UNIVERSITI TEKNOLOGI MARA
College of Built Environment

Poster Book

IIIDBEEX 2023

20 JANUARY 2023

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THE EFFECTS OF INDUSTRIALIZED BUILDING SYSTEM (IBS) APPLICATION IN INCREASING THE EFFICIENCY OF BUILDING CONSTRUCTION PROJECTS

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INTRODUCTION

Figure 1: Biaxial Hollow IBS Precast Slab System, PAM Building. Source: Bubbledeck Construction Sdn. Bhd.

In today's world, the construction sector is seen as a critical industry for boosting economic growth in both emerging and established countries. In conjunction with that, the increasing demands for more residential and commercial buildings come with a big risk when the manpower is not up to par to deliver the project in time [1]. Industrialized Building System (IBS) is one of the newly found efforts developed in the construction industry in tackling the glaring issue. Malaysia has begun to adopt the IBS idea to cater to its growing population and housing needs [2]. The main selling point of IBS is to increase construction project efficiency, i.e., energy consumption, waste management, and project completion period, to meet the consumer's demands [3].

PROBLEM STATEMENT

The construction industry has had many setbacks in terms of its development over these past few years. Several construction projects are in a precarious situation due to inefficiencies in worker productivity, coherence, quality, and cost consistency [1].

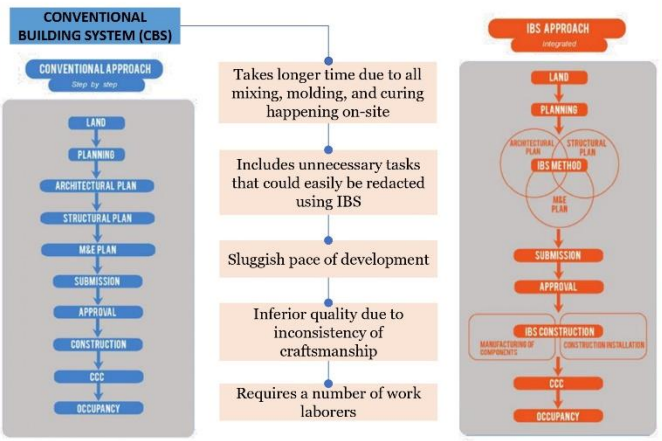

Figure 2: Process of using CBS and IBS approach by the developer. Source: Chee Hung Foo, 2015.

FRAMEWORK

ISSUES

The building construction efficiency

RESEARCH AIM

To analyze the effects caused by the application of IBS in increasing the efficiency of building construction projects compared to CBS

RESEARCH OBJECTIVES

1. To analyze the benefits of IBS
2. To compare and contrast the values between IBS and CBS
3. To develop an understanding of the impact that IBS can provide on the industry

METHODOLOGY

Mixed Method Research:

Data Collection Method
Questionnaire
Case Study

Data Analysis Method
Correlation Analysis
Comparative Analysis

RESULTS

IBS efficiency compared to CBS

TIME EFFICIENCY | **ENERGY EFFICIENCY**

FINDINGS

IBS Performance

The IBS performance factors are as listed in Table 1 (Q1 – Q8). Based on the findings, it can be seen that two significant factors are Q2 and Q4 with a CI of 1.00 highlighting a high significance of increasing the value of the IBS's efficiency.

Table 1: Conformity Index on IBS Performance

Performance Factor	FREQUENCY (Disagree) 1	2	3	4	(Agree) 5	Confirmity Index (CI)
Q1: Improve construction production	0	0	2	28	22	0.8769
Q2: Reduce construction duration	0	0	0	0	52	1.0000
Q3: Reduce usage of raw materials	0	0	1	28	23	0.8846
Q4: Reduce foreign labour	0	0	0	0	52	1.0000
Q5: Decrease construction waste	0	0	7	36	9	0.8077
Q6: Increase building quality	0	4	24	20	1	0.6735
Q7: Reduce project's cost	0	7	25	18	2	0.6577
Q8: Increase safety level	0	0	5	25	22	0.8654

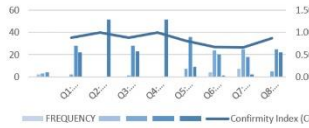

Figure 3: IBS Performance Index

Figure 3 shows the gap scores between the top two factors in contrast with the other factors where Q2 and Q4 yield a bigger significant advantage of IBS over CBS. However, most of the respondents do not guarantee that IBS could increase the building quality and reduce the project cost.

Contractors' Satisfaction

Figure 4 shows most of the respondents are satisfied using IBS with satisfaction factors of C1, C2, C4, C10, C11, C12, C13, C14, and C15 exceeding 50%.

Satisfaction factor	F(x)	mean
C1: Reduce time of completion	33	0.078
C2: Easier safety management	29	0.069
C3: Reduction cost for material disposal	11	0.026
C4: Reduce foreign labour	47	0.111
C5: Higher product quality	6	0.014
C6: Higher durability	12	0.028
C7: Higher design quality	1	0.002
C8: Material cost minimization	4	0.009
C9: Requires skilled workers for IBS installation	24	0.057
C10: Buildability	26	0.061
C11: Reduce concrete work on site	47	0.111
C12: Time certainty	50	0.118
C13: Reduce on-site energy usage	50	0.118
C14: Sustainable process and end product	34	0.080
C15: Reduce on-site construction workload	49	0.116

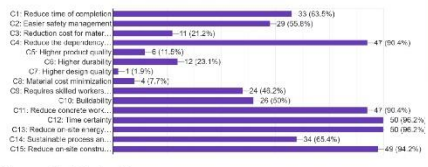

Figure 4: Satisfaction Factor

Table 2: Satisfaction Factors Categorization

Index	Satisfactory Factors	Category	Score
C12	Time certainty	Time consumption	50
C13	Reduce on-site energy usage	Energy consumption	50
C15	Reduce on-site construction workload	Energy consumption	49
C11	Reduce concrete work on site	Time consumption	47
C4	Reduce foreign laborer	Energy consumption	47
C14	Sustainable process and product	Energy consumption	34
C1	Reduce time completion	Time consumption	33
C2	Easier safety management	Energy & Time consumption	29
C10	Buildability	Energy & Time consumption	26

The figure above shows the gap difference between scores is not too far fetch between each other aside from the lowest scoring factors. Instead, the graph shows a similar level of satisfaction for about half of the factors. The top 9 factors are then classified into a more concise classification of category, i.e., time and energy consumption. This indicates that the respondents are most content with the time and energy efficiency of IBS productions.

IBS and CBS Application

Indah Heights was selected as a case study due to its two phases of development, i.e., in phase 1 the units were solely based on CBS meanwhile phase 2 utilizes IBS. Table 3 highlights the differences between CBS and IBS for on-site building work only, factory work is not included. The two main factors that significantly make the difference are time efficiency and energy efficiency. As seen in the comparison, the construction period is reduced by 30%, energy consumption is also reduced by 30%, and energy waste is reduced by 8%.

Table 3: Indah Heights Building System (Source: Kimlun Group, 2018)

Description	Conventional	IBS
Gross Floor Area (GFA) for one unit of 3 storey cluster house	304.86 m² (3281 ft²)	304.86 m² (3281 ft²)
Construction period		
Structure (superstructure) Arch (i.e. brickwork, plastering, skim coat, door/window installation, tiling, painting)	8 weeks 19 weeks	6 weeks 12 weeks
Number of labour		
Carpenter	15	10
Barbender	7	5
Concretor	10	10
Installer	-	5
Labour for architectural work	47	26
Machinery	Mobile crane for concreting	Mobile crane and crawler crane for concreting and the installation of precast panel
Quality (QA/QC Assessment)	80%	80%
Material wastage	11%	3%
Feedback from purchasers	- Wall finishing got hair line crack - Painting off white - Easy renovation - Got water seepage	- Smooth wall finishing - Wall tile hollow - Limited tile hollow - Got water seepage

CONCLUSION

Time Efficiency

Time efficiency is classified as the main advantage of IBS due to its consistency and insurance.

Energy Efficiency

The main contributor to this is the usage of prefabricated building components which reduce the concrete work on site, hence reducing energy consumption.

Project Efficiency

To conclude, IBS is a new alternative in the construction field that increases overall construction project efficiency proving that IBS is better in practice.

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