view of the NERD model house before finishing	42
Figure 4-14: External view of NERD model house after finishing	43
Figure 4-15: Isomeric view of model house at NHDA	. 44
Figure 4-16: External view of the finish model house, NHDA - Maligawatta	. 44
Figure 4-17: External view of a wall coloured model house, NHDA - Maligawath	a45
Figure 4-18: Kit form house product of ICC - Piliyandala	.46
Figure 4-19: Prefabricated wall panels produced by the ICC - Piliyandala	.46
Figure 4-20: Fully factory produced and site assembled steel house at Bolgoda, A	BS
(pvt)ltd	.47
Figure 4-21: Residential container conversion, Mclarence Logistics (pvt)ltd	.48
Figure 4-22: Visual impression	.50
Figure 4-23: "impermanent" or unsteady quality, RVDB house - Morakatiya	. 50
Figure 4-24: Visual impression of the house does not reflect a "prestige" or	
"Durable" look, RVDB house - Morakatiya	.51
Figure 4-25: Three inch thick partition wall, Model house – NERD Center	.51
Figure 4-26: Interior finish at entrance, Tsunami Kit-house- Thelwatha	. 52
Figure 4-27: Interior finish in room, Tsumami kit-house - Thelwatha	. 52
Figure 4-28: Use of material and technology	. 54
Figure 4-29: Some users idea about alteration to the existing prefabricated house.	. 55
Figure 4-30: A RVDB house at Moraketiya, finished using conventional materials	s 56
Figure 4-31: Flexibility to spaces and changes	. 56
Figure 4-32: A twin type house at Rukmalagama, converted to a two-story one wh	nile
the original walls remain same.	. 57
Figure 4-33: Economic value of investment	.58
Figure 4-34: A rich looking two storied house at Rukmalgama housing scheme bu	ıilt
by completely removing the smallest type of house.	. 59
Figure 4-35: Tally with local customs and beliefs.	. 60
Figure 4-36: The removed column by the user thinking that 9 columns are	
inauspicious	.61
Figure 4-37: Physical comfort level	
Figure 4-38: The user gets uncomfortable due to environmental impact	. 62

Figure 4-39: Materials are selected without considering the local climatic	
conditions	63
Figure 4-40:Prototype house done by the NERD Center by using prefab cement	
panels	64
Figure 4-41: The 'Magic Box' at Los Angeles	64
Figure 4-42: Exterior view of 'Magic Box' at Los Angeles	65
Figure 4-43: Attractive interior view of the 'Magic Box' at Los Angeles	65

List of Abbreviations

RVDB - River Valley Development Board

NERD - National Engineering Research and Development center

NHDA - National Housing Development Authority

ICC - International Construction Consortium (pvt) ltd