

CHAPTER 6

DISCUSSION OF THE FINDINGS

6.1 INTRODUCTION

The researcher has conducted an extensive and comprehensive study to determine the factors to increase customer satisfaction of IBS housing and the factors to improve IBS adoption using quantitative study. The researcher has also determined new strategies to improve customer satisfaction with IBS housing and strategies to improve the IBS adoption using the Quality Function Deployment (QFD) application. The requirements of QFD were systematically studied, observed and applied by the researcher throughout the course of the study. The academic demands were highly emphasized by the researcher to achieve the objectives of this study and also contribute significantly to the IBS construction industry in Malaysia.

6.2 DISCUSSION OF THE FINDINGS

The discussion of the findings is structured according to the issues arising from the problem statement. These issues were then addressed through the literature and the outcomes or findings of the main research study. This research has shown a very encouraging method for developing a QFD chart for the IBS construction industry in Malaysia. The strategies for improvement are presented in two parts. Part one explains the findings from that of customer perspective, namely, IBS house occupiers. Part two explains the findings of the construction stakeholders.

6.2.1 Factors affecting the customer satisfaction of IBS housing developed in Malaysia

The issues of low quality, poor consumer preferences, abandoned projects by the developers, and project delays of IBS house, as quoted by Elias (2006), Kamar *et al.* (2009), contribute to the intention of the researcher to determine the customer satisfaction factors of IBS housing projects. Furthermore, according to the IBS Roadmap Review (2007) report, the adoption of IBS in Malaysia is driven by the client or the house buyer. Clients or house buyers with a good knowledge and awareness of the benefits of IBS will surely encourage or appoint designers to design buildings according to IBS. This becomes the main reason why the researcher conducts this study which is to determine customer satisfaction of IBS housing.

The findings from the first part in the first phase of this study answer the first research questions. The (RQ1) is “what is the extent of customer satisfaction with IBS houses in Malaysia?” Nine (9) factors were identified, examined, analysed from the literature review, and quantitative study that affect the customer satisfaction of the IBS houses developed in Malaysia. The nine (9) factors are the followings: (i) environmental conditions, (ii) maintenance work, (iii) design quality, (iv) comfort, (v) building strength, (vi) quality of building materials, (vii) quality of workmanship, (viii) house price and (ix) the size of house. These findings indicated that the first objective (RO1) was achieved. These findings were also used in the first part of the second phase for further analysis in order to answer the third research question.

The first customer satisfaction factor of environmental conditions refers to low environmental impact (Stehn & Bergstrom, 2002), good air quality, reduce of noise pollution and reduce from traffic congestion (Abdul-Rahman, 1999).

The second factor of maintenance work refers to economics, especially in terms of operation and cost of maintenance (Stehn & Bergstrom, 2002), reduction in repairworks, repainting of buildings, good garbage collection system, good service, overall cleanliness, good management and maintenance of buildings (Abdul-Rahman, 1999; Dikmen *et al.*, 2005; Mustafa & Ghazali, 2011).

The third factor of design quality refers to a high quality product, attractive house layout (inner design and exterior design), flexible design and has a nice appearance or high aesthetic value (Mustafa & Ghazali, 2011; Abdul-Rahman, 1999; Dikmen *et al.*, 2005; Stehn & Bergstrom, 2002; Gargione, 1999).

The fourth factor of comfort refers to factors such as privacy, health, internal fittings (ventilation, temperature, and lighting), with good functional materials and accessories (NorAini, 2007; Jose & Simoes, 2003).

The fifth factor of building strength refers to safety, earthquake proof, and strength in structural elements (foundation, beam, column, roof, wall, and flooring) (NorAini, 2007; Jose & Simoes, 2003; Abdul-Rahman, 1999; Dikmen *et al.*, 2005; Kam & Tang, 1997).

The sixth factor of quality in building materials refers to high quality materials used for building (roof, floor, wall, door, window, finishes) (Mustafa & Ghazali, 2011; Abdul-Rahman, 1999; Dikmen *et al.*, 2005; Kam & Tang, 1997). The seventh factor of quality in workmanship refers to high quality workmanship in installing components (ceiling, door, window, tiling, painting, plastering, plumbing work, electric wiring) (Abdul-Rahman, 1999; Kam & Tang, 1997).

The eighth factor of house price refers to developer offer of affordable price of house (Mustafa & Ghazali, 2011; Stehn & Bergstrom, 2002). The ninth customer satisfaction factor of size refers to spacious house layout (Abdul-Rahman, 1999; Dikmen *et al.*, 2005).

6.2.2 The success and barrier factors of IBS adoption in the Malaysian construction industry

The second issue presented from the literature review is the delay of IBS adoption in the Malaysian construction industry. The IBS Survey 2003 stated that only 15% of construction projects used IBS in Malaysia (IBS Survey, 2003). While, the IBS Mid Term Review in 2007 indicated that approximately only 10% of the completed projects used IBS in the year 2006 (IBS Roadmap Review, 2007). The actual projection for the percentage of completed projects using IBS is in the range of 50% in 2006 and 70% in year 2008 (CIDB, 2003). This percentage is lower than expected despite an extensive publicity campaign by the government (Hamid *et al.*, 2008), hence, it becomes the researcher's intention to conduct a study to determine the success factors and barriers to IBS adoption in the Malaysian construction industry.

The (RQ2) is “what are the success factors and barriers to IBS adoption in the Malaysian construction industry?” A total of 34 success factors and barriers to IBS adoption were derived from the literature review study. However, after all the factors were analysed and examined in the main study in the second part of the first phase of the research process, there were nine (9) critical success and barrier factors that were identified, examined, analysed from the literature review and main study through the quantitative research approach. The nine (9) critical factors are the followings: (i) that construction players still lack scientific information about the economic benefits of IBS,

(ii) the limited number of local IBS manufacturers in Malaysia, (iii) IBS adoption does not attract enough incentives from the government, (iv) IBS designs are monotonous and stifle creativity, (v) IBS education and training are not sufficient in universities and in other institutes of higher education, (vi) the Bumiputera participation is left out in the IBS adoption plan, (vii) the faster completion of IBS construction, (viii) the quality of IBS products compared to conventional system, (ix) and the highly aesthetic end product of IBS. These findings also indicated that the second objective (RO2) was achieved.

The first critical IBS adoption factor is about the construction players. It was found that they still lack scientific information about the economic benefits of IBS (Badir *et al.*, 2002; Elias, 2006). This factor is considered as the barrier in IBS adoption. Studies have indicated that IBS could actually promote labour reduction and fast completion if properly planned and implemented (CIDB, 2003). This can contribute to the reduction in overall construction cost. Hence, scientific information about the economic benefits of IBS should be highlighted by the related organizations to the construction players.

Second, the limited number of local IBS manufacturers in Malaysia is also considered as the critical barrier factor to adopt IBS. This factor can contribute to the high cost of IBS house due to monopoly of prices by the IBS manufacturer or contractor through direct award or direct negotiation in tendering process. Furthermore, majority of IBS in Malaysia is imported from developed countries, thus, driving up the construction cost (Thanoon *et al.*, 2003; Haron *et al.*, 2004). If there are many local IBS manufacturers, clients can get fairly competitive price of IBS houses through transparent open tendering process resulting in lower prices of locally made IBS components.

The third critical barrier factor is when IBS adoption does not attract enough incentives from the government. This is due to the higher initial investment capital for pre-casters to purchase new factory, machinery, moulds, equipments and wages for skilled workers for the installation process. Hence, the IBS manufacturers have no choice but to request more incentives especially in terms of financial (capital injection), exemption from tax or levy, and also to create more IBS housing projects from the National Plan agenda in order to sustain the business survival of IBS developers and manufacturers in Malaysian construction industry (CIDB, 2004; Thanoon *et al.*, 2003).

The fourth critical barrier factor of IBS adoption is IBS designs are monotonous and stifle creativity (Elias, 2006; Warszawski, 1999; Hamid *et al.*, 2008). Hence, the IBS design should allow flexibility in architectural design in order to minimise the monotony of repetitive facades including the design of pre-cast elements as well as in construction so that different systems may produce their own unique prefabrication construction methods.

The fifth critical barrier factor of IBS adoption is the IBS education and training are not sufficient in universities and in other institutes of higher education (Thanoon *et al.*, 2003; Haron *et al.*, 2004). Hence, the Ministry of Higher Education and the universities should provide specific course on IBS design and IBS method of construction.

Another critical barrier factor to adopt IBS is the Bumiputera participation which did not adopt the IBS adoption plan (Elias, 2006). Many Bumiputera contractors were reluctant to adopt the IBS system and preferred to continue using conventional method of construction. This is due to the fact that Bumiputera contractors are already familiar with the conventional system and for them the technology suits their small-scale

projects, and, therefore, they are not willing to switch to a mechanized based system (Kamar *et al.*, 2009). Furthermore, small contractors lack the financial backup and are not able to set up their own manufacturing plants as it involves intensive capital investment.

However, there are also success factor to adopt IBS. The seventh critical factor of IBS adoption is faster completion of IBS construction. According to Pheng (1986) and CIDB (2003), IBS allows for faster construction time because casting of precast elements at the factory and the foundation work at the site can occur simultaneously, thus, enabling earlier occupation of the houses. Hence, faster completion of IBS construction which invariably results in cost-saving to the overall construction cost and prevents delay in project completion, thus, avoiding non completion of housing project.

The eighth success factor of IBS adoption is the higher quality of IBS products as compared to the conventional system. Din (1984) and CIDB (2003) stated that industrialised building system (IBS) components can produce a higher quality of components, which is attainable through careful selection of materials, use of advanced technology and strict quality assurance control.

The ninth success factor of IBS adoption factor is the highly aesthetic end product of IBS. In order to attract the future house buyers to buy IBS houses, the IBS developers must ensure that the IBS houses must have high aesthetic value and also quality finishings.

6.2.3 Strategies to improve customer satisfaction in IBS house construction

The third research question (RQ3) is “How to improve customer satisfaction in IBS house construction?”. From the application of QFD analysis, the first part of the second phase (qualitative study), five (5) strategies were laid out. The strategies include improvement of policies from the local authorities, strict supervision from the related organizations, improvement of the building design, provide the standard requirement of IBS house project, and the requirements of quality control. These findings were indicated and the third objective (RO3) for this study was achieved.

The first strategy to improve customer satisfaction in IBS house construction is the policies from the local authorities. Local authorities in Malaysia are led by the Ministry of Housing and Local Government (MHLG). It is further divided into smaller local authorities based on each district in every state in Malaysia. Basically, the local authorities control the approval of new construction development or renovation works in their own respective area. There are also key elements in the IBS Roadmap 2003-2010 which highlighted the role of local authorities such as enforcing Modular Coordination (MC) through Uniform Building by Laws (UBBL). The purpose is to develop a IBS verification scheme, to enforce the utilisation of IBS, to enforce the foreign labour policy in construction, to enforce approval of plans for housing development towards IBS adoption, to provide tax incentives for IBS developers and to offer a green lane programme for users of the standard plan (designed using standard IBS components and MC) (CIDB, 2003).

The second strategy is strictly one of supervision from the related organizations. The related organizations are Ministry of Housing and Local Government, Ministry of Public Works, CIDB, Government Agencies, and from the professional consultant of

architects, engineering and quantity surveying. They should conduct strict supervision of IBS housing construction. This is to ensure the quality of houses, and the completion of the housing project is completed on time. As for the IBS manufacturer and IBS developers, they are responsible to ensure strict supervision for the quality control of their IBS components produced by the factory and also in the assembly process that occurred in the construction sites.

The third strategy is the improvement of the building design. The IBS designer should allow flexibility in their IBS architectural design in order to minimise the monotony of repetitive facades including the design of pre-cast elements as well as in construction so that different systems can produce their own unique prefabrication construction methods.

The fourth strategy is to provide the standard requirement of IBS house project. This strategy is in concurrent with the existing IBS Roadmap 2003-2010 key elements. The key elements are; (i) to enforce the utilisation of IBS for government and private housing projects, (ii) to develop a catalogue of IBS housing components, (iii) to develop standard plans for IBS housing,

The fifth strategy is the requirement of quality control. In order to conduct quality control of the IBS houses, the IBS manufacturers and the IBS developers, are responsible to enforce strict supervision in quality control of their IBS components that are produced by the factory via Malaysian Standard (MS) certification and verification and also in the assembling process at the construction site that will be certified and verified by the site engineer. The IBS developers must also comply with the IBS standard, IBS design guide, guides for transportation, staking and installation.

According to Elias (2006) and Hussein (2005), the quality in IBS application include: (i) appearance (ability to customize to suit clients' taste within regional and local context, and the perceived value for money), (ii) flexibility (to enable free usage of designs, and to allow different systems to be used in different situations), (iii) in service performance (durability and maintenance requirements a perceived durability of traditional material design and materials to increase security and reduce vandalism, and maintenance of saleable value).

6.2.4 Strategies to improve IBS adoption in the Malaysian construction industry

Similarly, the finding in the second part of the second phase of this research, which is from the qualitative study, will answer the fourth research question (RQ4). The (RQ4) is "How to improve the level of IBS adoption in the construction industry?" From the investigation performed in this research there are five (5) strategies, which were identified. The five strategies identified from the QFD application are: (i) improvement of government policy towards IBS implementation, (ii) improvement in education and training, (iii) enhancement of the publicity and promotion of IBS, (iv) improvement in the provision of IBS courses in university education, and (v) improvement of fiscal (financial) incentive to the IBS manufacturers, developers and contractors in terms of capital package. These findings were indicated thus the fourth objective (RO4) for this study was achieved.

With regard to the first strategy that is the improvement of government policy towards IBS implementation. There are several policies that can improve the IBS adoption. These are: (i) to abolish levy IBS housing project, (ii) to provide tax incentives for manufacturers of IBS components, (iii) to provide green lane programme for users using IBS design, IBS components and modular coordination house.

The second strategy is the improvement in education and training. In order to improve IBS education and training, the related organizations need to incorporate a specialized syllabus on IBS or MC in architecture, engineering, and building courses in local universities. This strategy also includes the fourth strategy finding in this study that is the improvement in the provision of IBS courses in university education.

The third strategy is the enhancement of the publicity and promotion of IBS. In order to enhance the publicity and promotion of IBS, the related organizations needs to conduct huge publicity and promotion of benefits of IBS adoption, through media advertisement, newspaper, conference, professional & construction courses, proceeding, journals and books publication.

The fifth strategy is the improvement of fiscal (financial) incentive to the IBS manufacturers, developers and contractors in terms of capital package. There are several fiscal incentives that can improve the IBS adoption. These are: (i) to abolish levy on IBS housing project, (ii) to provide tax incentives, and (iii) financial aids for manufacturers of IBS components.

6.2.5 Recommendations to the construction organizations concerning IBS in the construction industry

The third phase of this research also produces a list of recommendations to the construction organizations of IBS in the construction industry. From the investigation performed in this research there are five (5) major roles of related organizations, which were identified. The five major roles of related organizations identified from the QFD application are: (i) roles of local authorities, (ii) roles of CIDB, (iii) roles of government agencies, (iv) roles of professional bodies, and (v) roles of Ministry of Public Works.

The first in the list of recommendations to the organizations in IBS construction is to be taken up by the local authorities to be engaged with responsibilities. These are: (i) to improve policies towards the application of IBS, (ii) to improve standard requirements, (iii) to conduct strict supervision, (iv) to conduct quality control, to provide IBS centre, and (v) to improve IBS co-ordination between local authorities and the relevant parties.

The other role identified through the finding of this research is the Construction Industry Development Board (CIDB). The roles identified through the findings of this research are yet to be implemented by the CIDB. These are: (i) to improve the policies from the CIDB towards the application of IBS, (ii) to improve IBS standard requirements, certification, verification and testing, monitoring the implementation of government IBS project, (iii) to improve existing IBS industry planning; (iv) to improve existing IBS promotion and marketing works; (v) to improve the role of existing IBS centre; (vi) to improve IBS coordination between CIDB and the relevant parties; (vii) to improve research and development works on IBS implementation; and (viii) to improve the existing IBS supply chain.

In addition, the findings indicate that the government agencies are also responsible for the role in the country's IBS construction. The list of responsibilities that can be inspired through these agencies include improvement in policies from government agencies towards application of IBS are (i) to improve standard requirements, (ii) to conduct strict supervision, (iii) to conduct quality control, to provide IBS centre, (iv) and to improve IBS co-ordination between government agencies and the relevant parties.

The major professional bodies are also identified in the findings as the major contributors towards the role of the country in IBS construction. These professional bodies are: the Institute of Engineers Malaysia (IEM), Board of Engineers Malaysia (BEM), Institute of Surveyors Malaysia (ISM), Board of Surveyors Malaysia, Pertubuhan Arkitek Malaysia (PAM), and the Master Builders Association Malaysia (MBAM).

The first professional body that plays a role in the country's IBS construction is the IEM and BEM. The responsibilities identified in the findings were: education and training of engineers towards IBS application are, (i) to improve publicity and promotion of IBS by conducting seminars, proceedings and journal publications, (ii) to improve standard requirements, (iii) strict supervision, (iv) quality control, (v) provide IBS centre, and (vi) to improve IBS co-ordination between engineers and the relevant parties.

The Institute of Surveyors Malaysia (ISM) and Board of Surveyors Malaysia (BSM) are professional bodies that are involved in the country's IBS construction. The responsibilities identified in the findings are: (i) education and training of surveyors towards IBS application, (ii) to improve publicity and promotion of IBS by conducting seminars, proceedings and journal publication, (iii) to improve standard requirements, (iv) to conduct strict supervision, (v) to monitor the quality control, (vi) to provide IBS centre, and (vii) to improve IBS coordination between surveyors and the relevant parties.

The other professional body is Pertubuhan Arkitek Malaysia (PAM), which is identified as the main professional body that plays a major role in the implementation of the

country's IBS construction. The responsibilities identified from the findings of this study are: (i) education and training of architects towards IBS application, (ii) to improve publicity and promotion of IBS by conducting seminar, (iii) to enhance proceedings and journal publications, (iv) to improve IBS standard requirements, (v) to improve IBS design requirements, (vi) to monitor strict supervision of their IBS projects, (vii) to monitor the quality control, to provide IBS centre, and (viii) to improve co-ordination of IBS projects between architects, government or clients, other IBS contractors, manufacturers, and the consultants.

The Master Builders Association Malaysia (MBAM) is another professional body that also plays its role in IBS. The responsibilities of this professional body identified through the findings of this study are: (i) education and training of contractors towards IBS application (ii) to improve publicity and promotion of IBS by conducting seminar, proceedings and workshop training (iii) to improve standard requirements, strict supervision, quality control, (iv) to provide IBS centre, (v) to improve co-ordination between the contractors and government or clients, other IBS manufacturers, clients, and consultants.

Last but not least, the Ministry of Public Works is among the last organizations that were identified as being able to take up the role concerning the implementation of IBS in the country's construction industry. The responsibilities for this ministry are: (i) to improve policies from government agencies towards application of IBS (application of IBS to all government projects), (ii) to provide more IBS incentives, to provide education and training towards IBS application, (iii) to improve publicity and promotion of IBS by conducting seminars, proceedings and workshops, (iv) to improve IBS standard requirement (v) to monitor quality control, (vi) to provide IBS centre, (vii) to

improve IBS design requirements, (viii) to conduct strict supervision of their IBS projects, (ix) to improve research and development works on IBS implementation.

6.2.6 Validation of the findings

The validation process indicates that the experts agreed and confirmed the findings of the customer satisfaction factors of IBS housing projects as found in the first part of the first phase and the findings of IBS adoption for housing project construction in the second part of the first phase. The finding of the third phase of the study, which is the identification of the strategies to improve customer satisfaction, and strategies to improve level of IBS adoption and identification of the five major roles to improve IBS adoption through QFD application, is confirmed by the experts who participated in the validation process.

For the first part of the first phase of the quantitative study, the following factors, which are very relevant and just as important as the customers' satisfaction to IBS house occupiers, are (i) environmental condition, (ii) maintenance work, (iii) design quality, (iv) comfort, (v) building strength, (vi) quality of building materials, (vii) quality of workmanship, (viii) price of house, and (ix) size of house. Among these factors, environmental condition is determined to be the most important customer IBS housing projects followed by maintenance work and design quality. Hence, it is obvious that these factors can be well-regarded as important factors to customers' satisfaction, regardless, as to whether it is low, medium or high cost IBS housing projects. However, the size of house is regarded by some IBS house occupiers as not important to IBS customers' satisfaction. The results are confirmed by the decision of the professional experts.

In the second part of the first phase of the study, the importance of IBS adoption factors were identified. These are: (i) the construction players still lack scientific information about the economic benefits of IBS, (ii) limited number of local IBS manufacturers, (iii) IBS adoption does not attract enough incentives from the government, (iv) IBS designs are monotonous and stifle creativity, (v) IBS education and training is not sufficient in universities and institutes of higher education, (vi) Bumiputera participation is left out in the IBS adoption, (vii) IBS reduces completion time of construction projects due to the usage of standardised prefabricated components and simplified installation process, (viii) IBS also provides higher quality finishings than conventional system, Last but not least (ix) IBS provides highly aesthetic end product, and erase the notion that IBS could not come up with a high quality aesthetic design.

The findings of the first part in second phase of the study indicate that the policy from the authorities, strict supervision, building design, standard requirement and quality control are all regarded as important strategies to improve the customer satisfaction factors in IBS housing projects. Among these factors, quality again emerges as the most important customer factor in IBS housing project. This finding reflects that in IBS housing project quality is a non-compromising customer factor whether it is a low, medium or high-rise.

Furthermore, in the second part of the second phase of the study, the government policy is regarded as a very relevant instrument towards the improvement of the IBS adoption. The government encouragement in the use of IBS in the design and construction is crucial to the improvement of IBS adoption in the local construction industry. The other strategies are that important are the education and training, publicity and promotion,

improvement of university education relating, and the improvement of fiscal incentive or financial incentive by the government.

The findings from the third phase of this study match the strategy of the customer satisfaction of IBS houses and the strategy in IBS adoption. There are five (5) major roles to improve. The validation of this final stage confirms that local authorities play a crucial role in improving IBS adoption. The implementation of IBS house construction depends upon the various relevant municipalities. The local authority ensures that government policy concerning usage and implementation of IBS are adhered and abided whenever projects are carried out. Besides the role of the local authorities, the other roles, provided by CIDB, government agencies, professional bodies and Ministry of Public Works, are also equally important thereby ensuring improvement in IBS adoption.

6.2.7 Research model development and validation process

The researcher was able to develop two research models from the study. The first research model is developed using the overall research process approach whereas the second research uses model which focuses on the application and process of QFD. The research models are shown in Figure 5.15 and Figure 5.16.

The model development was developed from the research process activities. Two initial findings have been developed, namely, IBS house owner requirements and the determination of IBS adoption factors from the construction stakeholders. Both results have been determined through quantitative study or questionnaire survey. Nine (9) IBS house owner requirement or satisfaction and nine (9) IBS adoption factors have been

identified. This was discussed in the earlier sections namely section 6.2.1 and 6.2.2. Both results were then used as the requirements. (i) (What's) to develop the strategies and (ii) (How's) by using the Quality Function Deployment (QFD) application.

From the QFD analysis that was conducted through qualitative study and focus group discussion the representatives from the valid IBS house owners, construction stakeholders, academician and researcher, several strategies were determined. However, the researcher only focused on the five (5) most important strategies in order to improve customer satisfaction of IBS housing projects and another five (5) most important strategies to improve IBS adoption in the Malaysian construction industry. The decision to select only the five (5) most important strategies was because the researcher was using Pareto Principle of (20-80) rule as discussed in section 4.3.2 (iii) (a). The strategies that were determined were discussed in section 6.2.3 and 6.2.4. In order to implement the strategies, the researcher proceeded to another QFD analysis. The analysis was conducted to determine the roles by which organizations are supposed to implement all the strategies that were determined in order to improve IBS adoption in the Malaysian construction industry. The organizations that were determined to play the roles in implementing the strategies were discussed in section 6.2.5.

The results from the validation process indicate overall, respondents from professional construction experts agreed that the research model from Figure 5.15 and Figure 5.16 were practical, simple, accurate, user friendly, affordable to implement, and the models can contribute to the application for the IBS industry. Meanwhile, only 25% of the experts did not agree that the research model in Figure 5.15 were accurate. 50% of the experts did not agree that the research model in Figure 5.16 were affordable to implement for the IBS industry. The experts believe that the models are developed

constructively and with clarity. 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 comprehensively planned and fully processed and, are therefore, relevant to the industry. The strategies and validation process are also clearly thought out.

6.3 SUMMARY

This chapter deals with the discussion of the findings. All nine (9) factors relevant to the house occupiers and nine (9) factors of IBS adoption from the IBS construction stakeholders were determined, examined and analysed. The results have been shared and explained to the readers in this chapter. This chapter outlines the benefit of the study in terms of answering the research questions and achieving the research objectives. The Q matrix and F matrix completion output are the major contributions from this study in terms of providing new strategies for improving customer satisfaction of IBS housing and the IBS implementation in the Malaysian construction industry. The output of the QFD is once again translated into the recommendations to the relevant local authorities. These are: (i) CIDB, (ii) government agencies, (iii) professional bodies, and (iv) the Ministry of Public Works for speedier achievement towards full IBS implementation in the Construction Industry Master Plan of (2015). The entire result findings and the research models are also verified and validated by the professional experts from the industry.

CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

7.1 INTRODUCTION

The researcher has conducted an extensive and comprehensive study to determine the factors to increase customer satisfaction in IBS housing and factors to improve IBS adoption using quantitative study. The researcher has also determined new strategies to improve customer satisfaction of IBS housing and strategies to improve the IBS adoption using the Quality Function Deployment (QFD) technique. The requirements of QFD were systematically studied, observed and applied by the researcher throughout the course of the study. The academic demands were highly emphasized by the researcher to achieve the objectives of this study and will hopefully contribute significantly to the IBS construction industry in Malaysia.

7.2 MAIN FINDINGS OF THE STUDY

The aims and research objectives of this study were achieved through the main findings of each of the phases of the study. The first objective (RO1), which is “to determine, examine and analyse the customers’ satisfaction factors of IBS housing”, has been achieved through the investigation of the factors. In this investigation, there are nine factors of customer satisfaction. These are: (i) environmental conditions, (ii) maintenance work, (iii) design quality or aesthetic value, (iv) comfort, (v) building strength, (vi) specification or quality of building materials, (vii) quality of workmanship, (viii) price of houses, and (ix) size of houses. These factors were derived

through the literature review, quantitative study and by using a self-administered questionnaire survey from the IBS house occupiers via data collection.

The second objective (RO2) of this research, which is “to determine, examine and analyse the success factors of IBS adoption in the construction industry”, has been achieved through the second part of the first phase (quantitative) of this study. From the investigation there are nine (9) critical IBS adoption factors. These adoption factors are: (i) The construction stakeholders still lack scientific information about the economic benefits of IBS, (ii) number of local IBS manufacturers are limited, (iii) IBS adoption does not attract enough incentives from the government, (iv) IBS designs are monotonous and stifle creativity, (v) IBS education and training are not sufficient in universities and institutes of higher education, (vi) Bumiputera participation is left out in the IBS adoption, (vii) IBS reduces completion time of construction projects due to (viii) the usage of standardised prefabricated components and simplified installation process, (ix) IBS provides higher quality than conventional system and IBS provides highly aesthetic end product through the process of controlled pre-fabrication and simplified installation. These findings were derived through the literature review, quantitative study and by using the self-administered questionnaire survey from the IBS construction stakeholders via data collection.

The third objective (RO3) of the study, which is “to develop the strategies to improve customer satisfaction in IBS house construction using QFD application”, has been achieved through the finding from the first part in second phase (qualitative through focus group discussion) of the research process. From this part of the study, there are five strategies to improve customer satisfaction in IBS housing project development. These are: (i) policies from authorities, (ii) strict supervision, (iii) building design,

standard requirements and (v) quality control. These findings were derived through the qualitative study based on the focus group discussion via data collection. The researcher used the QFD technique to develop the strategies.

The fourth objective (RO4), which is “to develop the strategies to improve the level of IBS adoption in the construction industry using QFD application”, has been achieved through the second part in the second phase of the study. From this investigation, the five (5) main strategies to improve IBS adoption in housing project development emerged and were identified. These strategies are: (i) government policy, (ii) education and training, (iii) publicity and promotion, (iv) university education and (v) fiscal (financial) incentive. These findings were derived through qualitative study based on focus group discussion as via data collection. The researcher used QFD application to develop the strategies.

In addition, to the identification of the strategies using QFD application, the roles of construction organizations were also identified from the third phase of the study. From this study, there were five major roles or recommendations to improve customer satisfaction and IBS adoption in the Malaysian construction industry. These are; (i) role of local authorities, (ii) role of CIDB, (iii) role of government agencies, (iv) role of professional bodies and (v) role of Ministry of Public Works. These findings were derived through the focus group discussion with the respondents from IBS house occupiers and IBS construction stakeholders via data collection. The researcher used the QFD technique to develop the major roles of the construction organizations.

Evidently, through the use of the Quality Function Deployment (QFD) as the basis of this study, the researcher has been able to determine the followings:

- i. Compile a list of customer satisfaction and IBS adoption factors
- ii. Develop the Quality matrix and rank them accordingly
- iii. Develop the Function matrix and rank them accordingly
- iv. Develop the QF matrix and rank them accordingly
- v. Establish the factors and the strategies of customer satisfaction and IBS adoption
- vi. Develop the set of recommendations given earlier
- vii. Develop two research models

Hence, with the evidence discovered from this study, the researcher believes this study will help and lead the way for the construction industry in Malaysia to move forward bearing in mind that customer requirements must be taken seriously into the design of all new development projects. This will ensure that the buildings are developed in accordance to customers' want, need and requirement. The implementation must be engineered, very aesthetically. Not only that quality and good furnishings must also be part and parcel of IBS. In addition, the researcher hopes that this study will lend support to the CIDB's efforts and aims to fully implement the IBS construction method by the year 2015.

7.3 CONTRIBUTIONS OF THE STUDY

The researcher has gained valuable experience in terms of learning and conducting a QFD project deployment in an objective way. The study has enabled the researcher to learn, use, deploy and gain first hand experience in QFD usage.

The study is a pioneering work not only for the researcher but also for the IBS construction industry in Malaysia as a whole. It is hoped that the new findings of this study will be used more objectively in developing, designing and managing the IBS

sector in the Malaysian construction industry, especially in the current economic recession and recovery phase.

This study contributes to the body of knowledge concerning the strategies to improve the customer satisfaction of IBS housing developments and to the strategies to improve the IBS adoption in Malaysia's construction industry. The contributions of the study include:

- i. Development of strategies to address the issue of low quality and low preferences of customer satisfaction in IBS housing construction;
- ii. Development of strategies to address the issue of delay in the implementation of IBS in the Malaysian construction industry;
- iii. The use of QFD application in this study can enhance the planning, management system of the IBS adoption in the Malaysian construction industry and contributes to the discovery of a new knowledge application;
- iv. Development of two research models in this study can help for better planning, management and implementation in order to improve customer satisfaction on IBS housing developments and IBS adoption in the Malaysian construction industry.

These contributions can also benefit agencies or groups, such as the CIDB, IBS manufacturers, house buyers and government ministries and the government agencies.

This study will be a catalyst to the CIDB to achieve the set objectives on a tight time scale. The general IBS implementation plan is falling behind time. However, it is hoped that this study can contribute to the implementation of IBS, as it will identify ways and means concerning how IBS can best be implemented. The methods to achieve the

implementation of IBS are well-structured and methodically explained. The systematic approaches used here hopefully will increase the chances of success of the implementation and the application of IBS in the Malaysian construction industry.

The future house buyers are expected to be the major beneficiaries of this study. The results of this study will help recommend the need to incorporate customer satisfaction when implementing IBS. The researcher believes that this study will encompass the concept voice of customers are important and must be heard and taken seriously by the construction industry stakeholders.

This study will contribute to the existing and future IBS manufacturers in terms of product design, planning and management. The use of QFD in this study is a significant application tool to make sure their locally made IBS products satisfy customers, thus, increasing the demand for IBS house development and increasing the IBS adoption in the Malaysian construction industry.

The current findings indicate that the government ministries and agencies are not conversant with the IBS technology and the regulations associated with it. It is hoped that this study will help to remove and overcome some of the prevalent weaknesses.

There are some limitations of this research study. The limitations of this study include:

- i. Three (3) projects of IBS housing projects limited to the area in Putrajaya and in Puchong, Selangor;
- ii. Data from each type of IBS house representing the IBS house occupiers for data analysis;

- iii. The study is limited to clients or developers, consultants, contractors and suppliers from the government ministries and agencies, private construction companies, and local contractors as construction stakeholders in the Malaysian construction industry;
- iv. The study is limited to only specific sampling frames;
- v. The study is limited to only specific data analysis and application.

7.4 RECOMMENDATIONS FOR FUTURE RESEARCH

Upon completing this research the researcher has formed some insightful ideas concerning the areas that may be considered for future work, particularly, pertaining to customer satisfaction and IBS adoption in the Malaysian construction industry. Firstly, future research should be continued using IBS design and QFD application so as to benefit the industry even more. Secondly, future research studies can be conducted on the development of IBS product planning and process using QFD application. Thirdly, future research studies may also be conducted on the development of IBS housing using QFD applications based on Malaysian IBS products. Last but not least, this study will benefit the local IBS manufacturers and developers, because it will enable them to produce or develop locally made IBS products in accordance to customer satisfaction-criterias or demands and this will directly encourage more new IBS manufacturers to become involved in the industry as a whole.