CHAPTER 5

RESULTS

5.1 INTRODUCTION

In this chapter the researcher presents the results and the analysis of data on the study conducted among the IBS house occupiers, construction stakeholders, focus group participants, stakeholders and academicians. Interviewing experts for validation of the entire study is also carried out. The researcher presents all the tables and figures in relation to the data analysis of results.

5.2 RESULTS: FIRST PHASE

The results of the first phase were divided into two parts, namely, to answer the first research question (first part) and second research question (second part). The first part of the results and data analysis is the satisfaction factors of the IBS house occupiers from the self-administered questionnaire. The second part of the results and data analysis is the IBS adoption factors for the construction industry.

5.2.1 Results of First Part: Factors of the Customer Satisfaction of IBS House Occupiers

For the results of the first part of the first phase of this study, the researcher analyses data from the IBS house occupiers through quantitative data collection method (self-administered questionnaire survey). The results of the first part of the questionnaire survey section are derived from the background information of the IBS house occupiers, background information of IBS house, overall analysis of customer importance and satisfaction level. These are discussed in the following sub-sections:

i) Background Information of IBS House Occupiers

In this section the researcher investigates all the finer details of the house occupiers. The findings are presented to the readers in detail. The findings are presented in a tabular form initially to show a summary of the data. This is followed by a detailed graph for each and every one of the questions asked. Some details like name, address and telephone number were captured in the researcher's database but were not presented here. The researcher starts with the relevant demographics, as shown in Table 5.1. In total there were 391 respondents, which accounted for 100% in this study.

Table 5.1: House Occupiers Information

Description	Frequency	Percentage
Location	**391**	**100**
Apartment	188	48.1
Low cost flat	101	25.8
Two Storey Terrace House	102	26.1
Age	**391**	**100**
20 and below	17	4.3
21-30	95	24.3
31-40	142	36.3
41-50	83	21.2
51 and above	12	3.1
No answer	42	10.7
Gender	**391**	**100**
No answer	40	10.2
Male	210	53.7
Female	141	36.1
Race	**391**	**100**
Chinese	12	3.1
Indians	34	8.7
Malays	318	81.3
Others	1	0.3
No answer	26	6.6
Citizen	**391**	**100**
No answer	8	2
Malaysia	383	98
Education	**391**	**100**
Primary school	2	0.5
Secondary school	134	34.3
Diploma	89	22.8
Degree	117	29.9
Higher Degree	15	3.8
No answer	34	8.7

Table 5.1: House Occupiers Information (Cont'd)

Description	Frequency	Percentage
Marital status	**391**	**100**
Married	288	73.7
Single	60	15.3
Widow (Male)	2	0.5
Widow (Female)	6	1.5
No answer	35	9
Children	**391**	**100**
1-2	147	37.6
3-4	118	30.2
5 and above	24	6.1
No children	64	16.4
No answer	38	9.7
Income	**391**	**100**
RM1000 and below	37	9.5
RM1001-3000	190	48.6
RM3001-5000	102	26.1
RM5001 and above	4	1
No answer	58	14.8
Type of House	**391**	**100**
Apartment/Condominium	289	73.9
Semi Detached	0	0
Terrace House	102	26.1
No answer	0	0
Floor Area	**391**	**100**
< 1000 m2	101	25.8
1001-2000 m2	187	47.8
2001-3000 m2	44	11.3
No answer	59	15.1
House Ownership	**391**	**100**
Employers House	222	56.8
Own House	59	15.1
Rented House	73	18.7
No answer	37	9.5
House Price	**391**	**100**
<RM25000	1	0.3
RM25001-100000	101	25.8
RM100001-200000	187	47.8
RM200001-300000	100	25.6
> RM300001	1	0.3
No answer	1	0.3
Reason for purchase of house	**391**	**100**
Near to basic amenities	18	4.6
Reasonable price	44	11.3
Safety features	7	1.8
Suitable location	78	19.9
Opportunity for value appreciation	7	1.8
Attractive loan	8	2
House design	13	3.3
Good neighbourhood	4	1
No answer	212	54.2

Apartment is the location where 188 respondents participated and provided the results. This group accounted for 48.1% from the total respondents or population. Two storey terrace house has 102 respondents representing 26.1% from the total respondents or population. The low cost flat accounted for 25.8% from the total respondents or population with 101 respondents.

Most of the respondents were in the 31-40 age brackets, with 36.3% of the respondents, and a further 24.3% were from the 21-30 age group**s**. The 41-50 age groups had 83 respondents accounting for 21.2%; 20 years and below had 17 respondents amounting to 4.3% and 51 years and above had 12 respondents with 3.1%. However, 42 respondents did not answer.

More than half the respondents were male. This group makes up 53.7% of the respondents, while female respondents make up 36.1%, however, some 10.2% respondents did not answer this question.

Most of the respondents were of Malay origin as they form 81.3% in this category with 318 respondents. Indians form 8.7% with 34 respondents, and 12 Chinese accounting for 3.1% of the respondents; 1 respondent was from other amounting to 0.3%. Some 26 respondents forming 6.6% did not answer this question.

Almost all the respondents were Malaysians, which form 98% of the respondents with 383 respondents; 8 respondents did not answer this question forming 2% of the total respondents.

Most of the respondents had received secondary education, with 134 or 34.3% respondents in this group. Degree formed 29.9% with 117 of the respondents. There were 89 diploma holders accounting for 22.8%; 15 respondents have higher degree education forming 3.8% while 2 respondents forming 0.5% had only primary education. The remaining 34 respondents chose not to answer this question.

In terms of marital status, the research shows that 73.7% of the respondents were married while 15.3% of the samples were single. This accounted for 288 and 60 respondents, respectively. A further 8 of the respondents were either widowed or divorced forming 2% of the total and 35 respondents did not answer this question forming 9%.

Most of the married respondents had children: 37.6% or 147 had 1-2 children While 118 respondents representing 30.2% had 3-4 children. Some 24 or 6.1% of the respondents had 5 or more children. A further 64 of the respondents amounting to 16.4% had no children and 9.7% or 38 respondents did not respond to this question.

In terms of income, most of the respondents were earning between RM1001-3000 with 190 or 48.6% of the respondents in this salary group. The RM3001-5000 is the next highest group with 102 or 26.1% respondents; 37 respondents earn less than RM1000 accounting for 9.5% and 4 of respondents forming 1% earn more than RM5000. Some 58 respondents forming 14.8% did not answer this question.

In relation to the type of house, a major portion of the respondents was from the apartment or condominium category, accounting for 73.9% or 289 of the respondents. Terrace house was next with 102 or 26.1% respondents.

Almost half of the respondents live in a built-up area of 1001-2000 m^2 with 187 respondents forming 47.8% in this category; 101 respondents live in less than 1000 m^2 accounting for 25.8% of the total respondents; 44 of the respondents have the luxury of living in 2001-3000 m^2. This group forms 11.3%, while 59 or 15.1% respondents did not answer this question.

As for the status of ownership, more than half of the respondents stated that they live in their employers' house. This group accounted for 56.8% with 222 respondents;73 lived in a rented house forming 18.7%. Own house occupiers accounted for 15.1% with 59 respondents and 37 or 9.5% did not answer this question.

In most cases, the purchase price was in the RM100,001-200,000 price bracket. This group accounted for 47.8% with 187 respondents. The RM25,001-RM100,000 price range was next with 101 respondents or 25.8%. This was followed by the RM200,001-300,000 price range with 100 respondents accounting for 25.6%. There was 1 respondent each in the less than RM25,000 and more than RM300,001 price group. These accounted for 0.3% each. Likewise, 1 respondent did not answer this question accounting for 0.3%.

There were several reasons as to why most house occupiers purchased the house. From the answered questionnaire the majority of house occupiers indicated that the reason for buying the property was because of a suitable location, with some 78 or 19.9% of respondents in this category. Reasonable price attracted 44 or 11.3% of the respondents. Proximity to basic amenities was the reason cited by 18 respondents amounting for 4.6%. The house design was the reason for 13 respondents accounting for 3.3%.

Attractive loan was the reason for 8 or 2% of the respondents. Safety features were cited by 7 respondents representing 1.8%. Value appreciation was the reason for 7 or 1.8% of the respondents. Good neighbourhood tempted 4 respondents amounting to 1%. However, some 212 respondents did not answer this question. This is because the house is provided by the government as there are government staffs.

(ii) Background Information of IBS House Occupier

In this section the researcher discusses the house background details in relation to the house occupier. The details are summarized in Table 5.2.

Table 5.2: House background details

Description	Frequency	Percentage
Developer	**391**	**100**
IBS A	289	73.9
IBS B	102	26.1
Number of floors	**391**	**100**
1	289	73.9
2	102	26.1
Number of rooms	**391**	**100**
1	0	0
2	0	0
3	289	73.9
4	98	25.1
5	1	0.3
No answer	3	0.7
Renovation	**391**	**100**
None	314	80.3
Yes	25	6.4
No answer	52	13.3

There were only two developers in this survey. The developers were known as IBS A and IBS B. The IBS A has a total of 289 respondents accounting for 73.9%. IBS B had 102 respondents amounting to 26.1% of the total respondents.

Almost three quarters of the respondents live in a single floor of multiple storey apartment buildings. This group accounts for 73.9% with 289 respondents. The balance one quarter of the respondents amounting to 102 respondents lives in a two-storey building.

It can be summarized that, all the houses have 3 bedrooms. A total of 289 respondents accounting for 73.9% were in 3 room accommodation; 98 respondents accounting for 25.1% of those surveyed live in 4 room accommodation; 1 respondent lived in 5 room accommodation. This accounts for 0.3%. Three respondents did not answer this question.

Some 314 respondents did not do any renovation to their house. This group accounted for 80.3%; 25 or 6.4% of the respondents had renovated their house. Another 52 respondents accounting for 13.3% did not answer this question.

The researcher attempted to get some feedback on the issues and problems faced by the respondents. In order to facilitate the respondents, the question was divided into 4 subsections covering leakage, cracks, damage and no problems. The data were summarized concerning the issues/problems of house occupiers, as shown in Table 5.3.

Table 5.3: Issues or Problems of House Occupiers

Issues/Problem	**Frequency**
Leakage	193
Cracks	174
Damage	9
No problem	77

iii) Results of Overall Analysis of Customer Importance and Satisfaction Level.

The overall analysis of customer satisfaction level and importance level revealed the factors of customer satisfaction on IBS house occupiers. The results of the overall analysis of customer satisfaction and satisfaction level on IBS house occupiers are as shown in Table 5.4. From this table the size of house, which is more than 2001m^2 is the most important (mean=4.421) and most satisfied (mean = 3.869) among the other two sizes of house (less than 1000m^2 and 1001-2000m^2).

Table 5.4: Size of House means response

No.	Size of House	Importance (Mean)	Satisfaction (Mean)
1	< 1000 m^2	3.868	3.039
2	1001 - 2000 m^2	4.225	3.505
3	> 2001 m^2	4.421	3.869

The results of the IBS houses occupiers are evaluated in terms of the house price, as shown in Table 5.5. The mean response for the house price is of more importance (mean=4.667) than being satisfied (mean=3.826).

Table 5.5: House Price mean response

No.	Factors	Importance (Mean)	Satisfaction (Mean)
1	House Price	4.667	3.826

The results of the quality of workmanship are shown in Table 5.6. In terms of importance, this table indicates that the house occupiers are most concerned with the external work (mean=4.873) and least concerned with the built in fittings (mean=4.380). Furthermore, the house occupiers are most satisfied with the superstructure

(mean=3.635) and least satisfied with the built in fittings (mean=3.375). The importance of the quality of workmanship is much more than being satisfied with the workmanship.

Table 5.6: Quality of Workmanship

No.	Quality of Workmanship	Importance (Mean)	Satisfaction (Mean)
1	Superstructure	4.620	3.635
2	External Wall	4.593	3.602
3	Internal Wall	4.618	3.597
4	Window	4.563	3.573
5	Door	4.598	3.553
6	Finishes	4.551	3.558
7	Building Services	4.640	3.418
8	Built in Fittings	4.380	3.375
9	Layout of house	4.812	3.473
10	External Work	4.873	3.379

The results of the investigation concerning the superstructure are shown in Table 5.7. From this table the house occupiers believe that the column (mean=4.636) is the most important element of superstructure whereas the floor beam (4.602) is the least important.

Table 5.7: Superstructure mean response

No.	Superstructure	Importance (Mean)	Satisfaction (Mean)
1	Column	4.636	3.694
2	Upper Floor	4.620	3.628
3	Floor Beam	4.602	3.594
4	Roof Beam	4.621	3.624

The results of the external wall, internal wall, window, door, and built in fittings are shown in Table 5.8. From this table the internal wall (mean=4.618) is the most

important among the five items with single level. The house occupiers are most satisfied with the external wall (mean 3.602) compared to the other five items without sub levels. House occupiers consider the built in fittings as least important and are also least satisfied with them.

Table 5.8: External wall, internal wall, window, door, and built in fittings mean response

No.	Quality of Workmanship	Importance (Mean)	Satisfaction (Mean)
1	External Wall	4.593	3.602
2	Internal Wall	4.618	3.597
3	Window	4.563	3.573
4	Door	4.598	3.553
5	Built in Fittings	4.380	3.375

The results of the investigation of the finishes of the 5 items are shown in Table 5.9. From this table the house occupiers believe that the ceiling finishes are the most important and external floor finishes (mean=4.511) the least important to them. Where as, the house occupiers are most satisfied with the internal floor finishes (mean=3.584) and least satisfied with the external wall finishes (mean=3.525).

Table 5.9: Finishes mean response

No.	Finishes	Importance (Mean)	Satisfaction (Mean)
1	External Wall Finishes	4.522	3.525
2	Internal Wall Finishes	4.556	3.571
3	External Floor Finishes	4.511	3.533
4	Internal Floor Finishes	4.581	3.584
5	Ceiling Finishes	4.587	3.576

The results of the investigation of the building services mean responses are shown in Table 5.10. From this table, the building services considered most important to the

house occupiers is the bathroom (mean=4.658) while the electrical installation (mean=4.613) is the least important. The building services that the house occupiers are most satisfied with is the electrical installation (mean=3.561) and the least satisfied is the pipe installation (mean=3.274).

Table 5.10: Building Services mean response

No.	Building Services	Importance (Mean)	Satisfaction (Mean)
1	Toilet	4.656	3.439
2	Bathroom	4.658	3.396
3	Pipe Installation	4.633	3.274
4	Electrical Installation	4.613	3.561

The results of the investigation of the layout of the house are shown in Table 5.11. This table indicates that the house occupiers view the master bedroom (mean=4.620) as the most important and the utility room (mean=4.392) the least important in terms of the layout of IBS homes. However, the house occupiers are most satisfied with the master bedroom (mean=3.657) and least satisfied with the wet area (mean=3.253) in terms of the layout of the IBS houses.

Table 5.11: Layout of House mean response

No.	Layout of House	Importance (Mean)	Satisfaction (Mean)
1	Master Bedroom	4.620	3.657
2	Bedroom	4.592	3.652
3	Living Room	4.583	3.584
4	Dining Room	4.554	3.578
5	Dry Kitchen	4.496	3.483
6	Wet Kitchen	4.541	3.494
7	Toilet	4.582	3.439
8	Bathroom	4.582	3.478
9	Wet Area	4.557	3.253
10	Utility Room	4.392	3.263
11	Balcony	4.465	3.384
12	Parking Lots	4.613	3.368

The results of the investigation of the external work are shown in Table 5.12 below. From this table, the house occupiers consider that the most important part of the external works in IBS homes is the access road (mean= 4.615) and the least important is the landscape (mean=4.554). However, the house occupiers are most satisfied with the drainage (mean=3.477) and least satisfied with the fencing (mean=3.327).

Table 5.12: External Work mean response

No	External Work	Importance (Mean)	Satisfaction (Mean)
1	Drainage	4.600	3.355
2	Landscape	4.554	3.477
3	Gate	4.580	3.332
4	Fencing	4.610	3.327
5	Access Road	4.615	3.401

The results of the investigation of the specification or quality of building materials are shown in Table 5.13. This table indicates that the most important to IBS house occupiers for the specification or quality of building materials is the superstructure (mean=4.891) while the least important is the built in fittings (mean=4.399). Similarly, the house occupiers are most satisfied with the superstructure (mean=3.532) and least satisfied with the built in fittings (3.314).

Table 5.13: Specification/Quality of Building Materials

No.	Specification/Quality of Building Materials	Importance Level (Mean)	Satisfaction Level (Mean)
1	Superstructure	4.891	3.532
2	External Wall	4.626	3.471
3	Internal Wall	4.587	3.471
4	Window	4.575	3.409
5	External Door	4.569	3.443
6	Internal Door	4.567	3.523
7	Finishes	4.560	3.447
8	Building Services	4.635	3.337
9	Built in Fittings	4.399	3.314
10	Building Layout	4.523	3.412
11	External Work	4.643	3.423

The results of this investigation of the superstructure mean response are shown in Table 5.14 below. From this table, the most important element of superstructure to IBS house occupiers is the column (mean=4.663) while the least important is the roof beam (mean=4.619). However, the IBS house occupiers are most satisfied with the column (mean=3.560) and least satisfied with the upper floor (mean=3.510).

Table 5.14: Superstructure mean response

No.	Superstructure	Importance (Mean)	Satisfaction (Mean)
1	Column	4.663	3.560
2	Upper Floor	4.634	3.510
3	Floor Beam	4.656	3.518
4	Roof Beam	4.619	3.542

The results of the investigation of the specification and quality of building materials are shown in Table 5.15 below. This table shows that the most important element to IBS house occupiers is the external wall (mean=4.626). Whereas, the IBS house occupiers are most satisfied with is the internal door (mean=3.523) and the least satisfied is the built in fittings (mean=3.314).

Table 5.15: External, internal wall, window, external door, internal door and built in fittings mean response

No.	Specification/Quality of Building Materials	Importance Level (Mean)	Satisfaction Level (Mean)
1	External Wall	4.626	3.471
2	Internal Wall	4.587	3.471
3	Window	4.575	3.409
4	External Door	4.569	3.443
5	Internal Door	4.567	3.523
6	Built in Fittings	4.399	3.314

The results of the investigation of the finishes mean response are shown in Table 5.16 below. From this table, internal floor finishes (mean=4.578) is among the five different items of finishes that are most important to the IBS house occupiers. While, the external

and internal wall finishes (mean=4.544) are the least important finishes. However, the IBS house occupiers are most satisfied with the ceiling finishes (mean=3.468) and are least satisfied with the internal wall finishes (mean=3.432).

Table 5.16: Finishes mean response

No.	Finishes	Importance (Mean)	Satisfaction (Mean)
1	External Wall Finishes	4.544	3.435
2	Internal Wall Finishes	4.544	3.432
3	External Floor Finishes	4.561	3.445
4	Internal Floor Finishes	4.578	3.455
5	Ceiling Finishes	4.575	3.468

The results of this investigation of the building services mean response are shown in Table 5.17. This table indicates that the water supply (mean=4.668) is the most important building service for the IBS house occupiers while the bathroom and the electrical installation (mean=4.611) are the least important building services. However, the IBS house occupiers are most satisfied with the electrical installation (mean=3.490) and least satisfied with the pipe installation (mean=3.250).

Table 5.17: Building Services mean response

No.	Building Services	Importance (Mean)	Satisfaction (Mean)
1	Toilet	4.642	3.296
2	Bathroom	4.611	3.295
3	Pipe Installation	4.641	3.250
4	Water Supply	4.668	3.353
5	Electrical Installation	4.611	3.490

The results of this investigation of the building layout mean response are shown in Table 5.18. Out of the 12 building layout areas, parking lots (mean=4.588) is viewed by the IBS house occupiers as the most important area. While, the least important building layout area is the balcony (mean=4.401). However, the building layout area

with which IBS house occupiers are most satisfied is the master bedroom (mean=3.525) while they are least satisfied with the wet area (mean=3.275).

Table 5.18: Building Layout mean response

No.	Building Layout	Importance (Mean)	Satisfaction (Mean)
1	Master Bedroom	4.560	3.525
2	Bedroom	4.551	3.496
3	Living Area	4.567	3.494
4	Dining Area	4.516	3.462
5	Dry Kitchen	4.481	3.364
6	Wet Kitchen	4.499	3.343
7	Toilet	4.561	3.378
8	Bathroom	4.577	3.397
9	Wet Area	4.536	3.275
10	Utility Room	4.426	3.328
11	Balcony	4.401	3.408
12	Parking Lots	4.588	3.477

The results of the investigation of the external work mean response are shown in Table 5.19. From this table, the access road (mean=4.677) is the most important element for the external work, while the least important is the landscape (mean=4.599). However, the house occupiers are most satisfied with the landscape (mean=3.505) and the least satisfied with the fencing (mean=3.343).

Table 5.19: External Work mean response

No.	External Work	Importance (Mean)	Satisfaction (Mean)
1	Drainage	4.653	3.458
2	Landscape	4.599	3.505
3	Gate	4.626	3.353
4	Fencing	4.658	3.343
5	Access Road	4.677	3.455

The results of this investigation of the design quality, or aesthetics, mean response from the survey are displayed in Table 5.20. This table indicates that the superstructure (mean=3.503) is the most important design quality or aesthetic element to the IBS house occupiers. Whereas, the least important is the building services (mean=3.377).

However, the IBS house occupiers are most satisfied in terms of design quality with the superstructure (mean=4.630).

Table 5.20: Design Quality or Aesthetic mean response

No.	Design Quality/Aesthetic Value	Importance Level (Mean)	Satisfaction Level (Mean)
1	Superstructure	3.503	4.630
2	External Wall	3.419	4.594
3	Internal Wall	3.401	4.594
4	Window	3.441	4.610
5	Door	3.422	4.600
6	Finishes	3.472	4.599
7	Building Services	3.377	4.612
8	Built in Fittings	3.345	4.419
9	Layout of House	3.403	4.547
10	External Work	3.433	4.604

The results of this investigation of the superstructure mean response is as shown in Table 5.21 below. From this table the IBS house occupiers seem to believe that the most important section of the superstructure is the column (mean=4.646) and the least important elements of the superstructure are the roof beam and the floor beam (mean=4.624). However, they are most satisfied with the roof beam (mean=3.515) and least satisfied with the column (mean=3.492).

Table 5.21: Superstructure mean response

No.	Superstructure	Importance (Mean)	Satisfaction (Mean)
1	Column	4.646	3.492
2	Upper Floor	4.626	3.500
3	Floor Beam	4.624	3.506
4	Roof Beam	4.624	3.515

The results of this investigation of the design quality/aesthetic value are shown in Table 5.22. From this table, the IBS house occupiers believe that the most important design quality or aesthetic value is the window (mean=3.441) and the least important is the built in fittings (mean=3.345). However, the most satisfying and least satisfying to IBS

house occupiers is the window (mean=4.610) and the built in fittings (mean=4.419), respectively.

Table 5.22: External wall, internal wall, window, door, built in fittings, mean response

No.	Design Quality/Aesthetic Value	Importance Level (Mean)	Satisfaction Level (Mean)
1	External Wall	3.419	4.594
2	Internal Wall	3.401	4.594
3	Window	3.441	4.610
4	Door	3.422	4.600
5	Built in Fittings	3.345	4.419

The results of the investigation of finishes mean response are shown in Table 5.23 below. From this table the IBS house occupiers' most important item for the finishes is the external floor finishes (mean=4.608) and the least important is the ceiling finishes (mean=4.575). While, the ceiling finishes (mean=3.557) and external wall finishes (mean=3.412) are the most satisfying and least satisfying for the IBS house occupiers, respectively.

Table 5.23: Finishes mean response

No.	Finishes	Importance (Mean)	Satisfaction (Mean)
1	External Wall Finishes	4.595	3.412
2	Internal Wall Finishes	4.601	3.463
3	External Floor Finishes	4.608	3.478
4	Internal Floor Finishes	4.592	3.456
5	Ceiling Finishes	4.575	3.557

The results of the investigation of the building services mean response is as shown in Table 5.24. The bathroom (mean=4.626) is considered the most important building services to the IBS house occupiers. While, electrical installation (mean=4.590) is the least important element of the building services. However, the most satisfying element

of the buildings services is the electrical installation (mean=3.464) and the least satisfying is the pipe installation (mean=3.308).

Table 5.24: Building Services mean response

No.	Building Services	Importance (Mean)	Satisfaction (Mean)
1	Toilet	4.613	3.388
2	Bathroom	4.626	3.347
3	Pipe installation	4.619	3.308
4	Electrical Installation	4.590	3.464

The results of this investigation of the layout of the houses are shown in Table 5.25. This table indicates that the parking lots (mean=4.601) are the most important layout item for IBS house occupiers, while, the least important layout item is the utility room (mean=4.436). However, the IBS house occupiers are most satisfied with the master bedroom (mean=3.542) and least satisfied with the wet area (mean=3.243).

Table 5.25: Layout of House mean response

No.	Layout of House	Importance (Mean)	Satisfaction (Mean)
1	Master Bedroom	4.588	3.542
2	Bedroom	4.583	3.527
3	Living Area	4.588	3.533
4	Dining Area	4.568	3.488
5	Dry Kitchen	4.536	3.381
6	Wet Kitchen	4.515	3.352
7	Toilet	4.561	3.386
8	Bathroom	4.598	3.334
9	Wet Area	4.511	3.243
10	Utility Room	4.436	3.277
11	Balcony	4.468	3.388
12	Parking Lots	4.601	3.372

The results of the investigation of the external works mean response are shown in Table 5.26 below. From this table the most important external works to IBS house occupiers

is access road (mean=4.628) and the least important is landscape (mean=4.584). However, the external works that IBS house occupiers are the most satisfied with is the landscape (mean=3.510) and they are least satisfied with the gate (mean=3.369).

Table 5.26: External Works mean response

No.	External Works	Importance (Mean)	Satisfaction (Mean)
1	Drainage	4.603	3.398
2	Landscape	4.584	3.510
3	Gate	4.589	3.369
4	Fencing	4.616	3.389
5	Access Road	4.628	3.495

The results of the investigation of building strength mean response are shown in Table 5.27. This table indicates that the building strength section that is most important to the IBS house occupiers is the stability of the building (mean=4.689) and the least important item is the security (mean=4.641). However, the IBS house occupiers are most satisfied with the stability of the building (mean=3.540) and least satisfied with the security (mean=3.229).

Table 5.27: Building Strength mean response

No.	Building Strength	Importance (Mean)	Satisfaction (Mean)
1	Structure Strength	4.677	3.519
2	Stability of Building	4.689	3.540
3	Weather Resistance	4.662	3.447
4	Fire Resistance	4.682	3.442
5	Security	4.641	3.229

The results of the investigation of the comfort mean response are shown in Table 5.28. The mean response for the comfort is of more importance (mean=4.657) than being satisfied (mean=3.816).

Table 5.28: Comfort mean response

No.	Factors	Importance (Mean)	Satisfaction (Mean)
1	Comfort	4.657	3.816

The results of the investigation of the environmental condition mean response are shown in Table 5.29 below. From this table, the most important environmental condition to IBS house occupiers is ventilation (mean=4.677) while the least important is the population condition (mean=4.642). However, the house occupiers are most satisfied with the traffic congestion (mean=3.243) and least satisfied with the ventilation (mean=3.068).

Table 5.29: Environmental Condition mean response.

No.	Environmental Conditions	Importance (Mean)	Satisfaction (Mean)
1	Ventilation	4.677	3.068
2	Pollution Condition	4.642	3.088
3	Traffic Congestion	4.653	3.243

The results of the investigation of the maintenance work mean response is as shown in Table 5.30. For the maintenance work section the IBS house occupiers most important issue is cleanliness (mean=4.624) and the least important is the garbage collection system (mean=4.592). However, the IBS house occupiers are most satisfied with garbage collection (mean=3.346) and least satisfied with repair works (mean=3.090).

Table 5.30: Maintenance Work mean response

No.	Maintenance Work	Importance (Mean)	Satisfaction (Mean)
1	Repair Works	4.597	3.090
2	Cleanliness	4.624	3.256
3	Garbage Collection System	4.592	3.346

The outcome of the overall analysis of importance and satisfaction level of the IBS house occupiers is shown in Figure 5.1. This figure indicates that the highest overall importance level is the comfort (mean=4.687), while the lowest overall importance level is the size of house (mean=4.165). This figure shows that the house occupiers are most satisfied with the house price (mean=3.826), while they are least satisfied with the environmental conditions (mean=3.133). Noticeably, the size of the houses is seen to have the smallest difference between the importance and satisfaction level, while the environmental conditions are seen to have the biggest difference.

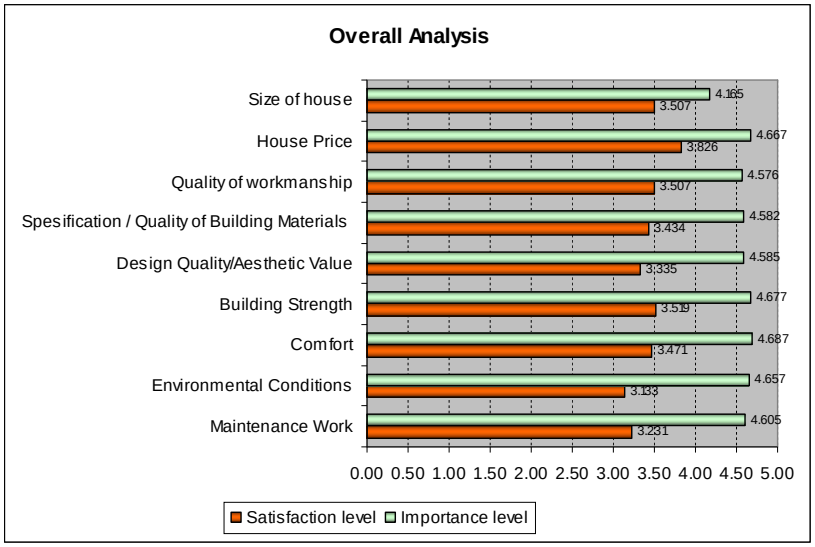


Figure 5.1: IBS House Occupiers comparison between Importance and Satisfaction level

The results of the house occupier satisfaction and importance gap level are shown in Figure 5.2. The gap analysis to compare between satisfaction level and importance level is important to determine the critical house occupier satisfaction factors (Parasuraman *et al.*, 1985*;* Zeithaml *et al.*, 1991). This figure indicates the size of house has the lowest gap (-0.7), while the highest gap is the environmental condition (-1.5).

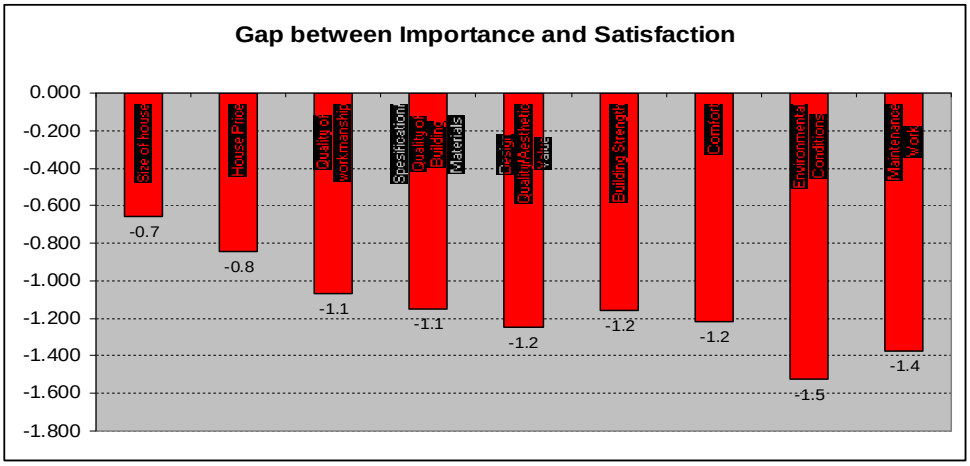


Figure 5.2: House owners satisfaction and importance gap level

Figure 5.3 indicates the gap analysis sorted from big to small. It was found that item no.1, which is the size of house, shows the smallest gap with -0.658. While, item no. 8, which is the environmental conditions, is the factor with the largest gap with -1.524.

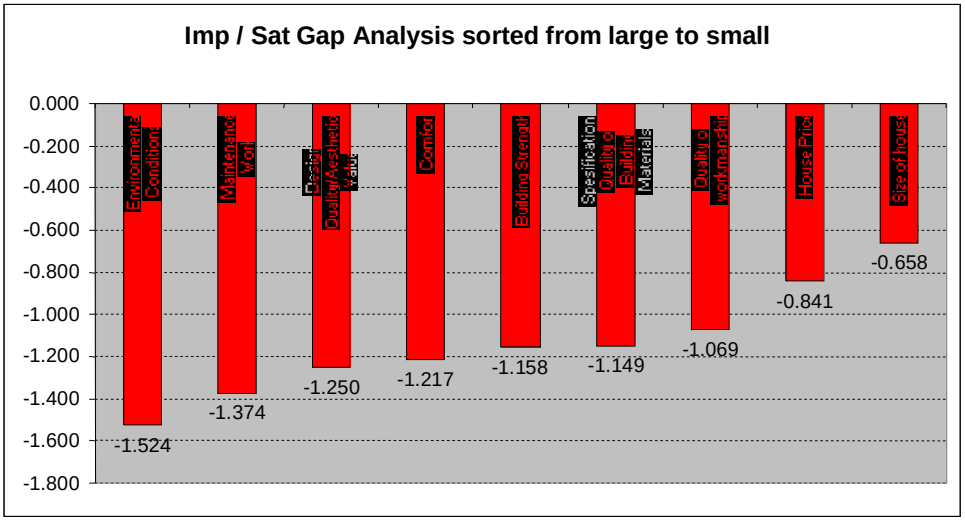


Figure 5.3: House Occupiers gap sorted from large to small.

The Table 5.31 indicates the house owners' satisfaction and importance gap level starting from the largest gap, which is the environmental conditions factor (-1.53) to the smallest gap, which is the size of house (-0.658).

Table 5.31**:** House owners Satisfaction and Importance gap level

No.	Q. No	Question	Gap
1	8	Environmental Conditions	-1.53
2	9	Maintenance Work	-1.37
3	5	Design Quality/Aesthetic Value	-1.25
4	7	Comfort	-1.22
5	6	Building Strength	-1.16
6	4	Specification/Quality of Building Materials	-1.15
7	3	Quality of workmanship	-1.07
8	2	House Price	-0.84
9	1	Size of house	-0.66

From the analysis of the results it was found that the 252 respondents were satisfied, accounting for 64.5%. Some 21 or 5.4% were very satisfied; 53 respondents were dissatisfied and this group accounted for 13.6%. Another group of 4 respondents was very dissatisfied and this accounted for 1%. Some 15.6% or 61 respondents did not answer this question. The details of the overall satisfaction level in percent are shown in Figure 5.4.

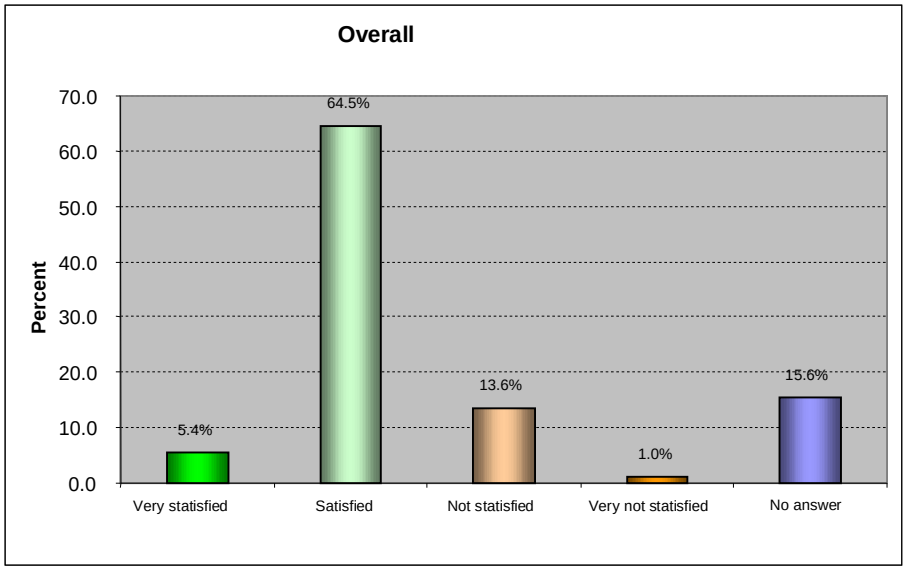


Figure 5.4: Overall satisfaction level.

5.2.2 Results of Second Part: Factors of IBS Adoption in the Malaysian Construction Industry

The results of the second part of the first phase are used to answer the second research question, which pertains to the factors of IBS adoption in the Malaysian construction industry. The first part of the questionnaire survey section is the background information of construction stakeholders' demographic profile, background information of IBS housing, and overall analysis of customer importance and satisfaction level.

5.2.2.1 Background Information of Construction Stakeholders Demographic Profile

The analysis of the respondents' particulars is shown in Table 5.32. The table shows that 105 respondents are responded to this study. From this table the results of the analysis are described as follows; job affiliation is one of the most important in describing the respondent profile. It can be seen here that there are 20 government officials forming 19.0% of the respondents in the job category. Designers or engineers form 16.2% with 17 of the respondents in this job category. There were 12 manufacturers or suppliers forming 11.4% of the respondents. This was followed by principal contractors accounting for 11.4% with 12 of the respondents in this group; 11 quantity surveyors forming 10.5% of the respondents in this study and sub contractors numbering 7 forming 6.7%. Designers or architects accounted for 6.7% with 7 in this group. There were 6 project managers in the study accounting for 5.7% of the respondents; 6 respondents did not answer this question while there were 5 clients and 2 academics or researchers forming 5.7%, 4.8% and 1.9%, respectively. As for the position executive group formed 23.8% of the respondents with 25 responses. Engineers accounted for 22.9% with 24 respondents; 14 technical officers formed 13.3% of the respondents. Some 10 respondents did not answer this question accounting for 9.5% of the total respondents. There were 9 project managers representing 8.6% of the

respondents. Managers formed 8.6% with 9 of them coming from this group; 7.6% of the respondents were managing directors with 8 responses. Directors accounted for 5.7% numbering 6 in this group.

Another aspect of respondent's profile that is equally important is working experience. A large percentage of the respondents are in the 5-10 year bracket of experience with 30.5% in this group whereas another 28.6% are in the 11-20 year of experience. A total of 24 respondents have less than 5 years experience forming 22.9% of the total respondents. Some 10 respondents are in the 21-30 year experience bracket accounting for 9.5% and 7 respondents accounting for 6.7% chose not to answer this question. There were 2 respondents accounting for 1.9% with more than 30 years of experience.

Table 5.32: Analysis of respondents' particulars

Variable	Frequency	Percentage
Job Affiliation	**105**	**100**
Academician/Researcher	2	1.9
Client	5	4.8
Designer/Architect	7	6.7
Designer/Engineer	17	16.2
Government Official	20	19.0
Manufacturer/Supplier	12	11.4
Principal Contractor	12	11.4
Project Manager	6	5.7
Quantity Surveyor	11	10.5
Sub Contractor	7	6.7
No answer	6	5.7
Position	**105**	**100**
Director	6	5.7
Engineer	24	22.9
Executive	25	23.8
Manager	9	8.6
Managing Director	8	7.6
Project Manager	9	8.6
Technical Officer	14	13.3
No answer	10	9.5
Experience	**105**	**100**
< 5 years	24	22.9
5 -10 years	32	30.5
11- 20 years	30	28.6
21 - 30 years	10	9.5
> 30 years	2	1.9
No answer	7	6.7

5.2.2.2 Background of Project Information

The overall outcome background of project information is presented in Table 5.33. From this table the results are discussed. The projects that respondents are most involved with are the residential projects. Some 51.4% of the respondents are involved with residential projects. Experience of institutional building projects accounted for 11.4%. Experience with commercial projects had 7 respondents amounting to 6.7%. Experience of industrial projects had 3 respondents with 2.9% of the total respondents. Others accounted for 22.9% with 24 respondents and 5 respondents who did not answer this question was 4.7%.

However, for other project types, which is from bridge, civil works, government office & quarters, roads, institute of higher learning, double track, onshore gas terminals and school projects the breakdown of the group is 24 respondents in total. About 10 respondents are involved in school projects with each accounting for 41.2% for each group. Six respondents involved in road projects with 25.2% of the total percentage. There are 3 respondents involved in onshore gas terminal with 12.6%. There is 1 respondent accounting for 4.2% was involved in bridge project, 1 respondent was involved in civil works, 1 respondent was involved in government office & quarters projet, 1 respondent was involved in institute of higher learning project and 1 respondent was involved in double track project.

With regard to residential building cost type, the research shows that 34% or 18 of the respondents deal with medium cost projects. High cost projects had 14 respondents accounting for 25%. About 6 respondents are from the low cost projects representing 12% of the total respondents. Another group of 16 respondents forming 29%, chose not to answer this question.

In terms of the height of the residential building, the survey indicates that almost half of the study population is in the multiple storey groups. They account for 47% with 26 responses. Two-storey has 6 respondents accounting for 12%. There were 5 respondents in the single storey group accounting for 9%. Some 17 respondents did not answer this question forming 32% of the total.

The different residential building types give different results. The study shows that a greater number of the respondents are involved with apartment projects. There are 18 respondents accounting for 35%. Single storey terrace had 4 respondents with 7%; 3 respondents are from the two-storey terrace group accounting for 5%. Condominium and bungalow had 2 respondents accounting for 4% each. Linked house group had only 1 respondent accounting for 1.0% of the total. There are 24 respondents who did not answer this question amounting to 44%.

Table 5.33: Project Information.

Variable	Frequency	Percentage
Project Type	**105**	**100**
Commercial	7	6.7
Industrial	3	2.9
Institutional Building	12	11.4
Others	24	22.9
Residential	54	51.4
No answer	5	4.7
Others	**24**	**100**
Bridge	1	4.2
Civil Works	1	4.2
Government Office and Quarters	1	4.2
Road	6	25.2
Institute of Higher Education (University)	1	4.2
Double Track	1	4.2
Onshore Gas Terminal	3	12.6
School	10	41.2
Residential Building Cost Type	**54**	**100**
Low Cost	6	12
Medium Cost	18	34
High Cost	14	25
No answer	16	29

Table 5.33: Project Information (Cont'd)

Variable	Frequency	Percentage
Height of Residential Building	**54**	**100**
Single storey	5	9
Two storey	6	12
Multiple storey	26	47
No answer	17	32
Type of Residential Building	**54**	**100**
Apartment	18	35
Link House	1	1
Single Storey Terrace	4	7
Two Storey Terrace	3	5
Condominium	2	4
Bungalow	2	4
No answer	24	44
Construction Method	**105**	**100**
Composite Construction Method	29	27.6
Conventional Construction Method	17	16.2
Formwork System	16	15.2
Prefabricated Construction Method	26	24.8
Others	4	3.8
No answer	13	12.4

The construction methods of IBS house were classified by building structure as shown in Table 5.34. Table 5.33 shows the following results. The building structure is mostly type C: "composite construction method", which is a combination of prefabricated and conventional construction method. This type comprises 27.6% with 29 respondents in this group; 26 respondents accounting for 24.8% used the "fully prefabricated construction method", which is breaking a whole housing unit into different components, such as the floors, the walls, columns, beams, roofs, etc, and having these components separately manufactured in standard dimensions in the factory or on site and assembled or erected outside. Type A: "Conventional construction method", which is "the traditional construction method using timber formwork and brickwork", comprised 16.2% with 17 respondents. The formwork system accounted for 15.2% with 16 respondents in this group; 13 respondents did not answer the question while 4 chose to answer "other". This column accounted for 12.4% and 3.8% of the total, respectively.

Table 5.34: Classification of the Building Structural

Item	Classification	Definition
A	Conventional construction method	The traditional construction method using timber formwork and brickwork
B	Formwork System	Uses material made of steel/fibreglass/aluminium as a prefabricated formwork
C	Composite Construction Method	Combination of prefabricated and conventional construction method
D	Fully Prefabricated Construction Method	Breaking a whole housing unit into different components, such as the floors, the walls, columns, beams, roofs, etc, and having these components separately manufactured in standard dimension in the factory or site and assembled/erected outside
E	Other	Please Specify

5.2.2.3 Construction Stakeholders Level of Importance and Satisfaction Analysis

The summary for all 34 questions is provided in Figure 5.5. The graph highlights the mean value for each question, as shown in the figure. The most important questions to construction stakeholders are question 11, question 17 and question 27 with a mean of 4.3. The three (3) least important questions are question 3, question 15 and question 32 with a mean of 3.3.

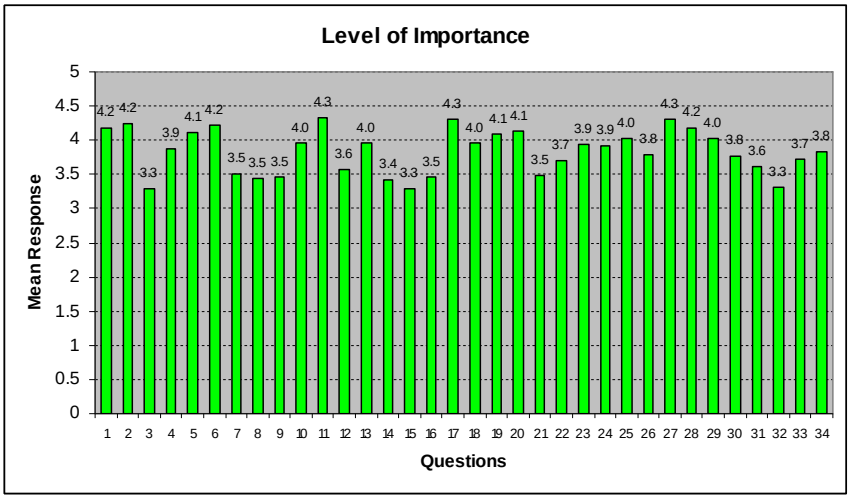


Figure 5.5: Construction Stakeholders Level of Importance

The graph highlights the overall mean value for each item asked in the questionnaire. The outcome of the satisfaction level among the construction industry stakeholders is shown in Figure 5.6. From this figure, the most satisfying to construction stakeholders

are question 17 and question 27. However, the least satisfying is question 15 with a mean response of 2.7.

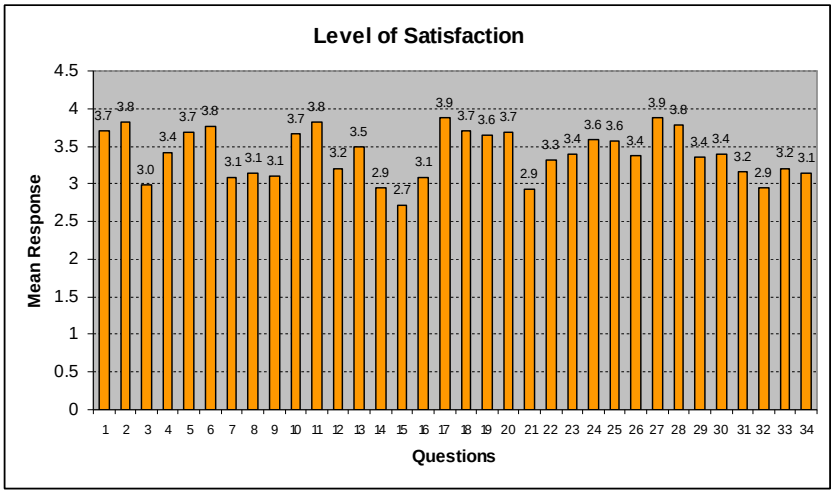


Figure 5.6: Construction Stakeholders Level of Satisfaction

The results of the importance and satisfaction levels from construction stakeholders were arranged side by side, as shown in Figure 5.7.

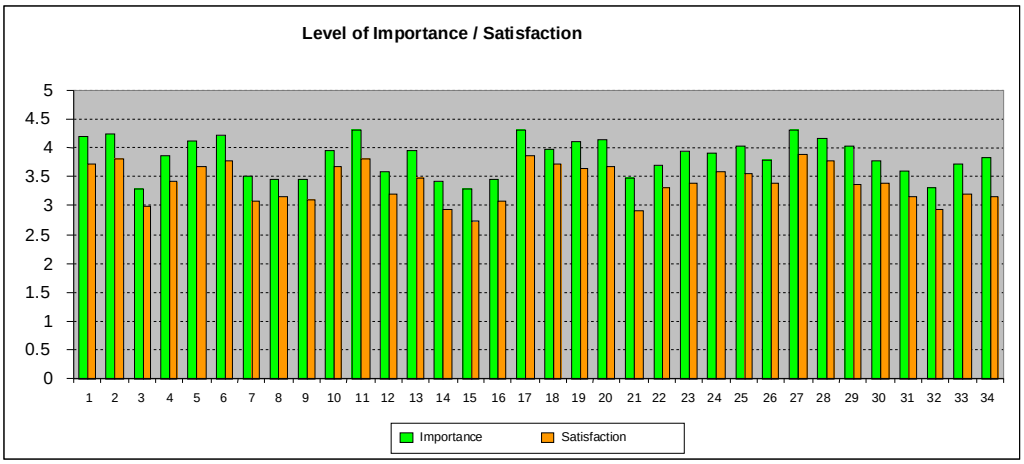


Figure 5.7: Level of Importance and Satisfaction

The results of the importance and satisfaction levels of the construction industry are shown in Figure 5.8. This figure indicates the rest of the items have a satisfaction level that is lower than the importance level. In other words, these factors are falling short of expectation.

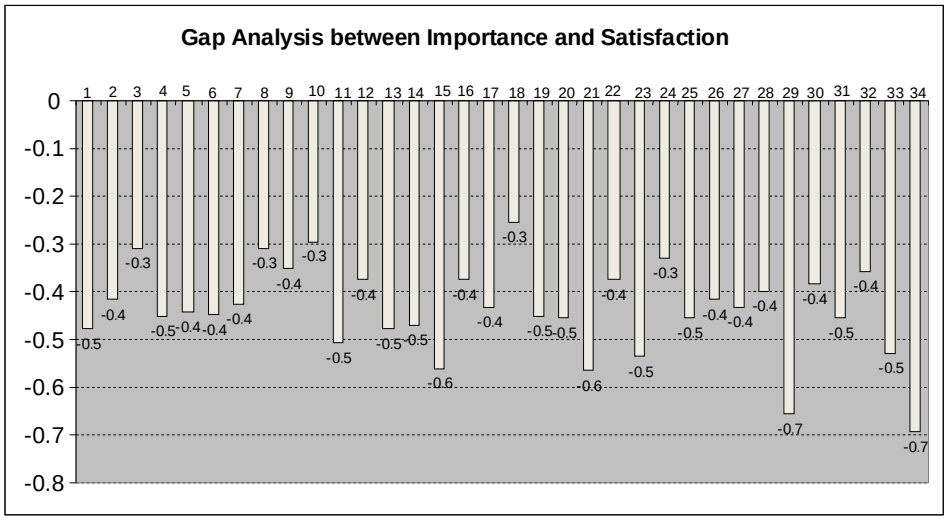


Figure 5.8: Level of Satisfaction and Importance gap

Figure 5.9 indicates the gap analysis sorted from large to small. It was found that factor no.34, which is the construction players still lack scientific information about the economic benefits of IBS and factor no. 29, which is limited number of local IBS manufacturers, show the largest gap with -0.7. While, factor no. 21, which is IBS adoption, does not attract enough incentives from the government and factor no. 15, which is the IBS designs are monotonous and stifle creativity, show a gap level of -0.6.

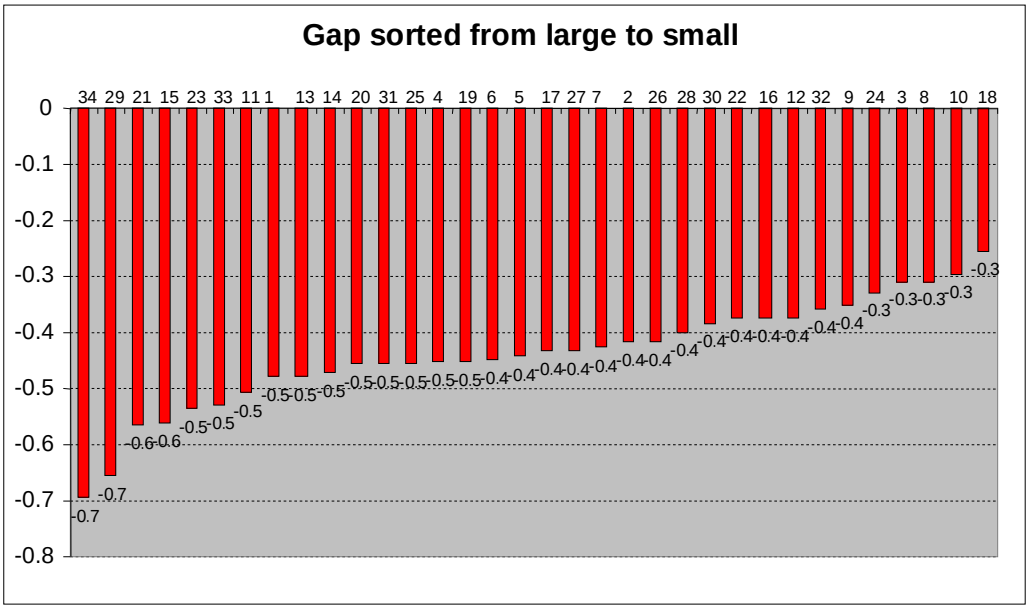


Figure 5.9: Construction Stakeholders satisfaction and importance gap level sorted from large to small

The selection of factors can be described in a tabulated form. The detailed break down of the factors is shown in Table 5.35 below. This table shows that 9 factors of the critical success factors of the IBS adoption were selected by using the Pareto Rules (20-80) concept. The difference between importance and satisfaction level is indicated by the gap as indicated in the table.

Table 5.35: Selection of factors

No.	Q. No	Question	Gap
1	34	Construction players still lack scientific information about the economic benefits of IBS.	-0.69
2	29	Limited number of local IBS manufacturers.	-0.66
3	21	IBS adoption does not attract enough incentives from the government.	-0.57
4	15	IBS designs are monotonous and stifle creativity.	-0.56
5	23	IBS education and training are not sufficient in universities and institutes of higher education.	-0.53
6	33	Bumiputera participation is left out in the IBS adoption.	-0.53
7	11	IBS reduces completion time of construction projects due to the usage of standardised prefabricated components and simplified installation process.	-0.51
8	1	IBS provides higher quality than conventional system.	-0.48
9	13	IBS provides highly aesthetic endproduct through the process of controlled pre-fabrication and simplified installation.	-0.48

The short description for the long description for each question of the 9 factors is described in Table 5.36.

Table 5.36: Short Description

No.	Long description	Short Description
1	Construction players still lack scientific information about the economic benefits of IBS.	Lack scientific information
2	Limited number of local IBS manufacturers.	Lack of IBS manufacturers
3	IBS adoption does not attract enough incentives from the government.	Lacks government incentives
4	IBS designs are monotonous and stifle creativity.	Monotonous and stifles creativity
5	IBS education and training are not sufficient in universities and institutes of higher education.	Lack of education and training
6	Bumiputera participation is left out in the IBS adoption.	Bumiputera participation is left out.
7	IBS reduces completion time of construction projects due to the usage of standardised prefabricated components and simplified installation process.	Reduces completion time
8	IBS provides higher quality than conventional system.	Higher quality
9	IBS provides highly aesthetic endproduct through the process of controlled pre-fabrication and simplified installation.	Controlled pre-fabrication and simplified installation

The overall satisfaction result is the main part of the study producing results, which is significant to this research. The overall IBS satisfaction gauged from the questionnaire indicates that the vast majority of the respondents are satisfied. This group amounts to 51.4%; 2.9% of the respondents are very satisfied. However, there is a considerable amount, up to 35.2% of the respondents, who are dissatisfied. A further 1% of the respondents are very dissatisfied. Figure 5.10 shows the breakdown of the groups.

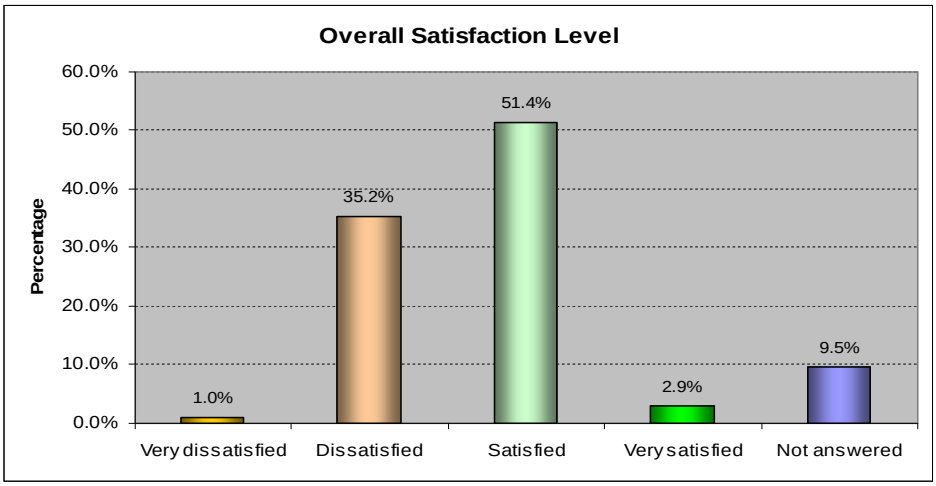


Figure 5.10: Overall Satisfaction Level of IBS Construction Stakeholders

5.2.3 Results of Understanding on QFD

The understanding of QFD is another important aspect of this research. At this stage the researcher measures the understanding and appreciation of QFD among the construction stakeholders. The results from answering the specific questions and the open-ended question are described in the following sub-sections.

5.2.3.1 Results of Answering Specific Questions

The results of understanding on QFD acquired from answering the specific questions are indicated in Table 5.37.

Table 5.37: Results of the Understanding on QFD

NO	QUESTION							
Q1	Respondent - 105	74	28	3				
		No	Yes	None				
	Have you ever heard about Quality Function Deployment (QFD) before?	70.5%	26.7%	2.9%				
		Agree	Disagree					
Q2	Respondent - 105	98	7					
	In order to ensure that the elements of quality are built into the product (house), a quality plan must be formulated and implemented right from the design stage	93%	7%					
Q3	Respondent - 105	20	44	29	6	1	5	
	Refer to Table 5.38 (Scale Description)	A	B	C	D	E	None	
	What do you understand by "Design Quality" in the context of construction?	19.0%	41.9%	27.6%	5.7%	1.0%	4.8%	
Q4	Respondent – 105	101	4					
		Agree	Disagree					
	Design should also be based on the feedback from customers	96%	4%					
Q5	Respondent - 105	19	66	7	2	6	2	3
	Refer to Table 5.39 (Scale Description)	A	B	C	D	E	F	None
	If you agree, what are the possible reasons?	18.1%	62.9%	6.7%	1.9%	5.7%	1.9%	2.8%
Q6	Respondent - 38	6	21	2	1	1	7	
	Refer to Table 5.40 (Scale Description)	A	B	C	D	E	F	
	If you disagree, what are the possible reasons?	15.8%	55.3%	5.3%	2.6%	2.6%	18.4%	
Q7	Respondent - 105	3	33	9	7	9	8	36
	Refer to Table 5.41 (Scale Description)	A	B	C	D	E	F	None
	Your suggestion towards IBS adoption.	2.9%	31.4%	8.6%	6.7%	8.6%	7.6%	34.3 %
Q8	Respondent - 105	95	6	4				
		Agree	Disagree	None				
	In the manufacturing industry, by incorporating the customers' demands into the product through design. Do you foresee this trend being adopted by the IBS construction sector in Malaysia	90.5%	5.7%	3.8%				
Q9	Respondent - 105	39	10	11	25	12	2	6
	Refer to Table 5.42 (Scale Description)	A	B	C	D	E	F	None
	If you agree, what are the possible reasons?	37.1%	9.6%	10.5%	23.8 %	11.4%	1.9%	5.7%
Q10	Refer to Table 5.43 (Scale Description)	A	B	C	D	E		
	Respondent – 35	18	5	5	6	1		
	If you disagree, what are the possible reasons?	51.4%	14.3%	14.3%	17.1 %	2.9%		

Table 5.37: Results of the Understanding on QFD (Cont'd)

NO	QUESTION							
Q11	Respondent – 105	5	84	16				
		No	Yes	None				
	Do you agree that if IBS products development with considering customer satisfaction factor through in Malaysia building construction industry?	4.8%	80.0%	15.2%				

Question 1 is "have you ever heard about Quality Function Deployment (QFD) before?" For the question concerning whether the respondents have ever heard about QFD, 74 of the respondents said they have not heard about QFD. This accounted for 70.5% of the total respondents who answered this question. Only 28 of those respondents who answered said they have heard of QFD. This group accounted for 26.7%. Some 3 respondents representing 2.9% did not answer this question.

"In order to ensure that the elements of quality are built into the product (house), a quality plan must be formulated and implemented right from the design stage" is crafted into question 2 on understanding of QFD.

For this particular question, 98 out of 105 respondents agreed that the quality cannot be inspected out of the product but instead it must be built in. This group accounted for 93% of the total respondents. The other 7 the respondents disagreed that the quality cannot be inspected out of the product.The group who disagreed represented 7% of the total respondents.

The question on whether the respondents understand the "design quality in the context of construction", the choice of answers range from A to E as described in Table 5.38.

Table 5.38: Description of “Design quality in the context of construction”

Item	Description
A	An effective design to serve its intended purpose
B	A constructible design with the best possible economy and safety
C	Designed to meet customer needs and expectations
D	Something you put into design of product through customer feedback
E	Others (please specify)

From Table 5.37, 44 respondents accounted for 41.9%, which describes a constructible design with the best possible economy and safety would be the best answer. However, 27.6% or 29 of the respondents answered,“ design to meet customer needs and expectations”. “An effective design to serve its intended purpose” was the choice of answer for 20 of the respondents amounting to 19.0%. “Something you put into design of product through customer feedback” was the choice answer of 6 respondents and this group accounted for 5.7%. Five respondents chose not to answer this question while 1 said others. These groups accounted for 4.8% and 1% of the respondents, respectively.

For the question as to whether “design should also be based on the feedback from customers” in question 4 and not solely on design codes, technical literature, knowledge and experience of designers so as to construct something elegant, useful and economical, attracted a very strong response from the respondents. Almost all of them, 101 respondents accounting for 96%, are in total agreement that customer feedback must be taken into account in the construction industry. However, 4 others, representing 4% of the total respondents, disagreed with question 4.

Question 5, which is “if the respondents agreed, what are the possible reasons?”, had 6 possible choices for the possible reasons, as shown in Table 5.39.

Table 5.39: Definition of answers for question 5

Item	Definition of answers
A	Quality of products is created by people, for people
B	Designer translates the customer's needs and desires into product
C	Designer emphasizes technological features rather than actual needs
D	If customer is unhappy over design, competitors might win over him/her
E	Doing it right, the first time to avoid delays, rework or changes in design
F	Others (please specify)

Of the respondents, 62.9% or 66 answered saying that the designer translates the needs and desires of the customer into the product. Another 18.1% or 19 of the respondents answered saying, "quality of products is created by people, for people";7 respondents accounting for 6.7% said "designer emphasizes technological features rather than actual needs". "Doing it right, the first time to avoid delays, rework or changes in design" was the choice of answer for 6 respondents accounting for 5.7% of the respondents. Otherwise, the respondents believe that "if the customer is unhappy over design, competitors might win over him or her". As for "others (please specify)" there were 2 respondents representing 1.9% of the total percentage of the total respondents; 3 respondents did not answer this question.

For the question concerning the possible reasons, the respondents disagree that the "demand should be based on the feedback from the customer". The choice of answers (ranging from items A- F) for this question is shown in Table 5.40.

Table 5.40: Definition of answers for question 6

Items	Definition of answers
A	It is not economical to conduct a market survey
B	Demands of customers are endless and impossible to satisfy them all
C	Too time-consuming
D	Traditional method based on knowledge & experience is good enough
E	Concept not suitable for construction industry
F	Others (please specify)

For this question more than half of the respondents state that “demands should also be based on feedback from customers” and it is endless and impossible to satisfy them all. This group accounted for 55.3% of the total respondents; 7 or 18.4% of the respondents indicated other than the defined answer; 6 of the respondents amounting to 15.8% said, “it is not economical to conduct a market survey”. “Too time-consuming” was the response from 2 or 5.3% of the surveyed respondents. “Traditional method based on knowledge and experience is good enough” and “concept not suitable for construction industry” was the choice of answer for 1 or 2.6% of the respondents in each of the groups, respectively.

The question on what is the respondents “suggestion towards IBS adoption” in the Malaysian building construction industry using QFD. The choice of answers (range from item A to F) for this question is indicated in Table 5.41.

Table 5.41: Definition of answers for question 7

Items	Definition of answers
A	It is not economical to conduct a market survey
B	Demands of customers are endless and impossible to satisfy them all
C	Too time-consuming
D	Traditional method based on knowledge & experience is good enough
E	Concept not suitable for construction industry
F	Others (please specify)

A total of 33 respondents accounting for 31.4% said, “demands of customers are endless and it is impossible to satisfy them all”. “too time-consuming and concept not suitable for construction industry” was the choice of answer for 9 respondents accounting for 8.6% for each of the groups, respectively; 8 respondents amounting to 7.6% said “other”. “Traditional method based on knowledge and experience is good enough” was the answer for 7 respondents accounting for 6.7% while 3 respondents or 2.9% said “it is not economical to conduct a market survey”. However, 34.3% or 36 of the respondents did not answer this question.

Question 8 is “in the manufacturing industry, producers are striving for continuous quality improvement by incorporating the customers’demands into the product through design. Do you foresee this trend being adopted by the IBS construction sector in Malaysia?”

For this question some 90.5% or 95 of the respondents agreed whereas some 5.7% or 6 of the respondents disagreed; 4 or 3.8% of the respondents chose not to answer this question.

Question 9 is that if the respondents agree that “in the manufacturing industry, producers are striving for continuous quality improvement by incorporating the customers needs”, then “what are the possible reasons?”

Table 5.42 is the range of answers to the question to the possible reasons if the respondent agreed “in the manufacturing industry, producers are striving for continuous quality improvement by incorporating the customers”.

Table 5.42: Definition of answers for question 9

Items	Definition of answers
A	The need to strive for excellence in the construction industry
B	To uphold the positive reputation of the industry, i.e., quality conscious
C	To compete with foreign companies who emphasize quality
D	More affluent consumers who choose products designed to their needs
E	To improve the current cost, delivery and reliability aspects in this sector
F	Others (please specify)

Some 37.1% or 39 of the respondents selected “the need to strive for excellence in the construction industry” as the most preferred choice. “More affluent consumers who choose products designed to their needs” was the choice of answer for 23.8% or 25 respondents; 12 or 11.4% of the respondents selected “to improve the current cost, delivery and reliability aspects in this sector”. The answer “to compete with foreign companies who emphasize quality” was the choice of answer for 11 or 10.5% of the

respondents; 10 respondents accounting for 9.6% chose “to uphold the positive reputation of the industry, namely, quality conscious”. Only 2 respondents representing 1.9% answered “other” while 6 respondents or 5.7% did not answer this question.

Question 10 asked “if you disagree” that “in the manufacturing industry, producers are striving for continuous quality improvement by incorporating the customers’ needs” and “what are the possible reasons?”

Table 5.43 is the definition for the answers “if you disagree” that “in the manufacturing industry, producers are striving for continuous quality improvement by incorporating the customers needs” “what are the possible reasons?”

Table 5.43: Definition of answers for question 10

Items	Definition of answers
A	Every project is unique with varying customer demands and needs
B	There are two parties of customer, i.e., developer and purchaser whose requirements may contradict each other
C	The industry involves many parties with different organizations, priorities and quality policies
D	Quality in construction is difficult to define or measure
E	Deploying customer needs into design & construction procedures is too costly and time consuming
F	Others (please specify)

For this question there were only 35 respondents in total who disagree; 51.4% or 18 respondents answered saying “every project is unique with varying customer demands and needs”; 6 respondents accounting for 17.1% said “deploying customer needs into design and construction procedures is too costly and time consuming”. Two answers,“there are two parties of customer, e.g., developer and purchaser whose requirements may contradict each other” and “the industry involves many parties with different organizations, priorities and quality policies” had 5 respondents or 14.3% in each of the groups, respectively. One respondent accounting for 2.9% chose “other” as the answer for this question.

Question 11 asked, “Do you agree that if IBS product development with considering customer satisfaction factor through QFD technique can improve the level of IBS adoption in Malaysia building construction industry?”

For this question 84 or 80.0% of the respondents said “yes”; 5 respondents accounting for 4.8% said “no” while 16 or 15.2% of the respondents did not answer this question.

5.2.3.2 Results on the Understanding of QFD Application (Open Ended Question)

This section provides the results of the comments and suggestions on the understanding of QFD application from the construction industry collected through open-ended questions. Many respondents chose not to answer this question. Out of these answers, 2 of the responses were on how to improve the questionnaire survey. As these were not related directly to the study the researcher removed these comments from the analysis. Most of the respondents gave only one answer, however, there were a few respondents who gave more than one answer.

There were altogether 38 comments and suggestions from the respondents in the construction industry. All these verbatim comments and suggestions on the understanding of QFD are tabulated as in Table 5.44.

Table 5.44: Comments and Suggestion on the Understanding of QFD from the Construction Industry

No.	Comments and Suggestion on the Understanding of QFD
1	The IBS product development should consider customer satisfaction the same as the conventional method
2	Marketing for IBS concept should be improved
3	A code of practice should be standard for IBS in Malaysia
4	Most designers, e.g., architects and engineers do not consider IBS adoption in their design
5	Awareness of the modular system is important to replace the measurement system, same as the metric system that is being used in the construction industry. The modular system provides more accuracy in measurement compared to the existing system

Table 5.44: Comments and Suggestion on the Understanding of QFD from the Construction Industry (Cont'd)

No.	Comments and Suggestion on the Understanding of QFD
6	Can IBS satisfy detailed drawings prepared by architect? If the architect's drawing is complicated, how can IBS fulfil the requirement
7	IBS adoption is compulsory to reduce foreign workers, but at the same time the quality in assembly and simple design should be improved
8	The IBS system is perfect to be adopted to reduce expenses for foreign workers
9	The adoption of IBS in Malaysia needs to be promoted extensively to the key players in the building industry and also to the potential buyers
10	IBS technology is good to minimize dependency on foreign labour in our country, but the implementation for IBS should not jeopardise the Bumiputeras who are involved directly or indirectly in the construction industry
11	The QFD can be one of the survey instruments in conducting the market needs and can also be a tool to upgrade the total implementation
12	Make sure the customers understand the advantages and disadvantages of IBS
13	Make sure no political agenda and not just benefit individuals
14	Make sure CIDB play their role
15	Make sure of a complete R&D before implementing IBS as compulsory
16	Make sure enough IBS manufacturers and not monopoly
17	Government should do proper planning and identify each of the disadvantages
18	Contractor's attitude to gain maximum profit with minimum capital. They always use cheap labour (unskilled workers) with continuous mistake and low quality of workmanship
19	The contractor's attitude that get the contract without tranparence tendering process
20	QFD and IBS should be more exposed to people. Maybe should start from college/ university.
21	Quality of IBS in the construction industry consists of two major categories, the quality of the IBS product and the quality of the system built with the IBS products
22	IBS products save workers or manpower cost, fast track construction and system verification in safety. Products can be recycled to promote environment friendly.
23	IBS already implemented in Malaysia. I think last year in my opinion, the IBS is well known here in Malaysia because we have many fabricators. The only thing that matters is whether the design is safe or not, is the quality monitored or not.
24	IBS not only concrete. IBS is normal in developed countries and how wide the subjects of IBS are all about.
25	Promotional
26	IBS has many benefits in construction but the design does not fit the consumers' needs
27	People should know the good of IBS. Lack of promotion and IBS itself to improve needs more R & D
28	Expose more to public
29	IBS through education
30	IBS should have been implemented in the Malaysian construction industry a long time ago. The government should introduce IBS at colleges/universities
31	Malaysia still does not know the benefit of IBS. The government should solve this matter
32	IBS is environmentally friendly
33	Form a team to expose IBS to public
34	IBS has a future in Malaysia
35	The design of building must include what the customer needs
36	The development of IBS is satisfactory
37	IBS is suitable to be implemented for mega projects such as school and house projects but not suitable for aesthetic projects
38	The use of IBS is good but the quality is not satisfied

From the analysis using the affinity diagram, the 38 listed comments and suggestions on the understanding of the QFD in the construction industry were divided into nine (9) different clusters. The clusters are marketing and promotion, create a code of proactive or standard, quality improvement, transparency friendly, incorporate customer need, complex architectural drawing, cost reduction and research and development (R&D). The analysis of these different clusters forms the affinity group of understanding of QFD in the construction industry. These different groups are listed in Table 5.45.

Table 5.45: Affinity group of Understanding of QFD in the Construction Industry

No	Different Affinity group
1	Marketing and Promotion
2	Create a code of practice/standard
3	Quality improvement
4	Transparency
5	Environment friendly
6	Incorporate customer needs
7	Complex Architectural drawing
8	Cost reduction
9	Research and Development (R&D)

The outcome from the affinity group drawn from the comments and suggestions from the construction industry are illustrated in Figure 5.11. From the Pareto analysis (Figure 5.11) of the construction industry comments on the understanding of QFD, the "marketing and promotion" was observed to be the highest frequency (12) followed by "create a code" (7) and "quality improvement" (5). The lower frequency being "environment friendly" (2) and "complex architectural drawing" (2) followed by "cost reduction" and "R&D" both with a frequency of only 1.

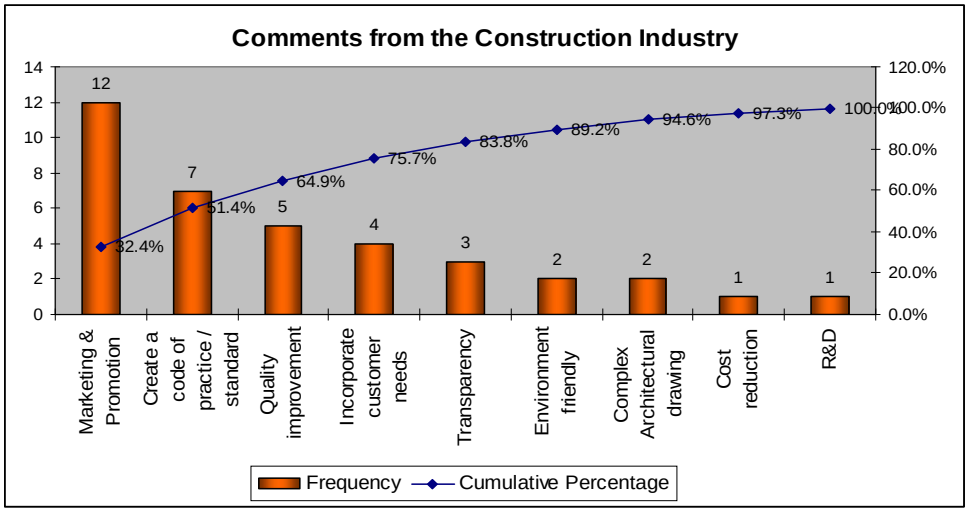


Figure 5.11: Pareto Analysis of construction industry comments

5.3 RESULTS ON DEVELOPMENT OF STRATEGIES FOR Q AND F MATRIX -SECOND PHASE

The results of the second phase are indicated by three (3) Quality Function Deployment matrixes. The first matrix is indicated by the "quality" or Q matrix, which describes the "IBS house occupiers" (external customers) indicating that customers were interested in the quality. The second QFD is the "function" or F matrix, which describes the construction stakeholders (internal customers) who are the functional aspect in the IBS adoption. The third QFD matrix is the combination of the strategies from the Q matrix and F matrix into the QF matrix. The results of these matrices are followed by the identification of the strategies to improve customer satisfaction and the strategies to improve IBS adoption.

5.3.1 Results: Strategies to Improve Customer Satisfaction of IBS house Q Factor in First Part (Second Phase)

The results of this section describe the strategies to improve the customer satisfaction of IBS houses. The overall factors are chosen and investigated and are shown by the gap of

each of the "quality" or Q factors. From this investigation the selected factors investigated to form the quality or Q factors are listed in Table 5.46. A total of nine (9) Q factors are discovered through this investigation.

Table 5.46: The "Quality" or Q Factors investigated in this study.

No.	Q. No	Question	Gap
1	8	Environmental Conditions	-1.53
2	9	Maintenance Work	-1.37
3	5	Design Quality/Aesthetic Value	-1.25
4	7	Comfort	-1.22
5	6	Building Strength	-1.16
6	4	Specification/Quality of Building Materials	-1.15
7	3	Quality of workmanship	-1.07
8	2	House Price	-0.84
9	1	Size of house	-0.66

The analysis of data indicates the "How's" identified in this stage. It is then further developed with the IBS industry stakeholders through a focus group into the QFD Q matrix. The results, which create this QFD Q Matrix, are shown in Figure 5.12.

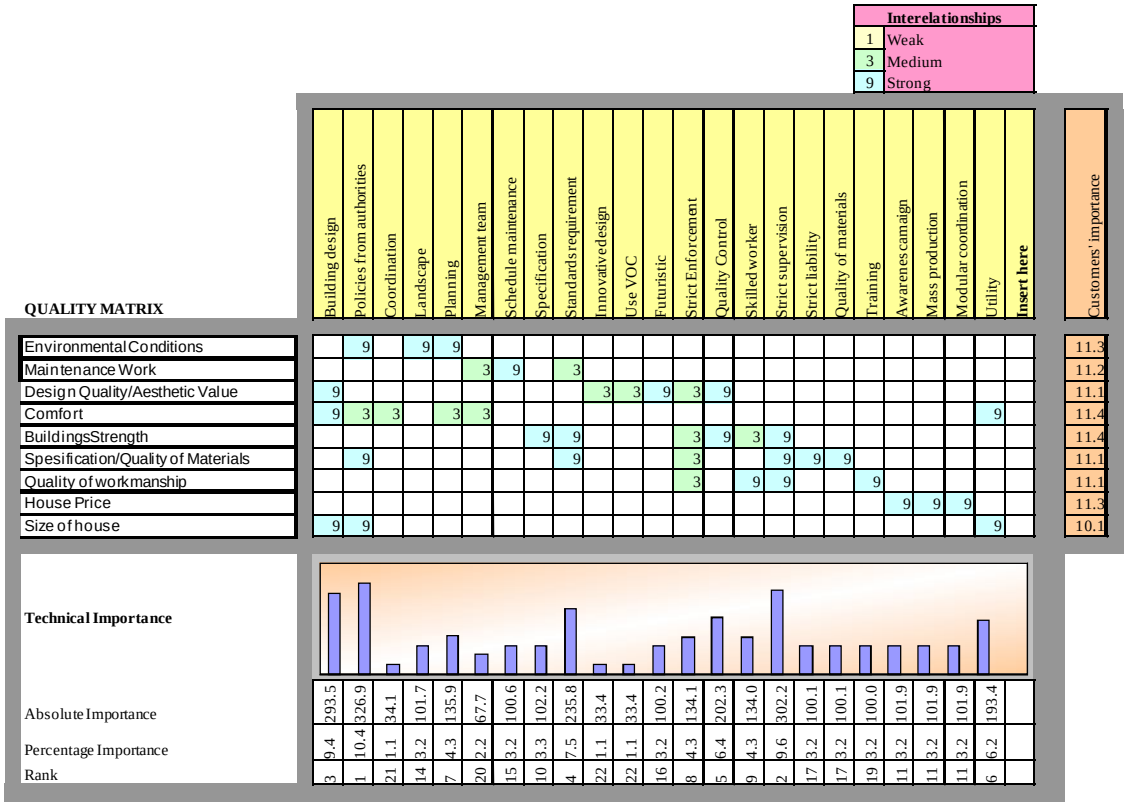


Figure 5.12: Quality Function Deployment (Q matrix)

The list of "How's" as a product of the Q matrix is shown in table 5.47 below. The first eight (8) items marked in italics and bold in Table 5.47 are transferred to the next level of the QF matrix. As a result, the "How's" identified and indicated in this table are the list of strategies to improve customer satisfaction in IBS housing.

Table 5.47: Q matrix "How's" developed from focus group

No.	Quality "Hows"	Importance (%)
1	***Policies from authorities***	***10.4***
2	***Strict supervision***	***9.6***
3	***Building design***	***9.4***
4	***Standards requirement***	***7.5***
5	***Quality Control***	***6.4***
6	***Utility***	***6.2***
7	***Planning***	***4.3***
8	***Strict Enforcement***	***4.3***
9	Skilled worker	4.3
10	Specification	3.3
11	Awareness campaign	3.2
12	Mass production	3.2
13	Modular coordination	3.2
14	Landscape	3.2
15	Schedule maintenance	3.2
16	Futuristic	3.2
17	Strict liability	3.2
18	Quality of materials	3.2
19	Training	3.2
20	Management team	2.2
21	Coordination	1.1
22	Innovative design	1.1
23	Use VOC	1.1
	Total	100.0

Note: Items in Italics brought to the QF Matrix

5.3.2 Results: Strategies to improve the level of IBS adoption (F factor) in Second Part (Second Phase)

The results of the function factor are the first part of developing the strategies to improve the level of IBS adoption. These factors of IBS adoption listed thirty-four (34) items selected from the quantitative study. The results of the analysis show that these IBS adoption factors create the most critical gap between importance and satisfaction

level and are transferred into the QFD chart. The nine (9) selected "function" factors are shown in Table 5.48. The table is shown in order of priority (the decreasing negative gap).

Table 5.48: The selected "function" factors

No.	Q. No	Question	Gap
1	34	Construction players still lack scientific information about the economic benefits of IBS.	-0.69
2	29	Limited number of local IBS manufacturers.	-0.66
3	21	IBS adoption does not attract enough incentives from the government.	-0.57
4	15	IBS designs are monotonous and stifle creativity.	-0.56
5	23	IBS education and training are not sufficient in universities and institutes of higher education.	-0.53
6	33	Bumiputera participation is left out in the IBS adoption.	-0.53
7	11	IBS reduces completion time of construction projects due to the usage of standardised prefabricated components and simplified installation process.	-0.51
8	1	IBS provides higher quality than conventional system.	-0.48
9	13	IBS provides highly aesthetic endproduct through the process of controlled pre-fabrication and simplified installation.	-0.48

From the previous analysis of the results, the F matrix is derived from the findings of the focus group discussion. The results show how the "How's" are established. Nine (9) critical factors are determined from the construction stakeholders' questionnaire. The repeated procedure performed in the Q matrix development resulted in identifying the corresponding "How's" for each and every one of the "What's" selected. The analysis of data produces some twenty-four (24) list of "How's", which are determined and analysed through this procedure. The list of "How's" are similarly ranked from the highest to the lowest, as shown in Figure 5.13.

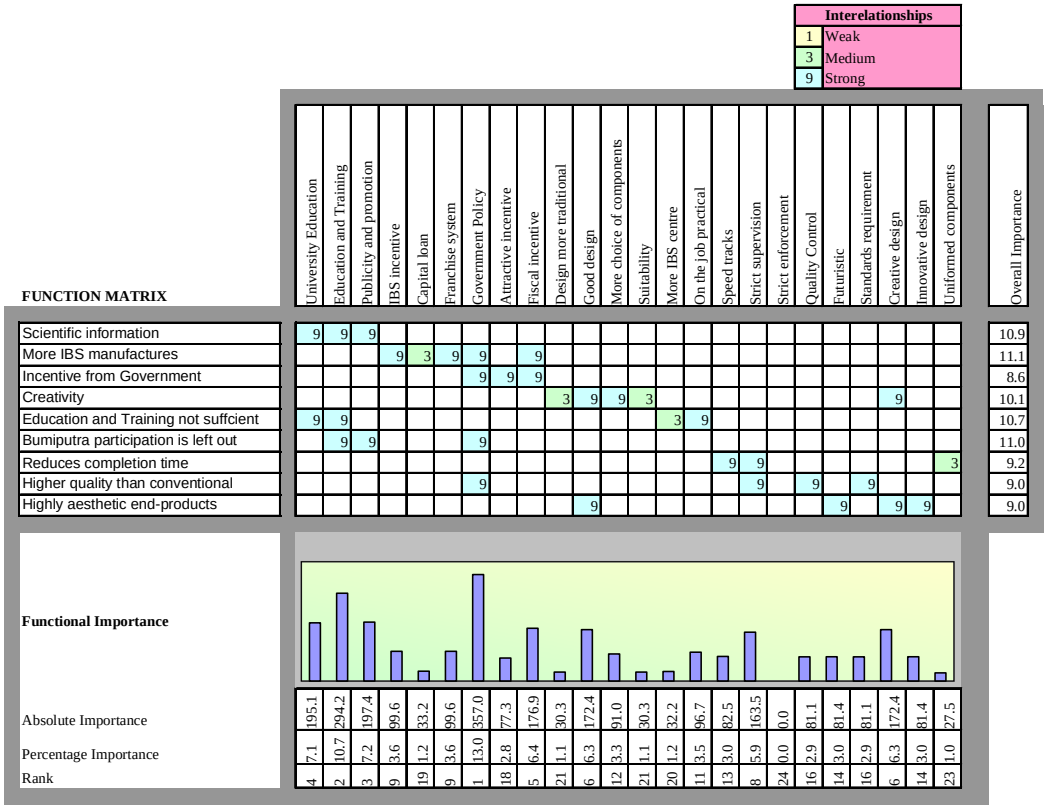


Figure 5.13: Quality Function Deployment (F matrix)

The list of 24 "How's" are shown in Table 5.49. The first eight (8) items marked in italics and bold are taken to the next level of QF matrix development. This table provides the list of 9 strategies to improve IBS adoption in the Malaysian construction industry.

Table 5.49: F matrix, "How's" developed by the focus group

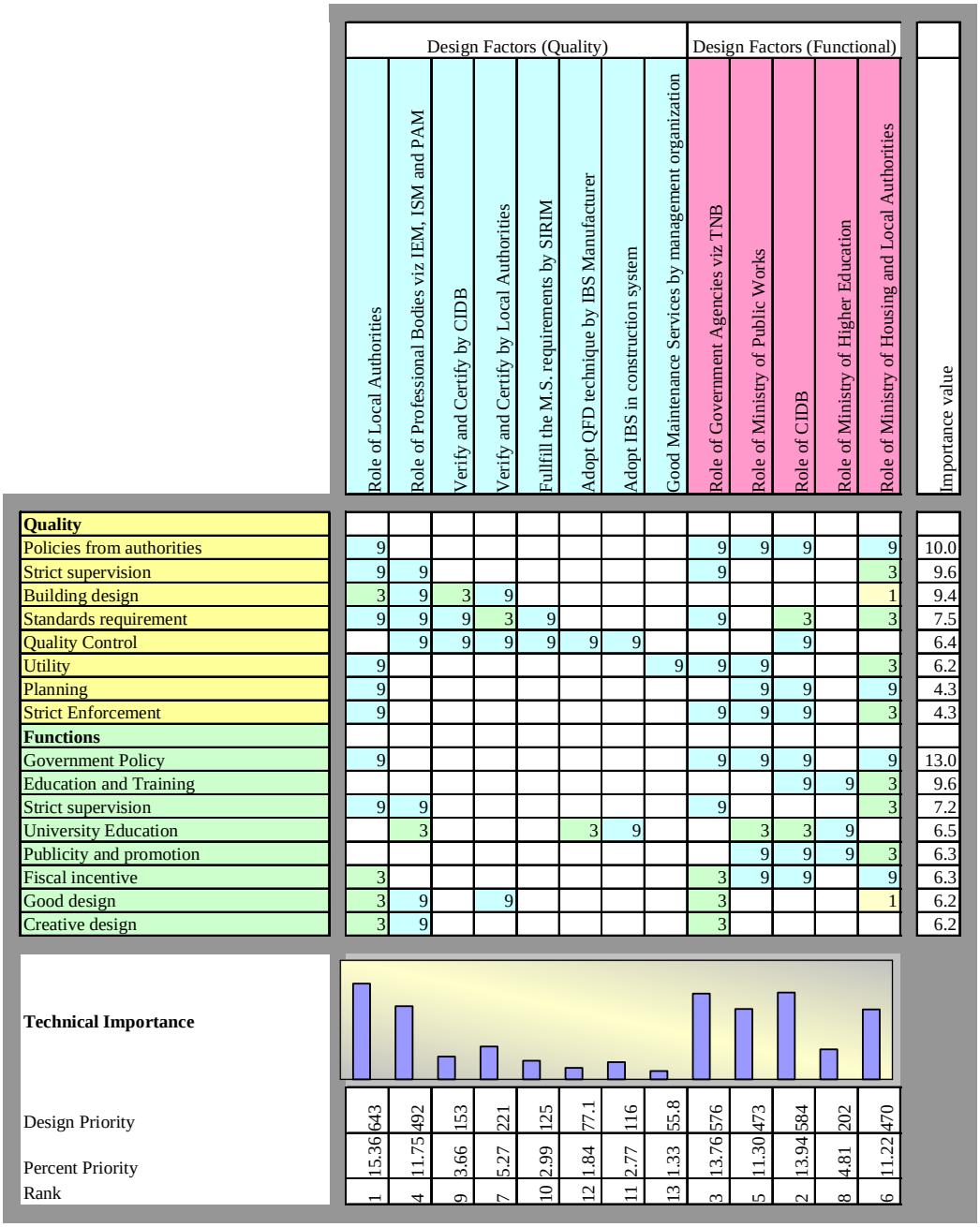
No.	Quality Hows	Importance (%)
1	***Government Policy***	***13.0***
2	***Education and Training***	***10.7***
3	***Publicity and Promotion***	***7.2***
4	***University Education***	***7.1***
5	***Fiscal Incentive***	***6.4***
6	***Good Design***	***6.3***
7	***Creative Design***	***6.3***
8	***Strict Supervision***	***5.9***
9	***Franchise System***	***3.6***

Table 5.49: F matrix, "How's" developed by the focus group (Cont'd)

No.	Quality Hows	Importance (%)
10	IBS Incentive	3.6
11	On the Job Practical	3.5
12	More Choice of Components	3.3
13	Speed Track	3.0
14	Innovative Design	3.0
15	Futuristic	3.0
16	Quality Control	2.9
17	Standards Requirement	2.9
18	Attractive Incentive	2.8
19	Capital Loan	1.2
20	More IBS centre	1.2
21	Suitability	1.1
22	Design more traditional	1.1
23	Uniformed Components	1.0
24	Strict enforcement	0.0
	Total	100.0

5.4 RESULTS ON DEVELOPMENT OF QF MATRIX– THIRD PHASE

The selected strategies from the Q matrix and F matrix are combined to form another final QFD application, known as the development of QF matrix, as shown in Figure 5.14. This figure also indicates the list of the first eight (8) "How's" from the Q matrix and another list of the first eight (8) "How's" from the F matrix, which are transported into this QF matrix to form the new list of "What's". Hence, the third QF matrix has sixteen (16) "What's", as seen in this figure. The results in Figure 5.14 also indicate that the new list of "What's" are placed row wise. The results of the QFD application from the focus group discussion developed a list of thirteen (13) "How's". These lists indicate which construction organizations need to take action in order to implement IBS adoption in Malaysia.



	Design Factors (Quality)								Design Factors (Functional)					
	Role of Local Authorities	Role of Professional Bodies viz IEM, ISM and PAM	Verify and Certify by CIDB	Verify and Certify by Local Authorities	Fullfill the M.S. requirements by SIRIM	Adopt QFD technique by IBS Manufacturer	Adopt IBS in construction system	Good Maintenance Services by management organization	Role of Government Agencies viz TNB	Role of Ministry of Public Works	Role of CIDB	Role of Ministry of Higher Education	Role of Ministry of Housing and Local Authorities	Importance value
Quality														
Policies from authorities	9								9	9	9		9	10.0
Strict supervision	9	9							9				3	9.6
Building design	3	9	3	9									1	9.4
Standards requirement	9	9	9	3	9				9		3		3	7.5
Quality Control		9	9	9	9	9	9				9			6.4
Utility	9							9	9	9			3	6.2
Planning	9									9	9		9	4.3
Strict Enforcement	9								9	9	9		3	4.3
Functions														
Government Policy	9								9	9	9		9	13.0
Education and Training											9	9	3	9.6
Strict supervision	9	9							9				3	7.2
University Education		3				3	9			3	3	9		6.5
Publicity and promotion										9	9	9	3	6.3
Fiscal incentive	3								3	9	9		9	6.3
Good design	3	9		9					3				1	6.2
Creative design	3	9							3					6.2
Technical Importance														
Design Priority	643	492	153	221	125	77.1	116	55.8	576	473	584	202	470	
Percent Priority	15.36	11.75	3.66	5.27	2.99	1.84	2.77	1.33	13.76	11.30	13.94	4.81	11.22	
Rank	1	4	9	7	10	12	11	13	3	5	2	8	6	

Figure 5.14: Quality Function Deployment (QF matrix)

The list of 13 "How's" are shown in Table 5.50. The first five (5) items marked in italics and bold are the list of 5 major roles from related organizations to improve IBS adoption in the Malaysian construction industry. Here, the results indicate that the major roles in implementing IBS are by local authorities (rank number 1), by Construction Industry Development Board Malaysia (CIDB) (rank number 2), government agencies

(rank number 3), professional bodies (rank number 4), and Ministry of Public Works (rank number 5).

Table 5.50: QF matrix (How's) developed by the focus group

No.	How's of QF Matrix	Importance (%)
1	***Roles of Local Authorities***	***15.4***
2	***Roles of CIDB***	***13.9***
3	***Roles of Government Agencies***	***13.8***
4	***Roles of Professional Bodies***	***11.8***
5	***Roles of Ministry of Public Works***	***11.3***
6	Roles of Ministry of Housing and Local Government	11.2
7	Verify and Certify by Local Authorities	5.3
8	Roles of Ministry of Higher education	4.8
9	Franchise System	3.7
10	Verify and Certify by CIDB	3.0
11	Adopt IBS in Construction System	2.8
12	Adopt QFD technique by IBS manufacturers	1.8
13	Good Maintenance Services by Management Organization	1.3

5.5 THE RESULTS FROM VALIDATION OF THE RESEARCH FINDINGS - PHASE 4

The respondents for the validation process consisted of the experts from among the academics, and stakeholders. The stakeholders selected were among the developers, consultants, contractors and the manufacturers of the IBS home. There were a total of ten (10) respondents who participated in the validation process.

The findings of the validation process were then analysed according to the total percentage of answered questions. This percentage is based on the number of respondents who answered each respective finding of the three (3) stages of study over the total number of respondents who participated in the validation process. The results calculated as a percentage should reflect the accuracy of the interpretation of the findings at each stage of the study. Therefore, the results of the structured questions (in percentage of the categories of strongly important/agree, important/agree and not important/disagree) would validate the findings of the study.

The results from validation of the findings process in the fourth phase are divided into three (3) stages. The results are represented in Table 5.51.

Table 5.51: Results of the Validation of Findings

Stage of Study	Findings during the stages of the study	Strongly Important/ Strongly Agree	Important/ Agree	Important/ Not Agree
(Quantitative) Customer Satisfaction	-Size of House	50%	50%	0%
	-Price of House	80%	20%	0%
	-Quality of workmanship	90%	10%	0%
	-Specification/Quality of Building Materials	60%	40%	0%
	-Design Quality/Aesthetic Value	20%	60%	20%
	-Building Strength	60%	40%	0%
	-Comfort	50%	50%	0%
	-Environment Condition	20%	80%	0%
	-Maintenance	30%	60%	0%
(Quantitative) IBS Adoption Factors	-Construction players still lack scientific information about the economic benefits of IBS	50%	50%	0%
	-Limited number of local IBS manufacturers	70%	30%	0%
	-IBS adoption does not attract enough incentives from the government.	40%	50%	10%
	-IBS designs are monotonous and stifle creativity.	60%	40%	0%
	-IBS education and training are not sufficient in universities and institutes of higher education.	50%	50%	0%
	-'Bumiputera' participation is left out in the IBS adoption.	70%	30%	0%
	-IBS reduces completion time of construction projects due to the usage of standardised prefabricated components and simplified installation process	40%	60%	0%
	-IBS provides higher quality than conventional system.	10%	70%	20%
	-IBS provides highly aesthetic end product through the process of controlled pre-fabrication and simplified installation			

Table 5.51: Results of the Validation of Findings (Cont'd)

Stage of Study	Findings during the stages of the study	Strongly Important/ Strongly Agree	Important/ Agree	Important/ Not Agree
(Qualitative) Strategies to improve customers' satisfaction factors	-Policies from authorities	60%	40%	0%
	-Strict supervision	60%	40%	0%
	-Building design	50%	50%	0%
	-Standards requirement	60%	40%	0%
	-Quality Control	90%	10%	0%
(Qualitative) Strategies to improve IBS adoption	-Government Policy	100%	0%	0%
	-Education and Training	80%	20%	0%
	-Fiscal Incentive	60%	40%	0%
	-University Education	30%	60%	10%
	-Publicity and promotion	70%	30%	0%
(Qualitative) Recommendations to the organizations to improve customers' satisfaction and IBS adoption	-Role of Local Authorities	100%	0%	0%
	-Role of Construction Industry Development Board (CIDB)	80%	20%	0%
	-Role of Government Agencies	60%	40%	0%
	-Role of Professional Bodies	30%	60%	10%
	-Role of the Ministry of Public Works	70%	30%	0%

5.5.1 Validation of Customer Satisfaction Factors of IBS House. Findings of Research Process in Part 1 (Phase 1)

The results in Table 5.51 indicate that "quality of workmanship" and the "price of house", which constitutes 90% and 80% of the total number of answered respondents, respectively, are the most important customer factors in IBS housing. As for the factor for "design quality and aesthetics", 60% were only important to customer satisfaction except of which 20% of the respondents affirmed to be not as important to customers' satisfaction. Meanwhile, the "environment condition and the maintenance factors" of IBS housing made up 80% and 60%, respectively, which were agreed by the respondents in customer factors category of IBS construction.

5.5.2 Validation of IBS Adoption Factors in the Construction Industry. Findings of Research Process in Part 2 (Phase 1)

As for the IBS adoption in the construction industry all the respondents confirmed the importance of IBS adoption factors in the Malaysian construction industry except for the two adoption factors of which one is the "IBS adoption does not attract enough

incentives from the government" with 10% of the respondents disagreeing with it. The other is "IBS provides highly aesthetic end product through the process of controlled prefabrication and simplified installation" with 20% of the respondents disagreeing with it. A total of 70% of the respondents strongly agree that a limited number of local IBS manufacturers, Bumiputera participation is left out in the IBS adoption, and IBS reduces completion time of construction projects due to the usage of standardised are the IBS adoption factors in the Malaysian construction industry.

5.5.3 Strategies to Improve Customer Satisfaction in IBS Housing Projects. Findings of Research Process in Part 1 (Phase 2)

Table 5.51 indicates that the policies from the authorities, strict supervision, building design, standard requirements and quality are strongly agreed with as the strategies that could improve customer satisfaction in IBS housing project development. Convincingly, 90% of the respondents confirm that quality control is the most important and agree with it being a customer factor in IBS housing project development.

5.5.4 Strategies to Improve IBS Adoption in the Construction Industry. Findings of the research process in Part 2 (Phase 2)

It seems that all the respondents (100%) strongly agree that the government policy is regarded as one of the strategies to improve IBS adoption in housing project development. However, 10% of the respondents do not agree; 80% strongly agree that education and training are the strategy to improve IBS adoption in the Malaysian construction industry. The validation exercise also reveals that 70% of the respondents strongly agree that publicity and promotion is also an important strategy to improve IBS adoption in the construction industry.

5.5.5 Recommendation to organizations to improve the customer satisfaction on IBS housing and level of IBS Adoption. Findings of research process in Phase 3.

The combination of the customer satisfaction of IBS house occupiers and the IBS adoption reflect the recommendation to construction organizations to improve the IBS. All the respondents confirm that one of the recommendations to improve customer satisfaction and IBS adoption is the role of the local authorities. However, 10% of the respondents do not agree that the role of the professional bodies is one of the recommendations to improve customer satisfaction and IBS adoption factors. It is clear that 80% and 70% of the respondents strongly agree that the Construction Industry Development Board (CIDB) and the Ministry of Public Works, respectively, are supposed to play an important role in recommending and improving customer satisfaction with IBS housing projects and IBS adoption in the Malaysian construction industry.

5.6 THE RESULTS FROM VALIDATION OF THE RESEARCH MODELS

The activities of the overall research process can be summarized in the first research model for this research study, as shown in Figure 5.15. The second research model was developed to indicate the application of QFD, as shown in figure 5.16. The researcher also conducted the validation process for the research models as recommended by Cavana *et al.* (2001), Crestwell (1998, 2006), Lincoln & Guba (1985), Miles & Huberman (1994), Malterud (2001), Mays & Pope (2000) and Fraenkel & Wallen (2006). There were a total of four (4) respondents who participated in the validation process. The research models validation processes were conducted among the facility manager of IBS house as representative from maintenance and management company, project manager as representative from the IBS manufacturer, certified professional

civil engineer as representative from Public Works Department, Malaysia, and certified professional architect as representative from architect consultant.

The results from validation of the research model are divided into two (2) sections. First, is the validation of the research process model and the second is the validation of model on strategies to improve customer satisfaction on IBS houses and IBS adoption using QFD Application. The results are presented in Table 5.52.

Table 5.52: Results of the Validation of Research Model

Model	Description	Strongly Important/ Strongly Agree	Important/ Agree	Important/ Not Agree
Research Model 1 Model on process to develop new strategies of customer satisfaction of IBS house occupiers, IBS adoption and determination of organizations to improve IBS adoption.	-Practicality of the model	50%	50%	0%
	-Simplicity of the model	75%	25%	0%
	-Accuracy of the model	25%	50%	25%
	-The model is user friendly	50%	50%	0%
	-Affordable to implement the model	25%	50%	25%
	-Contribution of the model to the industry	25%	75%	0%
Research Model 2 Model on strategies to improve customer satisfaction on IBS houses and IBS adoption using QFD Application	-Practicality of the model	50%	50%	0%
	-Simplicity of the model	50%	50%	0%
	-Accuracy of the model	75%	25%	0%
	-The model is user friendly	50%	50%	0%
	-Affordable to implement the model	25%	25%	50%
	-Contribution of the model to the industry	25%	75%	0%

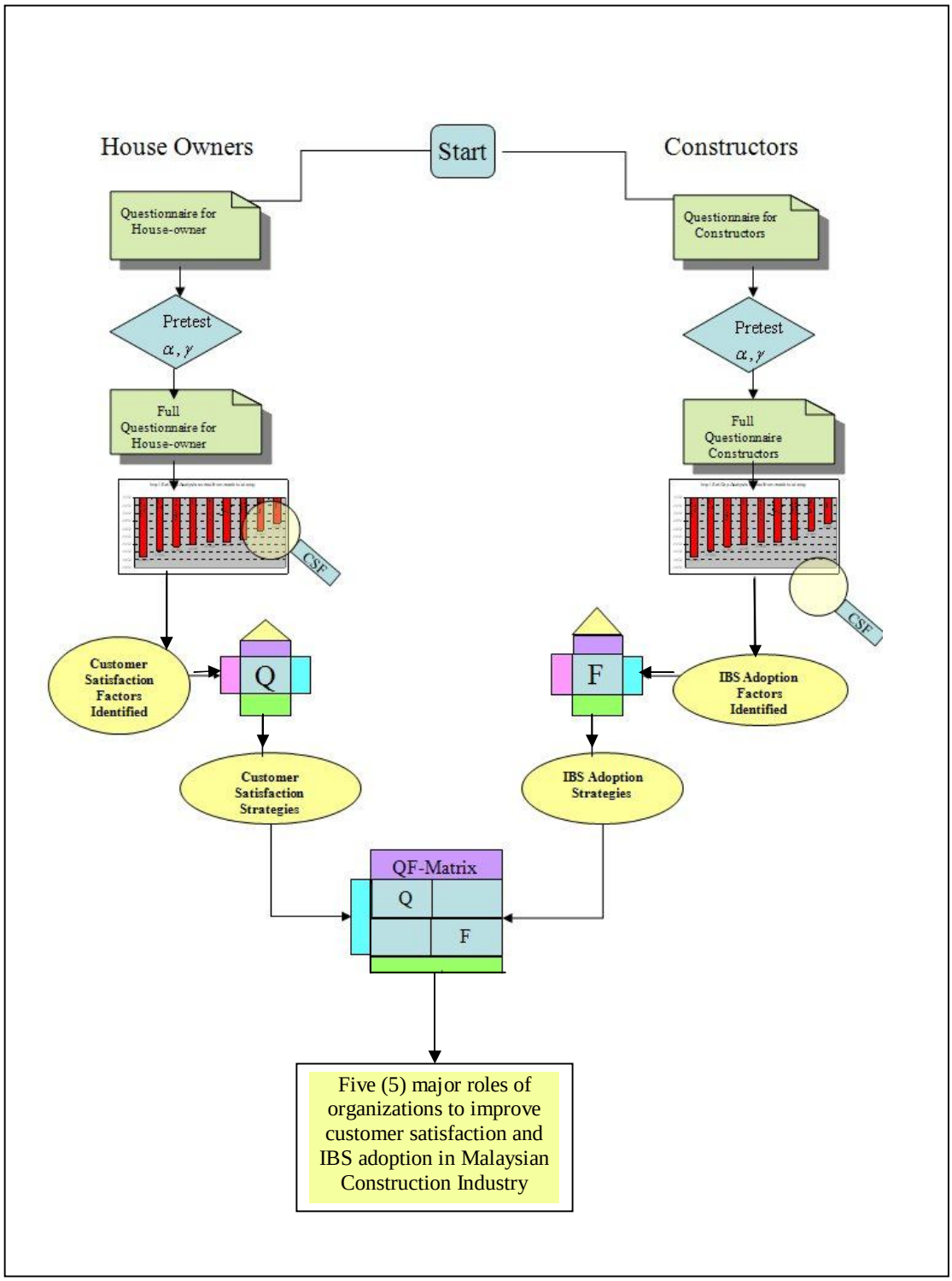


Figure 5.15: Model on process to develop new strategies of customer satisfaction of IBS house occupiers, IBS adoption and determination of organizations to improve IBS adoption

From the first model of the research process, the researcher has also developed the second model specifically focused on the application of QFD as shown in Figure 5.16. The second model is considered as part of the first model.

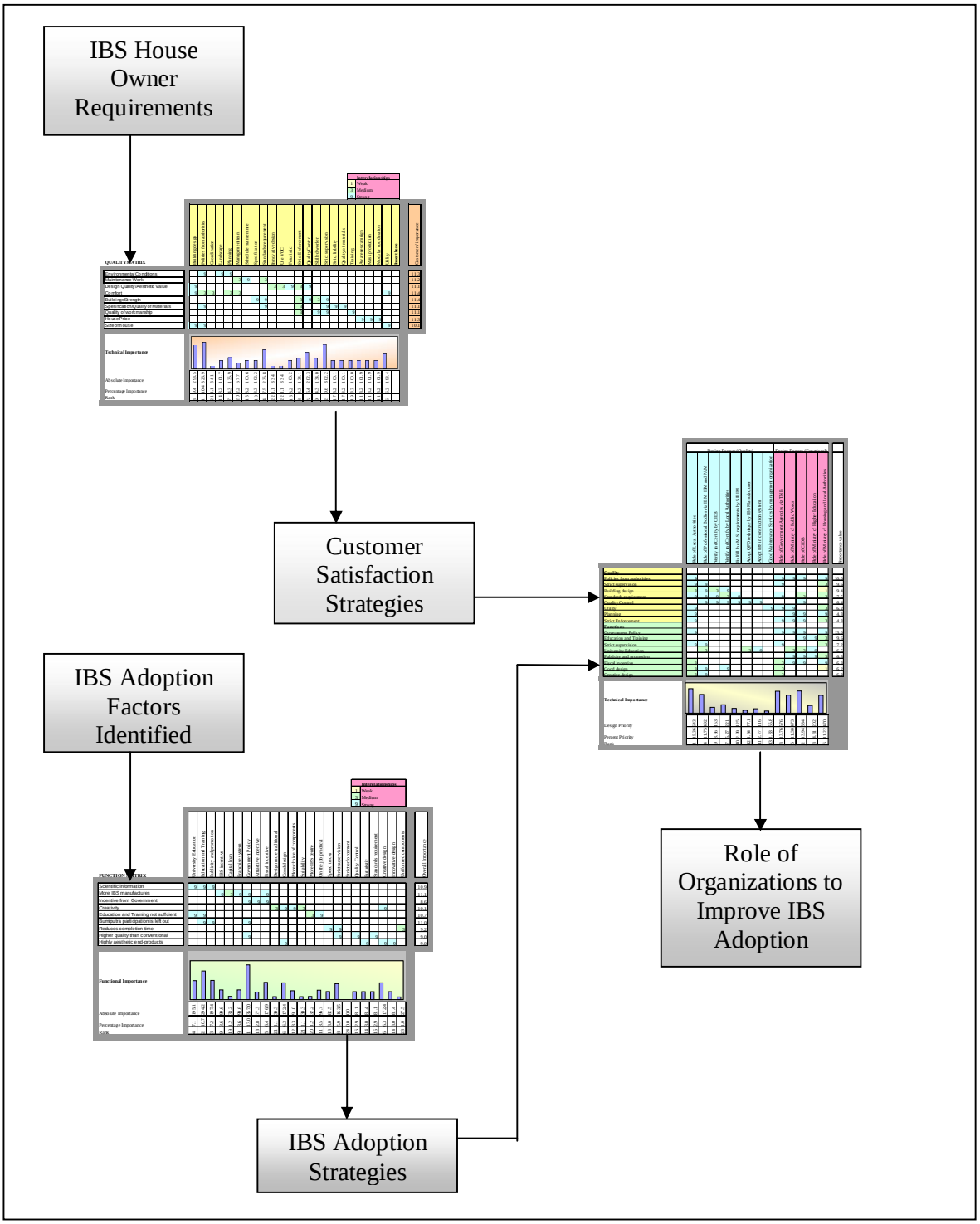


Figure 5.16: Model of strategies to improve customer satisfaction on IBS houses and IBS adoption using QFD Application

5.6.1 Validation of Research Models

The results in Table 5.52 indicate overall respondents from professional construction experts agreed and verified that research models from Figure 5.15 and Figure 5.16 were practical, simple, accurate, user friendly, affordable to implement, and that the models can contribute to the applications for the IBS industry. Meanwhile, only 25% of the experts did not agree that research model in Figure 5.15 were accurate and 50% of the experts did not agree that research model in Figure 5.16 were affordable to implement in the IBS industry. The experts believe that the models are developed in a constructive and clear manner. The models are also easy to understand and can be further used as a starting point for future development or study research. The experts also believe that the models involved were comprehensive thought fully process and is relevant to the industry. The strategies and validation process are also clearly thought out.

5.7 SUMMARY

This chapter deals with the extensive analysis of all the research questions arising throughout the study. All nine (9) satisfaction factors from the IBS house occupiers and nine (9) factors of IBS adoption from the IBS construction stakeholders are determined, examined and analysed. The results are shared and explained to the readers in this chapter. This chapter benefits the study in terms of answering the research questions and directly achieving the research objective. In this chapter the researcher explains in detail the processes involved in developing the QFD chart. It starts with the development of Q matrix, development of the F matrix and finally the development of the QFD matrix. The lists of “How’s” are all the functions or strategies that were developed through the focus group discussion, which was facilitated by the researcher during the course of the research process. The Q matrix, F matrix completion output is the major contribution from this study in terms of providing new strategies for

improving the customer satisfaction of IBS house project and the IBS implementation in the Malaysian construction industry. The output of the QFD is once again translated into the recommendations to the relevant organizations from the authorities, ministries and agencies for speedier achievement of full IBS implementation in the Construction Industry Master Plan (2015).