

flexZhouse

New business model for affordable housing in Malaysia

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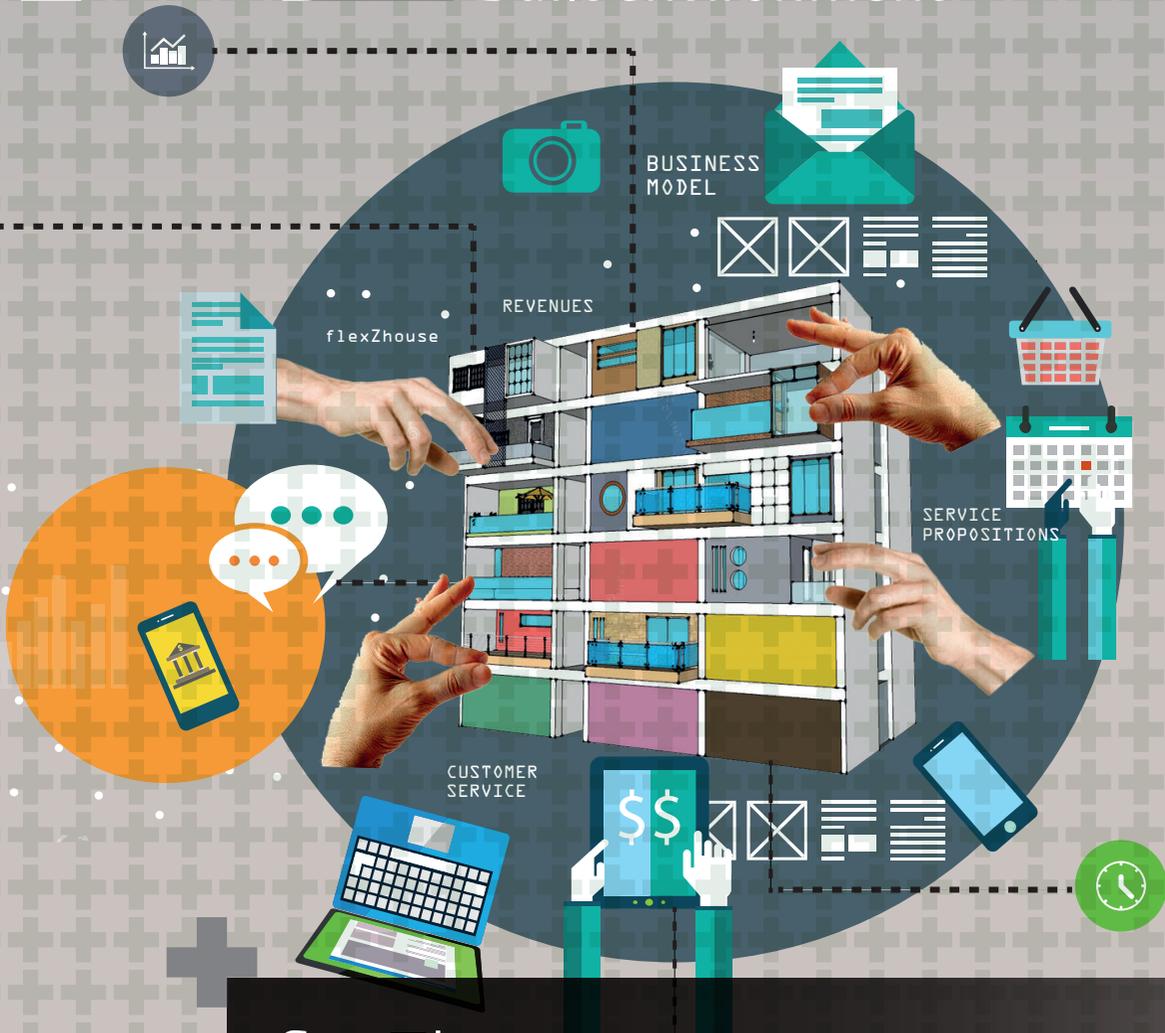
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New business model for affordable housing in Malaysia

Mohd Zairul bin Mohd Noor

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New business model for affordable housing in Malaysia

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flexZhouse

New business model for affordable housing in Malaysia

Proefschrift

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Tiada yang mustahil.. semua dengan izinNya...
for nothing will be impossible with HIS will...

Preface

The journey of my PhD began in the year of 2012 and at that point, everything looked equally mysterious, risky and more of a lonely journey. My wife, Dr. Noorhafizah had just been offered to pursue her Master's degree at one of the local universities. The implication on me was I had to go on with my PhD journey in a country which was thousands of miles away, worse still, without my family being around. Most of my friends were sceptical about going on with my PhD journey alone but to all our surprise, it worked!

As I can still recall the moment when I first started this #zackphdjourney, I was blessed with my youngest child, Akhiz Zuhd who was born 4 months after I landed in the country below sea level – Netherlands. Upon hearing the news, I was excited and decided to return home the soonest I could despite having to deal with my backlog of work. My first evaluation of go-no-go would be sooner than I had expected i.e., 9 months of my #zackphdjourney. Upon discussions, the committee was initially reluctant about allowing me to return to Malaysia owing to their concern about my work commitment. To my surprise however, I have earned the committee members' trust and received a 'GO' to allow me to continue my #zackphdjourney.

I have to say that the 'GO' decision definitely boosted my motivation for my #zackphdjourney. I was really excited about returning home as I, like any other father, husband and son in the world, I missed my children, wife and mum at home dearly. I still recall that quite often in my own room at the Hugo de Grootstraat, being lonely, I used to shed tears, thinking whether I had made the right decision and at times I doubted my decision which I had made earlier on. Nevertheless, I kept saying to myself that this decision would be a turning point in my life, therefore, I was very determined to make sure that I would reach the final line eventually.

Throughout the #zackphdjourney, I didn't miss the opportunities to visit several places in the Europe whenever there was a holiday break. I have made it a habit of spending almost 10 hours (especially during summer time) from 10 am to 8 pm every day for which I reward myself with a vacation. I have also made it my policy of not taking my work home. As soon as I return home, I usually spend time watching movies or Netflix and enjoy have a nice warm dinner.

I may have to admit that in terms of my work planning, I was a little sloppy at the beginning in terms of managing my PhD meetings with my supervisors. But in the course of time, I became more organised thanks to some experiences which I gained upon being appointed a project architect for several housing projects back in 2005 - 2007. I normally started the meetings with an agenda to be discussed at the meeting,

during the meeting I would take notes and record if necessary. After the meeting was over, I would summarize the salient discussions of the meeting and send it over e-mail to everyone for record purposes. During this #zackphdjourney, I have benefited from thousands of treasures, experiences, learning methods and so many other life lessons both directly and indirectly and I have summed it up into the following tips:

PhD is not a sprinter, it is not even a marathon, but it is a decathlon.

Doing PhD is like managing a housing project for which you can't conveniently expect an E.O.T (extension of time) upon signing the contract unless you are entitled to be granted (E.O.T) for solid reasons.

Managing available resources and benefiting from own experiences are of utmost importance in housing projects and this is so in PhD projects.

Delve into topic which you are familiar with, not something that you just discovered yesterday, and definitely not something that someone forced you to do,. Upon deciding the topic, accumulate all the right resources and do the right thing at the right moment.

You must remember that PhD is not meant for everyone, it should not be a goal in your life, and at any point of it, if you get stuck and luck is not on your side, change your path before it is too late.

*the hashtag #zackphdjourney commemorates my journey as a PhD researcher in TU Delft in my Instagram account @zackzairul19.

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My social circle of MA-NL (Malaysian Association of the Netherlands) and everyone in the community that supports my struggle and become my second family in the Netherlands. I love you guys so much.

My pillar, my backbone, my everything, my beloved mother Mama Zaiton, who is extending her life to my children while I was away, and to my other families who give their support boundlessly.

My children, Amra, Azra & Akhiz Zuhd, this is for you guys.

Foremost to my dearest wife, Dr Noorhafizah Abdul Salim, for her endless support, motivation, strength and faith for me, despite all the hiccups, ups and downs in ensuring my final goal achieved.

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Summary

Central to this PhD research was the problem of the lack of affordable housing for young starters in Malaysia. The solutions for affordable housing that are available in the market do not truly solve the problem from the customer's point of view. Hence, it was important to analyse the contributing factors associated with the term 'affordability'. The term touches upon interconnected elements that cover many issues ranging from demand (housing needs, demographics, household income, quality housing) to supply (the authorities' requirements, design, cost, sustainability and procurement). In this thesis, we discuss some of the problems related to the supply and demand issues and examine a possible intervention to solve the problem.

This research contributed to the body of knowledge by employing a prescriptive strategy and designing an innovative flexZhouse business model (BM), and by applying an in-depth strategy that revealed why the problem exists and why there is still no appropriate solution. The result provides a description of the situation that young starters find themselves in, the reactions of the industry's key players and the policies that hamper innovation in the housing market.

Methodology

We applied the model of 'design sciences' as described by Van Aken (2004). The strategy first helped us to understand the problem (the issues related to the term 'affordable housing'); the next step was to prescribe solutions for the practice by formulating the draft flexZhouse business model (BM). The mission of this research was to further develop knowledge for the design and understanding the problems that is, to provide alternative solutions to the affordable housing demands in the housing industry in Malaysia. We used the term 'design research' from Van Aken (2004) because the ultimate objective of studies in this category is to acquire a knowledge of how to develop solutions to problems in the real world (i.e. the new business model (BM) for affordable housing in Malaysia).

The research was guided by the main research question 'How can the flexZhouse BM provide a solution to the inflexibility, high prices and poor quality of newly built housing in Malaysia?' The three main deductive codes were established as a priori codes derived from literature and constructed as the primary coding of design, finance and production. The three main problems were identified, namely inflexibility in design choices, high housing prices and poor housing quality. The focus of the research was established as the need for customization through design flexibility, the financial affordability and the housing quality in the production. Towards the end, several emerging codes were derived, those are; technical & technology, housing as an investment, housing ownership, accessibility, authority related matters and cultural and market acceptance.

Findings

The draft flexZhouse BM, which was established by a conceptual framework derived from a literature review, proved to be useful for both theoretical understanding and the practical application of the preliminary idea of the flexZhouse. The draft flexZhouse BM makes use of an innovative leasing approach inspired by the concept of the circular economy to make the flexZhouse affordable for young starters. A series of focus groups and other data sources showed that the need for housing customization is high and widely acknowledged by the target group. However, we found that private developers are not ready for innovation and are likely to resist such change, also because they need a more concrete proof of concept before accepting it. Their reaction is partly caused by their resistance to change from the conventional method to a new system, and is partly a result of their caution in the face of a high degree of uncertainty. It also shows that the concept, which is still at the early stage, needs to be tested in the market before they will accept the new idea. Nevertheless, a positive reaction was received from the government sectors dealing with housing, which appear to be more open to new ideas to help the market to provide more affordable housing for the middle-income group.

Conclusions

The formulation of the final draft of flexZhouse led to the following conclusions:

- The flexZhouse BM provides a better understanding of the needs of and problems faced by young starters looking for their first home in Malaysia.
- The rejection by private developers of the flexZhouse concept shows their resistance to change, and is also due to the early stage of the flexZhouse BM proposal.
- The flexZhouse BM creates an alternative solution to affordable housing programmes for the mass housing industry in Malaysia.
- The flexZhouse BM revisits the issue of sustainability in the mass housing industry in particular and in the construction industry in general.
- The flexZhouse BM extends the idea of ‘open building’ and the concept of ‘infill’ for housing.
- The flexZhouse BM is an innovative BM for the housing industry in Malaysia.
- Young starters in Malaysia are grappling with the issue of affordable housing and have low literacy in financial investment and management.

Ownership is still a popular choice among young people in Malaysia, partly because of the ‘status quo’ among young Malays. The theoretical insights show that housing ownership is especially important for the security of future generations. The study also found that young starters need to be educated about the financial implications and about financial management to better understand the financial complications and to reduce the bankruptcy rate among young Malaysians.

Methodological reflections

The empirical study was supported by the triangulation of data collected through a design workshop with architects, focus groups and examples from the industry. The qualitative approach combined both deductive and inductive codes that helped to shape the research and achieve the objectives of the research, namely to develop a new flexZhouse BM that would solve the problems associated with, for example, housing flexibility, housing affordability and housing quality in order to provide alternatives to the current affordable housing in Malaysia. The primary goal was achieved by deriving problems from the literature and formulating the answers to the research questions through BM components. The secondary objective was to use realism epistemology as a conceptual lens to help interpret the real meaning of why the problems exist and why a solution is needed.

A member's verification procedure for the focus groups data was made easy by applying ARC (ask, record, confirm) technique to validate the data from the focus groups in real time. In this research, the transcription process was facilitated by the Post-it note intervention. The Post-it note intervention helped summarize the transcription text and answered questions related to the study. Furthermore, this step also takes into account several emerging codes derived from focus group sessions. In the appendices, an audit trail is provided. It describes in detail the basic procedures that were used, such as the data collection strategy and the data analysis approach. An audit trail helps to enhance the methodological trustworthiness of research. Generalization was not the objective of this research. In the conclusions, a new theoretical insight was presented in the findings chapter. Its purpose is to indicate a new direction for the country's affordable housing projects and to provide potential solutions to the current problems. The new ideas need to be tested in future studies.

The flexZhouse BM combines innovative leasing with elements of the circular economy as part of the strategy to provide affordable housing to the customer. The research contributes to the scientific community by combining the idea of industrialized housing production with innovative leasing inspired by circular economy principles. This thesis is the first study to suggest integrating flexible housing with the circular economy. It therefore fills a gap in the knowledge about industrialized housing and industrialized building (IB) industry. The research, which pursued the identified problems by developing a new BM, will benefit the government of Malaysia, as it formulated a solution for affordable housing schemes and created an alternative BM for the housing industry.

Samenvatting

flexZhouse: Een nieuw bedrijfsmodel voor betaalbare woningbouw in Maleisië

Mohd Zairul M.N. (MSc. Architectuur)

In dit PhD onderzoek staat het probleem van het gebrek aan betaalbare woningen voor starters in Maleisië centraal. De oplossingen die in de markt beschikbaar zijn voor betaalbare woningen lossen niet volledig het probleem op vanuit het perspectief van de gebruiker. Om die reden was het belangrijk om de factoren die bijdragen aan het begrip 'betaalbaarheid' te analyseren. Het begrip raakt met elkaar verbonden elementen van vraag-gerelateerde problemen (woonbehoeften, demografie, wooninkomen, woonkwaliteit) tot aanbod-gerelateerde problemen (vereisten vanuit de overheid, ontwerp, kosten, duurzaamheid en aanbesteding). In dit onderzoek worden enkele problemen geadresseerd die te maken hebben met de relatie tussen vraag en aanbod, en er wordt een mogelijke interventie verkend waarmee het probleem kan worden opgelost.

Dit onderzoek heeft bijgedragen aan de wetenschap door een prescriptieve strategie te hanteren, door het ontwerp van een innovatief flexZhouse bedrijfsmodel (BM) en door het toepassen van een grondige strategie die heeft weergegeven waarom het probleem bestaat en waarom er nog steeds geen geschikte oplossing is. Het resultaat is een beschrijving van de situatie van starters, reacties van de industrie en het beleid dat innovatie belemmerend werkt op de woningmarkt.

Methodologie

Het model van de ontwerpwetenschappen zoals door Van Aken (2004) is toegepast. De strategie heeft in eerste instantie geholpen om het probleem te begrijpen (de problemen gerelateerd aan de term 'betaalbare woningbouw'). De volgende stap was om oplossingen voor te schrijven voor de praktijk door het concept flexZhouse BM te formuleren. De missie van dit onderzoek was om kennis over het ontwerp en realisatie van artefacten verder te ontwikkelen – dat wil zeggen: om alternatieve oplossingen te bieden voor de vraag naar betaalbare woningen in de woningbouwsector in Maleisië. De term 'ontwerpend onderzoek' van Van Aken (2004) is gebruikt omdat het uiteindelijke doel van onderzoek is om kennis te verkrijgen over hoe oplossingen te ontwikkelen voor problemen die zich in de praktijk voordoen (het nieuwe BM voor betaalbare woningbouw in Maleisië).

Het onderzoek start met de hoofdonderzoeksvraag 'Hoe kan het flexZhouse BM een oplossing bieden voor de inflexibiliteit, hoge woningprijzen en lage kwaliteit van

nieuwbouwwoningen in Maleisië?’ De drie belangrijkste deductieve coderingen zijn a priori vastgesteld op basis van de literatuur en vormen samen de primaire codering voor ontwerp, financiën en productie. De drie belangrijkste problemen zijn geïdentificeerd, namelijk: inflexibiliteit in keuzes tijdens het ontwerpproces, hoge woningprijzen en lage kwaliteit van woningen. Als focus van het onderzoek is gekozen voor de behoefte aan maatwerk door middel van flexibiliteit in het ontwerp, financiële betaalbaarheid en woonkwaliteit tijdens het productieproces. Naar het einde toe zijn er een aantal opkomende coderingen geïdentificeerd, namelijk: techniek en technologie, woningbouw als een investering, eigenaarschap van woningen, toegankelijkheid, overheidsgerelateerde zaken en acceptatie in de cultuur/markt.

Bevindingen

Het concept flexZhouse BM, dat gebaseerd is op een conceptueel kader dat is afgeleid van een literatuurstudie, bleek bruikbaar te zijn voor zowel theoretisch inzicht als de praktische toepassing van het eerste idee van de flexZhouse. Het nieuwe BM maakt gebruik van een innovatieve huurconstructie, geïnspireerd door het concept van de circulaire economie, om de flexZhouse betaalbaar te maken voor starters. De reeks van focus groepen en andere databronnen heeft aangetoond dat de vraag naar maatwerk van woningen hoog is en algemeen erkend wordt door de doelgroep. Daartegenover staat we dat private ontwikkelaars niet klaar zijn voor innovatie en zich waarschijnlijk zullen verzetten tegen een dergelijke verandering, ook omdat ze een concreter ‘proof of concept’ in de praktijk nodig hebben voordat ze het accepteren. Hun reactie wordt deels veroorzaakt door hun weerstand tegen de verandering van de conventionele methode naar een nieuw systeem en deels door voorzichtigheid met het oog op een hoge mate van onzekerheid. Deze weerstand geeft ook weer dat het concept, dat zich in een vroeg stadium bevindt, moet worden getest in de markt voordat de ontwikkelaars het nieuwe idee zullen omarmen. Daarentegen werd er positief gereageerd door overheidsinstanties die met woningbouw te maken hebben: zij lijken meer open te staan voor nieuwe ideeën waarmee de markt kan voorzien in meer betaalbare woningen voor de middeninkomens.

Conclusie

De formulering van het definitieve concept van flexZhouse heeft tot de volgende conclusies geleid:

- Starters in Maleisië worstelen met het probleem van betaalbare woningen en hebben een gebrekkige kennis van beleggingen en financieel beheer.
- De afwijzing van het flexZhouse concept door private ontwikkelaars geeft hun weerstand tegen verandering weer, en wordt deels veroorzaakt door het vroege stadium waarin het flexZhouse BM voorstel zich bevindt.

- Het flexZhouse BM creëert een alternatieve oplossing voor betaalbare woningbouwprogramma's in de massawoningbouw in Maleisië.
- Het flexZhouse BM keert terug naar het vraagstuk van duurzaamheid in de massawoningbouw in het bijzonder en de bouwsector in het algemeen.
- Het flexZhouse BM geeft een uitbreiding op het idee van een 'open gebouw' en het concept van 'invulling' voor woningbouw.
- Het flexZhouse BM wordt een innovatief bedrijfsmodel voor de woningbouwsector in Maleisië.
- Het flexZhouse BM biedt een beter kader voor de behoeften van starters en de problemen die zij tegenkomen bij het zoeken naar hun eerste woning in Maleisië.

Eigendom van de woning is nog steeds een populaire keuze onder starters in Maleisië, deels vanwege de 'status quo' onder jonge Maleiers. De theoretische bevindingen laten zien dat woningeigendom voornamelijk belangrijk is voor de zekerheid van toekomstige generaties. Een andere bevinding van het onderzoek was dat starters betere voorlichting nodig hebben over de financiële implicaties en financieel beheer om beter te begrijpen wat de financiële complicaties zijn, en om het aantal faillissementen onder jonge Maleiers te reduceren.

Methodologische reflectie

De empirische studies in het onderzoek werden ondersteund door de triangulatie van data verzameld door een ontwerp workshop met architecten, focus groepen en praktijkvoorbeelden. De kwalitatieve benadering combineerde zowel deductieve als inductieve coderingen, die hebben geholpen om het onderzoek vorm te geven en om de doelstellingen in het onderzoek te behalen: namelijk om een nieuw flexZhouse BM te ontwikkelen. Hiermee zouden de problemen geassocieerd met bijvoorbeeld flexibiliteit, betaalbaarheid en kwaliteit van de woning kunnen worden opgelost door alternatieven te bieden voor het huidige aanbod aan betaalbare woningen in Maleisië. Het primaire doel werd bereikt door problemen uit de literatuur te ontleen en door de antwoorden op de onderzoeksvragen te formuleren in de componenten van het bedrijfsmodel. Het secundaire doel was om epistemologisch realisme als een conceptuele bril te gebruiken, om te bekijken wat de werkelijke reden was voor het bestaan van de problemen en waarom er een oplossing noodzakelijk is.

Ter bevestiging van de bevindingen in de focus groepen is een methode gebruikt genaamd ARC (ask, record, confirm). Deze methode maakt het mogelijk en eenvoudig om data op het moment zelf te valideren bij een deelnemer aan een focus groep. In dit onderzoek is het transcriptie proces uitgevoerd middels een interventie met Post-its. De interventie met post-its hielp om de bevindingen samen te vatten en vragen te beantwoorden gerelateerd aan de studie. Deze stap maakte het ook mogelijk om codes die uit de focus groepen naar voren kwamen, vast te leggen. In de appendices is een

controlespoor verstrekt. Deze beschrijft in detail de basisprocedures die zijn gevolgd, zoals de strategie voor de dataverzameling en de benadering voor de data analyse. Een controlespoor helpt om de methodologische betrouwbaarheid van het onderzoek te versterken. Generalisatie was in dit onderzoek geen doelstelling. In de conclusies is een nieuw theoretisch inzicht gepresenteerd. Het doel hiervan is om aan te geven wat een nieuwe richting is voor betaalbare woningbouwprojecten in Maleisië en om potentiële oplossingen aan te reiken voor de bestaande problemen. De nieuwe ideeën moeten worden getest in toekomstige studies.

Het flexZhouse BM combineert een innovatief huurmodel met elementen van de circulaire economie als onderdeel van de strategie om betaalbare woningen aan te bieden aan de gebruiker. Het onderzoek draagt bij aan de wetenschap door het idee van geïndustrialiseerde productie van woningbouw te combineren met een innovatief huurmodel, geïnspireerd door de principes van de circulaire economie. Dit onderzoek is de eerste studie waarin de integratie wordt voorgesteld van flexibele woningbouw en de circulaire economie. Daarmee komt het onderzoek tegemoet aan een kenniskloof in de woningbouwsector en bouwsector. Het onderzoek, waarin een oplossing voor de geïdentificeerde problemen is gezocht door een nieuw bedrijfsmodel te ontwikkelen, zal de Maleisische overheid veel voordeel opleveren, omdat het een oplossing heeft geformuleerd voor betaalbare woningbouwplannen en omdat het een alternatief bedrijfsmodel heeft gecreëerd voor de woningbouwsector.

PART 1 Theoretical



1 Introduction

§ 1.1 Research motivation

For the past 50 years, the Malaysian government has been campaigning the homeownership programmes. The reason is clear: every Malaysian deserves a quality place to live in for a quality life. The government has focused on various housing programmes through its Five Year Plans (2016-2020) to provide affordable housing for both city and rural areas (Economic Planning Unit, 2015). Private housing developers has been contributed all these while to the program and established several housing program (such as PR1MA and PPA1M ¹) in order to address the country's housing demands. Furthermore, since independence in 1957, the country has seen a significant migration trend from rural to urban areas. According to a census carried out by the Malaysian Department of Statistics (2015), almost 72% of the population now live in urban areas. Based on a United Nations estimate, by 2050, 87% of Malaysians (37 million) will be residing in urban areas. In the previous development plan (Unit, 2010), the government pledged to provide 500,000 units of quality affordable housing to meet the demand before 2018; however, by 2015 only 102,200 units of affordable housing had been delivered (Economic Planning Unit, 2015).

Although the government has made efforts to answer the plea for more affordable housing for the middle-income group, there are concerns about the rising household debt among young Malaysians. Given the rule of thumb on the affordability rate of 30% of expenditure of income on housing (for median incomes), the price of housing offered under the scheme is still unaffordable for many. This is partly caused by the increasing price of construction and raw materials (Chia, Skitmore, Runeson, & Bridge, 2012), a shortage of land and increasing land prices (Cagamas Berhad, 2013).

Despite the high housing prices, customers are also grappling with inflexibility in housing design and the poor building quality of new housing. Furthermore, affordability relates to a range of interconnected elements addressing issues from both the demand side (housing needs, demographics, household income, quality housing) and the supply side (authorities' requirements, design, cost, sustainability and procurement). Therefore, in this research, we examined some of the problems

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PR1MA (Housing for Malaysians 1Malaysia), PPA1M (housing for civil servants 1Malaysia).

related to the supply and demand issues in support of solutions for affordability, design flexibility and improved build quality. The suggested solution to the problems is to introduce a new business model (BM) that offers a flexible design for the value proposition, creating revenues through innovative leasing, and increasing the quality of the production through an industrialization strategy.

The problem is not on mass housing but revolves around housing issues and the solution to the issues is a new business model of flexZhouse for the mass housing industry. We started this thesis by explaining why there is a shortage of affordable housing in Malaysia. We focused on three main problems, namely the housing affordability for the young starters, the lack of options for flexibility in housing design and the poor built quality in the current mass housing industry. To solve the problems, we sought 1) a value proposition that would offer flexible housing design with minimal waste caused by modifications, 2) company revenues based on resource efficiency and longer product lifespans and, 3) logistical streams that focus on quality through an industrialized strategy and the improvement of customer's satisfaction. The idea of flexZhouse is to create an alternative solution to affordable housing industry in Malaysia with the following characteristics:

– **Value propositions that offer flexible housing design**

A study on existing mass housing development by Omar, Endut, and Saruwono (2012b) found that house buyers prefer housing customization and want an alternative to current mass housing developments in terms of design and design flexibility. In most emerging countries, individuation and customization in mass housing have become popular, and the need for individuation because of changes in lifestyle has increased (Hentschke, Formoso, Rocha, & Echeveste, 2014; Nahmens & Bindroo, 2011; Yashiro, 2014). Certain spaces in a house may become obsolete over time due to the changing needs of its occupants. In the present mass housing industry, housing modification and renovation post-construction are common (Omar, Endut, & Saruwono, 2012a). Housing is an inelastic product, at least under current circumstances. It is often difficult to physically adapt shelter, and physical modifications of existing dwellings often lead to unnecessary wastage and environmental burden (Wong, 2010). Furthermore, such modifications cause material, energy, time, money and manpower wastages (Zairul, 2015). These wastages are deemed unacceptable in the light of a future sustainable community (Hentschke et al., 2014; Wong, 2010). Therefore, the provision of affordable housing requires a more flexible housing design that will avoid unnecessary wastage during the modification and alteration work when the needs of the users change and evolve according to present and future needs. We sought a new BM that would adopt an approach that includes the customer in the early stages and co-evolve with the design.

– A company revenue that based on resource efficiency

The primary problem that is addressed mass housing industry in this thesis concerns housing affordability for young starters. Young people are at a higher risk than ever before when it comes to owning a house due to increasing prices (Gelain, Lansing, & Mendicino, 2013). With the current trend of climbing interest rates, a sizeable portion of their monthly income has to go to repaying their mortgage (Fahmi Azmi et al., 2015). Most of these young starters have just embarked on their careers and have minimal capital. The dream of owning a decent house can only be realized if it is affordable to them, that is, if the housing price does not become a financial burden. The current reality in Malaysia is that hefty property prices and the tightening of mortgages have made it practically impossible for young starters to buy their first home without assistance from their parents. The only recourse left for this group is to forsake their privacy and stay with their parents or become a generation of renters.

Achieving an affordable housing price for the customer depends on how the company or the housing developer creates revenues for its business. The price of the house could be reduced if the housing manufacturer could benefit from the economies of scale and from recurrent payments. Therefore, for the solution, we revisited the meaning of affordability by introducing a new BM that would introduce to the market an alternative form of affordable housing. But in order to convert housing into simple and affordable products, the solution had to propose an innovative BM strategy, one that would offer innovative leasing. In this strategy, the revenue of the company will rely on the housing product and stock. In this, we were inspired by a circular economy strategy and logistics streams that adopt industrialized production and focus on quality and defects control and maintenance of the products, thereby improving after-sales and the occupant's satisfaction.

– Logistical streams that focus on quality through industrialization

Aside from the affordability issue, customers in the housing industry are not given a fair choice of housing design. A recent study reported that house buyers are no longer interested in standard designs produced by housing developers (Daud & Hamzah, 2012). Notwithstanding the high prices and the inflexible models in the current housing industry, recent housing construction has been characterised by the poor performance of contractors, who deliver shoddy products (Amin, Sufian, Kader, Zubaidah, & Kassim, 2014); substandard and poor workmanship of the construction quality lowers occupants' satisfaction (Fauzi, Yusof, & Abidin, 2012). The issues of quality and poor workmanship arise from supply chain management and issues of skilled and semi-skilled workers (Mehdi-Riazi, Skitmore, & Cheung, 2011) and human factors (Rahman & Alashwal, 2013). There have been many proposals to overcome the issue of build quality including improving the quality and housing delivery through the introduction of build-then-sell (BTS) and the use of industrialized

building systems (IBS) (Nawi, Anuar, & Lee, 2013). BTS was introduced in April 2007 and allows a property to be sold only after completion. The Ministry of Housing and Local Authority (MHLA) pledged that in 2015 the BTS would be fully implemented and that the sell-then-build (STB) approach that is still practiced today would be scrapped (Cagamas Berhad, 2013). However, major industry players such as private developers and the Real Estate Housing Development Association (REHDA) reacted negatively to these suggestions (Abas, Hanafi, & Ibrahim, 2013). Some of the excuses include lack of readiness, worries that the houses will be difficult to sell and reluctance to change (Cagamas Berhad, 2013). Therefore, we sought a more holistic strategy in industrialized housing technology. Hypothetically, the industrialized process will improve quality, minimize defects, improve the maintenance of the products and improve after-sales by increasing the occupant's satisfaction. Also, the early involvement of end users increases the likelihood that the provided housing is indeed adopted by the market.

The new BM is intended to address the lack of industrialized housing production in the mass housing industry. In the current housing situation in Malaysia, customers are given few choices (standardized option). Although the government is providing more affordable housing for the middle-income group, a solution for mass customization has never been put forward. At present, the key players in the housing industry are resistant to change and will keep producing standardized designs and charging a premium price for a customized house. If a housing developer produces a high-quality house, the price will be increased and the buyers will be forced to pay it. This will make the house unaffordable for young starters. Therefore, re-establishing the connection between flexibility, affordability and building quality, as proposed in the flexZhouse BM, is necessary to promote an alternative affordable housing industry in Malaysia.

It is generally believed that housing is an expensive asset and that access to mortgages has become difficult for young starters. When embedded within innovative BMs that capitalize on increased accessibility and affordability, new technologies can deliver tremendous value. It has been asked why, with so many examples of successful industrialized building system (IBS) housing projects and prefabrication, the housing industry has not been innovative to a substantial point already. It is argued that the prefabrication of housing will lead to higher housing costs and make housing too expensive for young starters. Despite that, the idea of prefabrication can be seen to reduce the housing price through 1) application of prefabrication process at the early stage, 2) better quality control in the factory, 3) shorter construction costs thus shorter operation time and cheaper labour, 4) promote sustainability through minimizing the waste, 5) design integration in conception and construction, 6) better control on the aesthetic of the design, and all of these aspects contributes to the reduction of overall costs (Tam, Tam, Zeng, & Ng, 2007). In terms of revenue, the company generates its income by reducing the consumption of resources through the remanufacturing process. The products are built to last longer and to create longer lifespan products.

Nevertheless, the idea of reducing consumption by introducing the circular economy (Lewandowski 2016) helped to remodel the pricing strategy and the cost structure for the customer. Achieving an affordable housing price for the customer depends on how the company or the housing developer creates revenues for its business. The price of the house could be reduced if the housing manufacturer could benefit from the economies of scale and from recurrent payments. Therefore, for the solution, we revisited the meaning of affordability by introducing a new BM that would introduce to the market an alternative form of affordable housing. But in order to convert housing into simple and affordable products, the solution had to propose an innovative BM strategy, one that would offer innovative leasing. In this strategy, the revenue of the company will rely on the housing product and stock. In principle, we were inspired by a circular economy strategy and logistics streams that adopt industrialized production and focus on quality and defects control and maintenance of the products, thereby improving after-sales and the occupant's satisfaction.

In terms of individualization, the flexZhouse opens up the possibility of customer involvement during the early design stage. This will definitely add a new dimension to the mass housing industry in Malaysia. Individualization does not necessarily mean expensive. Lessons learnt from the case study of Sekisui Heim suggest the adoption of 'standardized customization' to allow more input from the customer at an early stage. Different customers have different needs. Therefore, the new BM provides flexibility in terms of design preferences, walks of life and user's affordability. The idea of individualization could help to reduce the cost of unnecessary wastage and environmental burden in the future (Wong, 2010). In return, individuation at the early stage will avoid unnecessary wastage during the modification and alteration work caused by changing in the lifestyle.

In the conventional mass housing, the price of the house is increasing caused by the soaring land prices and scarcity of the land (Cagamas Berhad, 2013). The conventional mass housing is associated with immobile and inflexible units. Usually after project completion, the housing developers will look out for new undeveloped for the next project and therefore created additional resources and land to be exploited. In contrast, the idea of flexZhouse helps to solve the cost of land bearing through a flexible and portable unit that movable by the road when the time permits. In this strategy, the structure of the building can be added up and removed based on the demands. By creating a module for both the structure and the infill, the flexZhouse is expected to reduce the carbon footprint of conventional construction and promote sustainability and therefore reduce the needs of land usage.

In Malaysia, state governments have complete power on the land matters especially on the land approval and conversion procedure. However, the federal government are responsible on passing the law and provide the regulation for the housing developers to comply. Therefore, the flexZhouse industrialized strategy is hoping to reduce once

bureaucratic land acquisition and approval process through manufacturing approach strategy. In this case, the proposal would be best to be proposed to a government bodies that dealing with housing such as PR1MA since, the government have ampler land to be developed. PR1MA under the PMO (prime minister office) has lead the way to provide mass housing by cooperating with state governments. The flexZhouse BM could also supported by land reserve for wakaf under the respective State Islamic Religious Councils. In Malaysia, the State Islamic Religious Councils (MAIN) can play a role to provide land allocation for the flexZhouse under the wakaf (charitable) land and reserve land for this purpose. According to a record provided by the State Islamic Religious Council, there are around 13,397ha idle wakaf land throughout the country (Cagamas Berhad, 2013). At the moment, the Selangor Zakat Board for instance has play a role to channel zakat funds through its Social Development Program by providing 1) a new construction and refurbishment program of individual house, 2) assist to built a mass housing, 3) rental option for transit house buyers and,4) housing for old folks. Under this scheme, the wakaf land (Cagamas Berhad, 2013) can be allocated for the purpose of providing house for the target group in the country.

In the conventional construction, the bureaucratic land processing approval processes have always hampered the industry from very beginning. The processes also differ from state to state. According to survey conducted among REHDA (real estate housing developer), requests from the authority towards housing developers has also contributed to the increasing of the housing price in the market (Cagamas Berhad, 2013). These include 1) planning requirements under the surrender of land for social community facilities, 2) surrender of land for the construction of utilities e.g. substation etc; 3) capital contributions for infrastructure etc. (Cagamas Berhad, 2013). The main element discussed here is the existence of different legal environments in various states of peninsular Malaysia and Sabah and Sarawak that are governed by each state's authority. Each state has its own regulations and jurisdiction pertaining to building and housing development. The legal and regulatory environment currently do not have provision for prefabricated housing per se. The discussion suggests that a new set of rules and regulations should be formulated to treat prefabricated housing differently from the conventional housing. Current housing law serves as a significant deterrent to a potential company to introduce a new BM to the industry, especially when faced with the conventional housing industry, whose time scale and lifecycle chain are totally different from those of the new flexZhouse. According to Housing Development Acts (Control and Licensing Amendment) Act 2012, housing development in Malaysia currently falls under Schedules G, H, I and J. Any developments that require an advance payment from purchasers will be deemed to fall under any of the schedules (G, H, I or J)" Housing Development (control and licensing) (amendment) act 2012" 2012). However, the flexZhouse will need a different strategy as the units will not require the purchaser to pay a deposit, as during the first five years of operation the focus will be on leasing activities. Therefore, the flexZhouse will not falls under the HDA acts, which govern all conventional housing in the current situation.

Therefore, for the flexZhouse concept, since the unit and the module will be portable, the land processing issues are expected to be reduced significantly. The flexZhouse is expected to remodel after its counterparts, the manufacturing sector. The flexZhouse development is expected to have more transparent and efficient land processing and thus reduce lead times to the customer. Initially, it is suggested that the government becomes the first party to initiate the project by acquiring the land and subsidizing the construction of the structure. The government under its housing agency will then construct the structure at the selected area or targeted area that has potential for the scheme. Next, the government will invite tenders for the infill (housing units) and then the selected suppliers will produce and apply the concept of the BM. The housing units or components will be leased to the potential customers and will have to be returned to the housing producer after the customer move out. In the original contract, it is suggested that the minimum contract term for the units should be 12 months, and tenants should agree to give a minimum of 2 months' notice before relocating. In the event of changing the module, the tenant will be required to inform the suppliers three months in advance that they want to change the housing module. All maintenance of the general services, common area and public utilities will be handled by the maintenance company appointed by the company providing the infill. In this framework, it is suggested that the monthly commitment for the users will be based on their financial capability and based on the 30% of income rules. The payment will consist of the rental payment for the structure, the infill and the maintenance of the building. The business lifecycle shows the potential of the circular economy through the remodelling and refurbishing of the existing unit/module for the next customers.

States that are ruled by the government and those ruled by the opposition must work hand in hand to ensure the need for housing is met to help address the aspirations of the administration and the industry. To support this, new policy related to flexible housing and a review of current law, in particular with regard to the national housing policy, restriction of interest, submission procedures, and fire and safety related issues. Therefore, under this issue, we raised one important proposition for a new set of rules and regulations to counter the present housing development act to promote the flexZhouse for the housing industry in Malaysia. Towards the end of the thesis, we proposed the flexZhouse to PR1MA (government owns company). PR1MA responsible to produce more affordable housing has ample of lands to be developed. In the proof of concept (chapter 7), the land that owns by PR1MA was used as an example to calculate the feasibility of the development.

We are aware that the new concept of flexZhouse is still new to the country. Therefore, the research serves as an innovative BM for the housing industry in Malaysia. By implementing the term innovative, the new BM seeks to challenge the standard practice of conventional BM, which is the cause of the problems that plague the industry. The flexZhouse aims to change the conventional way of working and to explain how complicated and expensive products such as housing can be converted

into simpler products that are affordable for many. This new innovation in the flexZhouse BM supports the theory of disruptive innovation to create competition for the long-established traditional housing business in the country. The idea of flexZhouse emphasizes the issue of sustainability in the construction industry in general. The current solution for sustainability normally involves a merely cosmetic solution that ends up sending yet more waste to landfills. By introducing the circular economy, the flexZhouse will revolutionize the way the public looks at housing and make the bulky, immobile and expensive housing stock more liquid, mobile and cheaper in the long run. The flexZhouse resolves the issue of sustainability through its off-site production and fabrication process that involves recycling and remanufacturing.

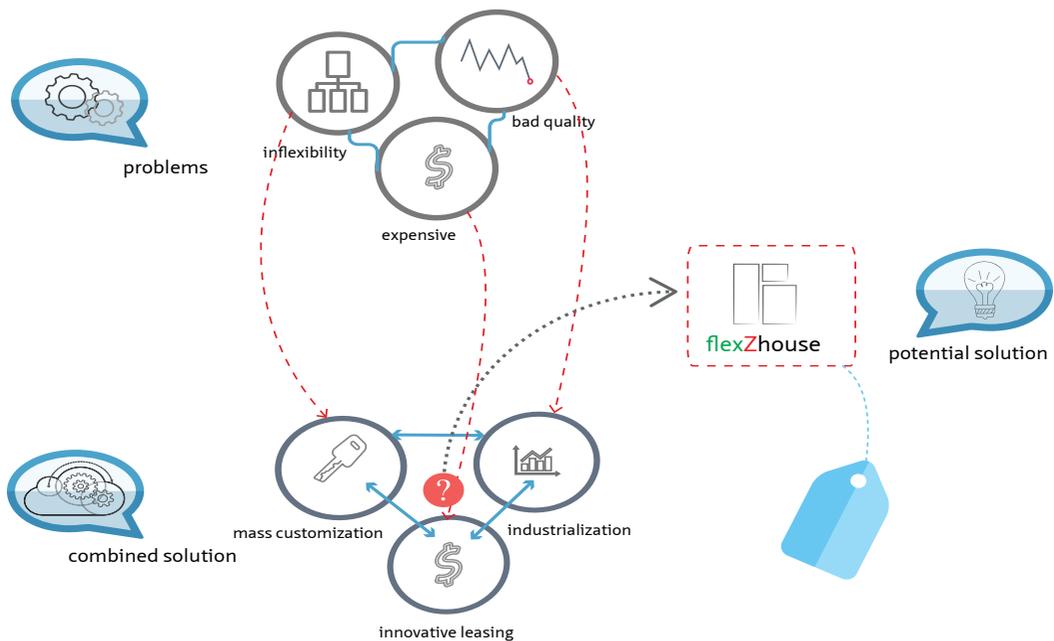


FIGURE 1.1 Overview of key problems and general directions for a business model that provides a potential solution

In summary, the flexZhouse BM offer more design options in the mass housing industry, offer financial solutions to young starters through innovative leasing and further improve the quality of the products through an industrialization strategy. The new BM also suggest to use principles of the circular economy as part of its strategy to provide innovative leasing to the customer. The research contributes to the scientific

community by combining the idea of industrialized housing production with innovative leasing inspired by circular economy principles. At present, few studies have paid specific attention to the intergration of flexible housing with the circular economy. Therefore, this research fills a gap in the existing knowledge of industrialized housing and pursued the identified problems through the development of a new BM. The research will benefit the government of Malaysia by finding a solution for affordable housing schemes and creating an alternative BM for the housing industry.

§ 1.2 Research aims

The aim of this research was twofold. The main goal was to formulate a model of flexZhouse through determining appropriate BM components. The second goal was to understand and explore the problems young starters face in finding affordable, flexible and well-built housing. The final result shows how housing entrepreneurs can implement the concept based on the BM framework. We employed a design workshop with architects, focus groups with young starters, government and industry representatives, and case examples as our main data sources and to obtain feedback on the draft version of the BM. Hence, the research had two sub-objectives, one aimed at developing knowledge for science using a 'prescriptive strategy' focussed on finding solutions (final draft BM in Chapter 7), the other aimed at providing new theoretical insights refering to new emerging data in the results chapter and further discussed in the Chapter 8. The prescriptive strategy was problem-driven and focused on finding solutions, while the theory-building strategy helped to develop a new theoretical insights based on the findings.

§ 1.3 Research questions

In this thesis, the term affordability is being proposed and we show how a company could reduce the cost of manufacturing and production by extending the lifespan of the products. One of the ways to reduce the cost of this innovation would be to develop an innovative leasing concept based on the circular economy principle for the housing components. The idea is that the manufacturers or housing developers agree with the potential customers on the leasing of the housing components. The number, quality or size of the housing components increases along with the financial capability of the customers during the period of the contract. In summary, the customer is free to

customize the housing unit, and thus providing the advantages of the 'ownership'. It allows the customer to rent the housing components, but at the same time enables the unit to be flexible according to certain requirements imposed on it. Moreover, this new tenure will promote a long-term relationship with the housing association or producer and a good business strategy for long-term cooperation. At the same time, the housing producer will reduce its production costs by remodelling and recycling the components. Further, this thesis presents relevant theories, methodologies and empirical work and formulates the final and revised flexZhouse BM by answering the main question:

How can the flexZhouse BM provide a solution to the inflexibility, high prices and poor quality of newly built housing in Malaysia?

§ 1.4 Research methodology

We use the 'Why?' and 'How?' behind the 'What?' through more in-depth discussion and discourse, rather than a survey. We started from the position that the answer to a research question that relates to a real problem in practice requires the active participation of the researcher himself to better understand the world and express it in a sense that is reasonable to many (Healy & Perry, 2000; Desai, 2002). We try to interpret the findings and understand the phenomena in terms of meaning that respondents bring to the introduction of the new BM itself (Chapter 5).

This section explains the methodological framework of the research. We formulate the methodological structure of the research, in which the reader will understand how the research questions are structured in a framework. Figure 1.2 provides a schematic overview of the research and will be explained in the following sections.

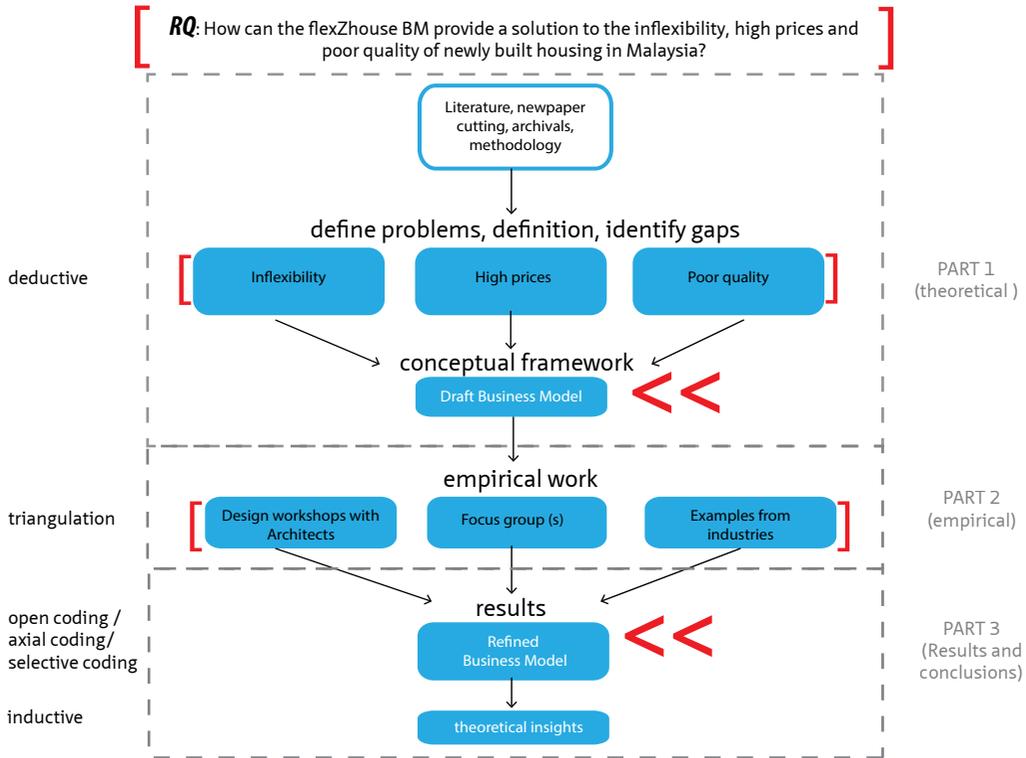


FIGURE 1.2 Outline of the research

§ 1.4.1 Research as 'design science'

We applied the model of 'design science' as described by Van Aken (2005). The strategy helped us to understand the problem (issues related to affordable housing) and then to prescribe solutions for practice by formulating the draft flexZhouse BM. The aim of this research was to further explore the scenario and understanding of the problems, that is, to provide alternative solutions to the demand for affordable housing in Malaysia. We adopted the term 'design research' from Van Aken (2005) because the ultimate objective of studies in this category is to develop sound knowledge for designing solutions to problems in the real world, in this case the new BM for affordable housing in Malaysia.

We start with the topic flexZhouse: New BM for affordable housing in Malaysia. We intend to contribute theoretically to a new BM which will act as an intervention addressing the problems associated with affordable housing. At present, the solution only involves a design intervention. Little research exists on how to use BM as an intervention to solve the problem. For this thesis, the research question follows the realist format, which is often summarized as what intervention works for which group, how, why and where? Since realist researchers seek to unravel the 'context-mechanism outcome' connection (Tilley & Pawson, 2000), we emphasize the intervention as a medium to trigger circumstances that will help to solve the affordable housing problem. In our case, the BM acts as an intervention to solve the affordable housing problem. The BM is seen to be one of the most influential elements when dealing with both supply and demands aspects especially when we want to solve affordable housing issues. As part of the result, in chapter 5, we discuss the meaning of the intervention for the target group, to answer the question 'Why?' and to interpret the reason behind the problems and how the intervention can help to solve the issues and how to move forward.

§ 1.4.2 Research using qualitative inquiry

Qualitative inquiry is seen as one of the ways to reveal things we did not know in a more in-depth way that allows flexibility in the investigation procedure. In contrast to the popular method of marketing survey, this approach is seen to be more sensitive and explorative and thus more suitable to uncover new ideas (Desai, 2002). This research used an explorative approach, in which respondents shared their feedback on the draft BM and were aware of the limitation that the research was exploring raw and not fully finished ideas, and that things might evolve along the way. As Desai (2002) mentioned, a qualitative inquiry is useful in understanding but not in predicting. The approach allowed respondents to understand the draft BM in depth, argue the suitability of the concept and criticize the preliminary concept to add to new ideas according to their needs and experiences.

The qualitative approach can be sensitive and gently probing, something one cannot achieve through the positivist approach (Iivari, 2007). So in many ways, it is suitable for the exploration and evaluation of a new idea through in-depth responses that one obtains from respondents. Qualitative research as described in a business study helps to reveal the complexities and banalities of our lives. We were searching for what else can be discovered beyond what is empirically known.

§ 1.4.3 Research methods

The present research used triangulation of multiple data sources through design workshop with the architects, focus groups and case examples. Triangulation was also used to enhance the confidence in the findings (Stange & Miller, 1994). The validation of the results involved a process of member verification procedure or what we called as ARC (ask, record, confirm) technique in real-time (to be explained further in section 1.4.3.2). The ARC technique also introduces 'feeding information' whereby results of one session were fed into others. The questions were further developed and the results from the previous focus group(s) were brought up for further discussion in the new session. In this part of the research, the unit of analysis was the BM of the prefab housing/detached housing industry, rather than the entire company BM.

§ 1.4.3.1 Design workshop with the architects

In the design workshop, the professional architects contributed to the design innovations of the flexible housing. There were five participants in this workshop: two professional architects, two design architects and a professor of architecture. The team comprised fairly experienced people working as professionals and with more than 20 years of experience in the field of design, authorities' requirements and teaching. The sample selected for the design workshop was purposeful and selected based on the knowledge of the respondents, whose experience was considered typical (Morse & Mcevoy, 1991), and from the group that the researcher is familiar with and can potentially learn the most from (Merriam & Merriam, 2009). It is important to note that the objective of the workshop was not to find the best design for the concept, but to elaborate and adjust the proposed design alternatives for the flexZhouse BM.

The design workshop started with a 15- to 20-minute presentation on the initial concept of the BM. The architects were then divided into two groups. A project brief was given based on the requirement of the flexible house and the industrialized building system (IBS). The workshop was conducted in two sessions: the first session (brainstorming and design) lasted three hours, the second (presentation and criticism of the conceptual design) 45 minutes. Participants were given the materials required for making sketches and presentations.

§ 1.4.3.2 Focus groups

Focus groups are commonly associated with a discussion or interaction that involves a mediator and a group of people (Gibbs, 1997). Focus groups are popular when seeking collaborative opinions, exploring new ideas, interpreting cultures, evaluating new ideas and restructuring people’s views on certain issues (Gibbs, 1997; Morgan, 1996). In seeking feedback on the new BM, we chose focus group to answer the questions on design (customization), affordability (financial) and production (supply chain).

Exploring new ideas and especially new BMs can be methodologically challenging, given that such knowledge is difficult to express and is not standard practice for most young starters. For this research several focus groups were employed that involved several groups:

- 1 **Group 1:** young starters (Malaysians aged between 25 and 34 years) (1 session of pilot study & 3 sessions held in Malaysia)
- 2 **Group 2:** private developers, entrepreneurs, NGO’s dealing with housing (1 session)
- 3 **Group 3:** government agencies dealing with housing, i.e. PR1MA and KPKT (1 session)

The focus groups with the young starters involved several steps, starting with a pilot study conducted among Malaysians living in the Netherlands. The subsequent sessions were held in Malaysia and involved three separate groups comprising participants from different backgrounds. During the focus groups with the young starters (sessions 1, 2 & 3) the emphasis was on the choices for design flexibility and financial flexibility. In focus groups 2 (private developers and entrepreneurs) and 3 (government agencies), the topics of finance and supply chain were emphasized. In this way, the topics of the focus groups were tailored to the interests and expertise of the focus group members.

GROUP	NO. OF PARTICIPANTS	COMPOSITION OF GROUP	DATA COLLECTION SITE
1	5	Young starters (pilot study)	TU Delft library, Netherlands
1	4	Young starters	Resource centre, FRSB, UPM, Serdang, Malaysia
1	4	Young starters	Resource centre, FRSB, UPM, Serdang, Malaysia
1	5	Young starters	Resource centre FRSB, UPM Serdang, Malaysia
2	5	Private developers, entrepreneurs & NGO	Seminar room, FRSB, UPM, Serdang, Malaysia
3	3	Government agencies dealing with housing	Resource centre FRSB, UPM Serdang, Malaysia

TABLE 1.1 Focus group sessions

Focus group 1 (young starters)

The focus group with the young starters involved three sessions during which they provided feedback on the new BM regarding the products and services offered. An analysis of the feedback was used to explore whether 1) the new model addressed the need for flexibility in the current choice of housing, 2) whether the financial problems faced by the young starters could be dealt with by the new BM and 3) whether the affected group found it necessary to have the model to provide an alternative to the current model (housing) in the industry.

Controls were exercised to determine occupation, age, income bracket and where the respondent resides at that moment (and other demographic factors) to account for how the participants understood the information, including responses from the presentation. The result influence how and in what ways the BM could be understood and what factors influence different understandings. Criteria for the selection of the focus group included the following: 1) young professionals age between 23- 30 years old; 2) household income (joint income) not more than RM 6000; 3) currently renting and living in the city or staying with parent; 4) have considered housing ownership or been rejected by a bank or other financial institution.

The second session with the young starters helped to further refine the questions for the subsequent sessions. The replies from the previous session allowed the author to assess the respondents' understanding of the concept and their acceptance of the new BM. The sessions were repeated using the 'feeding information' approach, and the results were used to strengthen the draft BM. Written and oral comments on the information gathered during the first session provided an opportunity to modify, delete or add topics for the second and the subsequent sessions. Details of the session are presented in section 5.3

Focus group 2 (entrepreneurs, private developers, NGOs)

The process of drawing a sample was different in focus group 2. The sample comprised active entrepreneurs and a private developer in mass housing in Malaysia. They were selected because they represent the industry and active in the housing industry as well as dealing with high housing demands at present. As the first discussion group focused on design and financials, the session with the private developers and housing entrepreneurs focused on the supply chain and financial matters. Details of the session are presented in section 5.4

Focus group 3 (government agencies)

The final focus group consisted of officials selected from government-related housing agencies. In this session, we were more interested in planning and legal aspects. We presented the revised scheme after the earlier focus group and 'feeding information'

that we had gathered from focus groups 1 and 2. The role of the government agencies provided the bridge between the young starters and the entrepreneurs. Details of the session are presented in section 5.5.

The ARC (ask, record, confirm) technique for member's verification in focus group

In general, member's checking requires the researcher to share the summary or the final transcripts of the finding (report) to check the authenticity of the works. However, obtaining validation of the report after the session often lead to dissatisfaction especially when the time has elapsed since the data collection took place. The ARC technique was initiated based on my previous problems handling with member's verification on the research findings. Based on my experience, member's verification consumed a lot of time and sometime changes in data due to changes in thought or opinions from the respondents. The current technique member's verification also lack of validation to help verify the findings in real-time. Previously, I experience incident where members deny the stories being agreed before and request some information to be removed from the text. To avoid similar problem, I introduce member's verification in real-time. The new technique will reduce significantly extensive demands on the respondent's time and minimize the error and further generates original data that agreed by all respondent's. The technique also helps to generate one holistic findings from the focus group session.

We divided the session into two sessions; first (focus group), and second (verification session). During the first session, the focus group starts with a 20-minute presentation on the conceptual model. We developed a guide and protocol for the focus group (refer appendix). During the presentation, we introduced the conceptual business model. We explained the ways in which housing manufacturers (providers) increasingly retain ownership over housing products or components where possible. The manufacturer also acts as a service provider (selling products) rather than selling products for consumption. The focus groups helps the respondents to share their views and learn from one another. The sharing benefits the group especially when the group are heterogenous in nature. The first session lasted till 30 minutes. During this session, audio and video taped were used to record both audio and visual of the sessions.

Next, I introduce ARC (ask, record and confirm) technique for ascertaining the validation and member verification procedures for focus group data in real time. During the session, the moderator will be helped by the second moderator who acts as the assistance for the first moderator and helps to clarify and recording things which are discussed during the session. The second moderator can further clarify keywords that he or she heard during group debates, thus avoiding obtrusively interpreting non-verbal actions between respondents. The goal of having a second moderator is to help

to identify verbal and non-verbal behaviors for further analysis and the transcription process in the next phase. In our case, the understanding of the topic subject is very important for both moderators, thus promoting a sense of camaraderie identity between the moderators. In this session, the respondents were each given markers and shared an A1-sized sheet description of the conceptual business model. The conceptual business model was printed to allow each respondent to provide feedback on the sheet of paper. We also gave each respondent different colored Post-it notes to ensure that each respondent could contribute to the discussion and not become excluded (Kidd & Parshall, 2000).

During this session, we introduce the ARC (ask,record,confirm) technique. We initiated the discussion by 1) **asking** the participants about related issues, primarily using open-ended questions. The next step involved 2) the participants **recording** their answers, offering their comments or reflections on Post-it notes and placing them in the right-hand section of an A1-sized piece of paper. The third step involved 3) **confirming** and reconfirming ideas, discussions, codes and question responses. As an example, in the focus group with the young starters, we anticipated that the respondents would collectively generate additional or different responses to the proposed business model from one session to another. The respondents were asked to share their experiences on housing ownership accessibility and their thoughts on how the new business model would transform the housing industry. We recorded all focus group sessions on video and audio devices. We used the ARC (asking,record,confirm) technique and ensured that the correct information was obtained from the respondents via Post-it note interventions. We permitted group debate on the feedback that we obtained. Member's verification was conducted in real time to avoid misunderstandings and to ensure the validity of the information obtained.

In our case, the transcription process was facilitated by the Post-it note intervention. The Post-it note intervention helped summarize the transcription process and answered questions related to the study. This means the transcription does not require a full transcription process and therefore does not require a verbatim text. During the transcription process, the following questions were asked. 1) Should all topics or only key session issues be transcribed? 2) Should sessions be transcribed verbatim or summarized? 3) Should observations (e.g., silence and other audible behaviors) be recorded (Zhang & Wildemuth, 2009)? Although complete transcriptions may be useful, additional efforts required to include these elements may not reflect research objectives (Zhang & Wildemuth, 2009). Furthermore, this step also takes into account several emerging codes derived from focus group sessions. For the purposes of the exercise, pictures and videos were taken and all respondents allowed their pictures to be used to supplement the study (refer to appendix).

§ 1.4.3.3 Case examples

The case examples were chosen to explore the existing BM of industrialized housing in the market. The case examples acted as a valuable method to develop theory, evaluate the characteristics of the BM under study and develop interventions for the research, as suggested by Baxter and Jack (2008). The case examples were chosen for this research as it facilitated the discovery of scenario in its own setting by using multiple data sources (Yin, 1981). In our case, the case examples consisted of multiple sets of individual studies of identified examples that could contribute to the formulation of the new BM. The cases selected provide examples of practice elsewhere that have proven to be successful in the housing sector or other fields. The examples provide inspiration, supporting materials and information that can be adopted by the flexZhouse BM. The data were obtained through primary data collection and interviews with company's personnel (Sekisui House) and secondary data collection from company websites, YouTube and archives. Examples that were gathered help to support the idea in terms of what can be learnt from Sekisui Heim's industrialized housing BM (value propositions, customer relationship, activities) and from the Hickory group (resources and activities).

The challenging part of the flexZhouse BM is to provide evidence that some of the components of the BM have been practiced elsewhere, not necessarily in the housing industry but also in other fields. The idea of flexZhouse started from innovative thinking on industrialized housing production that is already available in the market outside Malaysia, specifically in Japan, Australia and other developed countries. The examples that we chose for this research might not provide one-size-fits-all solution for the flexZhouse, but it does give some insights into how some of the elements in the BM could possibly be adopted in the flexZhouse BM. We also encountered some difficulties in attaining some of the information from the company due to the company policy and the confidentiality of the information (Sekisui House). Initially, the information that we obtained from the Ricoh and Philips were also superficial, therefore, the two cases were removed from our case examples but were used as an example from the literature. More details on the case example will be elaborated in the chapter 6.

§ 1.4.4 Researcher bias and assumptions

The researcher trained as an architect and was involved in housing projects for about four years as a project architect. It is likely that the results are biased due to his professional background as an architect looking for favourable answers. The researcher's experience could have influenced the respondents to respond according to their anticipations of what was desired from the focus group studies. As the researcher

was a primary instrument in the study, the researcher's bias is bound to have had some effect on the data collection and analysis of the findings. Merriam & Merriam (2009) reminded researchers to identify and monitor biases and subjectivities because of the influence they have in shaping the collection and interpretation of data. By minimizing these biases, the researcher tried to remain neutral in the data gathering and to rationalize all the findings.

§ 1.5 Research limitations and justification

The research focused on the housing industry, primarily the mass housing segment. The problem was addressed from the perspective of young starters in the middle-income group in terms of affordability. In order to make it marketable and affordable, inputs from the housing provider is necessary to realize the business model into practice. Although this thesis emphasizes the lifecycle chain of mass housing development, it does not address the procedures for securing land or planning permission. In order for the research to move forward, the next step of the research is to provide a prototype of the unit. This prototype will give a better explanation in terms of desing, technicality, technologically and also costing of the unit. The prototype will also spark a debate on how flexZhouse could fit into current housing law and policy. Nevertheless, we are aware of the complexity of the current regulations pertaining to housing, and therefore expect that the present laws could accommodate the changes that the flexZhouse BM will bring to the market.

If adopted, this approach will lead to radical changes in the housing market. It is a new strategy, and therefore positivist methods of inquiry were less suitable to test the feasibility of the new BM. The process of exploration involved a process to test the new idea and understand the responses from the target group, and therefore in-depth sessions were required to get the message understood. The applications studied in the selected manufacturing and prefab housing companies served as examples rather than cases, and the unit of analysis was the BM components. The companies selected either ran a prefabricated housing business as part of their business strategy, as is proposed in the flexZhouse BM as well.

In terms of methodology, an important lesson learned from these studies is that a researcher's degree of competence affects focus group moderation outcomes. Moderators must develop their skills in facilitating groups and in helping quieter members engage in discussions. My solution involves fully preparing before real sessions begin. In my case, the pilot focus group helps me to improve my skills in moderating the following focus group sessions. From my experience, when a focus

group is conducted first, the answers tend to become more generic, and groups tend to become more spontaneous and conversational. The ARC technique also introduces 'feeding information' whereby results of one session were fed into others. The questions were further developed and the results from the previous focus group(s) were brought up for further discussion in the new session. The information gathered from earlier sessions help to refine the business model and made the revision more concise and precise.

One prominent issue identified when assessing ARC (ask, record, confirm) technique related to the transferring of discussions into keywords or shorter codes, forcing some of the respondents to be succinct in expressing their ideas. When researchers wish to summarize points being discussed, moderators tend to interject in discussions and to provide suggestions for the keywords. This can create biases, in turn affecting final codes. Therefore, we must maintain a degree of distance from audiences and monitor dynamics as much as possible. Although assistance from moderators may be necessary, final responses must come from respondents.

A related issue concerns the homogeneity and heterogeneity of respondent backgrounds. When participants come from the same background, group dynamics function more effectively. However, respondents of differing backgrounds can also generate fascinating and broader responses. During the pilot study, I held a focus group of Malaysian students earning their PhDs at TU Delft. The homogeneity of the participants contributed to a sociable session and to a more relaxing environment. The respondents tended to support one another's opinions, although some sessions were extended because the participants behaved too casually. In subsequent sessions, we included respondents of differing backgrounds (graduate students, young lecturers, and young professionals). Although this focus group was dominated by certain members, the findings are more versatile. The discussion touched on several issues, and the senior members helped to clarify difficult terms to the junior or less experience members. This technique generated interesting information for the thesis and is thus worth exploring.

Beyond these broader discoveries, we also noticed in one session that the respondents wanted the moderator to record keywords for them. This is especially common when respondents belong to professional and older demographic groups. In this case, classic goals of rapport were necessary. This normally occurs when the respondents hold certain high positions and thus create a hierarchy during the discussion. Nevertheless, it is easier to validate results, and less time is required when the moderator is in control of the situation. In addition, keywords of the previous group were raised in subsequent sessions, thus making subsequent sessions shorter and more precise. This is simply attributable to the fact that these discussions did not require as much elaboration as the first focus group. The keywords derived from the previous sessions served as indicators of how ideas were generated and collected. The pooling of ideas also contributed to data saturation, as suggested by Bench, Day, and Griffiths (2011).

The main topic of future ARC technique exploration concerns the success of sessions with less than two moderators. Whereas one moderator must control the session, the other moderator should monitor keywords raised during debates and readdress them during the member's verification round. The second moderator can further clarify keywords that he or she heard during group debates, thus avoiding obtrusively interpreting non-verbal actions between respondents. This can be done by asserting comments in the ATLAS.ti video transcriptions. However, regardless of the recording methods used, the second moderator must be alert, especially when discussions become lively and when several participants talk at once.

For further understanding and elaboration, the aims and main research questions of each chapter are summarized in the following:

Chapter 2

Key question: What are key characteristics and challenges of the housing industry in Malaysia for which flexZhouse is proposed as a solution?

The answer to this question is based on reports, statistics and newspaper cuttings on the housing industry scenario and issues related to affordability and financial accessibility for the target groups, offers and incentives from the government, and the problems facing the housing industry in Malaysia. The description of the housing industry establishes the gap and the potential solutions for the industry. The discussion reiterates the new direction for the mass housing industry in Malaysia, especially to provide a solution to the three problems that the housing industry is facing.

Chapter 3

Key question: What would be appropriate components for the flexZhouse BM?

This chapter starts by defining the BM and identifying components that make up a business model. We discuss the strategy of the new BM to promote affordability towards young starters in Malaysia. The distinguished components of the BM are used as a tool to explain the strategy of flexZhouse to offer the product to the housing market. The new BM is expected to deliver more affordable and accessible housing to the market. Towards the end, this part reconnects the BM components with the problems and issues that are the backbone of this thesis and provides a first rough sketch of the proposed flexZhouse BM according to the distinguished components.

Chapter 4

Key question: What are known approaches that may contribute to providing elements that could help to construct the flexZhouse BM?

In this chapter, the conceptual framework and the draft flexZhouse BM are formulated. The conceptual framework is derived from known approaches that support the study of customization, approaches on affordability and scholars' views on the supply chain. Towards the end, the answer leads to a draft flexZhouse BM and benefits from lessons learnt from existing literature and known approaches to support the draft BM.

Chapter 5

Key question: What are the meanings, judgments and evaluations of the stakeholders concerning the draft flexZhouse BM?

The answer to this question was derived from feedback on the draft flexZhouse BM. The exploration focused on understanding people's attitudes, motivations and behaviours (the 'Why?' and 'How?' behind the 'What?') during the design workshop with the professional architects and the focus groups with young starters, practitioners, housing developers, industry key players and government agencies dealing with housing, to refine the proposed BM and gain new theoretical insights.

Chapter 6

Key question: What processes and methods are available to support the delivery of flexZhouse?

The answer to this question would strengthen the formulation of the flexZhouse BM. A case examples using primary and secondary data helped to shape the final draft of the flexZhouse BM. It also helped to explain the business motivations, propositions for the products and services, financials and revenues, and resources needed to operate each business. The innovative leasing concept helped to integrate the financial choices and ways to minimize the cost of operations from a different business strategy that could be useful for the flexZhouse BM.

Chapter 7

In this chapter, we revisit the main aim of the research, which was to formulate a new BM called flexZhouse to provide solutions to the unaffordability of housing for young starters in Malaysia. Conclusions from the design workshop, focus groups and case studies are presented and summarized in the revised flexZhouse BM. Further, the conceptual lifecycle costing using the preliminary input is established to give a proof of concept on how flexZhouse will create revenues for the company and offer affordable products to young starters in Malaysia.

Chapter 8

Finally, we summarize and conclude the reflections presented at the end of each chapter. The chapter answers the main research questions and formulates theoretical propositions and recommendations for future studies.



2 Framing the problems and addressing the gaps

§ 2.1 Introduction

In the previous chapter, the problems and methodology of the research were described. The mechanisms to achieve the aims of the research were elaborated and justified. In this chapter, the motivational problems and research gaps established in the previous chapter are elaborated. We begin by describing the key characteristics of the housing industry in Malaysia. We then look at micro-problems in Malaysia that relate to three main issues; 1) the affordability of current housing, 2) the quality and workmanship of current housing stocks, and 3) customization restrictions and the needs for customization in the current housing model. The gaps and limitations in the current housing model are described to address the potential solutions for the new flexZhouse business model. The following question is the guiding question in this chapter:

What are key characteristics and challenges of the housing industry in Malaysia for which flexZhouse is proposed as a solution?

§ 2.2 Key characteristics of housing industry in Malaysia

Malaysia is part of the Association of South East Asian Nations (ASEAN). The nation consists of two regions separated by the South China Sea, that is, the peninsular of Malaysia and the states of Sabah and Sarawak, on the island of Borneo. Malaysia comprises a federation of 13 states and three federal territories. It is a dynamic country that has evolved tremendously since the 1970s from a country that produced raw materials, such as rubber and tin, into a multi-sectoral economy that driven by innovation and technology.

The mass housing industry contributes to almost 4% of the gross domestic product (GDP) income to Malaysia socioeconomic growth. Many downstream activities are dependent on this industry, and it creates a domino effect when the housing industry

is not performing: the whole construction industry is affected. It is important for the government to guarantee that this industry is working efficiently and at the same time supports the environmental sustainability agenda.

Notwithstanding the reputation of the mass housing industry to the country's development, the industry is tainted by several pertinent issues. One big issue is related to the supply of housing for young starters. Private developers give affordable housing programmes low priority (Tan, 2014) and are especially keen to concentrate on high-end properties in order to make more profit (Cagamas Berhad, 2013). The construction of higher-end properties has thus exceeded the target laid down in the previous 5-year Malaysia Plans (2011–2015) (Economic Planning Unit, 2010b). There is an oversupply of higher-end properties and new units remain unsold (Department of Statistics Malaysia, 2015a). The government has failed to meet its goal of supplying affordable housing to the middle-income group. According to the recent census by Department of Statistics Malaysia, 2015a), the demand for residential units in the RM 250,000 – RM 300,000² price range makes up 50–90% of the total demand and most of the units were easily sold.

Given that the demand for homeownership is increasing in the market, the debate about current housing policy is shaped around the issues of affordability, particularly for the middle-income group (Cagamas Berhad, 2013; T.Tan, 2013). First-time house buyers (T.-H. Tan, 2013) or young starters aged between 23 and 30 years old (Cagamas Berhad, 2013). The middle-income group makes up 50% of the total population. Young starters constitute almost 60–70% of the middle-income group. The demand for housing is continually increasing, especially in the urban centers such as Kuala Lumpur, Selangor, Penang and Johor Bahru (T. Tan, 2009). However, the country is still facing difficulties in meeting the housing demands of young starters (Cagamas Berhad, 2013; T. Tan, 2012, 2013).

Homeownership, especially in the two most developed states in Malaysia (Selangor and Penang), remains inaccessible to many despite government incentives for ownership and housing programmes. Some of the reasons for this are caused by the location of the housing, especially in the prime area where the higher cost of land is driving house prices. Another issue is the deposit, income and credit obstacle: the middle-income group do not earn enough to meet bank lending criteria (Cagamas Berhad, 2013; Buang, 1997; MHLA, 2013). This is elaborated in the following section. Nevertheless, in order to accomplish high income status by year 2020, the government sectors and private have worked together to achieve the housing target. The government is open to new suggestions to improve the current business model, and any innovation and proposal are significantly welcome at this stage (MHLA, 2013). The thesis presents an overview of the need for mass housing in Malaysia. It also presents the problems faced by the industry, the forms of housing tenure currently available in Malaysia, the gap and solutions to the problems.

§ 2.3 Overview: The demand for housing in Malaysia

The world is currently facing problems caused by rapid urban growth. According to Tibaijuka (2013), almost half of the world's inhabitants is now living in city areas. According to a census carried out by the Department of Statistics Malaysia (2015b), almost 72% of the population now lives in city areas. The United Nations has estimated that by 2050, 87% of Malaysians (37 million) will be living in urban areas. The need for housing is increasing everywhere, but affordability for young starters is decreasing partly due to the rising cost of housing in relation to income (T.Tan, 2012). In this research, the term 'young starters' is used to describe the people of a certain age (23 -30 years old), at the start of their careers both on the business and the housing market. While T.Tan (2012) labels them as first-time house buyers.

It is argued that although the goal of ownership is to have a roof over one's head, the need for ownership has always been associated with a sense of status in the eyes of society, a sense of independence and a reflection of one's financial capability (Bright & Hopkins, 2011). Investing in housing is considered the most important investment in one's life. This is further supported by findings that young starters especially consider a house as an entity to reflect their identity and personality (Bruce and Kelly, 2013). Thus, the earlier definitions support the notion that the desire to become a house owner is high. The topic is also prominent and valid concern for policymakers.

Since independence, the housing provision has been part of government's social policy. It is crucial to ensure social and economic stability and to promote national development (Rahman & Alashwal, 2013), and for Malaysians to lead happy, productive and enjoyable lives (Cagamas Berhad, 2013). It is undeniable that residential and neighborhood satisfaction is an important indicator of housing quality and condition, which affect an individual's quality of life (LSufian, 2008). The government has focused on numerous housing programmes in its Five-Year Plans (Malaysia Economic Plan), to provide affordable housing for the people. With the help from the private housing developers, the private sector has provide housing for all income groups. Malaysia, like other developing countries, considers the housing sector as fulfilling the people's basic need and thus has the potential to be the catalyst to boost the nation's economy (Economic Planning Unit, 2010b).

In terms of supply, in the recent Malaysian plan (2016-2020) the government plays a role to provide housing for its staffs (civil servants), low-cost housing for the low-income group and affordable housing for the medium-income group (Economic Planning Unit, 2015). But at the moment, the middle-income group has to compete with the higher-income group to buy a house on the open market. Due to skyrocketing land prices and raw materials prices, house prices have recently increased, encouraging private developers to concentrate on high-end properties. In Malaysia, developers

of developments exceeding 10 acres are officially required to allocate 30% of their units for public (low-cost) housing. However, there are reported cases where housing developers have managed to escape the guidelines by submitting the projects into smaller parts (Cagamas Berhad, 2013) and submitting them for approval separately (T.-H.Tan, 2012).

At present, houses costing more than RM 500,000 (€120,000) dominate the housing market, especially in cities. Private housing developers are more interested to invest on high-end projects due to higher margins and profits (Department of Statistics Malaysia, 2013). Nonetheless, under the affordable housing program, 2733 units of Rumah Mesra Rakyat (30% of the housing needs under the Home Ownership for the People (HOPE) projects) were completed in 2010 and another 60% of the units are under construction (at least until 2014) (Department of Statistics, 2013). Nevertheless, most of the units under this scheme were built outside prime areas and were mostly inaccessible via public transport (Cagamas Berhad, 2013).

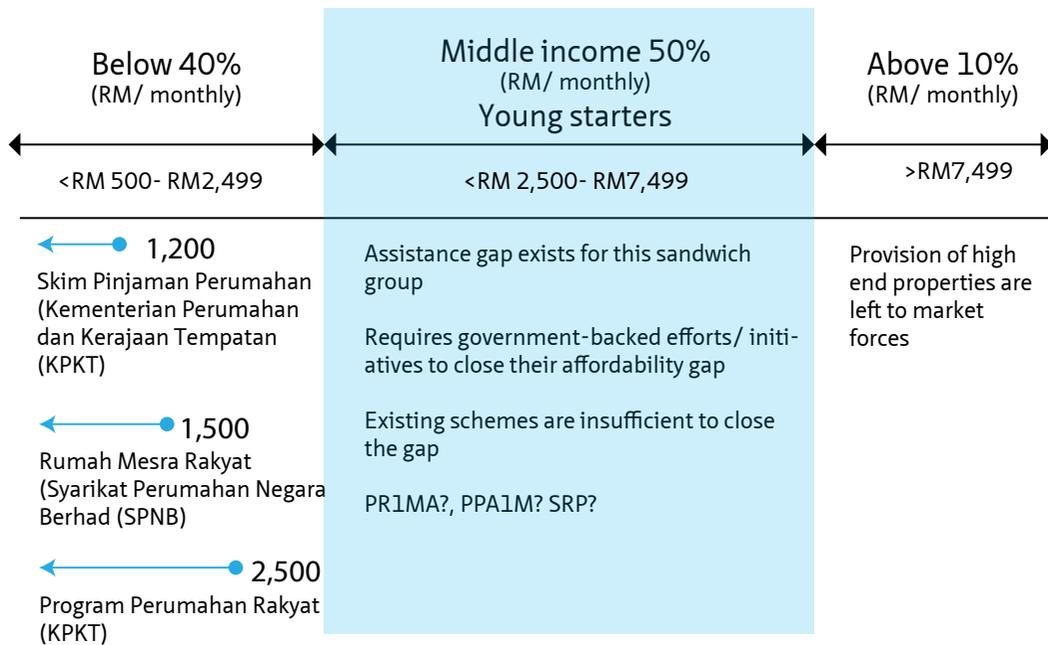
In response to this, the government pledged in the 10th Malaysia Plan (2011–2015) to deliver a sufficient supply of affordable housing for both the low-income and the middle-income group. An estimated 500,000 affordable houses were expected to be constructed during the term. However, only 102,200 units were completed (Economic Planning Unit, 2015). The government also promised to tighten the law and increase enforcement to ensure that the quality of affordable housing is not compromised (Unit, 2010b). However, the focus of the present research was not on the lower-income segment but on the young starters who make up around 60–70% of the middle-income group. This is also part of the government pledge to fulfill the plea for housing particularly from the middle-income group and urban settlers (Economic Planning Unit, 2015).

Recent polls reported by (Cagamas Berhad, 2013) showed that a large number of Malaysians, and especially young starters, found that house prices were beyond their reach, and a significant number of them wanted more affordable housing at suitable locations and with better designs. At present, the affordable housing schemes to promote affordability by the government are as follows:

	MY FIRST HOME SCHEME (SRP)	PR1MA	PPA1M
Target / Eligibility	the income limit for individual loans from RM3,000 to RM5,000 per month or joint household incomes for up to RM 10,000 per month and the eligibility to own property costs up to RM400,000	to provide 500,000 affordable homes in 50 cities nationwide with household eligibility income from RM6,000 to RM7,500 monthly.	RM 90,000 – RM120,000(joint income not more than RM 6000) RM 150,000- RM 220,000 (joint income not more than RM10,000) RM 221,000- RM 260,000 (joint income not more than RM10,000)
	18-35 years old and first-time buyers	First-time buyers	18-60 years old *only for government servant

TABLE 2.1 Schemes for middle-income group in Malaysia. Adapted from: EPU (2015)

In the figure 2.1, the blue column shows that the middle-income group mostly consists of young starters, who form the majority in urban areas, could not afford to buy houses on the current market especially in the urban areas. At the same time, they are not eligible for low-cost public housing. Therefore, it is important for the government to revisit the term 'affordable' and to ensure the proposed affordable housing schemes (such as PR1MA, PPA1M and SRP) achieve its objectives. As much as the government's effort to solve poverty in rural areas, the need to address urban young starters and the urban poor are also crucial for the housing industry.



Key considerations

The 20 years between 1990 and 2009 saw the population shifting from low income class to the middle income class with almost 50% of population falling into the RM2,500 to RM7,500 income bracket.

Housing needs of the bottom 40% have been addressed by existing government aided housing programmes. However, there is no existing programme for the middle-income group (young starters) household income between RM2,500 - RM7,500 which requires government assistance to close its affordability gap

Source: Economic Planning Unit, IOMP; Department of Statistics Malaysia, Household Income and Basic Amenities Survey (HISBA)

FIGURE 2.1 Overview of government supporting schemes indicating the gap for middle-income households. Adapted from: EPU (2012)

§ 2.4 Problems facing the housing industry in Malaysia

As mentioned, in the previous development plan (Malaysia Plan 2011–2015) the government pledged to provide 500,000 units of a quality affordable housing to meet the demand before 2018 (Economic Planning Unit, 2010a). However, the latest development plan reports that only 102,200 units have been completed (Economic Planning Unit, 2015). Therefore, a new strategy to support the effort is needed.

Although the government has made efforts to meet the housing plea for the middle-income group, we are concerned with the rising household debt among young Malaysians. Given the rule of thumb concerning the affordability rate of 30% of expenditure of income on housing (for median incomes), the price of housing offered under the scheme is still unaffordable for many. This is partly caused by the increasing price of construction and raw material resources (Chia, Skitmore, Runeson, & Bridge, 2012), the shortage of land and increasing land prices (Cagamas Berhad, 2013). In addition to the high housing prices and the issue of affordability, purchasers are faced with inflexible housing designs and the poor quality of the built housing. Furthermore, the term affordability touches interconnected elements that cover a range of issues on both the demand side (housing needs, demographics, household income, quality housing) and the supply side (authority requirements, design, cost, sustainability and procurement). Therefore, in this research, we examined some of the problems that relate to the supply and demand issues that are looking for solutions on the affordability, and ways to improve the housing quality and increase the design flexibility. In the following sections, these key challenges on the Malaysian housing market will be elaborated.

§ 2.4.1 Problem 1: High housing prices

According to the Department of Statistics Malaysia (2013), approximately 10 million people live in Malaysia's urban areas, such as Kuala Lumpur, Penang, Selangor and Johor Bahru. As a result, land prices in these cities are increasing, leading to skyrocketing house prices. The current higher prices of construction materials and labour costs have provided additional reasons for developers to increase house prices (Cagamas Berhad, 2013), making houses unaffordable especially for the medium-income group. Statistics from Bank Negara Malaysia (2013) show that household debt rose from 46% in 2000 to 140% in 2012. In 2012, the portion of household income that goes towards financing a house was about 50–70% of the total household debt, which make more than 30% affordable rate. Given that the affordability rate must be around three times or less, the property price has since increased tremendously in certain areas by five to tenfold (Cagamas Berhad, 2013).

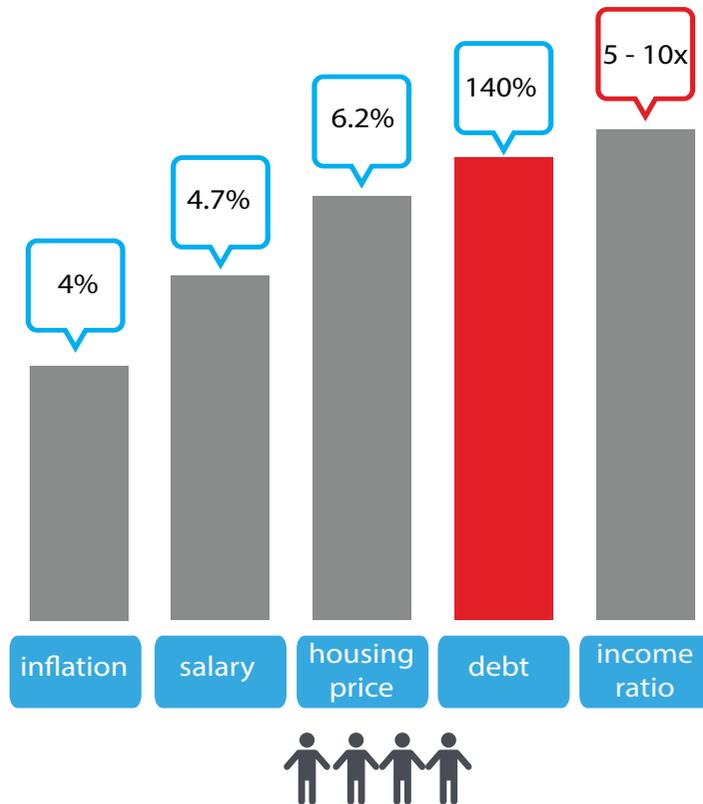


FIGURE 2.2 Housing price, household debt growth, salary, inflation and income ratio: Source: Bank Negara Malaysia, 2013

It has recently become even harder for young starters to buy their first house due to the relatively stringent measures introduced by Bank Negara Malaysia with regard to the lending process to reduce loan defaults. Although affordable housing projects have started to meet the demands of especially the middle-income group, homeownership has yet to be realized. Newly established housing schemes fail to meet the needs of the significant segment of young starters who have grown up with the demand for shelter. In fact, sub-standard housing quality coupled with less than desirable locations has ruined some housing projects nationwide (Cagamas Berhad, 2013).

Between 2002 and 2012, property prices in Malaysia rose by an average of 6.2% per year. At the same time, household incomes increased by only 4.7% annually (NAPIC, 2013), making it ever harder for young Malaysians to buy a house. The property price increase has had an impact on the low and medium-income markets and especially on young people whose incomes have not increased in tandem to housing prices over the past 10 years. To measure the affordability rate, normally by dividing the median housing price with the annual household income (Cagamas Berhad, 2013; Department of Statistics Malaysia, 2013).

A report made by Cagamas Berhad (2013) and NAPIC (2015), shows that homeownership is still the ideal among Malaysians. However, there is a relatively significant portion of the population that does not want ownership for several causes – such as increasing job mobility or expatriation – prefer to rent their housing (Cagamas Berhad, 2013). In most developed countries, housing rental has become a significant segment of housing in their national housing program. However, this is unlikely to be the case for emerging countries like Malaysia. Arguably, the rental sector is considered ‘dead money’ (Bright & Hopkins, 2011). This is because the landlord has the autonomy and control over the stability of the asset, not the tenant.

Skim Rumah Pertamaku (SRP) (My First Home Scheme) was well-received by Malaysians when it was launched in 2012. Home ownership is deeply embedded in the Malaysian culture as it represents a significant achievement in one’s life. Owning a decent home fulfils a fundamental need. However, it seems that this is getting harder to realize for most people nowadays. Young people, especially the young starters, suffer the most because they have the lowest incomes while at the same time being required to pay high prices for housing, especially in city areas. Under the scheme, young starters are offered a house in the RM 100,000–400,000 range³. The sum of the monthly commitment for single or joint applicants must not exceed 60% of their total combined net monthly income.

HOUSE TYPE	AVERAGE MEAN PRICE IN KUALA LUMPUR (RM)	SALARY GROUP
2 – 2 ½ storey >250 m ²	530,887	Middle income/ High income
Condominium / Apartment 160 m ² – 200 m ²	431,094	Middle income/ High income
1 – 1 ½ storey - 150 m ² – 200 m ²	326,207	Middle income
Low-cost terrace houses- 70 m ² – 140 m ²	181,138	Low income
Flats- 60 m ² – 70 m ²	128,297	Low income

TABLE 2.2 Price of house in Market. Source: Property Market Report, 2010

From the table above, it is clear that the only category of housing that is affordable for young starters under the My First Home Scheme is a 1–1½ story house, a low-cost terrace house, a flat or a low-cost flat. Nevertheless, low-cost terrace houses, flats and low-cost flats are intended only for the low-income group. Furthermore, it is hard to find housing projects that offer houses in the RM 250,000–300,000 range, especially in the Klang Valley (Kuala Lumpur). Based on data on housing prices in 2015 gathered by NAPIC (2015), there are not many options left to the middle-income group, especially young starters.

3 Two of the criteria a first-time buyer must meet are: younger than 35 at the time of application and a household income of not more than RM6,000 per month (First Home Scheme, 2012).

As shown by the following table, the disposable income of young starters (case 3, a property costing RM 280,000) is only RM 1018 a month. The calculation was based on the CPI (consumer price index), which shows that the price of everyday goods has increased by 4.7% annually, while the cost of electricity, water, gas and fuel has risen by 1.9%, annually (Cagamas Berhad, 2013). The following calculations illustrate the typical monthly expenses of young starters in Malaysia. However, the question is: how many properties on the market still cost only RM 300,000 or less?

In its 2010 annual report, Bank Negara reported that household debt at the end of 2010 was RM 581 billion, which is equivalent to 76% of GDP. On the other hand, the Consumers' Association of Penang (Penang, 2011) argued that if household debt is analysed from the aspect of disposable income, the amount of money that was spent paying off debts was alarming.

	CASE 1	CASE 2	CASE 3	CASE 4
PROPERTY PRICES (RM)	RM500.000,00	RM400.000,00	RM280.000,00	RM150.000,00
Loan amount (RM)	RM450.000,00	RM360.000,00	RM252.000,00	RM135.000,00
Net pay (household)	RM7,500	RM7,000	RM8,000	RM5,500
less: statutory deductions				
Income tax	RM225	RM210	RM240	RM165
EPF(Employment Provident fund) contributions	RM825	RM770	RM880	RM605
Net take-home pay	RM6,450	RM6,020	RM6,880	RM4.730
less: monthly commitment				
Mortgage instalments (6% for 30 years)	RM2,700	RM2,160	RM1,512	RM810
Utilities	RM300	RM300	RM300	RM300
Car hire-purchase (one car)	RM800	RM800	RM800	RM800
Petrol and maintenance for one car	RM600	RM600	RM600	RM600
Food and other expenses	RM1,000	RM1,000	RM1,000	RM1,000
Childcare (one person)	RM800	RM800	RM800,00	RM800
Insurance plan (RM 150 per pax)	RM450,00	RM450	RM450	RM450
Parents (RM200 per pax)	RM400	RM400,00	RM400	RM400
Net savings	(-RM600)	(-RM490)	RM1,018	RM 430
Household to income ratio	5.56	4.76	2.92	2.27

TABLE 2.3 Calculation of affordability rate among Malaysians .Adapted from MacDonald (2013)

In general, the minimum percentage that is acceptable for a debt service ratio is 30% of the income expenditure. Taking an example that one-third of the household income

is used to repay a loan or debt that includes the principal and interest portion of the payment. Further, the Malaysian household loan or debt ballooned from 9.1% in 2006 to 49.0% in 2009, although it fell slightly to 47.8% in 2010. The statistic shows that almost half of the income of Malaysians goes to paying monthly debts (Department of Statistics Malaysia, 2013).

In the first quarter of 2011, the Malaysian house price index (IHRM) was at 149.1 points; in the second quarter, the figure rose to 150.7 points. Over the 12-month period, the index had steadily increased by 9.0 % from 2010. According to the Malaysian House Price Index (2011), the price of the average house for all states in Malaysia was RM 206,513. The highest was in Kuala Lumpur (RM 438,150), the lowest in Perlis (RM 115,072). The statistics show that the housing price in Kuala Lumpur was approximately 40% more than other areas in Malaysia. Kuala Lumpur continued to have the highest 'average' terrace house price in the country (RM 467,809). Despite the term terrace house as stated in the statistics, the type or size is not specified for a terrace house. Based on the authors' observations, the built-up area of a terrace house in Kuala Lumpur is currently around 150 m². It is obvious that the availability of space in the city is shrinking. Selangor ranked second at RM 317,383 in terms of housing price, followed by Sabah and Penang at RM 281,740 and RM 281,589, respectively. In general, we can expect that the group of people who can afford to buy houses in Kuala Lumpur are mainly higher income earners.

CATEGORY	PROPERTY PRICE AS MULTIPLE OF ANNUAL HOUSEHOLD INCOME X PRICE /INCOME
Severely unaffordable	5.1 and over
Seriously unaffordable	4.1 to 5.0
Moderately unaffordable	3.1 to 4.0
Affordable	3.0 or less

TABLE 2.4 Housing affordability as a ratio of price to annual income. Source: (Cagamas Berhad, 2013)

Housing tenure and affordability

The affordability of housing depends not only on the price of housing but also on access to finance. In the current Malaysian housing market, homeownership remains the main as well as the preferred form of tenure. However, international experiences (Kramer, 2008) indicate that accessibility can be increased by introducing intermediary tenures liked shared ownership, equity cooperatives and shared equity loans (MacDonald, 2013).

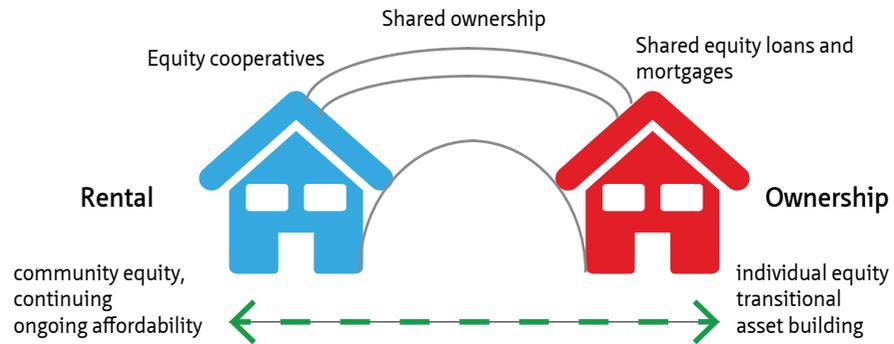


FIGURE 2.3 Hybrid options for Malaysia's housing industry: adapted from MacDonald (2013)

As depicted in the figure 2.4, most of the available tenure in Malaysia, however, is divided into only two types – owning or renting – and the line between them is very clear. There are several models that produce a range of forms of subsidized home ownership showing the configuration of subsidized housing models that may have to change degrees of limitation to categorize them closer to either renting or owning.

For the purpose of the research, we define traditional home-ownership as 100% of the dwelling and the land it is built on is in the hands of the resident. In traditional rent, 100% of the dwelling and the land is owned by the provider or the landlord. In hybrid shapes, ownership is shared between provider and resident and both share in capital costs and revenues on the basis of specific conditions which vary according to the applied scheme or tenure arrangement.

The third option that is available in some countries as the hybrid model. In countries such as the Netherlands, Australia and the United States, the hybrid model is a marginal phenomenon (figure 2.4). It is a strategy used to increase the affordability of semi-ownership to a wider group of people. In this model, potential buyers can choose from the available options that are available according to their affordability. However, introducing the hybrid model in Malaysia would require strong central government support, and perhaps a clear policy and significant public funds to stimulate the development. Although many studies into whether the pros and cons of buying or renting determine potential house buyers' choice showed that ownership is always the preferable choice, it is not impossible that the introducing of a leasing model with attractive packages might entice a certain segment of the population, and especially younger starters.

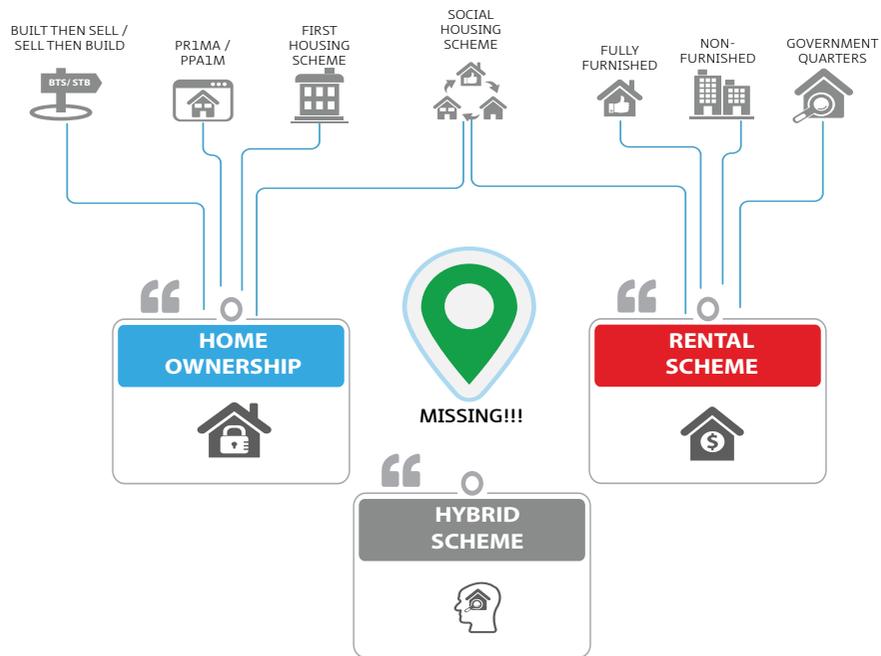


FIGURE 2.4 Type of tenures in Malaysia

However, there is a little studies on the pros and cons of the hybrid model from a housing developers point of view. In a traditional buy and sell, the sale normally ends after the purchase has been made and after the defects, warranty period ends, in contrast to the hybrid model in which the commitment from both parties is normally longer (Kramer, 2008). In summary, there are currently no hybrid model options in Malaysia while evidence from other countries suggests that these intermediary or hybrid tenures might contribute to financing accessibility and the affordability of semi home-ownership, in particular for lower middle-income households. Therefore, our proposed model also considers the potential of introducing intermediate tenures as part of the solution.

Based on the above problems and the housing affordability rate, the solution revisited the meaning of affordability. The solution had to provide a potential answer to the affordability problem for young starters. This means that construction costs have to be sustainable and realize the economies of scale, finance arrangements should be developed that fit with the means of young starters but will also have to consider possibilities for initially lower levels of housing consumption to increase the affordability, while promoting a fit between the preferences of the households and the quality of housing. This means that construction costs have to be sustainable and economies of scale achieved, that finance arrangements suitable for young

starters have to be developed, and that possibilities for initially lower levels of housing consumption should be considered to increase the affordability, while promoting a fit between the preferences of the households and the quality of the housing.

§ 2.4.2 Problem 2: Quality of newly built housings

Despite the high housing prices, the development of the housing industry has recently been damaged by the poor performance of contractors who deliver shoddy products (Amin, Sufian, Kader, Zubaidah, & Kassim, 2014): sub-standard and poor workmanship reduces occupants' level of satisfaction (Fauzi, Yusof, & Abidin, 2012). The quality and workmanship of some new-built houses have always been a disheartening issue for the housing industry. The quality and workmanship issues are attributed to the nature of conventional construction, which relies fully on human skills unlike manufacturing products (Zairul & Ibrahim, 2011). Furthermore, the country is currently facing a shortage of skilled workers (C. Malaysia, 2005). Training workers, especially foreign workers, to deliver the expected results would require huge investments (Cagamas Berhad, 2013). In most cases in Malaysia, the foreign workers usually left the project upon completion with knowledge and skills they acquired along the project at the corporation's cost (Nawi, Anuar, & Lee, 2013). In seeking solutions for skilled labour to improve the quality of building projects, the country is promoting the IBS (Industrialized Building System) to replace the conventional construction industry. Nonetheless, there is a lack of commitment by the industry's key players to change the way they do things (Nawi, Lee, Azman, & Kamar, 2013). We have therefore identified alternatives that can transform how the public perceives the industry by exploiting the manufacturing possibilities in the housing industry.

There are also supply chain issues that hamper the present housing development. As the market is maturing, legislation and regulations continue to change in response. However, instead of assisting the industry, they have become harsh and punitive (Cagamas Berhad, 2013). The strict compliance-related regulations demotivate law-abiding industry players. The board of architects Malaysia (LAM) has issued a guideline for professional architects to certify works in respect of housing projects of the sale and purchase agreement for land and building (Schedule G). The certificate comes with sale and purchase agreement (SPA) for sub-divided buildings under Schedule H of the housing development (control and licensing) regulations 1989. The figure 2.5 shows the process that has taken place for common housing developments in Malaysia. The supply chain process involves multidisciplinary, stages, steps to fulfil the regulations imposed by the government. As shown below, a normal housing construction project can last as long as 24 months and a total of 38 and 70 months in total.

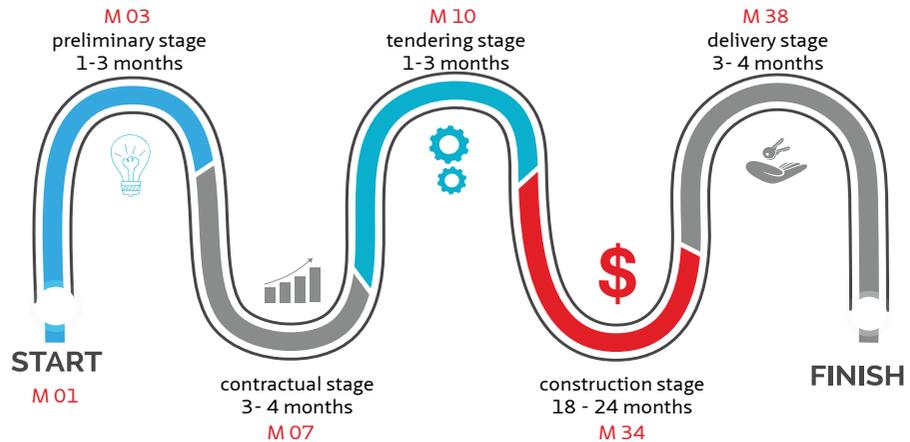


FIGURE 2.5 Conventional housing development in Malaysia

At present, the current housing development involves:

- 1 *Purchasing the land*
- 2 *Appointing consultants*
- 3 *Submitting proposals*
- 4 *Compiling and coordinating stages*
- 5 *Applying for planning permission*
- 6 *Obtaining sales & permit for advertisement.*
- 7 *Construction stage*
- 8 *Delivery & handover*
- 9 *Vacant possession*
- 10 *DLP period*

During the first phase, the process involves planning and preliminary stage. The phase starts with the purchase of the land and land development processes, which fall under the Land Acquisition Act 1960. The methods of acquiring land for housing development must involve state authority (Cagamas Berhad, 2013). After the land has been purchased by the developer, the process of appointing the consultants begins. It involves many parties, including the architect, engineers, quantity surveyor, contractors and subcontractors. The developer then applies for sales and a permit to advertise the housing. At this stage, the developer starts to market the housing and accept reservations for the proposed development. The steps are not necessarily sequential but are mostly done concurrently.

In the next phase, prior to the construction, the process involves designing, modifications, tendering and awarding contracts. The construction of a typical mass housing project takes around 18–24 months. The construction will be handed over to the customer when the certificates of completion and compliance have been

issued to the developer. At this stage, several steps are involved, including testing and commissioning, checking and inspection, and the beginning of defects and liability period upon the vacant possession period. In the present situation, house buyers have to deal with some uncertainties. This is because the sales & purchase agreement is signed before the house is built. House buyers are normally given only an illustration of their future house or are shown a show house that is supposed to represent how the actual house will be. Adding to the problems, purchasers still need to make payments to the bank for the mortgage in the event the developer decides to abandon the project as a result of any difficulties.

In addition, a housing development in Malaysia is pressured to include a sustainability agenda in its development planning. The issue of sustainability is prioritized in the recent Malaysia Plan (2016–2020) under strategies for sustainable development (Economic Planning Unit, 2015). However, the challenges to providing steady development for a modern community and the desire to promote a healthy environment have become the main setbacks especially in developing countries like Malaysia. The Construction Industry Development Board (CIDB), which is one of the country's key construction players, has identified the need to strengthen the awareness of sustainability issues in the construction industry (Shuid, 2015). The effort towards sustainability is supported by INSPEN (the Malaysian National Institution of Valuation), MASTIC (Malaysian Science and Technology Information Centre) and several grants to public universities to promote sustainable in the new construction paradigm. Despite all efforts made by these bodies, the delivery of a sustainable concept in the housing industry is still relatively minimal and has become a low priority among contractors and housing players in Malaysia. It was reported that, in Malaysia, 10–30 percent of the waste disposed of in landfills is mainly from construction and demolition in the building industry (Papargyropoulou, Preece, Padfield, & Abdullah, 2011).

It is generally recognized that the construction industry, and especially the housing construction industry, must transform its modus operandi from linear production into making sustainability its overarching element in planning. With the current problems of global warming, resources depletion and the excessive destruction of the ecology and biodiversity, this issue has garnered some attention from industry players worldwide (Gerberich et al., 2012). However, in practice, the housing industry in Malaysia still consumes an enormous amount of raw materials, which it converts into construction materials such as cement, aggregates, steel, plastic and timber (Cagamas Berhad, 2013).

Nevertheless, the mass housing industry has not changed since it was introduced back in 1970s. As a result, more resources are exploited that caused pollution and climate change. Further, the concept of sustainability is not widely accepted by the main players in the industry, partly because there are no strict regulations from the government (Abidin, Yusof, & Othman, 2013).

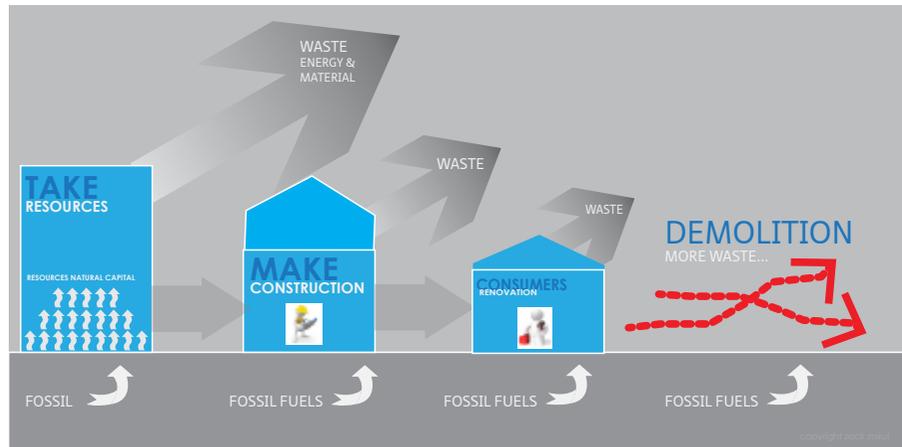


FIGURE 2.6 Linear economy of housing industry in Malaysia

In summary, the current, conventional way of producing houses is plagued by issues of sub-standard quality and involves a lengthy and tedious supply chain (Mehdi-Riazi, Skitmore, & Cheung, 2011). The solution proposed by flexZhouse would address this issue by implementing industrialized housing technology. The industrialized process will hypothetically lead to quality improvement, defect rectifications and maintenance of the products, improved after-sales and increased sustainability in the housing industry.

§ 2.4.3 Problem 3: Inflexibility of design options

Despite the high prices, and the long supply chain in the industry, the customer is not given many housing options. Thus, the third problem concerns the ability of the current way of housing provision to comply with the preferences of young starters. Attention for customization to address individual needs and (changes in) lifestyles has increased globally (Hentschke, Formoso, Rocha, & Echeveste, 2014). Some even argue that house buyers are no longer interested in standard designs produced by housing developers (Noguchi, 2003; Yashiro, 2014). However, customization has always been associated with extra cost and can, therefore, increase the housing price (Barlow et al., 2003; Gann, 1996). It is often difficult to physically adapt shelter and modify existing dwellings, and this often leads to much waste and environmental burden (Wong, 2010). Understandably, individual spaces in the house may become obsolete at times due to the changes in users' needs.

The need for customization in the mass housing sector is linked to the changing needs of consumers. The initial house purchased by buyers may become insufficient to fulfil their future needs as the family expands and income increases. Therefore, if one wants to accommodate these needs without moving, the house needs to undergo physical changes and to be upgraded or downgraded from time to time. In Malaysia, the conventional mass housing market delivers standardized products and often leads to future modifications and alterations to meet the new needs, as exemplified in figure 2.8 and figure 2.9. The most common reason to buy a house is to have the liberty to change and modify according to one's needs and future spatial requirements (Daud, Hamzah, & Adnan, 2012). However, although current housing allows customization, it often involves additional financial commitment (Daud et al., 2012; Wong, 2010), and current renting options do not permit much freedom for tenants to have the flexibility of space customization.

Furthermore, in the present mass housing situation, when house ownership is almost financially inaccessible for first-time buyers, regular renting contracts only allow little room for improvements and modifications (Zairul, 2013). Current physical housing scenarios give customers marginal options to 'grow' and 'shrink' with the house and to accomplish their future spatial requirements. The inflexibility of the current housing causes people to move to other housing to suit their changing conditions. As the function of housing changes from the provision of shelter to serving multiple functions, a house should be a product that has long lifespan and has the flexibility to be upgraded and downgraded. Each successive user should be able to make changes to the unit to match their needs and requirements as they evolve over time.



FIGURE 2.7 Typical standardized housing in Malaysia. Source: Google image

Figure 2.7 shows an example of the typical property in Malaysia, providing standardization or a one-size-fits-all solution for everyone. However, renovation and modification are often required as can be seen in the examples in Figure 2.8 and Figure 2.9. Nevertheless, developers in Malaysia are currently not responsive towards a buyer-centric approach (Daud & Hamzah, 2012).



FIGURE 2.8 Renovation involves major renovation



FIGURE 2.9 Renovation on the facade of the house

Options for customization could provide added value to the current housing solution. Demographically, it will support growing household needs and reduce wastage in the future. Economically, it will help young starters to customize their house according to changing preferences as well as financial capabilities.

Daud & Hamzah (2012) suggested that Malaysian house buyers are ready for mass customization in the housing product, while Abidin et al., (2012) showed that the dissatisfaction with the standardization design is overwhelming. Daud & Hamzah (2012) also reported that their study on housing preferences among Malaysians revealed that customers are willing to pay a higher price for a better customized house. Therefore, a new type of affordable housing should be more flexible and avoid unnecessary wastage resulting from modifications and alterations when the needs of the users change and evolve according to their present and future needs.

§ 2.5 Addressing the gap and potential solution for the formulation of flexZhouse

The current system of affordable housing provision in Malaysia seems not able to produce sufficient and adequate housing, particularly for young starters in middle-income groups. A solution could be found in a hybrid option that integrates the concept of industrialised, flexible housing with innovative tenure, which we refer to

as the flexZhouse business model. The main idea is to secure a flexible scheme that allows the flexible structure of the house and the flexible leasing of the property, while also improving the quality of the housing through an industrialization process. The potential solution is to give an alternative business model to the present housing industry while giving an alternative for the users in mass housing choices. In the current housing situation in Malaysia, customers are given only a few choices (as explained earlier). Although the government is trying to provide more affordable houses for the middle-income group, the solution for housing customization is never on the plate. Key players in the housing industry are reluctant to change and will keep producing standardized design and pricing it high for a customized house. The same applies to the quality of the housing; if it is improved, the price will increase and buyers will have to absorb the extra cost. This will make house prices even more unreachable for young starters. Therefore, re-establishing the valuable connection between those three components are necessary to promote an alternative yet affordable housing industry in Malaysia.

Therefore, we are aiming to design a housing business model that offers more options for design, produce quality products and at the same create alternative financial solutions for the users. One of the ways to reduce the price of the potential solution is to innovate on the new leasing concept of the housing components. It will be imperative for the manufacturers or housing owners to agree with potential customers on the leasing of the housing components. The number housing components will grow along with the financial capability of the customers during the period of the contract. Thus, the tenure or occupancy rights will, of course, be founded on the contract agreed between two parties.

In summary, the customer will be given opportunities to customize the house, signifying the attributes of new 'ownership' which enable the customer to rent the housing components while being flexible regarding certain requirements imposed on them. Moreover, such a form of tenure can help to promote a long relationship with the housing association or producer and a good business strategy for long-term cooperation. At the same time, the housing producer will reduce its production costs by remodelling and recycling the components.



3 Analytical framework: definition of business model and its components

§ 3.1 Introduction

In the previous chapter, the types of tenure and affordability that are available in Malaysian were explained, the gaps were identified and the potential solution was formulated. We emphasized the third option, which we called hybrid tenure, whereby the customer and the housing provider share risks as well as rights to the property, which include freedom to change, modify and upgrade some of the components accordingly. The previous chapter ended with proposing a potential solution (flexZhouse) that employs the hybrid option.

In this chapter, a business model (BM) is defined. The BM is a means to an end. It is the backbone of the newly formulated flexZhouse, and also acts as the intervention that we used for the research. Towards the end of this chapter, we present an analytical framework that forms a bridge between the problems identified in the previous chapter with the draft BM in Chapter 4.

The aims of this chapter are to define the term 'business model' and the components for the flexZhouse BM. The BM construct support the analytical framework of the research, providing a bigger picture on how a corporation would operate the flexZhouse BM and the activities and resources that would be needed to operate the company. The following is the guiding question in this chapter:

What would be appropriate components for the flexZhouse BM?

§ 3.2 Definition of business model

No single definition can define the term 'business model' (BM). Some describe it as a company innovation, a recipe to generate more money (Afuah, 2013) or a framework that explains how a company does business with clients, partners and vendors (Amit,

& Zott, 2012). Another author states that a BM explains how enterprises work, how they create, deliver and capture value (Magretta, 2002). Or it is defined as a strategy and organizational theory that focus on designing transactions (Brege, Stehn, & Nord, 2014) or an analytical tool (Kley, Lerch, & Dallinger, 2011). BMs are a combination of various aspects that includes the notion of value, financial aspects, and aspects related to the architecture and network between partners (Amit et al., 2012). Amit et al. (2012) analysed 103 BM publications and found that more than one-third of the publications do not have a clear definition of the term and that almost 20% used other scholars' definitions. Nevertheless, existing definitions only partially intersect, making possible multiple definitions.

In this thesis, we define a BM as an explanation of a way in which a company might deliver value to customers (this part helps to explain the products and services that the company produces), help customers to pay for value and generate revenue from the product and services (this part explains the means of income for the company) and create a partnership to deliver the value (justify the way the company delivers its product).

In this research, the BM components that we chosen help us to solve the problems discussed in the earlier chapters. The BM also acted as an intervention and provided elements that are necessary to operate flexZhouse. A successful BM must demonstrate the potential to achieve revenue growth and improve profit margins (Amit et al., 2012). It can help companies stay ahead of their competitors (Chesbrough, 2013). Examples of innovation in BMs include the evolution of iPod in the MP3 industry. Apple managed to revolutionize the MP3 industry by providing something that seemed personal. This innovative BM created a locked-in business that forces the customer to open an iTunes account in order to subscribe to music for his/her iPod. Innovation generally considered to be crucial for contemporary business strategies. Innovation can take the form of adding novel activities, for example through new ideas or improving existing ideas and by changing one or more parties that perform the activities can form innovation strategy (Amit et al., 2012).

In this research, an innovative BM is introduced, with 'innovative' referring to changes that interrupt the established system of working or current way of working in the particular industry (Bower & Christensen, 1995). According to Hwang and Christensen (2008), the theory of innovation helps explain how complicated and pricey products and services are changed into economical ones. However, Hwang and Christensen (2008) argued an innovative product is comparatively not as good as what existing customers are already using and thus sometimes does not appeal to the market right away. Nevertheless, the product may become appealing if it creates new opportunity and is affordable for a segment of customers who were previously disregarded by the market. Refer to for example, what Canon did to Xerox by making desktop printing cheaper, and how Chinese and Indian car makers are challenging Toyota by doing the same thing (Hwang & Christensen, 2008).

§ 3.3 Components to make up a business model

A BM is composed of various components. These components describe various processes of delivering the product, and the deployment of internal and external resources. (Hedman & Kalling, 2003). Several authors have produced structures for BMs based on different components. Mahadevan (2000) listed three main elements that help to shape the components as follows:

- 1 value streams for partners, value propositions for the buyer;
- 2 revenue streams (mainly describing the profit and source of income);
- 3 logistical stream (mainly describing various issues related supply chain).

There are numerous examples of components used for defining a BM. For example, Stewart and Zhao (2000) combined revenue stream and cost structure in what they called profit stream. Afuah and Tucci (2000) explained the connection between components and dynamics. They emphasized customer value, namely the way in which a company's product differs from existing products or can be provided at a lower price (Afuah & Tucci, 2000). In terms of revenue, Afuah and Tucci (2000) asked where the money comes from. Who pays what value, and what drives the customer segment to buy? New components that involve legal issues and technology were also discussed (Alt & Zimmermann, 2001). More recently, new components such as sustainability and sustainable income generation were deliberated as part of the BM components (N. MP Bocken, Short, Rana, & Evans, 2014; Richter, 2013; Schaltegger, Freund, & Hansen, 2012).

To select appropriate BM components for this thesis, the problems identified in the previous chapter were used and counter-analyzed to ensure the new BM would sufficiently address it. In this case, it is important to select components that are able to describe the methods and resources a company might use to build affordable, flexible but good quality housing for the market. In Chapter 2, the hybrid option was described. It sets out an agreement in which the customer and the housing provider share the risks as well as the rights to a property, which includes the freedom to change, modify and upgrade components according to the customer's current desires. In response to this, the flexZhouse BM aims to lead innovation in product offerings for a different segment of customers and improve customer relationship in the housing industry.

§ 3.3.1 Terms covering customer options for customization

Firstly, the discussion on this part renders the description of potential BM components as part of the solution for customization. The value streams and value capture (as suggested by Mahadevan (2000) & Stewart & Zhao (2000) explain the value propositions for the buyer and sellers. Hwang and Christensen (2008) describe value propositions as products that help the customers in their routine and daily life. Further definition by Bonaccorsi, Giannangeli, and Rossi (2006) describe the value as products and services offered by a company to be delivered to target customers. Alt and Zimmermann (2001) mentioned mission as part of the value and both describe the importance of service delivery to the customer. Bonaccorsi et al. (2006) emphasized customer services and an enhanced customer relationship in the BM. Therefore, under the notion of terms covering customer options for customization, customer relationship and different customer needs, the proposed flexZhouse BM suggests housing products and services a company could offer young starters (value propositions), for which customer segments (target customers) and what relationship to establish with the customers (customer relationship) (see overview in the following table).

TERMS ON VALUE PROPOSITIONS, TARGET CUSTOMERS, CUSTOMER RELATIONSHIP								
Mahadevan (2000)	Stewart & Zhou (2000)	Afuah & Tucci (2000)	Alt & Zimmermann (2001)	Bonaccorsi, Giannangeli & Rossi (2006)	Hwang & Christensen (2008)	Osterwalder & Pigneur (2010)	Amit et al (2012)	BM for flexZhouse
Value streams	Value capture	Customer value	Mission	Products	Value propositions	Value propositions	Novel activities	Value propositions
Buyer network				Customers	Target customers	Customer segments	Customer needs	Target customers
				Customer services	Customer services	Customer relationship	Customer relationship	

TABLE 3.1 Terms covering customization and customer needs

§ 3.3.2 Terms covering affordability and financial flexibility for young starters

It is generally believed that housing is an expensive asset and that access to mortgages has become difficult for young starters. When embedded within innovative BMs that capitalize on increased accessibility and affordability, new technologies can deliver tremendous value. It has been asked why, with so many examples of successful industrialized building system (IBS) housing projects and techniques to produce housing, the housing industry has not been innovative to a substantial point already.

One of the answers is that although technology has always helped the industry, it has done little to make housing more affordable and accessible for middle-income or young starters in Malaysia. Therefore, the next step is to identify the subcomponents that relate to affordability and financial flexibility.

Several scholars have described financial income as a revenue stream (Mahadevan, 2000), profit stream and customer selection (Stewart & Zhao, 2000). Afuah (2014) mentioned revenue resources, and others specify revenues as source of income and cost structure (Bonaccorsi et al., 2006), business logic (Alt & Zimmermann, 2001) revenue stream and costs structure, (Osterwalder & Pigneur, 2010), or income (Brousseau & Penanrd, 2007). Mahadevan (2000) describes revenue stream as a plan for assuring the revenue continuity for the business. Stewart and Zhao (2000) explained the profit stream as an income stream and cost structure for different customer segments. Several scholars have suggested the extent to which the company offer is different from the market and the way to reduce the price below that of its competitors as revenue resources (Afuah & Tucci, 2000). Therefore, many scholars are focusing on profit generators and sustainable income generation (Brousseau & Glachant, 2002). Further, Osterwalder and Pigneur (2010) provided empirical evidence that the cost structure influenced by resources the company used.

The idea of innovative leasing was introduced in previous chapter. The hybrid model specifically means that the customer and housing provider share risks as well as rights to the property. By combining an innovative leasing model with principles of the circular economy a company can increase its focus on the efficient management of the resources. This also generates opportunities for adjusting fees according to the services and products used by the customer The BM should therefore also incorporate a turnover formula, which defines the key resources needed to operate the business that later defines the pricing of the products and services provided by the company together with markups and gross and net profit margins.

TERMS ON REVENUE STREAMS, COST STRUCTURE & KEY RESOURCES								
Mahadevan (2000)	Stewart & Zhou (2000)	Afuah & Tucci (2000)	Alt & Zimmermann (2001)	Bonccorsi, Giannangeli & Rossi (2006)	Hwang & Christensen (2008)	Osterwalder & Pigneur (2010)	Amit et al (2012)	BM for flexZhouse
Revenue streams	Profit streams	Revenue sources	Revenues	Profit, income	Profit	Revenue streams	Novel activities	Revenues
		Price		Cost structure	Margins & velocity	Customer segments	Cost structure	Cost structure
	Customer selection				Assets & fixed cost structure	Value configuration, resources	Key resources	Key resources

TABLE 3.2 Terms covering affordability and financial flexibility for young starters

Thus, in the literature, the most discussed components of the financial structure are revenue stream, cost structure and key resources. The components under this section enable a description of how a company derives its costs and clarifies how much customers can afford to pay in each segment of the market. Further, in the description of financial components, the theory of innovative BM as laid out by Hwang and Christensen (2008) and Afuah (2014) is used for the flexZhouse BM. In this thesis, financial components explain how a company makes the value propositions affordable for the target customer.

§ 3.3.3 Terms covering supply chain and production

Under the notion of supply chain, several scholars have mentioned logistical stream (Mahadevan, 2000), strategic and processes (Afuah & Tucci, 2000; Alt & Zimmermann, 2001; Stewart & Zhao, 2000), as well as value chain positioning, partners' network, delivery chain, products and services delivery, network externalities and key network (Bonaccorsi et al., 2006; Brousseau & Glachant, 2002; Osterwalder & Pigneur, 2010). Some identified aspects related to the architecture and network between the company and its exchange partners (Amit et al., 2012). Under this notion, delivery channels, network relationships, logistics and infrastructure constitute a part of the generic BM, which can include channels to the customers, partnership, suppliers, distribution channels and activities carried out by a company. While the literature on BMs tends to focus on a corporation's key activities with its partners, most scholars agree on the strategic framework for the production processes that involve the supply chain activities.

TERMS ON PARTNERSHIP, CHANNELS AND KEY ACTIVITIES								
Mahadevan (2000)	Stewart & Zhou (2000)	Afuah & Tucci (2000)	Alt & Zimmermann (2001)	Bonccorsi, Giannangeli & Rossi (2006)	Hwang & Christensen (2008)	Osterwalder & Pigneur (2010)	Amit et al (2012)	BM for flexZhouse
		Scope	Actors & governance			Partnership	Partners	Partnership
Logistical streams	Strategic control scope	Connected activities implementation	Process & Structure	Networking	Processes	Channel	Channel	Channels
						Key activities	Key activities	Key activities

TABLE 3.3 Terms covering supply chain and productivity

Thus, under the notion of supply chain, the flexZhouse BM suggests a relationship between partners that are involved in its supply chain. It relates the components with how a company distributes and creates awareness of its products through channels and network. Finally, the flexZhouse BM needs to explain the key activity that defines the core business of a company. In the table below, we summarize the components for describing the flexZhouse BM.

CRITERIA	BM COMPONENTS
Customization	Value Propositions
	Target customers
	Customer relationship
Affordability	Revenue streams
	Cost structure
	Key resources
Supply chain (Production)	Partnership
	Channels
	Key activities

TABLE 3.4 Analytical framework to build flexZhouse BM

§ 3.4 Conclusion: a first sketch of flexZhouse business model

The components of the flexZhouse BM were derived from scholars' views and literature on BMs. The reason for the inclusion is derived from the issues and problems of the research. In this section, the framework for the flexZhouse BM is presented. It is important to understand how the BM components attempt to close the gap and address the problems of the study. Towards the end, propositions for the elaboration of the draft flexZhouse BM are formulated.

The starting point of a successful BM lies in its value proposition: a product and service that the business can offer. In this case, it includes a customization option for the young starters, namely it offers services accompanied with bundles of products to satisfy the customer's growing desires and individuation needs. It is important to identify which services are offered and for which customers. For instance, people from different walks of life have different needs and desires. They, therefore, require different housing solutions. At present, customers have only standardized and monotonous housing designs to choose from. In this new BM, the flexZhouse will address the untapped and often ignored needs and offer customers packages that suit their

current needs and enable them to grow with the house through flexibility options. It will provide a new means of interaction at the beginning of the design chain and the idea of co-evolve with the layout. Nowadays, customers are more aware of their rights. In today's business, housing consumers appreciate better pre-sales, during sales and after-sales service from the service providers. In the housing industry, this challenges the housing developers to improve their customer relationship from time to time. The customers' desire for better services and the importance of feedback actually promote product improvement (Hofman, Halman, & Ion, 2006) In this case, the flexZhouse BM emphasizes the customer relationship with the company. This will help a company to have loyal customers and strengthen their business operation.

On the financial aspect, the flexZhouse BM focuses on revenue streams that grant someone the exclusive right to use the asset or the unit (house) for a certain duration in return for a payment. For the company, this gives them advantage on recurring payment from the customer. From the customer viewpoint, this could reduce commitment of ownership while having the benefits, but still enjoy the freedom to upgrade and downgrade services. The new BM suggests recurring income from leasing product and service and economy of scale. In terms of key activities, aside from the housing manufacturing, the flexZhouse BM will focus on physical asset management, including periodic maintenance and educating the resident on the proper use of the unit (house). The goal for the flexZhouse BM is to sustain the building materials by extending the lifespan of the product. Thus, it involves a penalty for misuse of the products and a reward for good users. In this new BM, it requires the total integration of business management operation from beginning of the off-site construction and assemble it in sequence on site. This will necessitate a change in the way of working, the structure, the needs and the timing, and will influence the cost structure for the customers.

The flexZhouse BM intends to appeal the young customers among others through the use of social medias and IT as part of its distribution channel. However, the IT field will require new knowledge for a company to operate it. For example, the company will need to introduce apps that can help the customer to customize the house design and pay the associated fees. Further, the new BM will require a big infrastructure for the system to operate, bigger spaces for stock storage, and different sets of physical resources and human resources. The manufacturer will need to provide sound resources to operate the manufacturing process and applies it in the construction. Firstly, such activities need a special manufacturing plant, advanced technology to produce the unit, truck or trailer to transport the unit to the site and off back to the factory, a crane to help install and remove the units from a site. In comparison to the current housing industry, the activities of the flexZhouse will mostly be carried out in the factory and involve off-site activities. Minimal on-site work will be necessary during the early development, which involves the construction of the main structure and the building's services. The manufacturer will now have a longer term commitment

to the users and a reason to build a better customer relationship. The flexZhouse BM demonstrates an effort to industrialize the housing industry and at the same time innovate the current housing industry by providing affordable housing, especially for young starters. The new way of working for the new BM needs supports from different parties through partnerships and to distribute the risks among its partners.

Table 3.5 summarizes the above in the shape of propositions for the flexZhouse BM. Table 3.6 summarizes the components of the framework that will be used to elaborate the flexZhouse BM in chapters 5, 6 and 7.

BM COMPONENT	GAP AND LIMITATIONS IN THE HOUSING INDUSTRY	PROPOSITIONS FOR FLEXZHOURSE
Value propositions (product & services)	Current housing industry does not provide customization at the point of sales. The customer is given only limited design choices. Renovation or modifications start only after the owner has obtained the house key.	Several design options, options to upgrade, modify, add and remove components of the house. Period to modify and change units of the house, preferably not too soon and not too long. Involvement of the users at the early design stage, consultation on the design, options to design using apps, or any software/ technology to help the customers over design choices.
Target customers (customers demographic)	Current housing provider provides one design fits all to its customers. No preference is given to different demographic	Several designs for various phases of life, not necessarily tailor-made, but a combination of standardized customization would be a good start i.e. single occupants, young couple, small family, etc.
Customer relationship (after-sales, maintenance)	Current housing developers provide customer services at the point of sales until delivery of the house. It normally stops after the defects liability period ends.	Focusing on physical asset management. Therefore, periodic maintenance is necessary to promote a healthy practice of product use. Penalty for misuse of the products and rewards for good use.
Key resources & channel (sustainability, operational)	Current housing developers produce homes on the site, create a lot of pollution, involve a long, tedious planning and authority submission.	Mobile units, infill structure, produced in the factory. Crane was used periodically to install and remove unit from the site.
Revenue & cost structure	Current housing only allows housing mortgage with a tenure of 30 years. Young starters normally could not afford to pay for the upfront deposit or the monthly commitment is burdensome due to the high price of the property.	Recurring money from leasing product and service and economy of scale. Options for transit house. Options for ownership for loyal customer. Capital fund for a real house.

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BM COMPONENT	GAP AND LIMITATIONS IN THE HOUSING INDUSTRY	PROPOSITIONS FOR FLEXZHOUSE
Key activities & partnership	Current housing developers rely on human skills, which sometimes result in poor workmanship and sub-standard construction quality. Late delivery is common and projects are sometimes abandoned due to insufficient funds.	Quality to produce similar with other manufacturing products. Quality control by skilled workers in the factory. Partnership with new vendors, sharing risks

TABLE 3.5 Gap and propositions for flexZhouse

CRITERIA	BM COMPONENTS	ANALYTICAL FRAMEWORK FOR DRAFT BM OF FLEXZHOUSE
Customization	Value propositions	Options for customization for young starters offers services accompanied with bundles of products, satisfying growing desires and individuation needs, i.e. single, double and premium units.
	Target customers	Offering different products for different customer segments; accommodate different needs at various stages of life; tailor-made rather than standardized; i.e. single person, married couple, non-commitment person.
	Customer relationship	Establishing a relationship and maintain it through better communication, providing dedicating customer representative, assisting in technical aspects and after-sales; i.e. 24-hour technical assistance.
Affordability	Revenue streams	Determining methods of payment from the customers, how much the customers want to pay for the house, and how would they prefer to pay for the goods and services offers by the manufacturer; i.e. monthly commitment should not exceed 3 times salary.
	Cost structure	Determining the cost of the product based on the investment in the key resources; value-driven companies to provide assistance for young starters rather than cost-driven; i.e. recurring leasing and ownership of the property.
	Key resources	Determining the type of resources required to operate this business; determine the physical, financial, intellectual or human resources needed to run the company; i.e. manufacturing plant, designers, engineers, technicians.

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CRITERIA	BM COMPONENTS	ANALYTICAL FRAMEWORK FOR DRAFT BM OF FLEXZHUSE
Supply chain	Partnership	Determining the partnerships required to operate the business, sharing and reduce risk and to acquire resources for the company; i.e. partnership with components suppliers (baths, windows, doors, etc.).
	Channels	Determining through which channels the customers want to be reached. Determining the way to raise awareness of the products, help customers evaluate the goods and services, help the customers to know about their products much better. i.e. establishing learning centre on the products, show units for marketing and education purposes.
	Key activities	Providing design consultation, financial advice, prefabricating housing unit in the factory, delivering the product to the site, assisting in relocation, leasing, selling goods and services; i.e. providing industrialized housing.

TABLE 3.6 Analytical framework for the flexZhouse BM



4 Formulation of draft flexZhouse business model

§ 4.1 Introduction

In the previous chapter, the concept of a business model (BM) was introduced, and a specific BM framework was developed for this research. The analytical framework was formulated based on the problems that derived from the study on the housing industry. The formulation of the new BM is supported by the idea of innovative leasing that challenged the way current industry works in practice.

In this chapter, the first draft of the flexZhouse BM is formulated. Its formulation is derived from theories that support 1) customization options, 2) scholar's views on affordability and 3) supporting literature on supply chain and production. We take the challenge and extend the idea from Till, Schneider, Jeremy, & Tatjana (2006) that flexible housing will be more economical in the long run (affordable), encourages tenant empowerment throughout the tenure (customization), and allows for greater exploitation of industrialization in its supply chain process (supply chain). The following question serves as a guide:

What are known approaches that may contribute to providing elements that could help to construct the flexZhouse BM?

§ 4.2 Theories to support the flexZhouse conceptual framework

Firstly, this section explores the solution that relates to customization that explains value propositions, target customers and the improvement of the customer relationship. Secondly, we look at the literature that supports the financial affordability for the customers through revenue streams, cost structure and the key resources needed. Thirdly, we dissect the hidden activities that can support the supply chain of the industrialized housing from the production perspective that entails the aspect of channels, key activities and partnership. Towards the end, the draft BM has been

formulated and acts as the conceptual framework of the thesis. The following table serves as a guidance for the theories that we will discuss onwards.

CRITERIA	BM COMPONENTS
Customization	Value propositions
	Target customers
	Customer relationship
Affordability	Revenue streams
	Cost structure
	Key resources
Supply chain (production)	Partnership
	Channels
	Key activities

TABLE 4.1 Criteria and related BM components

§ 4.2.1 Supporting theories on customization

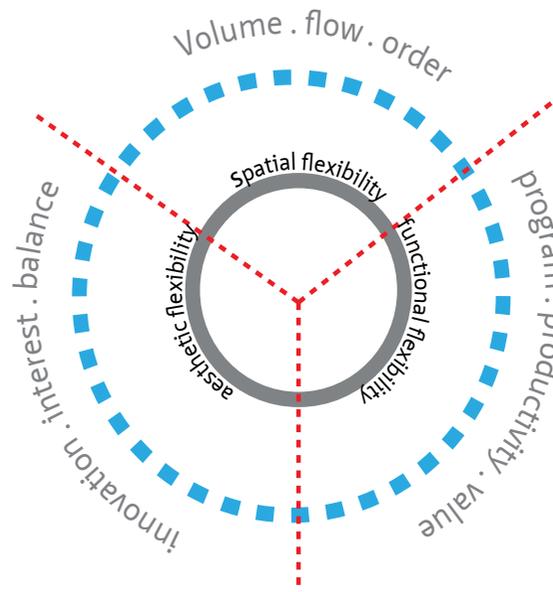


FIGURE 4.1 Integrative agility framework. Source: Sinclair et al., 2012

Sinclair, Mousazadeh, and Safarzadeh (2012) further noted that flexibility involves equilibrium towards the users, the design and the structure. Important aspects of flexibility following from Sinclair’s work include flexibility of the spatial configuration and the possibility co-evolve with the design; secondly, the flexibility of choosing different types of design and accessories for the aesthetic reason; and thirdly, the structure displays the flexibility of the structure through an advance mechanism that will utilize the technology today that has dramatically changed with the advancements in knowledge and sophisticated machines. In this sense, the structure could evolve as the needs increase in the future.

INTEGRATIVE AGILITY FRAMEWORK	
Spatial flexibility	The ability of the users to control space. The users have the power to configure the space the way they desire.
Aesthetic flexibility	It promotes a building with sense of character and quality of expression.
Functional flexibility	It allows different activities to unfold with a minimum amount of difficulty, demolition and disruption.

TABLE 4.2 Integrative agility framework. Source: Sinclair et al. (2012)

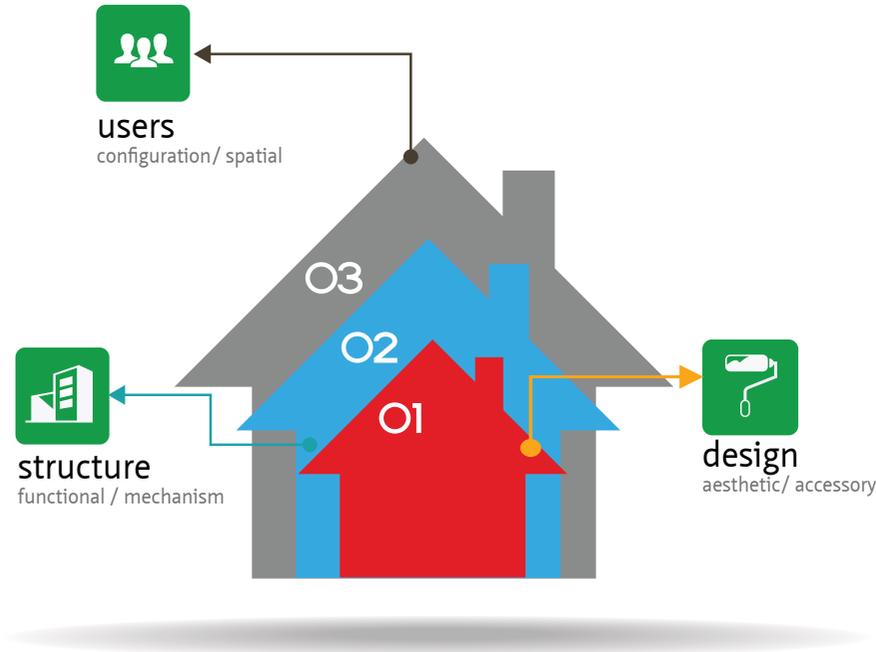


FIGURE 4.2 Support element for flexible housing. Adapted from: Sinclair et al., 2012

Further, Schneider and Till (2009) defined the flexible design in housing as something that 1) enables the layout to be changed according to the user's preferences, 2) has the potential to incorporate new technology, 3) can be adjusted according to the needs of users, 4) enables the use of the building to be improved or change the usage of the unit into something else. We added two additional criteria, namely that flexible housing should 5) be adaptable to the demographic changes from time to time and 6) be able to be relocated to other locations by 'adding' and 'removing' the components

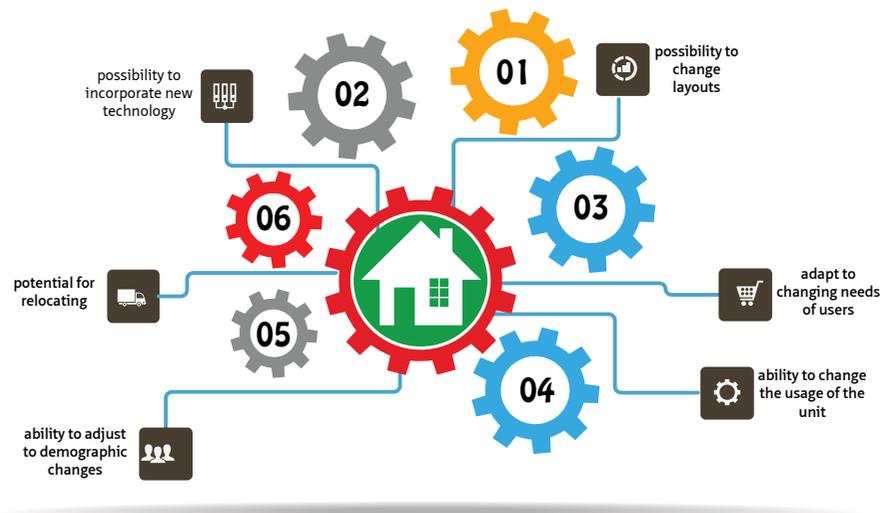


FIGURE 4.3 Characteristics of flexible housing

§ 4.2.1.1 Value propositions (customization option)

The idea of housing customization derives from the developing needs of the customers and to improve customer satisfaction by improving customer services. In Japan, the need for customization became apparent as early as the 1970s when customers started to disfavour standardization in housing design (Yashiro, 2014). Customers were given choices of housing types, floor plans, exterior elements, and interior finishes and fittings. In this context, customization can be defined as changing or allocating product and services according to the customer's needs and requirements (Schoenwitz, Gosling, Naim, & Potter, 2013; Schoenwitz, Naim, & Potter, 2012). In contrary, Malaysian mass housing industry offers pure standardization to its customers.

Customer is given a limited choices design and waiting for the house to be completed and delivered after the sales & purchase was signed.

We show some of the options available in the Japanese housing market as presented in Figure 4.4. The three companies selected by Barlow et al. (2003) show different approaches to delivering their products to their clients. The first company, Toyota Home, provides almost 2800 homes per year. It offers a broad range of assembled models with a standard and particular design or also called as 'segmented standardization'. The housing modules are designed and manufactured in a factory without customer input. The customers choose the type of house from a limited range of models prepared for them. The model was based on Toyota's car production system, whereby the final products are distributed to franchise dealers nationwide before being transported to the customer. This option is what we called standardization.

The second company, Sekisui Heim, supplied almost 20,000 homes every year (Furuse & Katano, 2006). This company adopted the 'customized standardization' approach whereby in the factory the houses are assembled to order, but the customer is allowed to choose from the available designs and options to customized their design before placing an order. This model is similar to that used by the manufacturers of personal computers. The advantage of customized standardization is a broader range of customers can be reached at the same time. Some clients favour standardization design to begin with, while others like to customize their house from the very beginning.

The next example is from Sekisui House, one of the companies in the Sekisui group. Sekisui House offers its customers a total user's customization tailor-made to the customer's requirements. This company offers a wider range of choices and designs as well as specifications, making it almost equivalent to the self-build housing, with the additional advantage that Sekisui House provides full technical support for its customers (Barlow et al., 2003; Johnson, 2007). In the Sekisui House model, housing production resembles manufacturing principles from the car production industry. From this perspective, the innovative architecture product is crucial in order to match its counterparts from manufacturing and delivers full customization according to the customer's needs (Gann, 1996).

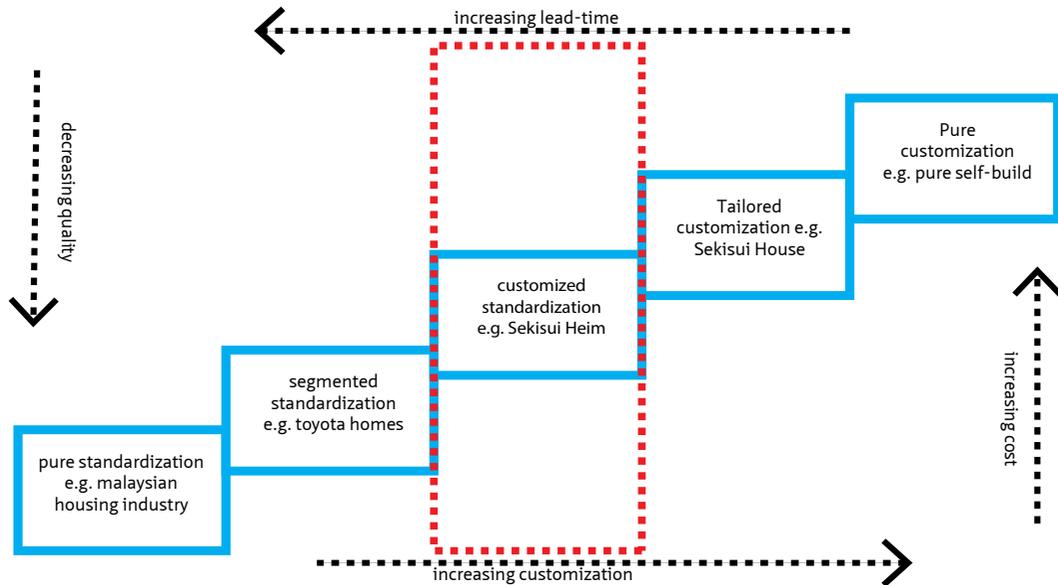


FIGURE 4.4 Customization versus standardization. Adapted from: Barlow et al., 2003

A survey conducted in Hong Kong showed that both public and private developers have opted for standardized layouts to avoid the price and economic issues related to fancy designs (Wong, 2010). However, Sullivan and Chen (1997) previously argued that the standard layouts prepared by the housing developers had caused more problems and was unable to satisfy the different needs of occupants or the housing buyers. Furthermore, (Wong, 2010) noted that the new occupants will end up making changes to their units after they get their house keys, and that this has led to the wastage of valuable resources, materials, energy, time and especially money and manpower. On the other hand, customization required more capital and a customer-oriented strategy. In terms of client access to design, this would require the housing supply to be changed radically.

As suggested by Schoenwitz et al. (2013), customization is not necessarily freedom of choice but rather choosing from given options. We note that the idea of customization involves higher construction costs thus make it not affordable for young starters in Malaysia. It is argued that offering too much choice can cause confusion rather than satisfaction. This is because housing is a complex product and comprises many elements and parts, and the risk of confusion is obvious (Barlow et al., 2003). Therefore, freedom is not necessarily good for customers. Schoenwitz et al. (2012) highlighted that the right degree of choice must be offered, and it is important to identify which elements are critical for the customers. It is important to determine the extent of the choices offered to the clients and to set clear boundaries.

The idea of flex house is to provide more options for customers to select the design based on multiple options and should provide the freedom to add or remove the housing components whenever needed. We suggest that the production of the unit be based on customized standardization. The value propositions will be ready for selection in the factory. However, the users will still have the ability to co-evolve and participate in the design.

§ 4.2.1.2 Target customer

The value proposition will determine the target group for the product and services offered by the company. The flexZhouse BM may require new or different types of customers. We know that Japanese prefabricated housing producers have always targeted high-income groups. The Japanese market has developed clever production methods and introduced aesthetics in the housing prefabrication production, thus responding to the consumer's demand for quality, but there has been less consideration regarding affordability (Noguchi, 2003).

According to Barlow et al. (2003), there is always a tendency for the customer to opt for certain basic standard design but to hope for individuation and customization. Borrowing the concept from other industries, the example of a personal computer and motor vehicle provides an example of how different needs of different target customers are processed and delivered. Depending on which groups are targeted, producing different value propositions could bring extra revenue for the company.

The beauty of the prefabricated concept is that the mass-customization has become necessary, and many industries have now begun to move towards a better level of customization by making use of economies of scale. In this new strategy, a company offers a menu-driven strategy, where consumers select features and additional items on top of basic parts (Barlow et al., 2003). Barlow et al. (2003) further argued that mass customization may cost more for the producers, but the value can be added to the product and services so that the customer relationship can be extended and thus improve the customer loyalty.

Introducing mass-customization under the flexZhouse BM might pose significant challenges for the new business. However, there is anecdotal evidence that there is a growing need for mass-customization and individuation in the housing market for middle-income groups in Malaysia (Daud, Hamzah, & Adnan, 2012). Therefore, the flexZhouse BM underpins the demands from the new customers in the market and therefore refined the present value propositions to its customers.

§ 4.2.1.3 Customer relationship

The move to improve customer relationships started earlier in such countries as the UK and Japan. We take examples from the UK and Japan concerning the need to improve customer relationships in the housing sector. The results of the National Customer Satisfaction Survey (2002) reported that 27% of UK new house owners were very satisfied, while 43% were 'fairly pleased' with the service provided by the housing provider. Only 18% of the respondents agreed to recommend their housing provider to another person (Barlow et al, 2003). In short, respondents in the UK reported relatively low satisfaction (60%) with after-sales performance. The survey reported that 81% of purchasers would like to be offered better choices regarding the initial design of their house and to have flexibility regarding the layout (Forum et al., 2002). In the UK, a certain group of housing providers have led the field in enabling customers' to customize the internal layout and fittings of their new housing (Barlow et al., 2003; Nicol & Hooper, 1999). Various researchers have found that more customer-centric approaches have become a priority in many industries (Itard & Meijer, 2008). Moreover, housing is the biggest investment that most people ever make. Home is a place for socializing, gathering and bonding activities among the family members. It is an investment of physical, psychological, social and financial at a lifetime (Forum et al., 2002). Hence, it should be built according to the need of the end users.

Japanese housing providers take just such an approach, investing in more hour with the customer before and also after sales period, thus developing a good relationship between provider and customer (Barlow et al., 2003). It has also been proven that satisfied customers' brand loyalty has a positive impact on business (Holm, 2000). The opportunity to enhance customer satisfaction and increase market share has become more popular lately (Zeithaml, Berry, & Parasuraman, 2012). And the viability of moving away from the conventional system, where housing developers purchase a plot of land and build a standardized design, has been demonstrated. At present, housing customers demand their rights and demand a unique style that reflects their lifestyle (Daud et al., 2012). Nowadays, the housing company needs to provide the most cost-effective service strategies for different customer groups (Lele, 1997).

At the moment, the way the housing industry works leads to a considerable amount of time elapsing between customer and housing provider communications (Cagamas Berhad, 2013). This makes customer's brand loyalty weaker (Barlow et al., 2003). However, Lele (1997) argued that after-sales could lead to extra costs for the manufacturer. Lele (ibid.) therefore suggested providing an after-sales service that sustains the viable advantage of the product by investing in technological improvements such as modularity and greater component reliability.

§ 4.2.1.4 Summary of customization (value propositions, target customers, and customer's relationship)

The uprising trends in the market has calls for a new housing BM that is focused on flexible housing solutions. The flexZhouse BM will provide products for different customers and needs. It calls for better after-sales to maintain a healthy relationship with the customers. Hence, in this section, we establish the following conceptual contribution for the new BM as follows:

- The customer will have multiple design options to choose from and have the freedom to change the exterior parts, interior elements and services that match their requirements and budget.
- The customer will be more active and participate at the beginning of the development and co-evolve the design.
- The customer will be able to change or modify (add or remove) certain components after a certain period of time.
- The services that come with the products from the company will improve the customer relationship and prolong the business of the company.

The flexZhouse provider should consider setting up several customer services as part of its marketing strategy to make maintenance work and after-sales activities more efficient and to improve service response time towards the customers. The flexZhouse after-sales services can be divided into three parts: product or design-oriented; focusing on service support system (e.g. reducing equipment repair time) and minimizing risk (e.g. through extended warranties). For instance, the quality assurance is necessary to achieve customer's satisfaction, and this will bring return customer especially in the housing industry where the market is a customer driven.

flexZhouse intended to address the lack of industrialized housing production in the mass housing industry. At present, customers are given few choices (standardized option). Although the government is providing more affordable housing for the middle-income group, a solution for mass customization has never been put forward. At present, the key players in the housing industry are resistant to change and will keep producing standardized designs and charging a premium price for a customized house. If a housing developer produces a high-quality house, the price will be increased and the buyers will be forced to pay it. This will make the house unaffordable for young starters. Therefore, re-establishing the connection between flexibility, affordability and building quality, as proposed in the flexZhouse BM, is necessary to promote an alternative affordable housing industry in Malaysia. flexZhouse promote flexibility in terms of providing designs for various phases of life, not necessarily tailor-made, but a combination of standardized customization would be a good start.

The flexZhouse model will extend the meaning of 'support' and 'infill' from Habraken and Valkenburg (1972). In terms of 'support', it means a base building that acts as the structure and in which the services of the building will be installed. The structure could be reinforced concrete (RC) or steel frame for a lightweight construction. The 'infill' comprises flexible units, which means a 'box' or a 'modular unit' (called a box frame in industrialized building system terminology). Each unit is produced using a steel frame structure and is fabricated in the factory. The shape is approximately that of a container but not necessarily the size of an ISO container. The infill will be available in different modular sizes. The process will start with customers selecting from a menu additional features or additional requirements to add to the basic unit or part. At this stage, the customer will be able to choose the type of exterior wall finishes, the type of bathrooms that suits their needs, the design of the kitchen, the size of the room and the finishes, and the layout of the windows according to their taste and preferences. The customer will have the option to add on module(s) if they wish. The process will then go into production, installations of units, site work and finally hand-over. The advantage of a module is it can be 'added' or 'removed' and even relocated.

§ 4.2.1.5 **Proposed solution no 1: mass customization (flexZhouse)**

The design brief called for an exploration of structure and infill concepts. Structure or the support could be made from RC (reinforced concrete) materials or steel structure. The building's services will be run through the structure and here, infill is defined as a modular box structure of a standard size. It can be added on and be dismantled. The box structure itself consists of columns and beams. Although the size were benefits from the size of the container, the design brief allows designers to use any size that is habitable and movable by the road (logistics).

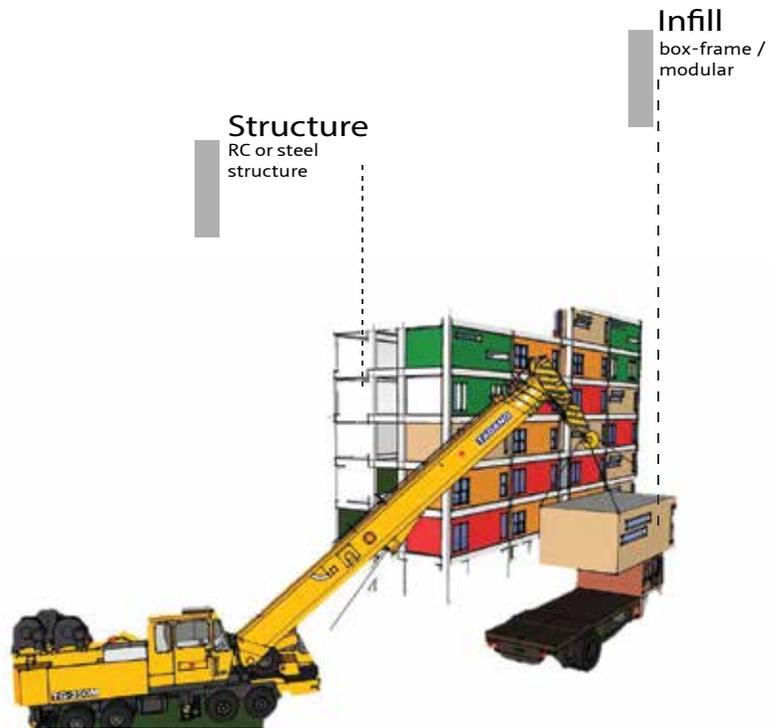


FIGURE 4.5 Conceptual idea of flexZhouse

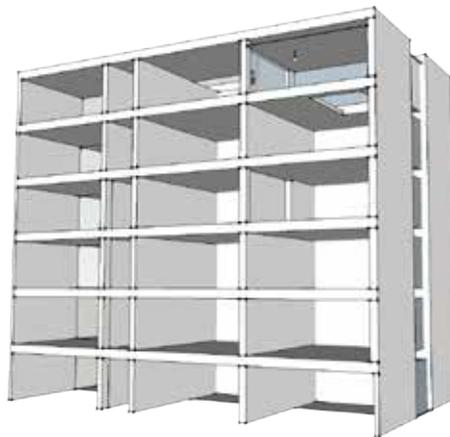


FIGURE 4.6 Conceptual image of the structure

Figure 4.5 show core area for the services and the support system, which combines the structural sub-system and the collective services. The principle of the open building for the new concept of flexZhouse was used to support the design. The structure acts as the platform for the services and utilities (water supply, sewerage, electricity and gas) connection to the infill. Figure 4.7 shows the infill (i.e. the prefabricated components of the dwelling) in place. The infill can be formulated based on one module. Later, the module can be added on horizontally or vertically. The infill design is subject to customer preferences and is designed for relocation.



FIGURE 4.7 The infill installed in the structure

The flexZhouse model requires the design brief to include a unit that can be easily relocated. The box or the components will be equipped with bedrooms, kitchen equipment complete with piping, bathroom with all necessary utilities and choices of bedroom designs.

The first idea to support the customizable options is to design a module/unit that is adaptable to current and future needs. The size of the module is similar in size to that of a normal container house with a cubic grid 3.5 m x 8.0 m (approximately 28 m²). This module is further arranged into several types, which include a studio unit (28 m²), a single unit with one bedroom (28 m²) and two extended units, namely a double unit (56 m²) and a duplex unit (56 m²) with subdivided floor with a staircase as part of the circulation area. The interior of the unit is further divided into several basic parts, which include bedroom, bathroom, choice of kitchen type, living area and choice of balcony.



FIGURE 4.8 Conceptual design for flexZhouse

The proposed flexZhouse arose from the idea of 'open building' with 'flexible infill' with the flexibility of the unit or infill to fill the spaces between two load bearing columns within the unit. In this module, the notion of empowerment is reflected in the choices of the infill and the spaces inside the unit. The unit will allow users to take control of their own design during the design stage. This is a way to support the idea of involving the user at the beginning of the design development chain and promote interaction, participate and co-evolve with the layout (Schneider & Till, 2005). The flexibility of the infill is the capability to be produced systematically in the factory and designed for ease of assembly and disassembly.

Although the proposed model benefits from container technology, they are not necessarily shipping containers. Each module will be developed and manufactured according to the client's requirements in terms of number of rooms, internal fit-out and external façade (based on standardized dimensions and structure). In this system, the user will be able to change the design after an agreed period of time. In terms of the sequence, the customer will place the order at the factory after choosing from the available designs and customizing the internal and external features. The rent will then be determined, after both parties have agreed to the terms and conditions. At an agreed time, the unit will be transported to the site and the user moves in. After a certain time (e.g. 18 months) as per conditions agreed in the contract, the user will be able to change both the inside and the outside of the unit. The new unit will be transported to the site and replace the old one, which will be taken back to the manufacturer's to be upgraded or downgraded.

For this concept to work, the factory should be located to support the transport of the module from manufacturing facility to the allocated site. The initial idea shows the notion of the structure is determined by a very basic RC (reinforced concrete) structure with the support of RC slab with metal rail to assist the installation of the unit into the 'slot.' Traditionally, people move to a new place when their personal needs change over time, but with this concept, the idea of growing and shrinking with the same spaces is possible with the support of the manufacturing strategy. The idea of this flexible dwelling is that it can be transported using trailers, and assembled in one day. The flexibility of the unit allows the user to change the interior and exterior façade of the house according to own preferences. It is argued that it is unlikely that the flexibility of the house would depress the housing market and limit the continuing sales of housing. This is because leasing the unit and allowing changes to be made to it will prolong the lifecycle of the units and provide continuous investment for the developers.

This thesis has presented a conceptual design for the flexZhouse. A future study could look into details concerning the construction of the products and further clarify the technology that is available on the market, especially mechanisms for sliding the units in and out of the structure. Further study on the technical aspects of the products will help in terms of finalizing the production costs and the price of the unit to be sold on the market. The flexZhouse requires strong technology support. New skills require technology transfer from other countries. Awareness on the new technology and training should be given as part of the development of skilled and semi-skilled workers to operate the new BM. Given the current technology in the IBS (industrialized building system) in Malaysia, the flexZhouse will need a new paradigm to shorten the supply chain cycle. Lessons learnt from Japanese house builders on key resources are necessary to support the flexZhouse.

The proposed flexZhouse was inspired by the concepts of 'open building' Habraken (2003) and 'flexible infill', that is, the flexibility of the unit or infill to fill the spaces between two load bearing columns within the space of a unit. In this module, the notion of empowerment is reflected in the choices of the infill and the spaces inside the unit. The unit will allow users to take control of their own design during the design stage. This is a way to support the idea of involving the user at the beginning of the design development chain to promote interaction, participation and co-evolution with the layout (Schneider & Till, 2005). The infill is also flexible in that it can be produced systematically in the factory and is designed for ease of assembly and disassembly. The analogy of the open building for the new concept of flexZhouse was used to support the design. The structure acts as the platform for the services (electrical, etc.), utilities (water supply and sewerage) connection to the infill. The infill is the components of the house mainly presumed to be factory made and managed by the manufacturers. It can be formulated based on one module. Later, the module can be added to horizontally or vertically. The infill design is subject to customer preferences and is designed for relocation. In this strategy, the infill unit will have a

longer time span approximately 30 - 50 years (since it made from durable and quality materials) compared to existing mass housing solution. Longer time span also means the company able to generate more revenues and at the same time reduce the price of ownership to the end users. The structure according to concept of open building from Habraken (2003) must have longer lifetime for up to 100- 200 years. Similarly, in the case of flexZhouse, The support is made from either precast pre-stressed concrete members or pre-engineered steel-exoskeleton to extend its service life. The nature of skeleton can also be added according to new demands in the future. Since the skeleton and the infill is independent, it is very easy to remanufacture, refurbish and renew the infill components according to new needs and different lifestyle. The nature of skeleton can also be added according to new demands in the future. The infill also allocates the main services such as piping, ducts and cables. Examples can be seen from open building in Kanto area in Japan as mentioned by Yashiro (n.d.). Moving out could also means moving to a different complex, a different flexZhouse project or an independent location. By developing the same housing complex in other locations could increase the production and expand the possibility for new occupants in different complexes.

Idea of open Building

Skelton/Support

- Use of 100 to 200 years
- Requires continual engineering assessment report based on monitoring

Infill

- Private property exchangeable respecting on ever changing requirement

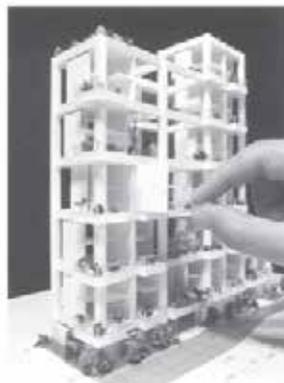


FIGURE 4.9 Open building concept by Yashiro inspired by Nakazato: Source: Yashiro (n.d)

Three aspects that involve technical capability and technology were discussed concerning the appropriateness and the type of facilities that are suitable for the flexZhouse (technical aspects, available technology and mechanisms). In the example above, the double edge flat truck provides one-piece construction with built in parallelism. Below, the HDS2 system contains all the major components to produce

high capacity gantry systems. The extreme rigidity of the construction beams allows for long unsupported spans up to 6m depending on the load. This system will be best to use as part of the module and to be integrated with the frame therefore saving weight and cost.



FIGURE 4.10 Double edge flat track. Source: HepcoMotion



FIGURE 4.11 Assembled beams with carriages. Source: HepcoMotion

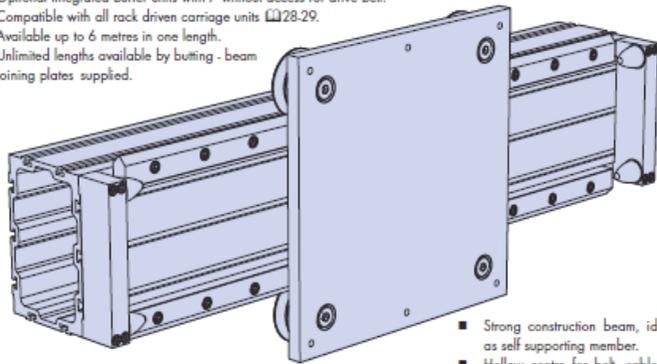
The heavy duty slide system available as assembled units or in component form, providing maximum flexibility of design. The system can accommodate up to 68 kN. The slides and tracks available in one piece up to 4 metres long, saves on assembly time. The long lengths comprising replaceable segments, reduces downtime in the event of damage.



FIGURE 4.12 Heavy duty slide system by HepcoMotion. Source: HepcoMotion

Assembled Beams with Carriages □26-27

- Fully assembled factory built beam with ready adjusted carriage.
- Available for all opposing corner mounted V slide options for all sizes of beam.
- Optional integrated buffer units with / without access for drive belt.
- Compatible with all rack driven carriage units □28-29.
- Available up to 6 metres in one length.
- Unlimited lengths available by butting - beam joining plates supplied.



- Strong construction beam, ideal as self supporting member.
- Hollow centre for belt, cable or

FIGURE 4.13 Heavy duty slide system specification by HepcoMotion. Source: HepcoMotion

As mentioned, this research just provides a guideline about the new technology and how it can support the flexZhouse. It will be important in future studies to discuss such aspects as the type of machines, equipment, infrastructures and mechanisms that will be required to operate flexZhouse BM. Attention should be paid to novel techniques in the new system. The market must be aware of the new technology and how it can improve the existing problems to create a market that continues to support the new BM.

In term of the lifetime circle differences between living modules and primary structures is according to open building concept proposed by Nakazato (Yashiro n.d.). By following the concept, the lifetime circle of the skeleton and the lifetime of the infrastructure of the building can be maintained on a long-term basis, while the infill itself can be expanded since the unit already supported by services and can be standalone and transferred to a new place without the need of the primary structure.

Sinclair, Mousazadeh, and Safarzadeh (2012) further noted that flexibility involves equilibrium towards the users, the design and the structure. Important aspects of flexibility following from Sinclair's work include flexibility of the spatial configuration and the possibility co-evolve with the design; secondly, the flexibility of choosing different types of design and accessories for the aesthetic reason; and thirdly, the structure displays the flexibility of the structure through an advance mechanism that will utilize the technology today that has dramatically changed with the advancements in knowledge and sophisticated machines. In this sense, the structure could evolve as the needs increase in the future.

The flexZhouse model will extend the meaning of 'support' and 'infill' from Habraken and Valkenburg (1972). In terms of 'support', it means a base building that acts as the structure and in which the services of the building will be installed. The structure could be reinforced concrete (RC) or steel frame for a lightweight construction. The 'infill' comprises flexible units, which means a 'box' or a 'modular unit' (called a box frame in industrialized building system terminology). Each unit is produced using a steel frame structure and is fabricated in the factory. The shape is approximately that of a container but not necessarily the size of an ISO container. The infill will be available in different modular sizes. The process will start with customers selecting from a menu additional features or additional requirements to add to the basic unit or part. At this stage, the customer will be able to choose the type of exterior wall finishes, the type of bathrooms that suits their needs, the design of the kitchen, the size of the room and the finishes, and the layout of the windows according to their taste and preferences. The customer will have the option to add on module(s) if they wish. The process will then go into production, installations of units, site work and finally hand-over. The advantage of a module is it can be 'added' or 'removed' and even relocated.

In the following illustration, the elaborate explanation of the flexZhouse along its lifecycle is discussed.



FIGURE 4.14 Sample of packages offer by the company

For example, Ronald, 24 years old, single, engineer, chooses package 1. During the design process, he chooses his own furniture from the options offered to him by the manufacturer. He changes the exterior façade of the unit and the type of windows. After the cost of the customization has been calculated, he agrees with the leasing price of the unit with a minimum tenure of 12 months. Later, he gets a new job in a new place, and he decides to move out after 18 months. He returns the components to the manufacturer for refurbishment.

Alice, 28 years old, single, lawyer, chooses package 2. She changes the furniture and the façade of the unit according to her needs. She signs the contract with the company and, after 18 months, upgraded the components of the house. However, due to certain changes in her life, she decides to move out after 24 months. All the units are returned to the factory for remodeling and refurbishment for the next customer.

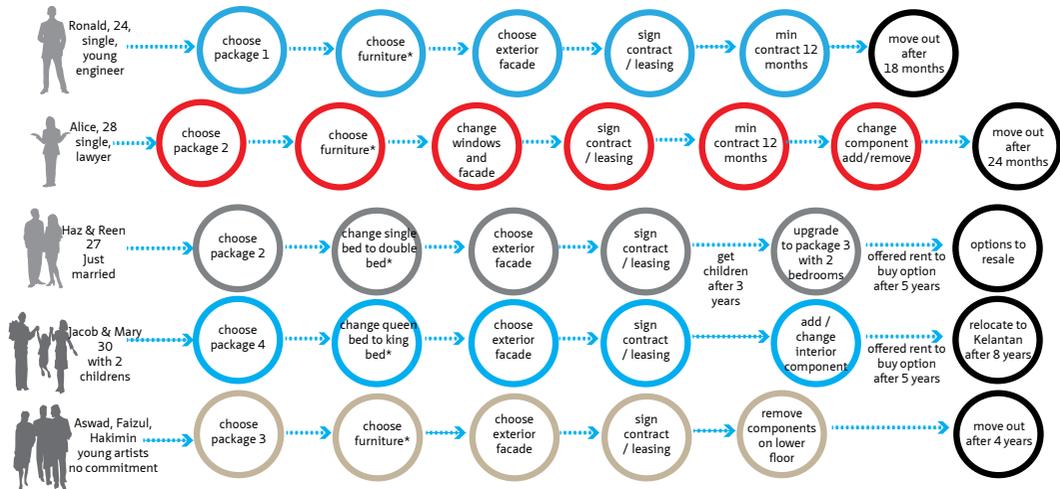


FIGURE 4.15 Illustration of flexZhouse business offerings 1

In the third case, Haz and Reen, both 27, newly married couple, are initially interested in package number 2, but change the furniture in the bedroom to double bed instead of single. They amend the exterior façade and sign the contract. Three years later, they have children and decide to upgrade the module to package 3, which has additional bedrooms. After 5 years they are entitled to a loyalty programme, which gives them the option to buy the units from the manufacturer. The cost of the unit depends on the market price and additional discount from the company.

The fourth case illustrates the flexible house and the ability to be relocated to different places. After 5 years, the couple decide to buy the unit and relocate to a different location that has the same structure run by the same company.

In the final scenario, the users decide to change the unit into an art gallery and to use only the upper floor for accommodation. The flexibility of the building allows the users to modify the usage of the unit according to their future plans.

§ 4.2.2 Supporting theories on affordability (financial)

It is argued that the customization of housing will lead to higher housing costs and make housing too expensive for young starters. Therefore, the idea of Stahel (2005) to focus sales into intellectual asset management, physical asset management and

to enable the manufacturer to increase revenues without jeopardizing resources and waste will be introduced. The key point is to provide flexible payment, to allow young starters in Malaysia access to housing without an excessively large commitment and financial burden.

§ 4.2.2.1 Revenue streams

The innovative leasing is described as the customer choices on the products and services that suit their current financial situation. Based on the circular economy principle of MacArthur (2013) and Stahel (2008), the flexZhouse BM focuses on leasing the housing components and services that enable the manufacturer to retain ownership of the housing components and resources and thus contribute to its own future resource supply. In the case of flexZhouse, the housing module is expected to adopt a remanufacturing strategy and can be upgraded based on recent technology. The technology also allows the innovation that can longer the lifespan of the housing module. Further, the sustainable concerns are making a debut in the construction industry in general and towards housing industry specifically.

As mentioned in section 2.4.1, housing tenure in Malaysia is either renting or ownership. We therefore looked into forms of tenure in other countries to learn about the choices of housing tenures and the reason for their inclusion. Based on a report by (Scanlon & Whitehead 2011), in several countries in parts of Europe, the USA and Asia, homeownership is the most common form of tenure in all countries except Germany. The numbers seem to be increasing, but decreasing trends were also observed and generally reflect the cyclical changes in the housing market. The report found that the proportions of young starters buying a house are sometimes stable but often fall by quite significant amounts. The main reason that young starters are not buying properties is affordability. Given that interest rates have decreased in most countries, affordability problems normally associated with higher house prices in the market (Zairul, 2013).

Several countries have introduced policies to help first-time home buyers (Australia, UK, USA) and some rely on the help of other family members (Denmark, Netherlands) (Gruis et al., 2005, Scanlon et al., 2011). Nevertheless, some lessons learnt from the home ownership choices is probably because limited choices in the present mass housing options in Malaysia. In the USA, several schemes give fair access to reduced mortgage interest rates, such as a series of equity sharing models by providing community land trusts, cooperatively owned housing and fairness loans (Scanlon et al., 2011). In Spain, equity share schemes are prevalent, providing two forms of subsidized home ownership: VPO (Vivienda de Proteccion Oficial; 'officially protected housing') and VPT (Vivienda a Precio Tasado; 'controlled price housing') (Scanlon et al., 2011). In Australia, there are several models of leasing using equity loans/mortgages,

shared ownership and subsidy retention models. In the Netherlands, there are almost similar hybrid forms of sale, namely Koopgarant, Koop Goedkoop and Sociale Koop (Kramer, 2008; Economic Planning Unit, 2010). In several countries (e.g. Japan and the USA), home ownership has generally become cheaper in comparison to renting, mainly because of lower nominal interest (Chambers, Garriga, & Schlagenhauf, 2009). Reporting on future of tenure patterns, Scanlon et al. (2011) wrote that in the short term, and particularly in Europe, the housing market would be shaped by the relatively stable conditions of the previous few years, which would lead to lower prices and thus enable young starters to enter the housing market.

In many countries, social renting is the most affordable form of tenure for all income earners. For young starters, private renting is less expensive than home ownership, but this is not always the case in Malaysia, especially when the property is located in a prime area. Landlords buy properties with mortgage repayments of RM 500 a month, then rent them to tenants for RM 700–800, especially in areas that have good transport networks. The discriminatory practices in home mortgage lending make it difficult for young starters to obtain an appropriate mortgage product that suits their current income and leaves them with no choice but to rent.

According to a recent survey conducted by an independent body in Malaysia (Numbeo, 2014), the price to rent ratio in Selangor and Johor Bahru has increased between 20% to 35% particularly in the city centre, this is worsened by the fact that the price to income ratio has increased from 8 to 13 times for Selangor and Johor Bahru, respectively. The following index gives the current figures of the housing index in three big cities in Malaysia (Selangor, Penang & Johor Bahru).

INDEX	SELANGOR	PENANG	JOHOR BAHRU
Price to income ratio	6.18	8.74	13.70
Mortgage as percentage of income	47.73%	65.06%	114.45%
Loan affordability index	2.09	1.54	0.87
Price to Rent ratio- city centre	25.00	21.71	36.62
Price to rent ratio – outside city	20.28	41.94	27.20

TABLE 4.3 Housing price index in three big cities in Malaysia (numbeo, 2015)

In the UK and Finland, ‘intermediate tenure’ was established to close the gap between ownership and renting (Scanlon et al., 2011). For example, in the 1990s, a hybrid ownership rental tenure was created, using a model first devised in Sweden. Under this term, the tenant pays 10–15% of the market value of the property and then monthly fees for using the property, which cover the capital and the maintenance costs (Scanlon et al., 2011). The basic idea is that as long as tenants meet the regulations, landlord cannot evict them. The construction is mostly state subsidized. The right of occupancy

can be sold to a third party at a regulated price determined by construction costs (Priemus, 2010; Scanlon et al., 2011).

TENURE	DESCRIPTION	TRANSFERRED OR PROPERTY RIGHTS CONCERNED	OWNERS USERS PERCENTAGE RIGHTS	COUNTRY (EXAMPLES)
Fixed rent	Rent higher but is fixed for 5-10 years	Rent setting	100:0	Netherlands
Fixed rent increase	Rent increase is fixed for an extended period	Rent setting	100:0	Netherlands
Living long and comfortably	Longer stays for a tenant with the options of a limited number of free improvements to their house (kitchen, insulation, etc.).	Limited options for interior maintenance	50:50	Netherlands
Guaranteed rent	Rent increase is fixed for 10 years; in return, tenant is responsible for interior maintenance	Interior maintenance and rent setting	50:50	Netherlands
Self-maintenance property	Lower rent but tenant fully responsible for interior maintenance	Interior maintenance and rent setting	50:50	Netherlands
'Shell and interior' scheme	Tenant purchases the interior structure but rents the structure of the property	Interior maintenance, economic ownership of the inside of the dwelling	50:50	Netherlands
Socially-bound ownership	Tenant can buy the dwelling at a discount on the market value on condition that they resell their dwelling at turnover to the landlord at the same discount (and share profit and loss)	Maintenance, economical with limited (positive and negative) risk	50:50	Netherlands
Growing ownership (shared ownership)	Tenant makes an increasing payment for ownership	Initially 50% economic ownership, growing each year according to tenants' payments	50:50	Netherlands
Ownership with buy-back option	Tenant can buy the property under the condition that the dwelling in first offered to the landlord at turnover	Full transfer of property rights except conditional sale restriction	50:50	Netherlands
Insured ownership	Tenant can buy the property with protective conditions against decrease in value	All property rights except conditions for sale concerning price and future buyer	50:50	Netherlands
Discounted ownership	Tenant can buy the dwelling at discount on market value	All property rights, but sometimes conditions are set to prevent speculation; the discount has to be paid back if the property is sold, mostly within a set period	50:50	Netherlands
Built then sell (BTS)	Buyer pays 10% deposit and remaining 90% after the completion of house construction	All property rights, but with higher margins of interest from the bank Normally the price will get higher due to valuation price	0:100	Malaysia

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TENURE	DESCRIPTION	TRANSFERRED OR PROPERTY RIGHTS CONCERNED	OWNERS USERS PERCENTAGE RIGHTS	COUNTRY (EXAMPLES)
Ownership (unfurnished) / Sell than build (STB)	Buyer pays 10% deposit plus interest during construction period. Property normally unfurnished but with basic sanitary fittings and electrical fixtures	100% ownership but with optional of leasehold or freehold property	0:100	Malaysia
Ownership (fully-furnished)/ (serviced)	Property normally is high end at prime location and equipped with furniture and additional services & amenities (swimming pool, gym, etc.)	100% ownership but with optional of leasehold or freehold Additional payment for maintenance of the facilities available	0:100	Malaysia
Rental (unfurnished)	Rent normally fixed for a period of contract	Rent setting	100:0	Malaysia
Rental (fully-furnished)	Rent depends on the type the property and its location	Services and facilities maintenance and rent setting	100:0	Malaysia
Government Quarters	Rent depends on the type of property and its location Mostly subsidized by the government, lower rental rate in the market	No options for renovation, basic options for maintenance with rent setting	100:0	Malaysia
Low-cost housing	Basic construction normally not larger than 1000 sq. ft. selling under the jurisdiction of state government or private residential developers	100% ownership	0:100	Malaysia
Low-cost housing (rental)	Renting for low-income earners with a very minimum rent	Rent setting	100:0	Malaysia
Shared equity ownership	Government or non-profit agency invests substantial public funds in reducing price of purchasing home	Contractual limit on their equity appreciation and homeowner normally walk out with an average 25% of gain	50:50	USA
VPO housing	House subsidized by government, can therefore only be sold when determined by government, subject to 20-year qualification period	Normally after the qualification period ends, the house can be sold at market prices	0:100	Spain
VPT housing	The price of the medium-cost housing will be lower than market price but higher than VPO housing	A lock-in period of 5 years; if less than that, the purchaser needs to return the amount of subsidies for the earlier price difference	0:100	Spain
Shared ownership models	Purchaser buys share of the property and rents the other share	Partial ownership with limitation of modifications until purchaser is able to fund entire property	50:50	UK

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TENURE	DESCRIPTION	TRANSFERRED OR PROPERTY RIGHTS CONCERNED	OWNERS USERS PERCENTAGE RIGHTS	COUNTRY (EXAMPLES)
Shared equity models	Purchaser buys the title of the home using an equity loan from a housing association, finance institutions fund the part they cannot afford	Partial ownership until purchaser is able to fund the other part	50:50	UK
Hybrid ownership rental	Purchaser pays 10–15% of the market value and then pays monthly fees to cover capital and maintenance costs	The right of occupancy is sold at a regulated price determined by the construction costs	50:50	Finland
Social owner-occupied stock	Purchaser buys house at cost price	House can only be sold back to the municipality, and it has the obligation to buy it back	50:50	Iceland
Shared home ownership	Purchaser buys percentage of the property (normally 70%) and the agent holds the rest (normally 30%)	Purchaser can sell the property back to the agent at any time, but the price will depend on the then-current market value of the share in the property and subject to any capital increment to the property Improvements to the property are allowed only with the approval of the agent	50:50	Australia

TABLE 4.4 Summary of type of tenure. Adapted from: (Gruis et al., 2005 & Scanlon et al., 2011)

Take, for example, the Netherlands. The innovative tenures were available as early as the 1980s and 1990s. Housing associations have already established several tenure improvements, for instance fixed-rent contracts, tenant maintenance programmes and different forms of sale with a discount and risk-reducing conditions (Gruis, Elsinga, Wolters, & Priemus, 2005). We found interesting schemes reported in the innovations made by the *WoonbronMaasovers* (a large housing association managing 35,000 dwellings in the Rotterdam region), which offered the full ownership, part ownership and normal traditional rent (Gruis, et al., 2005). The other interesting features of the housing policy in the Netherlands is that the housing players can offer different tenures according to their own preferences and without any restrictions from the governments, except that the tenures must be operated in the full interest of the consumers with stipulated regulations under the Social Rented Sector Management (BBSH) (Gruis et al., 2005).

Table 4.4 shows how property is offered to tenants in the form of several innovative packages. Although the tenants are offered several options that lead to ownership, the landlord is usually responsible for maintaining the exterior of the property and has the right to buy the dwelling (with certain conditions agreed) from the tenants should they choose to move out. In other words, tenants are still subject to some restrictions on

modifications and renovation. Although there are several innovations in the forms of tenure offered by the housing association, users still have little freedom when it comes to customizing their housing. This is mainly caused by the inflexibility of the current housing typology.

However, the study of *WoonbronMaasaevers* did not mention what the demographics of those who chose the individual options offered by the housing association. Some of the choices – especially the fixed rent contract, fixed increase contract and traditional rent contract, – have made it possible for the association to increase the rent to the limit set by the authorities, or fixed within the agreed period of between 5 to 10 years. Meanwhile, for the socially-bound ownership, tenants are given the option to purchase the property at a 25% discounted rate from the existing market price, however with the condition that the property must be sold back to the association for the same price and be subject to shared profit and loss. The next option – the buy-back option – requires tenants who decide to move out, to offer to sell the property to the landlord first, but it is not mandatory for the landlord to buy back the property. But the growing ownership option is normally without discounted price. In the following Table 4, we show some of the tenures available across countries with the options of renting or buying the properties.

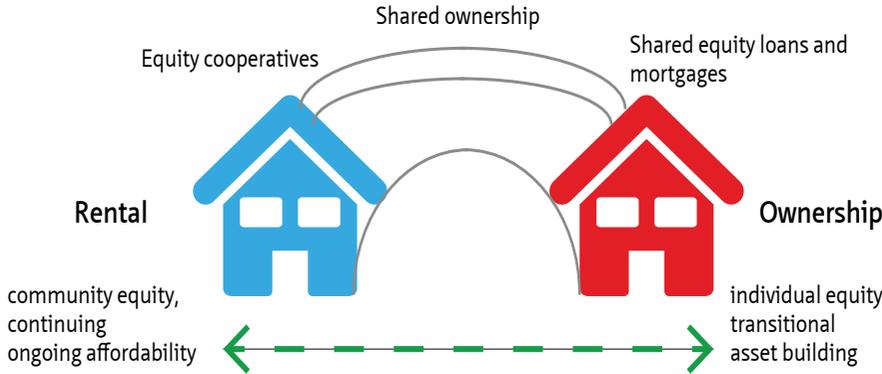


FIGURE 4.16 Shared equity approaches. Adapted from: (MacDonald, 2013)

TYPE OF TENURE	NAME OF TENURE	EXAMPLES OF COUNTRY(S)
Full ownership (0:100)	PrIMA	Malaysia
	Ownership (fully-furnished / serviced)	Malaysia
	VPT housing	Spain
Full rental (100:0)	Rental (unfurnished)	All
	Rental (fully-furnished)	All
	Government quarters	Malaysia
	Rental (unfurnished)	All
	Government quarters	Malaysia
	Low-cost housing (rental)	All
	Fixed rent	Netherlands
	Fixed rent increase	Netherlands
Hybrid model (50:50)	Ownership with buy-back option	Netherlands
	Insured ownership	Netherlands
	Discounted ownership	Netherlands
	Shared equity models	UK
	Hybrid ownership rental	Finland
	Shared ownership model	UK
	Social owner-occupied stock	Iceland
	Shared home ownership	Australia
	Shared equity ownership	USA
	Penang's shared Ownership Scheme	Malaysia
Rent-to-Own	UK, Malaysia, Australia, USA	

TABLE 4.5 Summary of example tenure offers in different countries

The concept of shared ownership has raised several questions and, at least in the UK, is poorly understood (Abidin, Yusof, & Othman, 2013). The concept argues the expectation of the customers in terms of restraints imposed by the landlord. The question is, how do the hybrid models of renting and ownership fulfill the satisfactions of the customers? Will the current model of hybrid tenures meet user's growing needs and at the same time reduce the price of consumption?

§ 4.2.2.2 Cost structure

The basis for the cost structure of the products that will be offered is the resources needed to operate the business and a partnership with other companies. By this simple concept, the cost structure for the flexZhouse relies on the value propositions, partnership and resources used to operate the business. The adoption of an industrialized strategy in the housing industry will change the process of normal construction. Therefore, this change

will impose a substantially different cost structure in comparison to the conventional housing. Based on the revenue and innovative leasing in the previous section, the flexZhouse will introduce the closed loop system for construction materials to reduce the operational cost by recycling and remanufacturing the housing components.

The idea of innovative leasing is, therefore, crucial for the formulation of affordable flexZhouse. The value configuration is closely related to other business elements. Changes in the value propositions lead to changes in the lifecycle cost and also impact the cost structure of the products (Mokhlesian & Holmén, 2012). flexZhouse may require completely different activities, partnerships and resources compared to the present housing industry. As a result, the new BM might cost the housing manufacturer more due to its infancy. Therefore, a new strategy that involves circular economy and closing the loop by optimizing the remanufacturing of the components could be the solution to the problem.

The increasing popularity of the circular economy and sustainable construction in the housing industry might give an edge to flexZhouse to operate in the industry. However, the new BM will need support from partners and perhaps the government to realize it. The reconfiguration and remanufacturing of the components is an underpinning process for the flexZhouse BM. Take Ricoh as an example. Ricoh has adopted a long-term strategic approach to address sustainability issues and reduce prices by cutting resource consumption. Under its resource conservation programme, Ricoh pledges to reduce its operational impact through zero waste to landfill. The waste is now decoupled from turnover, and thus tons of waste to landfill has improved by 77%. Another strategy is to remanufacture existing products. Remanufactured products include photocopy machines, toners and printers. In the case of remanufactured machines, the old machine is stripped to its chassis and all parts are replaced and all panels are resprayed. Next, the firmware and software are modified, and then the product is completely rebranded and sold as a new product. The quality control ensures that the remanufactured products are indeed as new as new products. This has extended the lifecycle and provided the sustainable loop of the products (Ricoh, 2015). In terms of revenue, the company generates its income by reducing the consumption of resources through the remanufacturing process. The products are built to last longer and to create longer lifespan products.

In the case of Philips promises to support sustainable business by integrating its operation of activities from linear production into the circular economy. The company aims to decouple economic growth from the use of natural resources. According to its new BM, the company promotes the selling of light as a service rather than the product itself. In terms of cost structure, the company pricetag is based on how many units of light are used rather than the consumption of the light itself. The key characteristics of the new BM involve the changing of ownership from the customers to the manufacturers. The customers pay for light as service and thus change the previous

transactions into a relationship via a services and solution model (Frans van Houten, 2014). To support this, all Philips models are now designed for disassembly and serviceability. This helps the company to maintain its assets through the refurbishing and remanufacturing of the products instead of building from scratch. Philips provides free service and maintenance of its products to ensure that their lifespans are secured.

Nevertheless, the uncertainty caused by the immaturity of the new BM is a concern, as it may lead to extra costs for either the manufacturers or the partners. However, there are ways to ensure the cost structure could provide customers with affordable prices. One way is to determine the economies of scale and the economies of scope. The cost of producing the components is expected to be reduced by the introduction of the circular economy and innovative leasing. In this new strategy, the customer leases the components for a certain period and is only allowed to buy the units after a moratorium period. Because of this, the high costs of the production could be prolonged, and the manufacturer will benefit from the leasing fees and the customers will save on the cost of ownership.

§ 4.2.2.3 Key resources

The affordability of the cost structure will be very much related to the arrangement of activities and resources, which means it will determine the price of the products. The new BM needs to change completely its way of working to match the circular economy principles. This is important because one of the factors driving the higher cost of conventional construction is the depletion of natural resources, which leads to increasing prices for cement, steel and other construction materials (Begum, Siwar, Pereira, & Jaafar, 2006). The concept of the circular economy includes reducing resource input by increasing stock and implementing the remanufacturing process.

The key resources will be improved human resources and new equipment. However, the investment returns is still undetermined (Amit & Zott, 2012). A lesson learnt from the Japanese housing builder is that resources play the main role in the production line. The investment by the Japanese housing builders contributed to a big manufacturing plant, show houses and a learning centre for the buyers. In these markets, companies such as Sekisui House, Sekisui Heim, and Toyota build their industries on the provision of specialized technical skills of skilled workers (Gann, 1996).

§ 4.2.2.4 **Summary of affordability (revenue streams, cost structure and key resources)**

Considering the innovative leasing available in the current market in various parts of the world, the flexZhouse BM will be a hybrid model that provides both the owner and the customer with advantages. It will allow the customer to lease the unit with flexible payments and to be free to customize the unit.

Therefore, we suggest that the flexZhouse BM deal with the lifespan of the product, management and operationalized system, the design stage and the maintenance aspect of the product. In a nutshell, the flexZhouse BM approach will support flexible housing by providing a sustainable BM to close the loop in contrast to the current linear process of production.

The flexZhouse BM with innovative leasing will adopt the idea of open building and infill derived from (Habraken, 2003; Habraken & Teicher, 2000; Habraken & Valkenburg, 1972); Schneider and Till (2007) and identify the multiple elements that are essential to support the idea of innovative leasing inspired by the circular economy from MacArthur (2013). The novelty of flexZhouse for the housing industry is to create the longest possible lifespan with the highest potential use of value and at the same reduce the dependence on material resources and energy as much as possible. Hence, this section summarizes the potential of innovative leasing with a creative financial planning that could provide affordable housing stock for young starters in Malaysia.

§ 4.2.2.5 **Proposed solution no 2: Innovative leasing**

Considering the changing needs of customers over their lifetimes and their improving financial capability, customers will want to improve their homes. In flexZhouse, the customer is free to customize the housing, and is one of the attributes of this new form of ownership that allows the customer to rent the housing components but at the same time allows for flexibility according to changing needs. Moreover, this new form of tenure will promote a long relationship with the company for a long-term business strategy. At the same time, the company's costs will be reduced due to the re-production of the new components when the existing components are made available for remanufacturing. One of the ways to reduce the cost of implementing this new innovation is to adopt the new leasing concept of the housing components. The current linear conventional housing construction in Malaysia relies on large quantities of easily accessible resources and energy, and a big expenditures on raw materials such as steel, cement, and concrete have led to expensive housing price. A dependency on these materials will only lead to inevitable loss of natural resources and higher production costs as the resources are depleted. Therefore, a change of the entire system seems necessary.

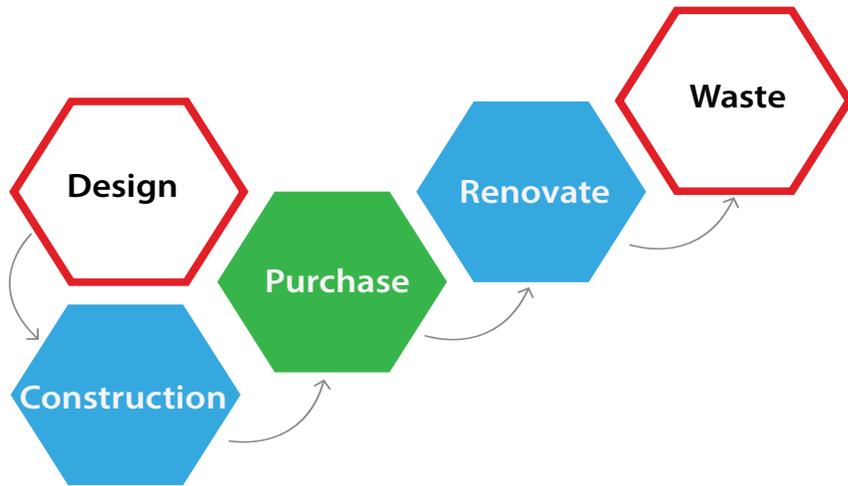


FIGURE 4.17 The linear housing consumption (current business model)

Here, the idea of the circular economy by MacArthur (2013) and its application to housing product ownership by the housing producer is outlined. A great deal of change in the flexZhouse is to integrate the existing theory of circular economy into the new BM. A critical change is to shift from the consumption economy (current housing industry) to what we call the service economy (flexZhouse). The new lifecycle chain of the alternative flexZhouse should have no beginning and no end. According to Straub (2002), the most interesting element of this new lifecycle chain is the stock management. In this attempt, the usage of the housing component is the key to the selling point rather than just selling the component. A good practice in the circular economy is to provide incentives to the customer who returns the goods to the manufacturer. This will help the business and sustain it in a long-term basis. The flexibility of existing and future products that change according to the client's needs and demographics will challenge the technology and design capability of designer and engineers. The company will rely its success in the business by maintaining a long-term income through recurring payment from the leasing activities. The manufacturer will change its strategy from selling the house to selling the usage of the housing components.

In short, the housing provider increasingly retains its ownership of its housing products or components and, where possible, will act as a service provider (selling the use of the products) rather than sell the products for consumption. This change will encourage the 'return policy' and the production of more durable products that support disassembly, reuse and redistribution, refurbishment and the remanufacturing process.

Business model based on one-way supply chains will not benefit companies in the long run. At present condition, the housing industry is producing waste while tapping into imprudent resource consumption. Therefore, to promote resource adeptness is to promote circular economy. This strategy requires initial consideration of the entire lifecycle chain and demands structural changes and a new BM. It is expected that future technical innovations that helps to produce durable goods will help to prolong the lifespan of the product.

Next, we will further explore the idea of how the innovative leasing idea integrated with the idea to 'design out waste' and design for remanufacturing and reconfiguration on a housing component level – whilst being supported by a change towards selling the housing performance rather than selling the physical house itself.

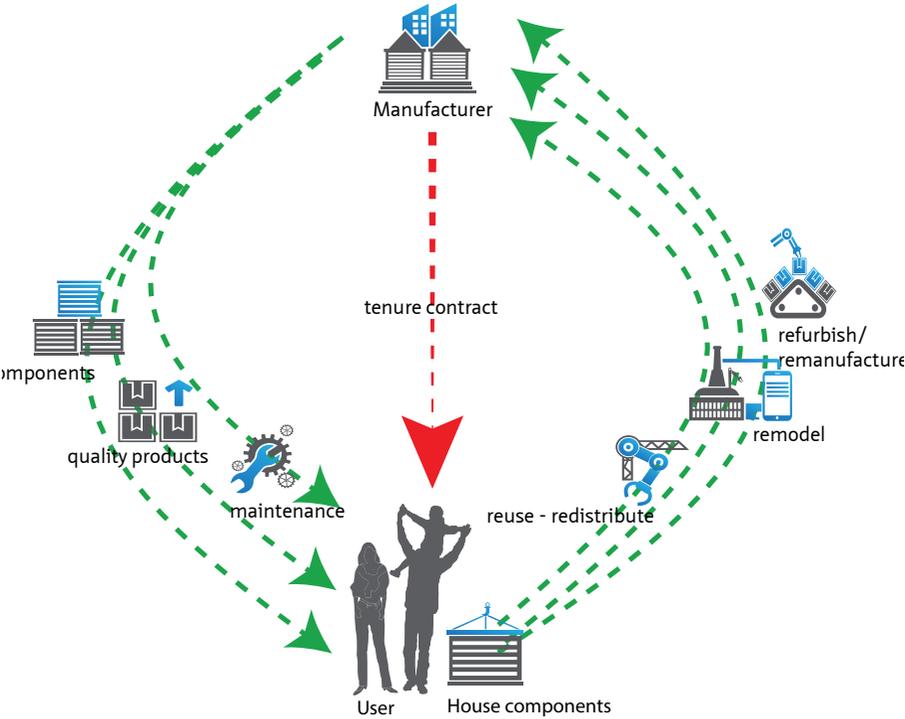


FIGURE 4.18 The strategy of the new model of leasing

To answer the question, based on the contribution factors established at the beginning of the chapter, the idea of innovative leasing inspired by the circular economy will support the financial framework for the understanding of how the flexZhouse will provide an affordable option for young starters.

In closing the loop of housing production, manufacturers will have to change their mindset from being the sellers of the housing products and become the emancipators, provided by long-lasting upgradeable products of housing components. Their goal now will be to sell results rather than products, that is, performance and satisfaction rather than how many units of houses. Instead of purchasing the house, the young starters could lease it, paying a monthly fee based on how long they used their housing component (figure 4.14).

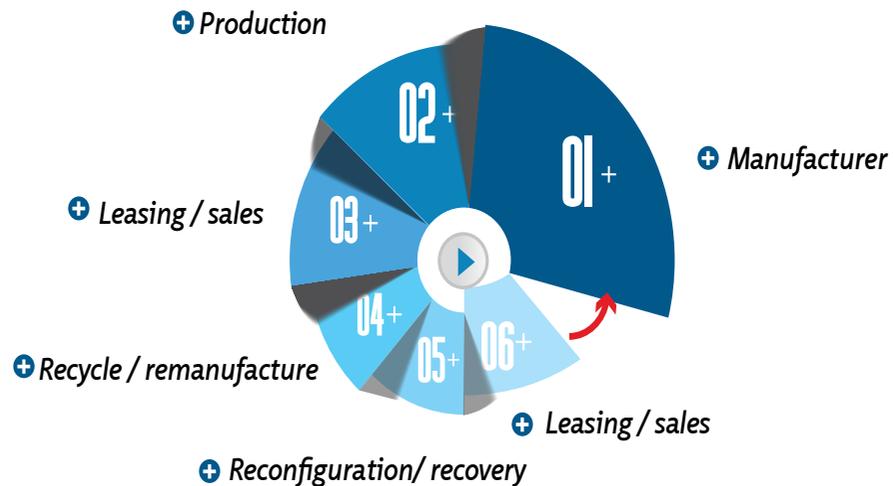


FIGURE 4.19 New 'loop' of innovative leasing + flexible housing

Inspired by the theory of disruptive innovation (Hwang & Christensen, 2008), the flexZhouse intends to provide an economical and affordable alternative to the current bulky, rigid, inflexible housing stocks. In this case, housing developers or manufacturers will provide a performance contract and temporarily allow the users (customers) to use the housing product/module (components) over a period of time agreed on by both parties. This will allow customers more design choices at the very beginning and to enjoy the services and the products without having to pay the full costs of possession.

In Figure 4.16, moving towards flexZhouse BM needs a paradigm shift in the way things are made. In the new situation, the housing production will shift to mass and flexible production and reap profit from the recycling of stocks and housing components. The new BM will help developing countries such as Malaysia to move further in industrialization and avoid being vulnerable to resource price shocks especially related to construction materials such as cement, steel and others. The new financial model is a change from normal ownership models and alters the relationship between manufacturer and customer. The innovative leasing or pay-as-you-use contracts are more suitable to the current condition of young starters in Malaysia.

Buyers will need to pay 10% for the down payment and obtain a mortgage for the remaining 90% of the financing. An interest rate of 6% is usually charged. The maximum length of a mortgage is 30 years. However, in the flexZhouse BM, we extend the 'loop' of the financing in table 4.6⁴. The price of ownership is reduced because the unit belongs to the manufacturer. In this case, users enjoy services provided by manufacturer but at the same time has options to upgrade and downgrade the units. In the former case, housing developers reap the profit only once and need to move to the new location for another project. However, for the later, the manufacturer retains possession of the unit and responsibility for maintaining, recycling and remanufacturing it for the subsequent users.

	Deposit 10%	Y1	Y2	Y3	Y4	Y5	Y6	Y7- Y10
Say household net income RM6000	RM4000	RM2,158	RM2,158	RM2,158	RM2,158	RM 2758	RM 2758	RM 2758
Ownership (current) RM 400,000.00								
(monthly repayment of 6% over 30 years)					Renovation loan + RM 600 RM 2758			
flexZhouse BM Unit price RM 400,000.00	No deposit	RM 1000	RM 1000	RM 1000	RM 1500	RM 1500	RM 1200	RM 1200
(monthly commitment based on package and location)				Add component + RM 500 RM 1500			Reduce component - RM 300 RM 1200	

TABLE 4.6 Comparison of conventional BM and the flexZhouse BM

4 Calculation was based on sales price of RM 400,000 property on mortgage of 90% of the price with monthly repayment of 30 years with 6% interest.

§ 4.2.3 Supporting theories on supply chain

Studies of industrialized house production in the literature are abundant, for example, pre-engineered, modular homes, factory manufactured, timber IBS, drywall partition and many more (Nawi, Lee, Azman, & Kamar, 2013). The idea of flexible housing is not new; it is a paradigm that is associated with industrialized housing production. In contrast, the idea of conventional buildings or house proves to be static, rigid and intractable. A study by Kendall (2012) highlighted that the prefabrication of housing was considered a process of mass customization and supported the remark by Sinai and Souleles (2005) that market demands can only be addressed if the housing industry adopts the industrialized and appropriate manufacturing concept.

The idea of improving supply chain performance in the housing industry started in the early 20th century. In 1914, Le Corbusier introduced a flexible housing system called Dom-ino (LE CORBUSIER'S DOM-INO, 2009). It is believed to be one of the most influential designs that portray the simplicity and standardization in terms of construction, have a flexible layout, are structurally independent and provide external non-load bearing cladding. In his famous quotation, Le Corbusier said that 'the house must go up all of a piece, made by machine tools in a factory, assembled as Ford assembles cars, on moving conveyor belts'. The attempt made by Le Corbusier, Walter Gropius, Bemis and Buckminster Fuller resulted in a new dimension in the industrialized housing production in the world (Gann, 1996). It led to the evolution of new methods of construction in the 1960s with the term 'systems building'.

The other useful lesson from manufacturing is that it brings the economic forces from within its process. Contractors agree that the industrialization of components and parts make the cost much cheaper, reduce on-site labour dependencies and at the same time ensure the quality of the production (Schoenwitz et al., 2013). Industrialization is seen as the solution to the quality and workmanship problems that are blighting the housing industry. This is simply because tolerances at the factory are smaller and tighter than at the construction site (Zairul & Ibrahim, 2011).

§ 4.2.3.1 Partnership

A partnership is a form of the risk-sharing activity among the shareholders or among parties involved in the business. When a company discovers that it does not have access to certain capabilities or resources, it can form a partnership to provide the opportunity for the business to exploit the capabilities of others (Mokhlesian & Holmén, 2012). Collaboration is necessary especially when one company wants to reduce its operational cost and the manpower for the process.

The overarching partnership for the flexZhouse will be the interdisciplinary partnership with the suppliers of the product, the providers of maintenance services for the building and probably the logistics aspect of the business. This is because every company has its own aspirations, motivations and objectives (Bossink, 2009).

However, it is important to analyse the strength and weakness of the partners and the shareholders to avoid unsatisfactory quality and delays in the delivery process. This is because different partners might have different experience and expertise (Ngowi, 1998). Conflict may arise if the differences are not properly understood. As flexZhouse is an innovative BM, the awareness and understanding of partners might lead to a slow rate of adoption. However, awareness is necessary to overcome the fragmented and adversarial issues among the key players in current conditions.

§ 4.2.3.2 Channels

The supply chain include a wide range of process from the inception of the projects (raw materials) through the production stage in the factory, the delivery and installation of the components through a systematic distribution process and marketing. Therefore, Channels explained the continuous improvement of processes and relationship that available to help the delivery of the product.

The advent of the technology and electronic commerce has further improved how the channels could reach the potential customer. At the early stage, the awareness of the product can be created by organizing and communicating information through social media, for example Facebook and Twitter (Tucker, Mohamed, Johnston, McFallan, & Hampson, 2001). More traditional approaches to improving interactivity may also be used, for instance show houses and learning centres (Peterson, Balasubramanian, & Bronnenberg, 1997).

Channels include ways people can pay and perform the necessary transactions; this will further reduce paperwork and unnecessary complexity (Sandilands, 1997). And improving the flexibility of the communications through the means of internet and web browsing for the customers. In our case, the flexZhouse will need to make use of the internet to increase the awareness, to promote the products and services, and to spread information regarding the products.

§ 4.2.3.3 Key activities

Literature supports industrialization attempts in the building sector with various objectives including reducing onsite activities (Vrijhoef & Koskela, 2005), flexibility in design (Habraken & Valkenburg, 1972), concurrent engineering (Chimay J, John M., & Anne-Francoise, 2007), modular design (Gann, 1996), lean construction (Barlow & Childerhouse., 2003) and different understanding in a different context. Girmscheid and Scheublin (2010) presented nine aspects to describe industrialized production, namely 1) the use of mechanical means and technologies, 2) the use of high-tech systems and tools, 3) production in a constant process, 4) continued development of productivity, 5) standardization of products, 6) prefabrication, 7) rationalization, 8) modularization and 9) mass production. Further, Yashiro (2009) divided the framework of the industrialized building (IB) system in Japan into several categories, including prefab houses of the 1940s, mass construction, component-based, mass customization, platform-oriented and service providing.

It is useful to understand that the concept of the IB system in Malaysia is mostly employed in mass construction with less innovation of the mass customization approach. The idea of industrialized housing production is not new. Envy of Henry Ford's standardized car production line influenced many architects at the time to ponder the manufacturing of housing in the future. The series of attempts to streamline the knowledge transfer between the industries made it a valuable reference for this research (Gann, 1996). According to Tam et al.,(2007), there are seven benefits of applying the industrialization process: 1) application of prefabrication at the early stage, 2) better monitoring of the quality aspects in the factory, 3) reduced overall costs, 4) shorter construction time, 5) sustainable through waste minimization, 6) design integration in conception and construction, and 7) the aesthetic of the design.

We argue that different categories have a different supply chain maturity. This is supported by Ali, Kamaruzzaman, and Salleh (2009). There are barriers to implementing the system mainly related to operating cost and financial barriers (Kamar, Alshawi, & Hamid, 2009). Several studies have argued that using an industrialized solution could increase the cost of the whole project and therefore discourage the utilization of the system (Haron, Abdul-Rahman, Wang, & Wood, 2014). Despite the barriers, Japanese housing manufacturers are investing heavily to improve the flexibility of the housing design to meet their customer's new requirements and to achieve customer satisfaction. The old market of standardization has been changed to a more flexible one in terms of design. By the 1970s, the production of prefabricated housing units prefabricated had reached new levels of quality and quality, and resulted in satisfied customers. The customers were more prepared to accept factory-made housing and the provider increased its efforts to satisfy customer's quality expectations.

In Japan, the new concept of industrialized housing by Japanese housing providers offered many benefits in the planning and coordination of resource allocation and minimizing time-consuming on the site. In comparison to conventional housing, the Japanese manufactured housing industry managed to shorten the period of conventional construction from 120 days on site to only 40 days on site, which includes the preparation of foundation works, the interior and the inspection (Barlow et al., 2003).

However, the multiple stages and different characteristics in the construction industry have triggered a lengthy discussion and debate in the industry whether the sequential and fragmented activities in the current housing industry or in construction, in general, might be replicated in other industries, or vice versa (Love, Irani, & Edwards, 2004). It is necessary to integrate the physical differences, the actors involved and its operation. Barlow et al. (2003) argued that the housing industry differs from the manufacturing industry in several respects, including the size of the production, the higher degree of complexity in terms of production and higher operational cost. However, the important lesson that the housing industry can learn from the manufacturing industry is its effective and efficient forms of integration and the repetitive actions and management of process leading to the production with respect to time, cost and quality (Ali, Kmaruzzaman, & Salleh, 2009). Nevertheless, one of the main reasons for the housing industry to adopt the strategy used in manufacturing is to reduce the carbon footprint of conventional construction and promote sustainability.

The new approach needs a new management decision in several fields. It is anticipated that some of (but not only) the following features will be part of that setup:

- The operating plant for manufacturing and remanufacturing will have to be located as close as possible to the development area. This will allow small repair and after-sales activity more efficient.
- The product needs to be designed for disassembly and technology improvement.
- Designers need to think of a product that will utilize the raw materials efficiently and durably over long period of time.
- A new job specifications will arise, and this will boost operation and management specialization.
- The users will learn how to take care of the product to enjoy the privilege of consuming the product, and any misuse will lead to penalties.
- The production will reduce the operational cost by recycling the stock.
- The company will focus on the efficient management of the resources, creating money and wealth through the recurring money from the leasing activities, and adjusting fees according to the services and products usage.

§ 4.2.3.4 Summaries of supply chain (partnership, channels & key activities)

Japanese industrialized housing manufacturers as described by Barlow et al. (2003) in his case study of Japanese industrialized houses have shown that there were significant lessons to be learnt before the industry could move forward. It was reported that the factors that contribute to the successfulness of Japanese housing industry is the size of the market itself, coupled with increasing demands from the population.

The maintenance of the current rigid housing is seen to be costly, needs a special craftsman and sometimes caused difficulty on site (T. Tan, 2012). Therefore, it will be necessary to examination closely the potential of partnership involved in the process of the production, and key resources required to support the key activities. The complexity of the housing industry presents a challenge to monitor along the supply chain. A survey on the adoption of the industrialized systems showed that quality can be achieved through better supervision in the factory and the thorough inspection of the product before it leaves the factory and is installed on site. (Abas, et al., 2013; Bari, Abdullah, Yusuff, Ismail, & Jaapar, 2012; Bildsten, 2014). However, the value of cross-industry learning does not stop at the techniques but also applies to the knowledge transfer. Therefore, the idea tends to focus on the supply chain management strategy within the housing industry and reveal the opportunities to improve the time leads and the quality of the product.

The required improvements to supply chain management include improving quality, increasing productivity and preventing further depletion of natural resources by introducing the circular economy. Therefore, in this section we highlight the following conceptual contributions to the BM:

- 1 Lead times can be reduced with shorten supply chain process and reduce the number of actors involved.
- 2 Quality can be assured from the beginning by having better supervision in the factory.
- 3 A good project delivery could be achieved by planning the key activities to maximize value creation.
- 4 A proper channel and network are necessary to create awareness and to provide more information on product offers by the company and support smooth operation.

§ 4.2.3.5 Proposed solution no 3: Industrialized housing production

Here, we explore the possibility of the future housing industry adopting an industrialized manufacturing strategy. We seek an alternative that offers faster construction, modern technology and faster delivery with an acceptable quality, and at the same time is affordable. Prefabricated housing in Malaysia is still in its infancy. Most prefabricated buildings are made from concrete and are used for commercial and institutional purposes. The type of construction normally involves a heavy concrete structure with a very delicate process of site delivery, thus making it unpopular in Malaysia.

Hypothetically, industrialized housing production will be the main approach for the flexZhouse. This includes the introduction of the flexZhouse to the IBS (Industrialized building system) industry in Malaysia. Currently, conventional construction is regarded as producing bad quality housing, to have long lead times, and to have fragmentation and adversarial issues among actors (Anumba et al., 2006). It is therefore about time for the housing industry in Malaysia to look into an alternative to housing delivery through innovative technology to support industrialized housing production. However, we must take into consideration that industrialization includes investment in equipment, facilities and technologies in order to achieve quality and reduce dependency on manual labour (Warszawski, 2003). Industrialization is defined as modularity, systemization, reproduction, flexibility, re-engineering and leading towards what the industry called as reducing on-site activities (Anumba et al., 2006; Habraken, 2003; Habraken & Teicher, 2000; Habraken & Valkenburg, 1972; Koskela & Vrijhoef, 2001; Anumba, 2006; Swan & Khalfan, 2007; Yashiro, 2009, 2014).

The possibility of integrating the flexZhouse with an industrialization strategy will be used. This is by means of integrating aspects of industrialization by the use of machines to produce houses, computerized systems, production in a continuous process, continued improvement of efficiency, standardization, prefabrication, rationalization, modularization and mass production (Girmscheid & Scheublin, 2010).

CONSTRUCTS	CONCEPTUAL FRAMEWORK OF FLEXZHOURSE
<p>Customization : Desire for individuation (need for customization)</p>	<p>Customer will have more options to choose a design from the available choices but at the same time have the freedom to change the exterior, interior elements and service to match their requirement and budget.</p> <p>Customer will be able to change or modify (add or remove) certain components after a certain period.</p> <p>Customer will be more active and participate at the beginning of the development and co-evolve the design.</p> <p>Operating plant for the manufacturing and the remanufacturing will have to be located as close possible to the development area. This will make small repair and after-sales activities more efficient.</p> <p>The product needs to be designed for disassembly and technology improvement.</p>
<p>Affordability: Innovative leasing and housing financial model</p>	<p>Company will focus on managing the resources efficiently. Creating money and wealth through the recurring income from the leasing activities.</p> <p>Adjusting fees according to the services and products usage. Designers need to think of a product that will utilize the raw materials efficiently and durably over long period of time.</p> <p>New job specifications will arise, and this will give a boost to operation and management specialization.</p>
<p>Supply chain: The production aspect of flexZhouse</p>	<p>Users will learn how to take care of the product to enjoy the privilege of consuming the product, and any misuse will lead to the penalty by the company</p> <p>Increasing lead times can be avoided by shortening the supply chain process and minimizing the number of supply chain actors.</p> <p>Quality can be assured from the beginning by closely monitoring the quality during fabrication in the factory.</p> <p>Good project delivery could be achieved through proper planning [on the key activities involves the value creation.</p> <p>Proper channel and network are necessary to create awareness and to provide more information on the product offers by the company and support the smooth operation.</p> <p>Production will reduce the cost of operation by recycling the stock.</p>

TABLE 4.7 Summary of criteria for flexZhouse conceptual framework

§ 4.3 Synthesizing the theoretical framework into the conceptual model

In Chapter 3, we related the innovative leasing to the problems of the linear economy and how depleting materials resources has led to an economic downturn and expensive housing stock. The production of housing product in the conventional way has caused significant loss of renewable resources and created more wastage. Here, innovative leasing has introduced a different BM that creates a sustainable loop of lifecycle chain that gives future house buyers a better option in the form of the new concept of housing ‘ownership’.

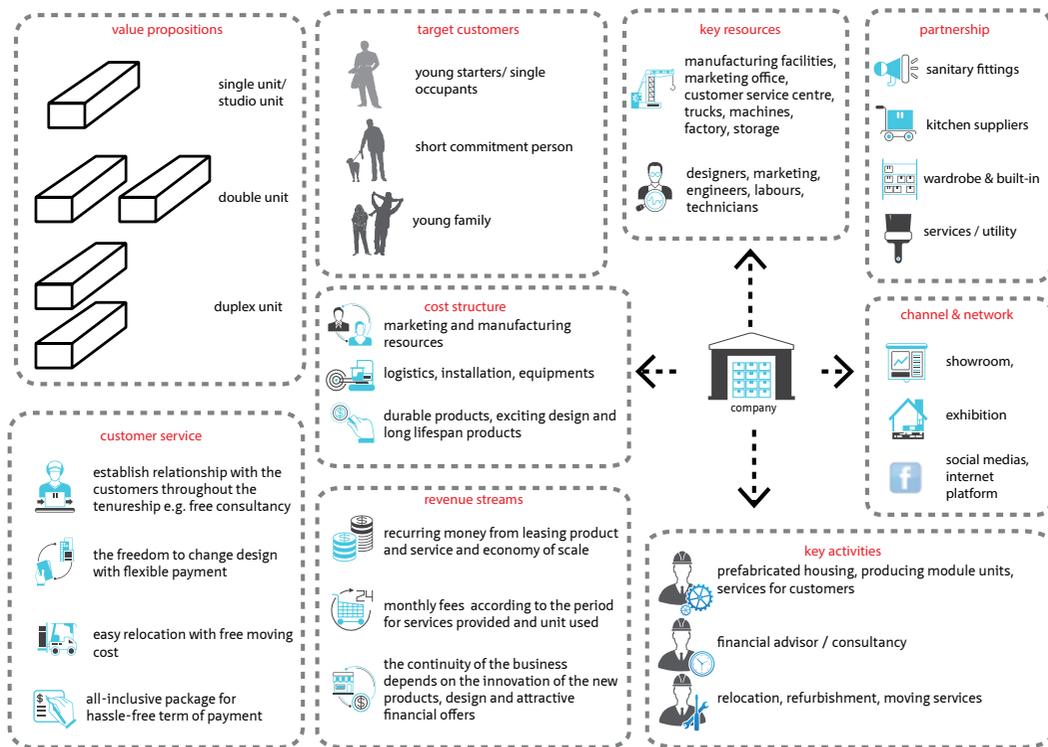


FIGURE 4.20 Draft business model of flexZhouse

The new concept of housing ownership has changed the paradigm to the long-term (rental) income for the housing producer and the housing producer is now responsible for the product, which includes risk and cost of waste. In a nutshell, the housing producer will take responsibility for its own actions.

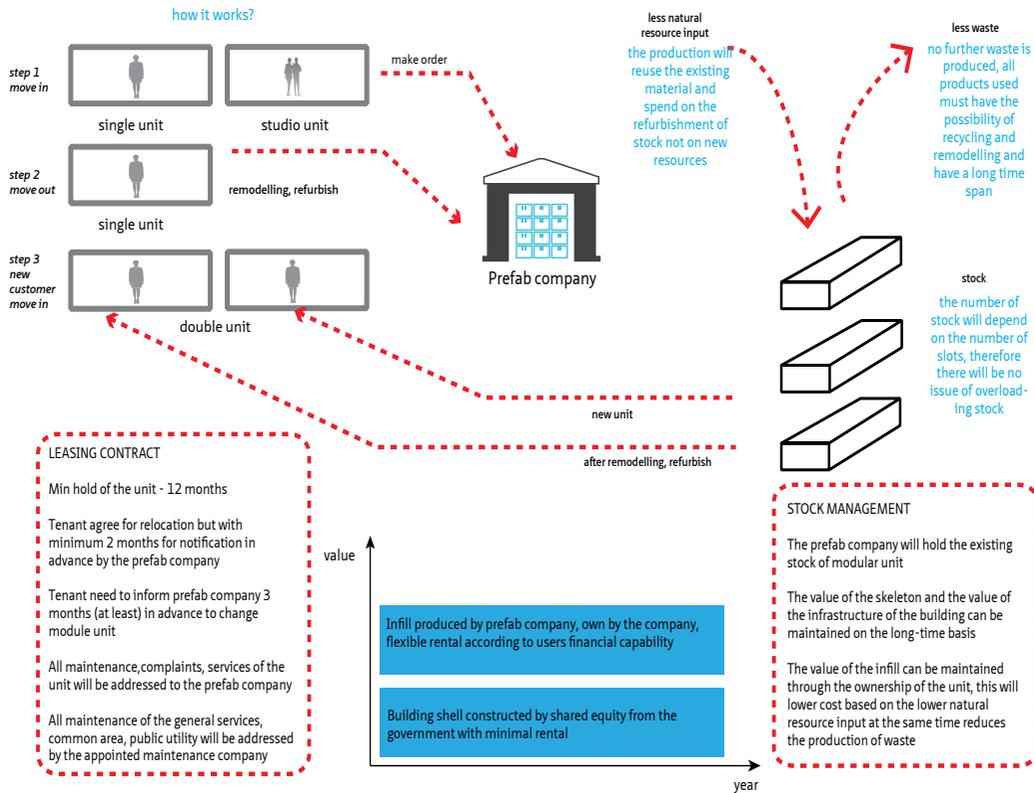


FIGURE 4.21 Draft business framework of flexZhouse

In the flexZhouse BM, the company will emphasize on the customer satisfaction not only on the selling part. The main revenue will come from the recurrent fees based on the leasing activities, coupled with maintenance activities. The next idea is to introduce usage fees based on the component that included in the package prepared by the company. The flexZhouse BM shifts to a new skill that promote durable product for the housing component. The value creation expected to be delivered through customer satisfaction rather than high sales. This can be done through prudent use of the energy, resources and a high quality housing component. In this case, the customer will have peace of mind and satisfy with the product and contribute to a long-term relationship with the company.

From the company standpoints, this approach will benefit on the reduction of resource consumption investment and increase their revenues at the same time. In relation to that, the flexZhouse BM contributes to the sustainability cause in the local housing scene and helps to reduce carbon footprints caused by conventional housing construction.

Initially, it is suggested that the government becomes the first party to initiate the project by acquiring the land and subsidizing the construction of the structure. The government under its housing agency will then construct the structure at the selected area or targeted area that has potential for the scheme. Next, the government will invite tenders for the infill (housing units) and then the selected suppliers will produce and apply the concept of the BM (Figure 4.19). The housing units or components will be leased to the potential customers and will have to be returned to the housing producer after the customer move out. In the original contract, it is suggested that the minimum contract term for the units should be 12 months, and tenants should agree to give a minimum of 2 months' notice before relocating. In the event of changing the module, the tenant will be required to inform the suppliers three months in advance that he or she wants to change the module unit. All maintenance of the general services, common area and public utilities will be handled by the maintenance company appointed by the company providing the infill.

In this framework, it is suggested that the monthly commitment for the users will be based on their financial capability and based on the 30% of income rules. The payment will consist of the rental payment for the structure, the infill and the maintenance of the building. The business lifecycle shows the potential of the circular economy through the remodeling and refurbishing of the existing unit/module for the next customers.

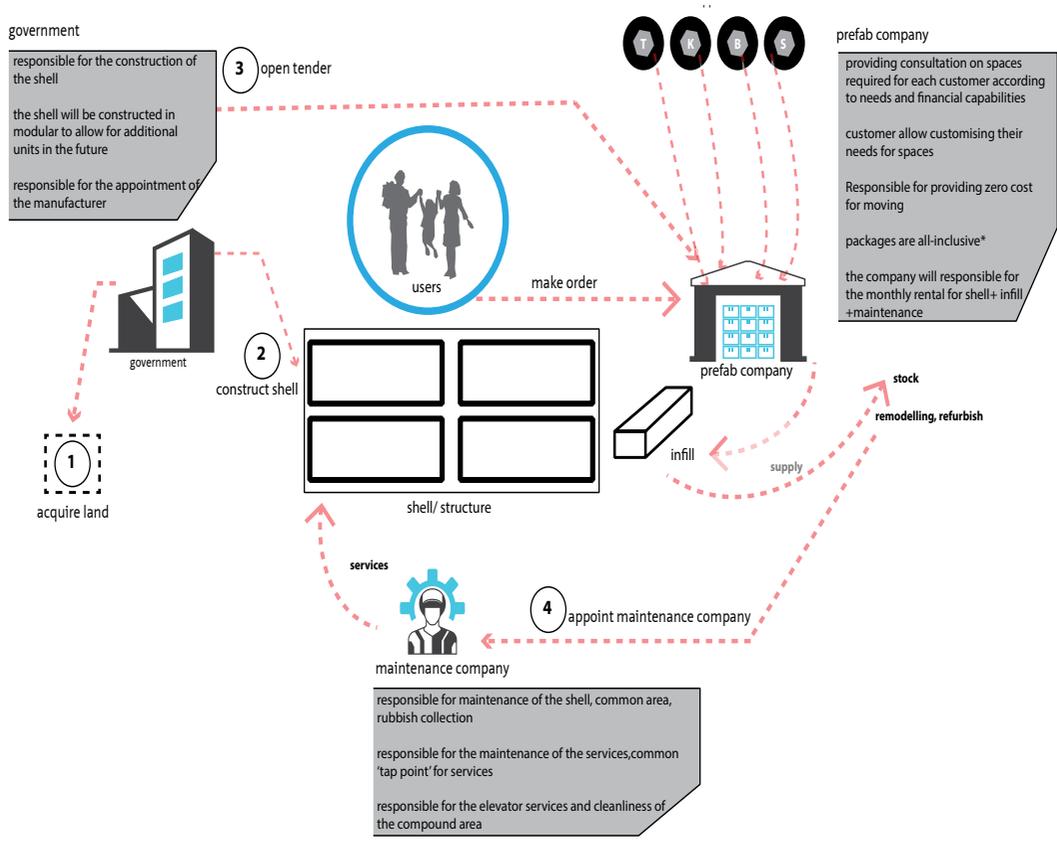


FIGURE 4.22 Draft business lifecycle of flexZhouse

CONSTRUCTS	THEORETICAL QUESTION GAPS	ELEMENTS OF BM
Design perspective: market needs, demographic changes, demands, choices	<p>What will be the appropriate products and services to suit the needs of the target customer (young starters)?</p> <p>How can the new BM learn from the manufacturing sectors to improve its customer service?</p> <p>What type of products and services support housing customization?</p>	Target customers, customer services, value propositions
Financial perspective: innovative leasing, financial capability, flex-term	<p>What would be the appropriate duration of a contract in order to have real return investment?</p> <p>How much is the customer willing to pay and how (mechanism)?</p> <p>Would there be any option for ownership for a loyal customer?</p> <p>What would be the best payment mechanism? Monthly arrangement of leasing?</p>	Revenue streams, cost structure, key resources
Supply chain perspective: supply chain, production time, lead times	<p>What are the main activities of the company and who is involved in the supply chain?</p> <p>What kind of partnership can the new BM establish to ensure smooth operation and the proper delivery of the product to the customer?</p> <p>How can the new housing suppliers create awareness of their products and improve the network?</p>	Partnership, key activities, channel & network

TABLE 4.8 Theoretical constructs for the flexZhouse BM

§ 4.3.1 Theoretical contributions to the formulation of the conceptual framework

The theoretical part of the thesis has resulted in the induction of a set of analytical factors that will function as the basis for the further theoretical development of the lifecycle chain in the flexZhouse model. Since this research is prescriptive and contributes to the design sciences, it is necessary to develop the theoretical proposition for a guidance to be used for the empirical analysis in the next part of the research. Beforehand, the following analytical factors serve as guidance for the empirical chapter later.

CONSTRUCTS	ANALYTICAL FACTORS	STRATEGY OF INQUIRY
Customization the market needs, demographic changes, demands, choices	Design options to support the idea of customization Investigation of the needs and choices of the target market, namely current and future young starters in Malaysia Type of customer relationship to prolong services to the customer	Design workshop with architects, focus group with young starters
Affordability financial capability, flexible financing, terms of payment, payment options	Exploring the housing problems for young starters, the financial affordability How can they pay (method) and how much they can pay? How can the company create revenue?	Focus group with young starters, representative from private developers, entrepreneurs, NGOs and government agencies dealing with housing
Supply chain supply chain, production time, lead times, managing the housing stocks	Exploring the possibility of the new model to fulfill the gap, waiting time, quality and workmanship of the product/ unit	Focus group with young starters, representative from private developers, entrepreneurs, NGOs and government agencies dealing with housing

TABLE 4.9 Analytical framework

In summary, we aim to offer an innovative BM and a way to provide young starters in Malaysia with housing that is affordable and flexible in terms of design and offering. At the same time, we aim to provide housing that improves the bureaucratic process and provides quality housing. In order to accomplish that, we described the flexZhouse BM and we aim at giving 'answers and meaning' that are holistic, explanatory, context bound and qualitative by nature, as suggested by Leedy and Ormrod (2005).

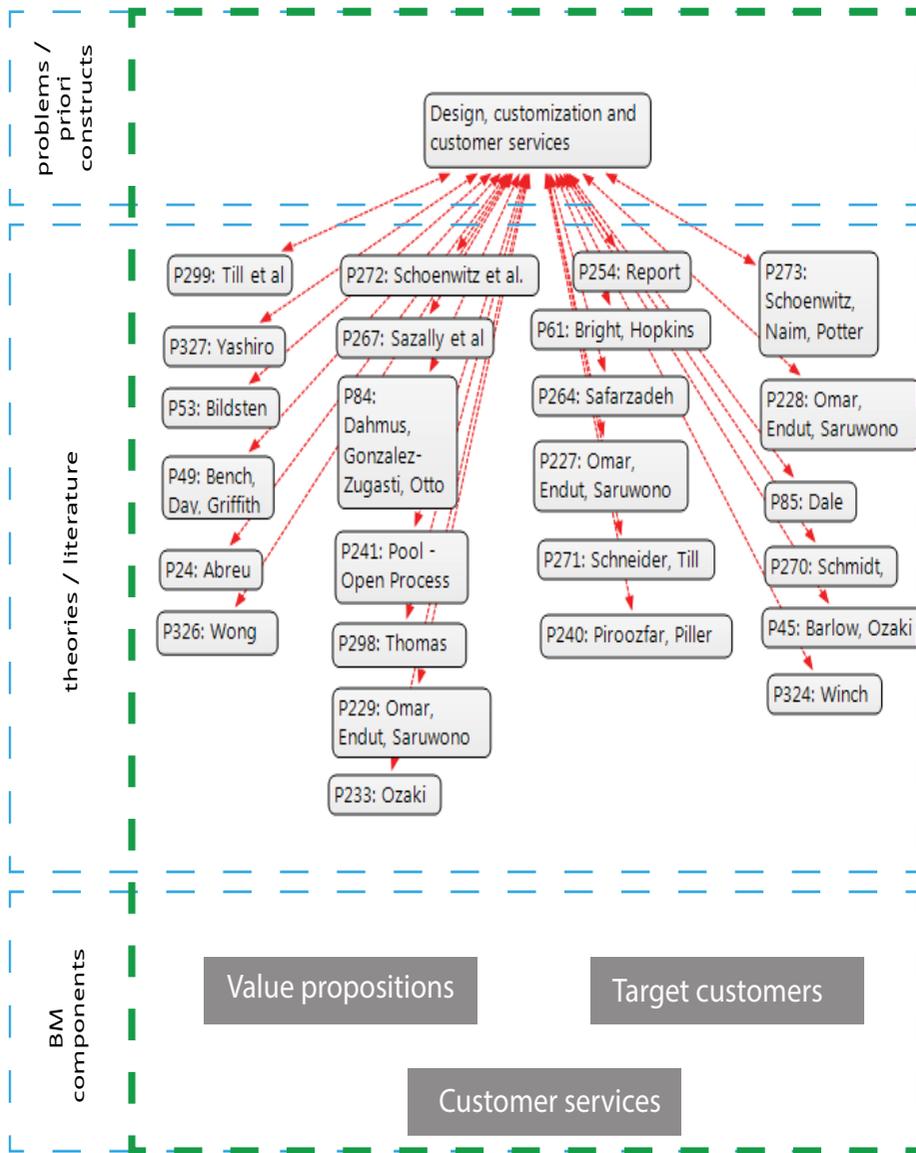


FIGURE 4.23 Conceptual diagram leading to the formulation of conceptual framework (Customization)

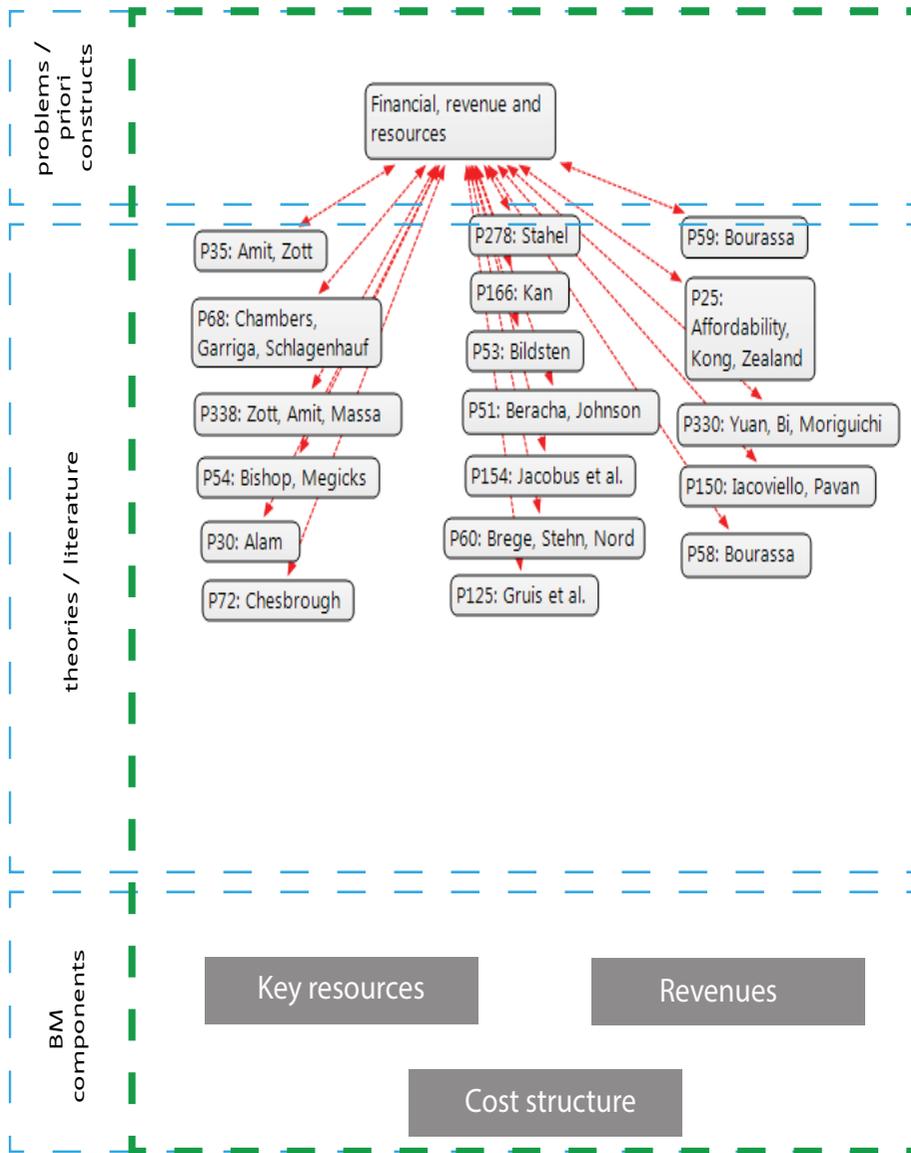


FIGURE 4.24 Conceptual diagram leading to the formulation of conceptual framework (Financial)

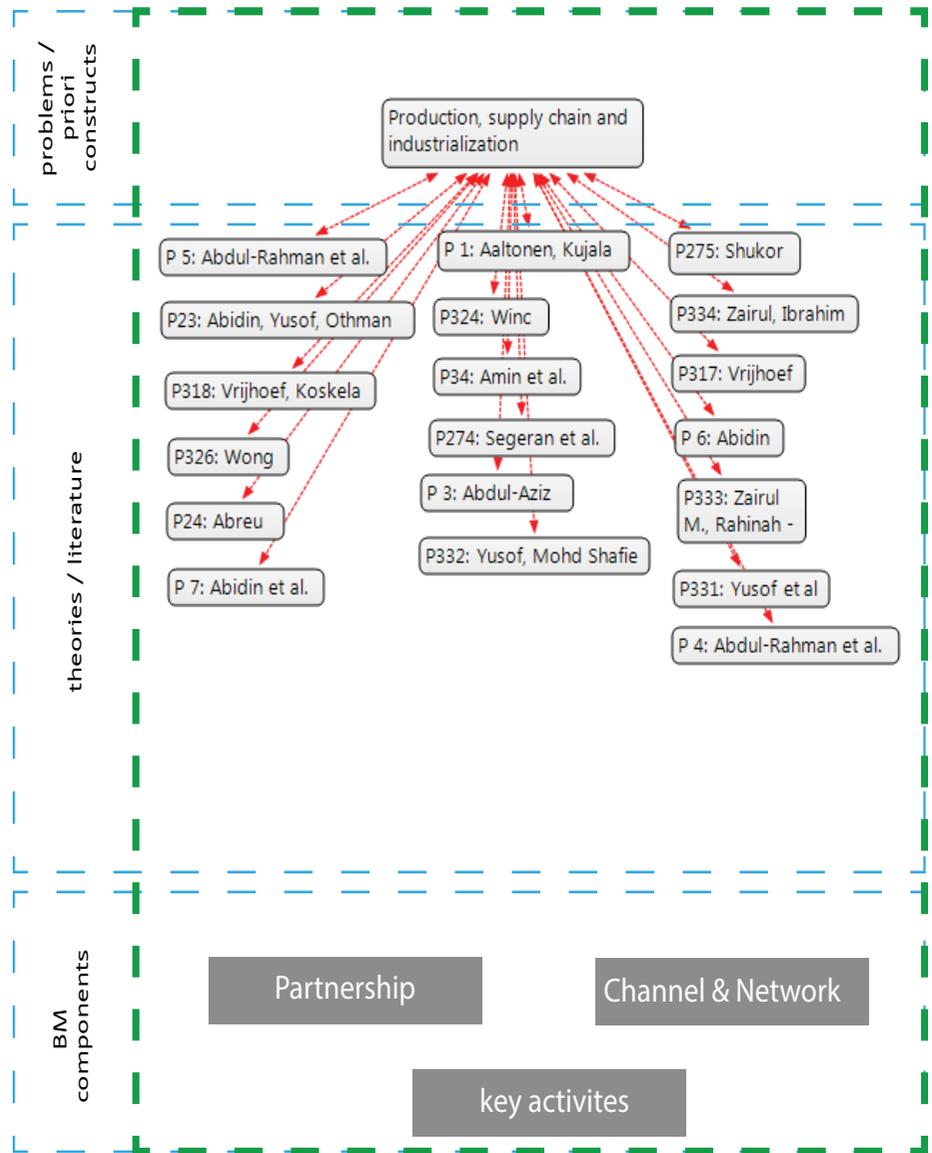


FIGURE 4.25 Conceptual diagram leading to the formulation of conceptual framework (Production)

The proposed model in Figure 4.23, 4.24 & 4.25 are based on three features or a priori concepts that outlined the research. An a priori concept means a set of variables that are drawn from the literature and become the objective that underlines the whole research. Features are semantically explained in the model by topic and subjects. In the top part of the figure, literature that supports the gap and the problems was discussed

and linked to the associated issues or problems. In the bottom part, every feature of the BM provides a concept of the image of a strategic relationship between the formulation of the new BM with the issues that relate to its constructs.

The first concept of customization was further emphasized by several theories from the sphere of open building and flexible housing. This further strengthens the type of products and services that the company could offer under the value proposition umbrella. It is important for this element to identify the type of customers for each product for whom the value is created. When considering this construct, it is important to understand the type of relationship each of the client segments expect to establish and continue with them.

In terms of financial matters, we are interested in exploring how the revenue streams and the cost structure of the BM could help to provide an alternative to current payments for the housing. It will involve how much the young starters are willing to pay; what the problems with current payments are; how much they are willing to pay; and what type of pricing would support the system. Secondly, the key resources that the company invests will determine the pricing mechanism; therefore it is important to determine what resources would be needed and what element could be outsourced to minimize the resources investment. Thirdly, the cost structure of the business provides an idea of what the pricing for the units would be. Here, we will determine the most important costs inherent in this BM. We will identify the characteristics of the company and how it can provide long-term return investment.

Finally, in terms of production and supply chain, the theoretical framework suggests the integration of manufacturing process and the industrialized procedure to maintain the quality and the workmanship of the products. In this section, it entails the supply chain process that might determine the quality of the production. For example, the partnership will lead to optimization of the production, and provide a reduction of risk and uncertainty in the supply chain. This is further reinforced by the key activities that determine how the supply chain is arranged to support the delivery of the products and to ensure customer satisfaction through channels and network. This is particularly important to ensure that the products will arrive just in time and help the customers starting from the awareness level, evaluation and purchase, through to delivery and after-sales.

PART 2 Empirical



5 Design workshop & focus groups

§ 5.1 Introduction

In the previous chapter, the draft BM of flexZhouse was formulated based on principles of customization, affordability, and supply chain (production). The draft BM took into consideration issues and arguments and concluded with a summary of each criterion. Next, this chapter builds upon the empirical data gathered from the design workshop with the architects and a series of focus groups. We started with a conceptual design of a possible flexZhouse (previous chapter). We presented the draft flexZhouse business model (BM) to the target group and asked for feedbacks. Although the design has only been developed to a conceptual stage, consideration has been given to the technological issues behind it.

This chapter starts by discussing a design workshop held with professional architects about the concept of flexZhouse. It is important to gain input, especially on the Uniform Building By-Laws (UBBL) aspects. The design workshop was seen as a way to develop design sciences where knowledge is not limited to the understanding of the concept but give feedback of the pros and cons of the design (Aken, 2005). The responses from the participants provided suggestions for the technical solutions and the construction materials to suit to the concept. The main reason to organize the design workshop was to develop the design more fully and to acquire insight into its feasibility from an architectural perspective. The workshop also served as part of the triangulation process for the scientific contributions.

The main part of this chapter describes the series of focus groups that were conducted to gain feedback on the draft BM. The sessions provided information on the revised business model, business framework, and business lifecycle and process to obtain the primary data. For this part, we started the research in a deductive manner. A priori constructs were built based on three main criteria, namely customization, affordability and supply chain. In this way, we first developed the schemes and then collected and coded the data. Further, a set of emerging codes were developed based on a priori constructs that were valuable for further recommendation and further discussion (see section 5.7).

FOCUS GROUP / DESIGN WORKSHOP	NO. OF PARTICIPANTS	GROUP OF STUDY	LOCATION
1	5	Architects, professional architects (design workshop)	Resource centre, FRSB, UPM, Serdang, Malaysia
2	5	Young starters (pilot study) (focus group)	TU Delft library, Netherlands
3	4	Young starters (focus group)	Resource centre, FRSB, UPM, Serdang, Malaysia
4	4	Young starters (focus group)	Resource centre, FRSB, UPM, Serdang, Malaysia
5	5	Young starters (focus group)	Resource centre, FRSB, UPM, Serdang, Malaysia
6	5	Private developers, NGO and entrepreneur (focus group)	Seminar room, FRSB, UPM Serdang, Malaysia
7	3	Government agencies (PR1MA, Ministry of Housing and Local Government) (focus group)	Resource centre, FRSB, UPM, Serdang, Malaysia

TABLE 5.1 Design workshop and focus groups

§ 5.2 Design workshop with the architects

This section consists of two parts. The first part explains the workshop results and the discussion that took place. The second part presents the BM input that was derived from the design workshop.

Two professional architects, two design architects and a professor of architecture participated in this workshop. They were all fairly experienced working professionals: each participant had more than 20 years' experience in the field of design, the authorities' requirements or the teaching of architectural design. All participants in this workshop had been active in the design and the housing industry for several years. As a result, they had accumulated experiential knowledge through their professional knowledge of IBS, fire requirements and the authorities' requirements related to the brief. The sample selected for the workshop was purposeful and selected based on the knowledge of the respondents and whose experience was considered typical (Morse, 1991), and from the group that the researcher is familiar with and can learn the most (Merriam & Merriam, 2009).

The workshop was divided into two groups and lasted for almost four hours. Each group presented the schemes and discussed the advantages and disadvantages of each one.

The idea was further developed using 3-D design and AutoCAD to show the design alternatives. Next, the advantages and disadvantages of each design were explored.

The design workshop demonstrated the design options and alternatives that the architects and designer could produce based on the brief given. During the workshop, the participants suggested that flexZhouse should deal directly with two main issues, namely time and user preferences. The former suggests the changing needs of humans over time and the necessity to provide the house within a short period of time, considering the house is a fundamental human need. The latter, however, signifies the different needs/ preferences of users. The economics of the unit depends on the changing function and the needs of residents in terms of space requirement.

The workshop was able to show how the concept could be developed into several options to support the idea of flexible housing. One of the components of flexible housing is the ability to transport a unit to a new location, provided there is a similar frame structure (support). Finally, the design workshop provided an answer to the question that we asked earlier regarding the value proposition for the new business model.

§ 5.2.1 Design workshop results

During the workshop, the idea of supporting flexible housing opened up many opportunities and design possibilities. The design workshop was held to create design possibilities and to integrate the design with inputs on bylaws and local regulations that were relevant to the development of the unit at that stage. The workshop exercised the knowledge of the architects on the technology for the industrialized building system (IBS) and how to translate the knowledge into flexZhouse design. The workshop was divided into two teams. The first group comprised two members (producing types A & B). While the other team comprised three members (producing type C).

The first group described the potential of the design to include the use of the lightweight structure for the 'open building' part. The structure could be manipulated and modular for the infill. One of the respondents stated:

*With so many technologies that are available nowadays. It is good if the structure could multiply and become flexible to allow additional unit and expansion in the future.
(design workshop)*

The respondents raised the issue of the building's services and expressed concern about how the water services and electricity are handled in this type of building.

It is important to consider how the change of the house configuration would affect the services layout of the house. (design workshop)

The author responded to this by saying that several case studies had already been done elsewhere (Kendall, 2012) and showing some examples from a fit-out system that provides flexible wiring and grey water drain piping. Respondents suggested that in order to provide an excellent logistics network for this new business model, the company must have enough networking resources to bring the unit to the site.

The first thing that came to my mind is, this business model needs a sound network to support the logistics. It must be closer to the factory or, at least, accessible to highways for the crane and trailers to transport the unit to the site. (design workshop)

Other issues raised during the workshop and discussion concern the plot ratio of the building. The plot ratio will often depend on the location and the surrounding factors of the area. For this matter, we refer to Chapter 1, Section 2 - Akta 267, Akta (Perancangan) Wilayah Persekutuan, 1982 define plot ratio as a ratio between gross floor area of building divided by a total site area (common law / development requirement). The higher the plot ratio, the more gross floor area can be allocated to the site. Plot ratio dictates the maximum intensity of the development or how much can be built on the site. If a site's allocated plot ratio is higher than that utilized for the existing building or if it is revised upwards, then more gross floor area can be assigned to the site. This would raise the site's value because a developer could build and sell more homes on the site (Yaakup, Johar, Sulaiman, Hassan, & Ibrahim, 2003). One of the respondents noted this:

I think the height of the buildings could be determined by the location later on... but maybe at this point, it is important to take note on the requirement of the plot ratio. (design workshop)

Subsequently, the participants in team 2 proposed a 'slot-in' design arguing that it would allow more units on each floor for (type C). The argument for this kind of design is that it offers more choices for customers and more revenues for the company. During the discussion, the respondents sometimes reacted as experts and sometimes as potential users. This can be seen as sharing personal experiences, such as the need to own a garden area, and type of opening was a form of explicit knowledge that shape the needs for customization for this scheme. One of the respondents stated:

If you want to offer freedom of customization, we must be able to include the choices of different treatments for the facade and the ability to change the usage of the open areas. (design workshop)

At the end of the session, the workshop produced multiple designs to support the idea of flexZhouse. The design brief forced the architects to rethink the way architects design normal mass housing. This can be seen from the industrialized strategy that the flexZhouse introduces. For normal mass housing, the units are normally standardized in design and there is no flexibility in respect of design configuration. The design of each module of flexZhouse should take into consideration the customer demand for changes over time.

Type A



FIGURE 5.1 Typical arrangement and 3-D visualizations

The proposed size of type A is 2.4 m x 12 m, which takes into consideration the size of the ISO container allowable on Malaysian highways. The standard height for each module is 2.5 m (interior) / 2.9 m (exterior). Every module has a living area with dining room and integral kitchen in one space and includes a bathroom with shower at one end. Units do not require bases or an additional structure. The units can be moved from one place to another using a crane. In the example of type A1, the proposed design is also suitable for the studio type. The unit is to be installed lengthwise (on the longer part) and to maximize options for further expansion. In this module, the design of the building allows an additional modular slab for further expansion. The design in type A2 shows how the unit to be added to allow a second module. In types A3 and A4, the

design allows a maximum of three modules to be attached together and type A4 shows the new balcony for a customer who wants an extra view.

For this design, the architect explained that it features a kitchen, a full-sized bath and all elements needed to comfortably support four adults at the same time. The design of type A enables more sunlight to reach into the unit.



FIGURE 5.2 Typical unit type A (long type) *position of opening (door & window) will change according to location

For type A, it can be seen that the advantage of the unit is that the module gives the user a broad sunlight and ventilation exposure. One respondent mentioned this:

As we can see, both type A3 and type A4 have long windows opening on both sides. It helps the positioning of all the main systems: power supply, water and waste recycling. (design workshop)

However, one of the respondents said that a disadvantage of this unit is that it definitely needs a longer frame and structure to accommodate it, since the unit is very long and narrow. The positioning of the opening (door & window) could also create problems with the units since it will block one unit when another is placed next to it.

The module is long and narrow. Therefore, it needs extra care during lifting. (design workshop)

Type B



FIGURE 5.3 Typical arrangement and 3-D visualizations

The size of the unit for type B is 2.4 m x 6.0 m (approximately 14 m²). This unit is proposed in two sizes. Type B1 is suitable for a studio and for a single person. It can provide space for a bathroom, a kitchenette and a single bed. For type B2, the unit is the combination of two units of type B1. The B2 type offers the perfect compromise between comfortable living area and the modest size of bedrooms.

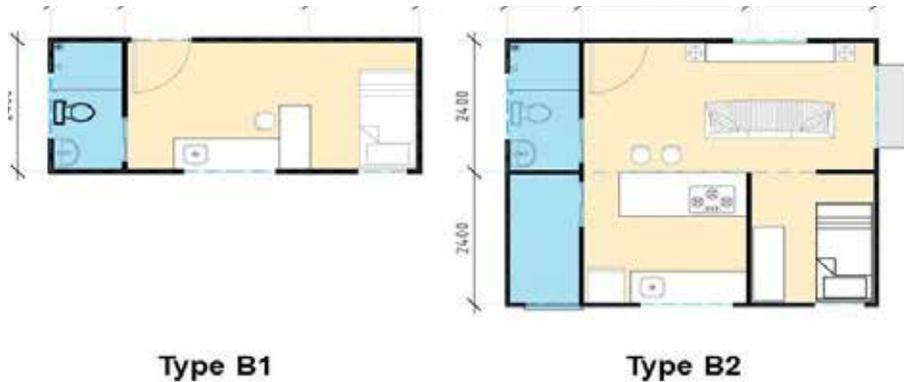


FIGURE 5.4 Typical unit for type B (short) *position of opening (doors & window) will change according to location

The advantage of this unit is it gives more light and ventilation, and at the same time it is practical for the logistics and easy to manage. (design workshop)

The design gives the occupants the option to expand their units lengthwise, thus making the unit more feasible and comfortable. It offers a choice for the users to have more open spaces for various purposes, for example roof garden, space for gardening, open balcony, etc. This type would definitely appeal to discriminating young starters, as one of the respondents mentioned:

This type fairly offers something in the middle, it is not that wide and can be easily transported and a right size for the young starters to begin with. (design workshop)

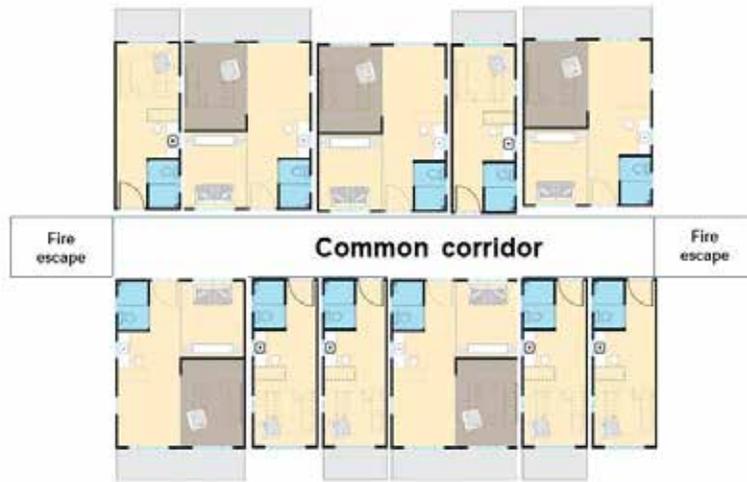


FIGURE 5.5 Typical arrangement and 3-D visualizations

Type C is different from the previous type in the way it is arranged and slotted in (short part). The unit is flexible and allows changes in both structural and design parameters. The unit has a simple build: it comprises a rectangular floor space. The dimensions are 7.2 m (l) x 2.4 m (w) x 2.5 m (h).

According to the respondents, the unit should be insulated in accordance with Malaysia's climate. The floor spaces are rectangular and comprise a bedroom that is ideal for a single bed but can accommodate a double bed, a bathroom unit with a shower at the other end, and a small kitchen. The unit has the potential to be added to (C1) and the interiors are characterized by the functional furnishings requested by the users.



FIGURE 5.6 Typical unit for type C *position of opening (doors and windows) will change according to location

The module unit can be added on to and or down sized, depending on the needs of the users. However, one issue was raised during the presentation of the module by one of the respondents:

This concept definitely needs a lot of consideration about the ventilation of the intermediate unit... and to avoid of being a stuffy unit. (design workshop)

§ 5.2.2 Summary of the design

The unit's support system will be designed not only for comfort but also for efficiency. Each module will feature a fully-appointed living room with modular wraparound couch and LCD TV with an ample built-in cabinet. The kitchen will be equipped with high-tech appliances, including a built-in refrigerator, an induction stove, microwave oven and washing machine and dryer for an upgraded unit. Depending on the size, the dining area will be equipped with a restaurant-style booth. The bedrooms will be fitted with fully furnished beds with ample storage underneath. The bedroom will have a built-in wardrobe and be upgradable, according to the package. The bathroom for each unit will have a large shower, a full vanity unit and a porcelain low-flush toilet. For the upgraded version, the user might have the option to have a private sundeck with an outdoor shower (if the location permits such). The facilities such as air-conditioner and water boiler will be optional for customers and could be added as part of the chosen package. The lighting will be built into the walls and the ceiling to reduce maintenance. It will be able to last for up to 100,000 hours of continuous use. The interior and exterior of the house will be customizable as regards materials, color combinations and specifications, according to the financial capability of the customers.

All respondents agreed that the idea of the unit was using the ISO container as a basis (although not necessarily be built from shipping containers) and must be easily transportable. Although the system will benefit from container technology, the majority of the sizes and modules could be wider, longer and taller than a standard ISO container. For this case, the unit will arrive at the site with the mechanical, electrical and sanitary systems already incorporated. It was suggested that thermal insulation provided by a ceramic material could be covered with a spray similar to that used by NASA for space shuttles. Both the roof and the walls will be made from prefabricated metal panels clad with sheets of acrylic and fabric to insulate against the tropical climate of Malaysia.

The different designs proposed by the architects during the session provided design alternative versions of the flexZhouse. The input will be taken into consideration along with their pros and cons for the final revision of the flexZhouse. Some of the illustrations produced earlier show only the typical layout of the unit and module; the position of the opening will be changed according to the location (end/intermediate).

§ 5.2.3 Business model components

For the second part, the BM components were extracted from the discussion. Several ideas were gathered that lead to the contribution of the BM as follows:

CUSTOMIZATION	Value propositions	Single unit & double unit Proposal 1: 2.4 m x 12 m (module) Proposal 2: 2.4 m x 6.0 m (module) Proposal 3: 7.2 m x 2.4 m (module)
	Target customers	Young starters (approved the conceptual design)
	Customer relationship	Maintenance of the unit, cleaning services, centralized laundry, function/common area, gathering spaces
AFFORDABILITY	Revenue streams	Not relevant to the session
	Cost structure	Not relevant to the session
	Key resources	Manufacturing plant, crane for lifting, customer service centre, design consultation, architects, and designer, logistics and transport
SUPPLY CHAIN	Channel & Network	Efficient logistics, networking
	Partnership	Not relevant to the session
	Key activities	Modular housing, mobile housing, industrialized housing activities, factory housing fabrication, housing production, installation

TABLE 5.2 Summary of business model component for design workshop

Value propositions

As regards value propositions, this group proposed mainly three type of modules. The type is based on the single unit, double unit and a duplex unit derived from the previous conceptual stage. After the session, the design workshop proposed designs for module type A: 2.4 m x 12 m; type B: 2.4 m x 6.0 m; type C: 7.2 m x 2.4 m.

Target customers

The target customers as mentioned during the workshop remained the same as in the previous proposal (draft BM). However, the discussion was mainly about the issues facing the housing industry. The target customers for the above products and services are primarily the middle-income group age bracket (25–34 years old). However, no new insight into these elements were discussed.

Customer relationship

The design workshop suggested a new level of involvement for the housing provider, namely providing a customer service centre and providing its customers with design consultation. As more housing developers prefer short term relationship with their customers, the workshop agreed with the new business model emphasizing the sustainability of the relationship by providing unit maintenance, cleaning services,

a centralized laundry area and a common area for gathering and social activities. The workshop suggested ways to solve current problems of maintenance in a high-rise building, especially in private apartments and condominiums, that is, regular maintenance of the common area and good after-sales services to its customers.

Key activities

The core activities will be the prefabrication of modular housing and industrialized housing production. The workshop suggested rebranding the current IBS terminology in the country, which only focuses on RC slab and modular concrete structure. The workshop suggested that the new BM should provide services from an early stage as designing, consultation in financial aspects, production, delivery, installation and after-sales activities (e.g. maintenance and technical support). This suggestion is expected to attract the customers to the products and become loyal to the company.

Revenue streams

The workshop did not contribute to the discussion on this element.

Key resources

A typical IBS factory needs state-of-the-art technology to support its business operation. The workshop suggested that a huge investment would be necessary at the very beginning of the operation to, for example, purchase physical assets such as manufacturing facilities (e.g. machines to produce and fabricate the units, and facilities for stocking and storing the units). Vehicles to transport the units are vital for this type of business, as are cranes to insert the unit into the structure. The architects suggested that the company should invest in architects and designers and engage architects during the early stage of the customization process with the customer. The architect (in-house or external) should accommodate the customer's needs and translate them into the appropriate unit for the customer, or what is described as a spatial and emotional framework for most rituals of people's lives, namely eating, sleeping, relaxing, etc. The concept of home triggers the desire of users concerning both the interior and the exterior, and fulfilling that desire demands immense skills and an intimate knowledge of the customer's personality. The workshop suggested architects should play an active role in translating a customer's needs into personalized space and customizing it according to the customer's preferences.

Cost structure

There was no discussion of this matter during the workshop.

Channel & Network

Efficient logistics and networking are important to ensure the unit can be transported according to the schedule and logistics matters is under control.

Partnership

No related discussion would benefit this section.

§ 5.3 Focus group with young starters

The focus group with young starters was conducted in four sessions. The first session was a pilot study at TU Delft; the rest were conducted in the resource center, at the faculty of Architecture and Design, UPM Serdang, Malaysia. Each session lasted approximately 3–4 hours. 'Feeding information' techniques were used from one to the next session, in which one output fed to others. Questions were improvised each time to ensure the improvement of each session. The findings highlighted two major aspects of the contribution made by deductive and inductive coding. The deductive codes are the a priori codes that we derived from the literature and based on the problems that we derived from the housing industry in Malaysia. The inductive codes emerged after the sessions.

The focus groups with the young starters answered the following questions;

- 1 What type of products should be offered to (you) young starters?
- 2 How much are (you) customers willing to pay? What are the mechanisms (for you) to pay? What are (your) their options to pay?
- 3 How does the business reach (you) the customers? How long does it take to be delivered (to you)? How does it differ from current conventional housing?

In the first section of the exploration, the question 'What type of products should be offered to (you) young starters?' led to the establishment of multiple categories. The categories were further narrowed to the elements of design & services, safety & security, and the additional requirement of the flexZhouse. The final codes contributed to the answers to the value propositions that cover choices and options for design, different needs for a different group of customers, and the new strategy in dealing with their customers through better customer services.

Next, we further explored the financial capability of and the affordability for our focus groups with the guidance of the questions 'How much are customers (you) willing to pay?', 'What are the mechanisms (for you) to pay?' and 'What are their (your) options to pay?'. The findings resulted in several categories related to the final theme of housing package, ownership and cost structure of the new BM. Under this section, the feedback recalled several questions related to financial matters and how customers want to pay for the product and services offered to them. The section links the answers for the

related BM components on the revenue sources of the company and the cost structure of the new BM. However, as regards key resources, not much information was obtained from the sessions.

Finally, the focus groups with the young starters explored the questions 'How does the business reach (you) the customers?', 'How long does it take to be delivered (to you)?' and 'How does it differ from current conventional housing?'. In this section, the feedback provided answers for the delivery process, the appropriate transition period and the problems that the new BM promise to solve regarding late delivery in the present housing scenario. The answers provide some key answers to the components that relate to channel & networking of the new BM, the partnership of the new BM to help with the daily operations and the activities that essential to support the new BM.

§ 5.3.1 A priori code 1: Customization (design)

As mentioned, we used several a priori codes (codes that are developed before examining the data) to guide our focus groups. In this first part, we discuss the issues related to the design of the flexZhouse. The design propositions could be associated with value propositions components for the new business model. The following questions were asked;

What type of products / services can be offered to you (young starters)?

For reporting purposes, we divided the codes on design into several categories. The first category is the design & services; the second is the security & safety aspects, and the third is the additional requirements.

Under the first category (design & services), several respondents said they would like the flexible housing to provide a fully furnished concept and to include the utility fees in their monthly bills:

If possible, the house must have all the [regular] facilities, require minimum renovation [before occupancy], and be close to public transportation. At the moment, I am tired of waking up early just to face traffic congestion. The closer to public transportation network the better. I wouldn't mind paying more. (focus group).

Another respondent said:

I want to have a drying yard. The view must be good, to get peace of mind. If possible [the location of the] the drying yard should be hidden from outside view. (focus group)

Other respondent stated:

I want to add a balcony or change the layout of the exterior. The current design does not allow that.(focus group)

Other interesting feedback under this category concerned the sustainable factors, namely the open concept, a vegetable garden, lighting issues and ventilation for the units. One of the respondents requested to have a private outdoor space for gardening purposes. Another stressed the importance of good lighting and ventilation to avoid feeling claustrophobic, especially if the compound is located in a busy area. This can be seen from some of the responses:

I want an airy unit, supported with good lighting and ventilation (focus group)

It is interesting to note that some respondents were not keen on the idea of customization from the beginning. There was a group of young starters who just wanted a very basic home to begin with. The argument is that respondents seek standard basic units, but also hope for some individual appreciation and customization in the future. The respondents suggest a smaller unit of (2.5 m x 5.0 m) for a start. They do not require fancy homes to begin with. One of the respondents said:

I think flexibility [choosing different layouts] is not needed at the beginning. When I have a family and commitment, I will add [the additional components]. So maybe at the beginning, a basic unit is sufficient. At the moment, I just use the house for resting, playing games, and a place to eat. Partly, maybe because I am single... (focus group).

The focus group with young starters further approved the sizes that were discussed earlier, namely 1) studio unit (2.5 x 5.0 m); 2) single unit (2.5 m x 7.0 m); and 3) double unit (2.5 m x 12.0 m) x 2 (horizontal) and duplex unit (2.5 m x 12.0 m) x 2 (vertical). The idea from the design workshop with the architects was further developed and discussed in the series of focus groups with the young starters. The sizes were revised to be 2.5 m width, which is an acceptable size for habitable space.

QUOTATIONS	CATEGORY	THEMES / CODES
If possible, the house must have all the [regular] facilities, require minimum renovation [before occupancy], and be close to public transportation. At the moment, I am tired of waking up early just to face traffic congestion. The closer to public transportation network the better. I wouldn't mind paying more.	Facilities, amenities, garden allotment	design & services
I want to have a drying yard. The view must be good, to get peace of mind. If possible [the location of the] the drying yard should be hidden from outside view. (FG1)	Personal laundry area, hidden drying yard	design & services
I want to add a balcony or change the layout of the exterior. The current design does not allow that. (FG2)	balcony, customization	design & services
I want an airy unit, supported with good lighting and ventilation.(FG2)	Good lighting & ventilation	design & services
I think flexibility [choosing different layouts] is not needed at the beginning. When I have a family and commitment, I will add [the additional components]. So maybe at the beginning, a basic unit is sufficient. At the moment, I just use the house for resting, playing games, and a place to eat. Partly, maybe because I am single... (FG2)	Basic unit, design, individual spaces	design & services

TABLE 5.3 Summary of coding for design & services

The next category under the design propositions is safety & security issues. Most of the respondents agreed that safety and security are the most crucial elements before they choose to buy or rent a property. Apart from the design & services that can be offered by the management, it is important to include elements of safety and security as part of the concept of the housing complex.

During the sessions, most respondents were really concerned about the increasing crime rate, especially in urban areas. Therefore, it is important for the flexZhouse to include a design that supports safety and security of the users at all times. Some of the idea raised by the respondents include a gated & guarded facilities, 24-hour surveillance and integrated safety design elements as part of the house layout.

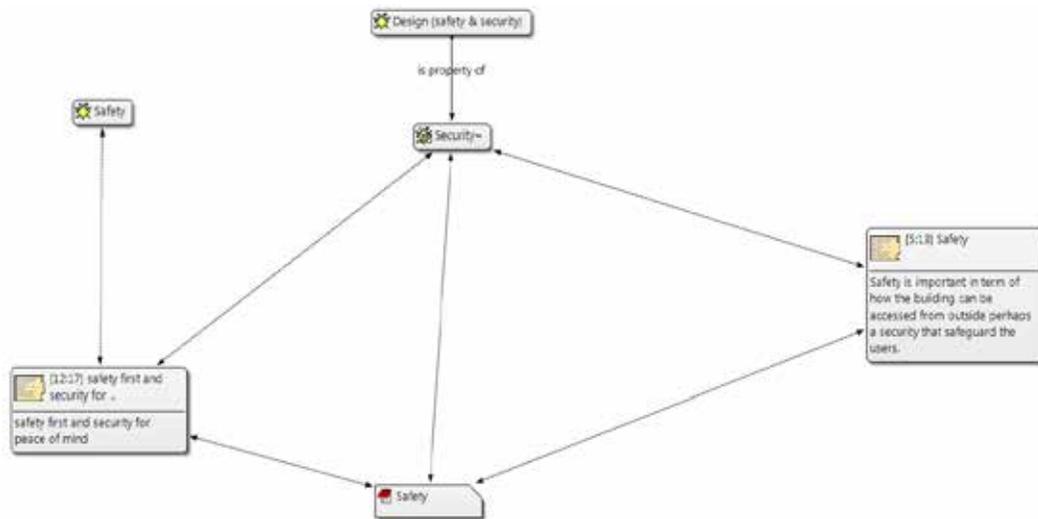


FIGURE 5.7 Network view for safety & security

QUOTATIONS	CATEGORY	THEMES / CODES
Safety is important now, a lot of crime rates in the city area, if possible [we] need extra security with the latest technology. (FG3)	Safety and security equipment	Safety & Security
Yes, it is important to have security for the house. There is a lot of crime happening these days. (FG3)	Safety, crime rate	Safety & Security

TABLE 5.4 Coding for safety & security

We found several elements that fall under additional facilities, including proximity to public transport, social community places (e.g. a common and function hall) and places for worship. One of the respondents stated:

I am not sure about housing segment, but how about community in that area? Is there a community hall, places of worship, swimming pool, bbq area and function hall? (focus group)

QUOTATIONS	CATEGORY	THEMES / CODES
I am not sure about housing segment, but how about community in that area? Is there a community hall, places of worship, swimming pool, bbq area and function hall? (FG2)	Places of worship, community services, social	Additional requirement
I want to have the lift closer to the access door so I can easily bring my stuff up [groceries, etc.]. (FG1)	Accessibility, proximity	Additional requirement
I want to have easy access to the parking area and accessible for my vehicle. (FG3)	Close proximity, design requirements	Additional requirement

TABLE 5.5 Codes for additional requirements

Therefore, to conclude the section on value propositions, the elements of design & services, safety & security, and the additional requirements are some of the essential components of the new BM. The codes contribute to the answers to the value propositions that cover choices and options for design, different needs for a different group of customers and the new strategy in dealing with their customers through better customer services.

§ 5.3.2 A priori code 2: Financial

Under this section, we further categorized the financial coding into two categories, namely housing package and cost structure & ownership. The following question was used to guide the session:

*How much are (you) the customers willing to pay? What are the mechanisms to pay?
What are (your) their options to pay?*

QUOTATIONS	CATEGORY	THEMES / CODES
It would be good if loyal customers could get a discount. (FG1)	Loyalty programme, incentives	Housing package
Capital fund to secure deposit for new homes and offer ownership option [for customer] (FG 4)	Loyalty programme, incentives	Housing package
More options to buy and ownership [scheme] (FG3)	Rent-to-buy, capital fund, affordability. facility	Ownership
The price of the house should be 20% lower [than market price] (FG3)	Buying options, ownership	Ownership
All-inclusive bills in the monthly payment [commitment] (FG2)	Monthly payment, affordability	Cost structure
If follow the package, the price should be based on the location, but as a guideline; Package 1: RM 500, package 2: RM 1000, package 3: RM 2000 and Package 4: RM 2500. Probably 20% decrease or increase in different locations. (FG3)	Monthly payment	Cost structure
Easy payment, using monthly deduction and flexi payment (FG2)	Monthly commitment, affordability, payment rate	Cost structure

TABLE 5.6 Codes for financial

Based on the question on the financial aspects, there were interesting responses concerning housing packages. They included incentives for early payment, a loyalty programme for loyal customers. Several respondents agreed that the rent should depend on the location. For example:

If follow the package, the price should be based on the location, but as a guideline; Package 1: RM 500, package 2: RM 1000, package 3: RM 2000 and Package 4: RM 2500. Probably 20% decrease or increase in different locations.(focus group)

A loyalty programme for loyal customers would also be good for the business strategy of the company. The respondent suggested that the management could reward loyal customers by, for example, giving a discount on the monthly bill or on the interior and exterior components, etc. There were several suggestions to include a housing package with rent-to-own options and incentives for taking good care of the units.

As regards cost structure, some respondents suggested that the monthly payment for the lease should be at least 20% lower than in the surrounding market. There were suggestions to have all-inclusive bills for the utilities and the rent. One of the respondents in the focus group with young starters suggested that automatic monthly deductions from their account (direct debits) would be an easy payment option.

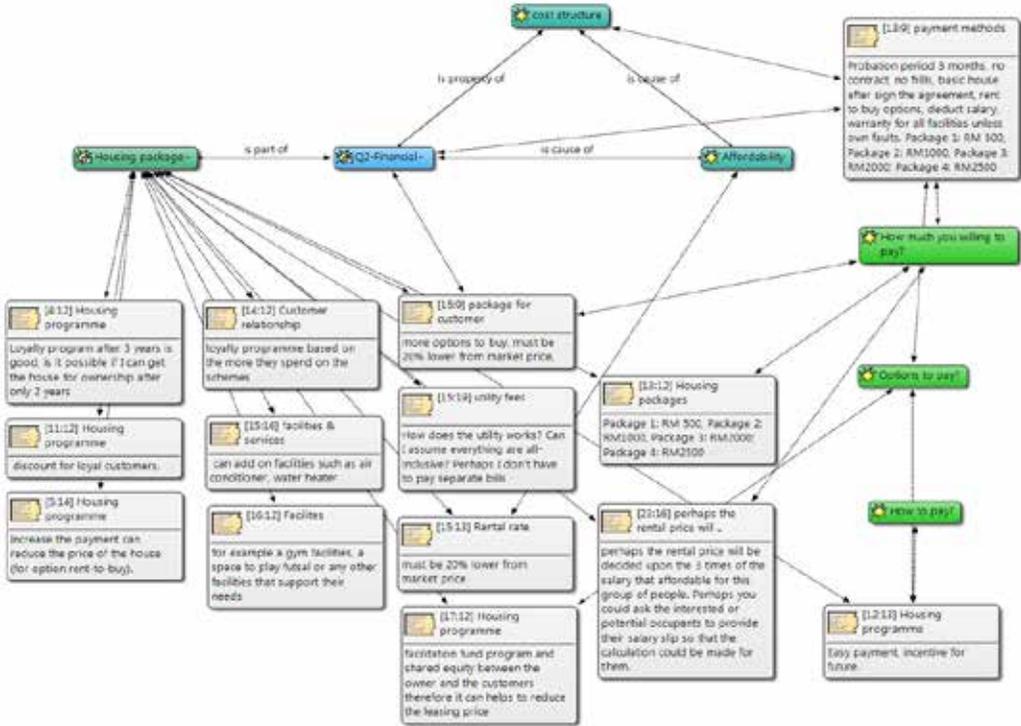


FIGURE 5.8 Network view for financial

Under the same coding of financial, the findings resulted in a category named cost structure. Under the ownership category, the respondents raised the possibility of owning the units. Respondents asked for an option to sublet the property for the purpose of rental returns. We notice that the options to buy seemed to entice the respondents towards the proposal. We found that the ownership options were more attractive to the young starters compared to renting.

Under this section, the feedback concerned several questions related to financial matters and how the customers want to pay for the product and services. The section provided answers for the related BM components on the revenue sources of the company and the cost structure of the new BM. However, as regards key resources, not much information was obtained from the sessions.

§ 5.3.3 **A priori code no 3: Supply chain**

In this section, we note that the supply chain involves what we regard as 'hidden activities'. During the focus group session with the young starters, the focus of the questions was more on the delivery of the products, the time expectations for the delivery and the transition period during the upgrading and downgrading period. We started the sessions with the following guidance questions:

How does the business reach (you) the customers? How long does it take to be delivered (to you)? How does it differ from current conventional housing?

Based on the feedback, all respondents from every session agreed that current conventional housing takes longer to complete and involves uncertainty and risks for the housing purchaser. Based on the experiences of some respondents, faster delivery is necessary for flexZhouse. Some respondents suggested that the provision of the units should not take more than four months. One of the respondents said:

Maximum 6 months for waiting time. Is it possible to deliver within 3-4 months from the order date? And have time for transition [moving into] to new unit. (focus group)

Another respondent said:

Need to have close link with the supplier and manufacturer for technical repair. I would suggest 2-3 months [delivery time] for new units and within 6 months for the replacement of the new units ... Or it could be shorter, depending on the complexity of the design. (focus group)

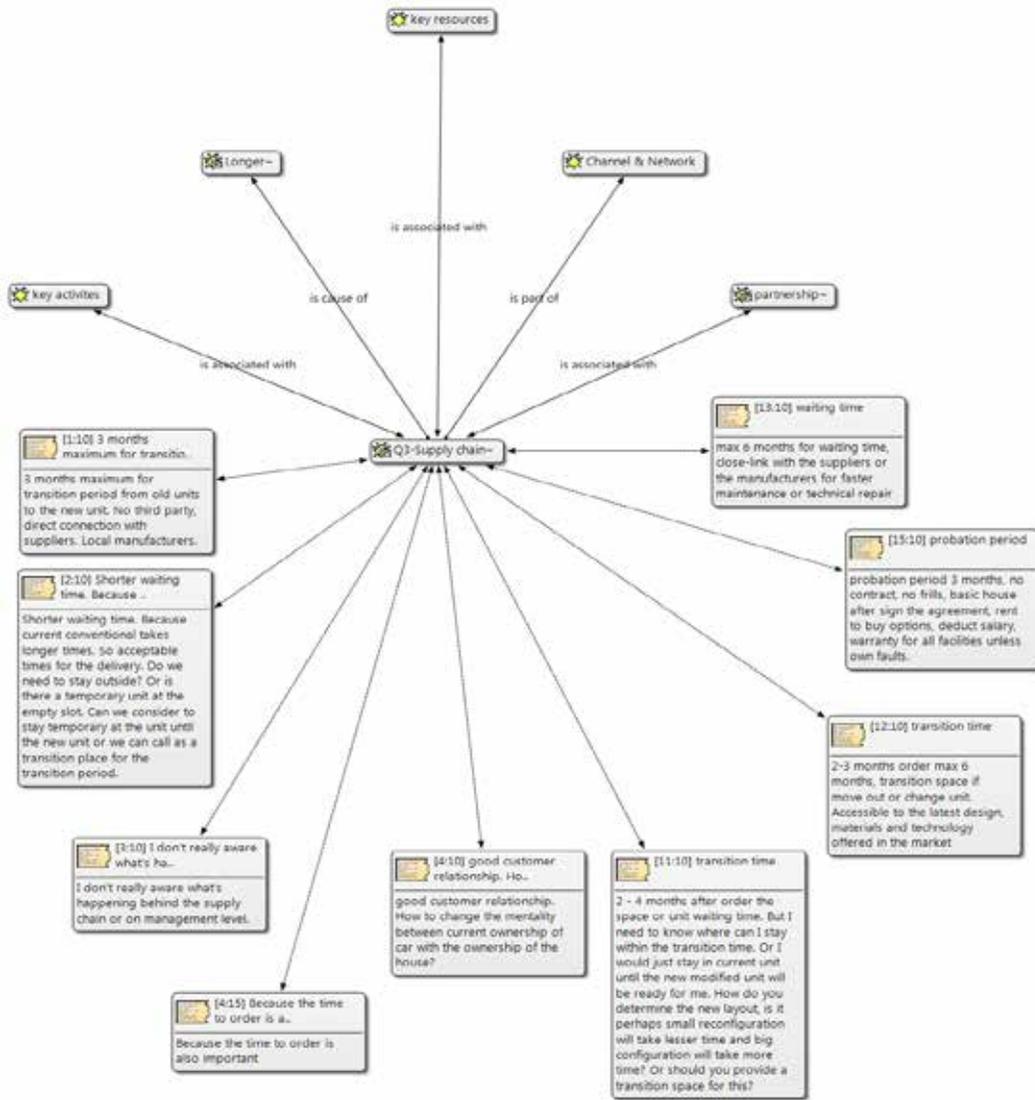


FIGURE 5.9 Network view for supply chain

Several questions were raised during the sessions about transition housing in case they change the entire design of the house. These questions helped the author to provide a framework on the lifecycle chain of the products and activities involved during the transition period.

In the discussion, the partnership of the company with other parties was raised. The coordination of the job and tasks to expedite the works and delivery process were among issues that were discussed to improve present housing delivery. One of the respondents said:

*We can partner with the local manufacturers, using local craftsmen to support this.
(focus group)*

As regards the delivery of the units, one of the respondents stated the following:

Therefore, it is important for this BM to initiate a very structured way of providing good logistics and delivery system for its clients according to the time that was agreed by both parties...(focus group)

In summary, this section provides answers to the delivery process, the appropriate transition period and the problems that the new BM promises to solve in regards to late delivery in the present housing scenario. The answers provide some key answers to the components that relate to channel & networking of the new BM, the partnership of the new BM to help with the daily operations and the activities that are essential to support the new BM.

§ 5.3.4 Business model components

For the second part, the BM components were extracted from the discussion. Several ideas were gathered that lead to the contribution of the new BM as follows:

CUSTOMIZATION	Value propositions	Type of unit studio unit (new), single unit, double unit, duplex unit (reconfirmed), services for the unit, all-inclusive, farming, outdoor garden
	Target customers	Single person, young couple, young parent with children, young executives
	Customer relationship	After-sales services, maintenance, defects liability period, warranty of the product
AFFORDABILITY	Revenue streams	Account deduction, not exceeding 30% of monthly salary, renting on units, and usage fees on services, option for ownership, rent-to-own, rent-to-buy
	Cost structure	Leasing: Package 1: from RM 500 Package 2: from RM 1000 Package 3: from RM 2000 Package 4: RM 2500. Selling: 20% lower from market price (subject to location)
	Key resources	No significant information
SUPPLY CHAIN	Channel & Network	IT, social medias, show house, learning center
	Partnership	No new inputs
	Key activities	Local manufacturers, sanitary fittings supplier, electrical, furniture, doors, windows and housing equipment

TABLE 5.7 Summary of business model component from focus group with young starters

Value propositions

The input from this section really contributed to the value propositions of the new BM. Further, we divided the codes into three categories, namely design & services, safety & security, and additional requirements.

Most of the respondents said that safety and security are the most crucial elements when they are deciding to buy or rent a property. Apart from the design and services that can be offered by the company, it is important to include elements of safety and security as part of the services for the housing complex. Some of the ideas raised by the respondents were a gated & guarded complex, 24-hour surveillance and integrated safety design elements as part of the house layout.

Several components were found that fall under additional facilities, including proximity to public transport, social community places (e.g. a common and function hall) and places of worship.

In summary, the focus group with young starters suggested one additional product – the studio unit (2.5 m x 5.0 m) – and further improved the design of the unit from previous sessions, which include single unit (2.5 m x 7.0 m), double unit (2.5 m x 12.0) x 2 (horizontal), and duplex unit (2.5 m x 12.0) x 2 (vertical). The feedback suggested that several facilities or services should be provided, such as gardens and allotments, outdoor garden, laundry area, facilities for social gathering and security services for customers.

Target customers

Based on the feedback, the new business model is more attractive to young couples and families with small children. It is interesting to note that single persons/young starters who have just graduated prefer a smaller unit/module. For starter and basic unit, the respondents would like a lease price of around RM 500 – RM 700 per month (all-inclusive). This could give some ideas for the revised BM to take into consideration. The feedback confirmed that the need of housing is increasing, and the demands is especially high in prime areas and places near main facilities and transport networks.

Customer relationship

The focus group suggested better customer relationship compared to current conventional housing. The relationship will start in the pre-sales phase and continue through sales, design consultation and after-sales. It is suggested that the defects liability and quality of the product should be the priority of the company. The groups said that they hoped that the product defect warranty will be extended and that the products would be more durable and designed for longer use. The feedback suggests personal assistance is helpful in terms of better communication with the customers, for example setting up a customer hotline and providing technical assistance.

Key activities

The respondents were mainly aware of the activities run by the manufacturer especially regarding prefabricated housing and industrializing of the housing systems. Nevertheless, no particular input was obtained to contribute to the key activities of the company.

Revenue streams

Under this section, the author further categorized the financial coding into several categories, which include housing package, cost structure & ownership. Respondents suggested operating a loyalty programme for loyal customers, whereby the management rewards loyal customers by giving them discounts on their monthly bills or on the interior and exterior components, etc.

There are several suggestions to include a housing package with rent-to-own options and rewards for equipment that has been taken care of by the customers. Under the ownership category, some respondents raised the possibility of owning the units, while others were interested in an option to sublet of the property for the purpose of rental returns. The buying option was attractive to the respondents. The ownership options were more popular among the young starters compared to rental. Other input related to automatic account deductions (direct debits) to make payment easy, and usage fees on services.

In summary, the sessions suggest leasing as the main revenue for the company. However, the company could provide rent-to-buy and rent-to-own options. The leasing could use the 30% of income parameter for the customers while the ownership scheme should be open to loyal customers who longer in the premises.

Key resources

No significant information on the key resources was discussed during the sessions.

Cost structure

From the young starters point of perspective, the cost structure is mainly built around the monthly payment that is affordable for them. Suggestions involved several ideas on the amount that would be affordable for the group to pay, and to use the 30% of monthly commitment based on salary capability. In one of the sessions the rental price were suggested as follows:

Package 1: from RM 500; Package 2: from RM 1000; Package 3: from RM 2000; Package 4: RM 2500. However, the group agrees that the rental price should depend on the location and market price of the area.

Channel & Network

The overall feedback suggested that the young starters were very excited about the new concept. They liked the idea of a learning centre and a show unit or sample house, and supported the idea of the new BM using social media and apps to provide new designs and new products to create publicity for the product. In order to provide the awareness of and continuous support for the new business, the use of updated technology, apps and a website would be best to reach customers. Since the affordability is the key issue of the new BM, the new channel should include value-driven as its priority.

Partnership

As regards partnership, the sessions suggest that the new BM should establish collaboration with local manufacturers and suppliers. This includes a better utilization of local manufacturers' products to minimize importing outside resources. The sessions suggest local designers and manufacturers should start thinking about designing durable, recyclable products that can be used extensively.

§ 5.4 Focus group with entrepreneurs, housing developers and an NGO

The next focus group was conducted at the Faculty of Architecture & Design at UPM, Serdang. It involved entrepreneurs in the housing sector, private housing developers and an NGO that deals with social housing. We sought the participants' views and feedback with the purpose of obtaining their insights into the proposed BM, focusing on the affordability and related issues.

This session demonstrated that the industry, practitioners and private developers were not keen to the new idea. Several new themes emerges, which we will elaborate in the final section. There was consensus that the new BM should be proposed to government agencies such as PR1MA and SPNB. There was a clear view that although the BM elements seem enticing and have prospects, the new company model still needs to focus on the acceptance of the market before it is being introduced. We agree that the barrier to innovation in the housing industry is mostly attributed to intolerance of uncertainty, accustomed to the current way of working and fundamental shift in the current actors involved. Innovation means a change in how they works and therefore approval is likely hard to be obtained.

§ 5.4.1 A priori code: Financial

Respondents highlighted the importance of having feedback from the financial institution in the case of the house wanted to get into the mortgage system.

This kind of concept, as I said, need supports from the banks and government especially to back up the idea [in terms of support / subsidy]. (focus group)

Other suggestions included a facilitation fund towards ownership model. The respondents, especially the private developer, still believe the ownership model is an attractive solution. However, the suggestion to put aside some money or to make a monthly deduction from the monthly payment for the capital fund is worth including. Under this proposal, some portion of money could be put aside to generate deposit to buy the unit. In response to this, one of the respondents said:

It would be interesting for this model to include the option to generate a facilitation fund; this would help the young starters to have some money for the deposit on the new house. (focus group)

It is interesting to note that capital appreciation is necessary for the developers to make a profit. One of the respondents said:

[We expect]A capital appreciation to match with rental and then it can create investment return.(focus group)

The importance of value chain was emphasized throughout the sessions, which implies that the new BM must ensure that the requirements of the entire lifecycle chain are addressed. One of the respondents mentioned the necessity to include the value creation for the new BM for the potential business entity. It requires additional care on how the local issues will be dealt with by the new BM.

Further, most of the discussions were about the situation that plagued the industry in relation to land issues, the authorities' requirements, developers' incentives for profits and legal aspects that involve the planning of the building, which will be discussed in the following section. The participants realized that the new BM will need to set up a big, centralized manufacturing plant. The plant should be located in a strategic location so that the modules could be moved efficiently and in a feasible manner for the business. The session suggested that the lack of skilled and semi-skilled workers should be addressed regarding this matter. However, the participants agreed that the new business model will reduce the industry's dependence on foreign labourers.

§ 5.4.2 Results from the inductive coding

Interestingly, several new codes emerged from the session. Respondents described the new BM as a totally new innovation, and they spoke about the need to consider the issue of land acquisition, especially land that belongs to the state governments as it is beyond the federal government's jurisdiction.

Land and the authorities matter

One of the respondents stated:

Firstly, you need to understand how the current market works. In reality there are a lot of things that need to be considered, for example, the land matters [state vs. federal], the authorities' requirements [to implement this kind of unit]. This model is new, therefore, I am sure it will be difficult for the housing developer to adopt it. (focus group)

Another respondent said:

We anticipate the feedbacks [reluctant]]from the private industry and then you will present the idea to the government sectors dealing with housing [and see their reactions]. (focus group).

In response to the proposed model, especially the private developer was not keen, simply because private developers would need to change how the game is currently being played in the conventional housing industry. The private developer was sceptical about the reception from the market. He later added:

Tomorrow, you can ask PR1MA, how do they get the land? How do you identify the land [title]? The issue is why Pr1MA does not want to do [housing project] in Selangor? It is because political and state ruling, maybe you need to tackle this issue first. (focus group)

Market acceptance

The sentiment towards the new business model was caused by the market acceptance of this new idea. Most of the respondents said that they would not dare to take the risk of uncertainty.

One more thing, you need to do the survey (to public) to see the response (market) to the new concept. Have you asked around [public]? Or you can promote this [new BM] using the facilitation fund from the government and introduce share equity [in hoping] to reduce the monthly commitment. (focus group)

There were several recommendations to identify the number of Malaysians who are still renting and how many had already bought a house. This would ensure that the new BM will be feasible and accepted when introduced in the market. One of the respondents said:

Maybe you can survey [households to see] how many are still renting or have already bought a house? (focus group).

§ 5.4.3 Business model components

For the second part, the BM components were extracted from the discussion. Several ideas were gathered that led to the contribution of the BM as follows:

CUSTOMIZATION	Value propositions	No further insights
	Target customers	Not relevant
	Customer relationship	Not relevant
AFFORDABILITY	Revenue streams	Ownership and customization of the spaces
	Cost structure	Maintenance, resources location, manufacturing technology, people, designers, technical personnel, 40% cost profit
	Key resources	Factory, resources, crane facilities, mobilization facilities, trucks, trailers
SUPPLY CHAIN	Channel & Network	Not relevant
	Partnership	Small entrepreneurs, local suppliers, international expertise on technical
	Key activities	Industrialized housing production, modular/mobile housing, housing for middle incomes

TABLE 5.8 Summary of business model component from focus group with entrepreneurs, housing developers and an NGO

Value propositions

The respondents were not interested to provide feedback on this aspect.

Target customers

The respondents agreed that the target of the new business model should be the middle-income group. However, the findings suggest the focus should be on how to create the new flexible housing as a 'transition' house for the young starters before they are able to buy a house on the open market. Therefore, no further insight was obtained from the session.

Customer relationship

The respondents did not indicate what type of customer relationship would be suitable for this kind of business. However, they did agree that the current business model needs to improve its customer relationship.

Revenue streams

The respondents suggested a capital fund for the transition house idea (facilitation fund). The new BM could provide a 'financial bridge' between the transition house and the 'real' house. One of the respondents suggested a capital fund towards ownership model. The respondents, especially the private developer, said they still believe the ownership model is an attractive one in Malaysia. Therefore, the suggestion to put aside some money or a monthly deduction from the monthly payment for the capital fund is worth including. In this proposal, some portions of money are to be put aside to generate deposit to buy the unit. The revenue could be obtained from the customization activities. The respondents agreed to the proposal on rent-to-buy and rent-to-own options to entice the ownership market.

Key activities

The respondents suggested that the new BM should adopt a newly industrialized solution for the housing. The new perspective on mobile housing should address the issue of how to reduce the cost of production, the land and the authorities' requirements, and the cultural acceptance among Malaysians. It is understandable that the industrialized building system is still new in Malaysia and production normally involves the use of concrete and RC (reinforced concrete).

Key resources

The respondents were, in general, hesitant about the new concept due to the big investment that would be required during the early stage of the business setup. However, they agreed that a huge investment would need to be capitalized at the beginning of the project. Setting up a big, centralized manufacturing plant would be the top priority. The plant should be located in a strategic location so that the modules could be moved efficiently and in a feasible manner for the business. The group suggested that the lack of skilled and semi-skilled workers should be addressed before implementing the new BM. They agreed that the new BM will reduce the industry's dependency on foreign labourers.

Cost structure

The respondents shared the sentiment that the cost structure would be expensive due to the investment in the initial resources. However, they suggested that the cost could be reduced if the government were to subsidize some of the operations. The session demonstrated the acceptance by the industry, practitioners and private developers of the new idea. Basically, the group suggested that the new BM will be feasible for the private developers if they can keep the average 40% profits for the new BM.

Channel & Network

As regards channel and network, no further insight was discussed during the session. However, the respondents agreed that the new BM should use new technologies and social networks to support business operations. The current BM provides showrooms or show houses during the launch of new products, making it easier for customers to decide before committing themselves to purchasing.

Partnership

As regards partnership, the respondents suggested that the new BM should benefit local manufacturers, small entrepreneurs and local suppliers. It was suggested that a new joint venture with overseas experts would be necessary to provide support for the business operation. The participants suggested that for the launch of the company, experts and skilled workers from experienced international companies should be recruited for technology transfer and mutual benefits.

§ 5.5 Focus group with government agencies

The final focus group was conducted with the government agencies dealing with housing in the country including personnel from Pr1MA and the Ministry of housing and local authorities (MHLA). We brought all feedback that we gathered from the focus group session 1 (young starters) and 2 (private developers, NGO, and entrepreneurs) into the session using the 'feeding information' technique.

In this session, the information that we gathered from previous focus groups really helped us to organize what we need for the BM of flexZhouse. It further strengthened our previous argument whether the government needs a new BM to support its effort to provide housing for young starters in the middle-income group. Our mechanisms (design workshop, formulation of conceptual model, focus groups with young starters and industrial key players) resulted in a further understanding of people's attitudes and provided feedback, motivations and behaviours (the 'why' and 'how' behind the 'what') for the formulation of the new BM (Desai, 2002). Participants in this session suggested that a much wider range of study cases and examples of the available technology should be conducted to support the new BM. Our findings agree with those of the industry concerning the need for a new sustainable business, the reform of house financing, and the provision of affordable and accessible housing for the middle-income group.

§ 5.5.1 A priori code: Customization (design)

The discussion brought the findings from previous sessions. The design ideas and the value propositions were presented. The idea of the four basic units of housing was presented as the options for the customers to choose from. The session was briefed about the meaning of the term 'standardized customization' and how the design evolves with the customers. The respondents at this session were more keen on the new BM, as shown by this response:

I think this is a good idea, perhaps we could use this to help us to achieve the number that the government targeted [housing for young Malaysians].(focus group)

Despite the considerable infrastructure barriers that would have to be overcome to execute the flexZhouse BM, respondents accepted that this new type of housing could be the solution to the country's housing problem, but strongly emphasized the need for several case studies from outside the country to support the research. Most respondents said they felt that the government had run out of ideas for providing more housing for young Malaysians and needs a fresh and innovative idea.

The discussion focused on the middle-income group and young professionals who have just started working in an urban area and are looking for affordable housing. The respondents agreed that the target customers for this new BM are the middle-income group with salaries in the RM 2999–7999 range.

Transition house for young starters

The government has recently proposed the idea of transit housing in Kuala Lumpur. Under this scheme, the Ministry of Housing and Local Authority would buy several houses from private developers at prime locations in the city and rent them out to young starters at a very minimum price for a period of up to 5 years. After that, the renters would have to move out to make room for another person to rent the unit. The respondents agreed that the flexZhouse BM could be a transit house for the young starters before they being able to finance the deposit on their new house:

I am looking at this concept as a transit house for the young starters, they can live for a while and obtain capital [deposit] before they can decide to buy it [the unit in the future]. (focus group).

The discussion mostly concerned verbal and written information and other information resources (cases from outside: Sekisui House, IKEA house, etc.). The government agency would like to see the final scheme of the BM along with supported study cases from outside the country for further consideration.

Another respondent stated that this new BM would definitely allow more SMEs, new entrepreneurs, and local manufacturers and suppliers to become partners of the company.

§ 5.5.2 Business model components

For the second part, the BM components were extracted from the discussion. Several ideas were gathered that led to the contribution of the BM is as follows:

CUSTOMIZATION	Value propositions	Transition house for young starters, medium high-rise accommodation
	Target customers	Young starters, middle-income earners, income bracket RM 2,999–7,999
	Customer relationship	Not relevant
AFFORDABILITY	Revenue streams	Not relevant
	Cost structure	Leasing and selling
	Key resources	Subsidized by government, lower than market price, according to 30% of the household income
SUPPLY CHAIN	Channel & Network	Exhibition by government agencies, website
	Partnership	Local market, local suppliers, SME partnership
	Key activities	Not relevant

TABLE 5.9 Summary of business model component from focus group with government agencies dealing with housing

Value propositions

As regards products and services, the government agencies were more inclined to label the units as ‘transitional and medium high-rise housing for young starters’. However, the respondents did not object to the size of the modules of the proposed housing. The government is always open to new ideas on how to provide more housing for young Malaysians. The government has recently proposed the idea of transit houses in the city and densely populated areas.

Target customers

The objective of the research is to provide alternative housing for the middle-income population and young starters. Therefore, it was agreed that the government needs to promote better housing options for the same target group. The focus group discussed more specifically young starters with incomes in the RM 2,999–7,999 bracket (household).

Key activities

Although the respondents did not discuss the key activities for the new BM, they did agree and further approve that the newly industrialized housing should be introduced in the country and could be an alternative to current housing scenarios in the country.

Customer relationship

The session did not contribute significant information related to this component.

Revenue streams

The respondents agreed that leasing will be an attractive package to begin with and leads to ownership for an additional option for the customers. The respondents suggested providing additional services to support the need for housing. The company revenue could be derived from recurring leasing fees and usage fees related to the housing services. The respondents agreed with the previous idea of leasing, rent-to-own and rent-to-buy as being part of the source of income for the company.

Key resources

The respondents agreed with the proposed BM on the resources needed to operate the new BM, but did not provide any additional information on the type of resources needed.

Cost structure

Government agencies are looking at ways to provide subsidies for the new BM and assumed a role in operating the company from the government capacity. Therefore, it is suggested that the operation costs could be reduced by using own resources and operating the business through the in-house operation. Further, the respondents stated that further studies are needed to provide examples from existing business to support the new BM.

Channel & Network

The respondents suggested a roadshow organized by the agencies and websites to promote the product. Several channels will be needed to raise awareness of the products. In this respect, it was seen that the government has the leverage as regards reaching the customer.

Partnership

The new BM provides a new opportunity for local players to participate in the supply chain. A respondent stated that this new BM will definitely allow more SME's, new entrepreneurs, and local manufacturers and suppliers to participate become partners of the company.

§ 5.6 Summary of BM components from the design workshop and focus group studies

In the previous chapter, the conceptual design derived ideas from the literature. We started with raw ideas about how the BM propositions would look like. The initial ideas outlined the type of unit that is suitable for young starters, namely single/studio unit and double/duplex unit of 3.5 m x 8.0 m and 3.5 m x 16 m, respectively. Based on Malaysian demographics, we also identified target customers as young starters, young executives and the middle-income group. Next, in the customer relationship, we identified some of the components to improve the housing situation by introducing services before and after sale, and providing the customer with design, technical and financial consultation. We introduced the idea of the circular economy through leasing the unit and components so that the company will benefit from lower resource consumption and durable products. However, the new BM needs support from new resources that rely on manufacturing strategy. In contrast to conventional housing construction, the new BM needs support from sophisticated production machines in the factory, including machines to produce the units, cranes for lifting on site, trucks and trailer for transport, and human resources such as skilled and semi-skilled workers. As to cost structure, the company will rely on the investment of the resources and production by the company. The networking involves producing sample housing for potential customers and a learning centre to create awareness.

In the new BM, the company will focus its activities on housing prefabrication, giving advice on design and financial matters to its customers, and maintaining the units. The company can share the risk through a partnership with local manufacturers and suppliers through support in production and sales activities. The design workshop and the focus groups highlighted certain issues and modified certain components. In summary, the discussion of the proposed BM in the design workshop and the focus groups led to the following modifications:

- *Value propositions* –The design workshop and the focus groups provided additional insights into the size of the unit. The design workshop highlighted several alternatives to the existing brief. The size of the units was further modified and confirmed after the series of focus groups. The focus groups also added another additional unit, namely the studio unit or beginner unit for young starters.
- *Target customers* –The design workshop and the focus groups reaffirmed the earlier proposal from the conceptual stage and enlarged the target group by adding young families to it.

- *Customer relationship* – The design workshop and focus groups further confirmed the earlier proposal to address the problems in the current housing situation by providing more services to the customers.
 - *Revenue streams* – The principals of the circular economy imply significant changes in the ways businesses operate. The new idea was supported by the design workshop and the focus groups. Furthermore, in the focus group with the young starters, several ways of paying and how much to pay were discussed and highlighted.
 - *Cost structure* – The idea remained the same and supported the earlier conceptual idea. The focus groups did not generate any new insights concerning this aspect.
 - *Channel & network* – Based on the examples available in the literature, the idea of a sample housing unit and a learning center were supported in the design workshop and the focus groups. The respondents also agreed that the new media such as Facebook and other social media can be a tool to promote and create awareness of the product.
 - *Key activities* – The focus groups confirmed that the company's key activities should focus on the housing prefabrication, giving design and financial consultation to the customers, and providing periodic maintenance of the products.
 - *Partnership* – The idea of sharing the risks among partners was supported by both the design workshop and the focus groups. Additional partners were suggested, including local manufacturers, home suppliers and small entrepreneurs.
- In the following, we summarize the BM component insights from the sessions we conducted:

	CUSTOMIZATION		
	Value propositions	Target customers	Customer relationship
Conceptual design	Single unit/ studio unit, (3.5 m x 8.0 m) Double unit/ duplex unit (3.5 m x 16 m)	Young starters, young executives, middle-income group	Before and after sale services, design and technical consultation, financial consultation
Design workshop with architects	Type A: 2.4 m x 12 m Type B: 2.4 m x 6.0 m Type C: 7.2 m x 2.4 m	Young starters, single persons, young couples, Gen-Y, age bracket 25–34 years old	Maintenance of the unit, cleaning services, centralized laundry, function/ common area, gathering spaces
Focus group with young starters	Type of unit (half-box) (2.5 m x 5.0 m), single unit (2.5 m x 7.0 m), double unit (2.5 m x 12 m) x 2 (horizontal) duplex unit (2.5 m x 12 m x 2), services for the unit, all-inclusive, allotment, outdoor garden All-inclusive bill utility, laundry area, facilities for socializing, security services	Single persons, young couples, young parents with children	After-sales services, maintenance defects liability period, warranty of the product
Focus group with private developers, NGO and entrepreneurs	Not relevant	Not relevant	Not relevant
Focus group with government agencies	Transition house for young starters, high-rises accommodation	Young starters, middle-income earners, income bracket RM 2999–RM 7999	Good workmanship/ quality of the product, good customer services, after-sales services

TABLE 5.10 Summary of BM components from design workshop and focus group studies

AFFORDABILITY			SUPPLY CHAIN (PRODUCTION)		
Revenue streams	Key resources	Cost structure	Channel & Network	Key activities	Partnership
Through leasing of the units, leasing of the components, maintenance fees	Manufacturing plant, crane for lifting units, trucks and trailers for logistics, human resources (i.e. engineer, designer, semi-skilled workers)	Structure + infill + operating cost (factory, machines, installation, maintenance, promotion, sales & marketing)	Sample unit, learning center, social media	Housing prefabrication, design & financial consultation, building components producers/ suppliers, maintenance consultant	Local manufacturers and suppliers, new modular contractors, steel suppliers
No relevant data	Manufacturing plant, crane for lifting, customer service center, design consultation center, trucks, trailers	Machines (automated system), designers, engineers, customer services personnel, technicians, semi-skilled workers, skilled workers	Customer services center, showroom, learning center	Modular housing, mobile housing, industrialized housing activities, factory housing fabrication, housing production, installation	Steel manufacturing companies, home suppliers, local windows, doors, sanitary fittings, electrical, home accessories
Account deduction, subletting units, usage fees for services, option for ownership	No relevant data	Maintenance of the building, investment in the machines, factory, management, designers, technical personnel, engineers	Showhouse, in-house sales, website, apps to promote new units, design	Modular housing, industrialized housing activities, prefab housing, off-site activities, minimal site activities	Local manufacturers, sanitary, electrical, furniture, doors, windows, technology
Capital fund and option for ownership, Recurring fees from leasing, Rent-to-own or Rent-to-buy	Factory, resources, crane facilities, mobilization facilities, trucks, trailers	Maintenance, Resources location, manufacturing technology, people, designers, technical personnel	No relevant data	Industrialized housing production, modular / mobile housing, housing for middle-income group	Small entrepreneurs, local suppliers, international expertise in technical matters
Leasing and ownership	Factory, investment in human and machine resource	Subsidized by government, lower than market price, according to 30% of household income	Roadshow by government agencies, websites	Prefab manufacturers, housing producers	Local market, local suppliers, SME partnership

§ 5.7 Emerging codes

We searched for emerging codes based on the transcription from the thematic analysis. This addressed the new (implicit) pattern that was discovered post-analysis. As mentioned, we used a combined technique of a priori code and inductive thematic analysis. Following data collection from the five focus groups and the design workshop, we uploaded both the transcripts and the documents into ATLAS.ti P-Docs and conducted a systematic coding process and identifying the appropriate themes.

This procedure seems linear, but the study of the phenomenon was an iterative process. Emerging codes created a pattern in the data that differed from that made by the a priori codes. The findings extended the meanings derived from the focus group with the young starters that relate to security, housing package and customers' perception of the new product. We attempted to interpret the reluctance and scepticism of the industry's key players about the new concept that relates to prefabrication process and the availability of manpower and skilled workers, which led to a theme of technology and technical matters. We identified concerns pertaining to land issues and the need to conform to the authorities' requirements. The interesting thing about the emerging codes is that they became part of the major storyline of the thesis and could also lead to further studies and further recommendations. Emergent themes shaped patterns that go beyond the scope of the research but added interesting implicit features to support the thesis storyline.

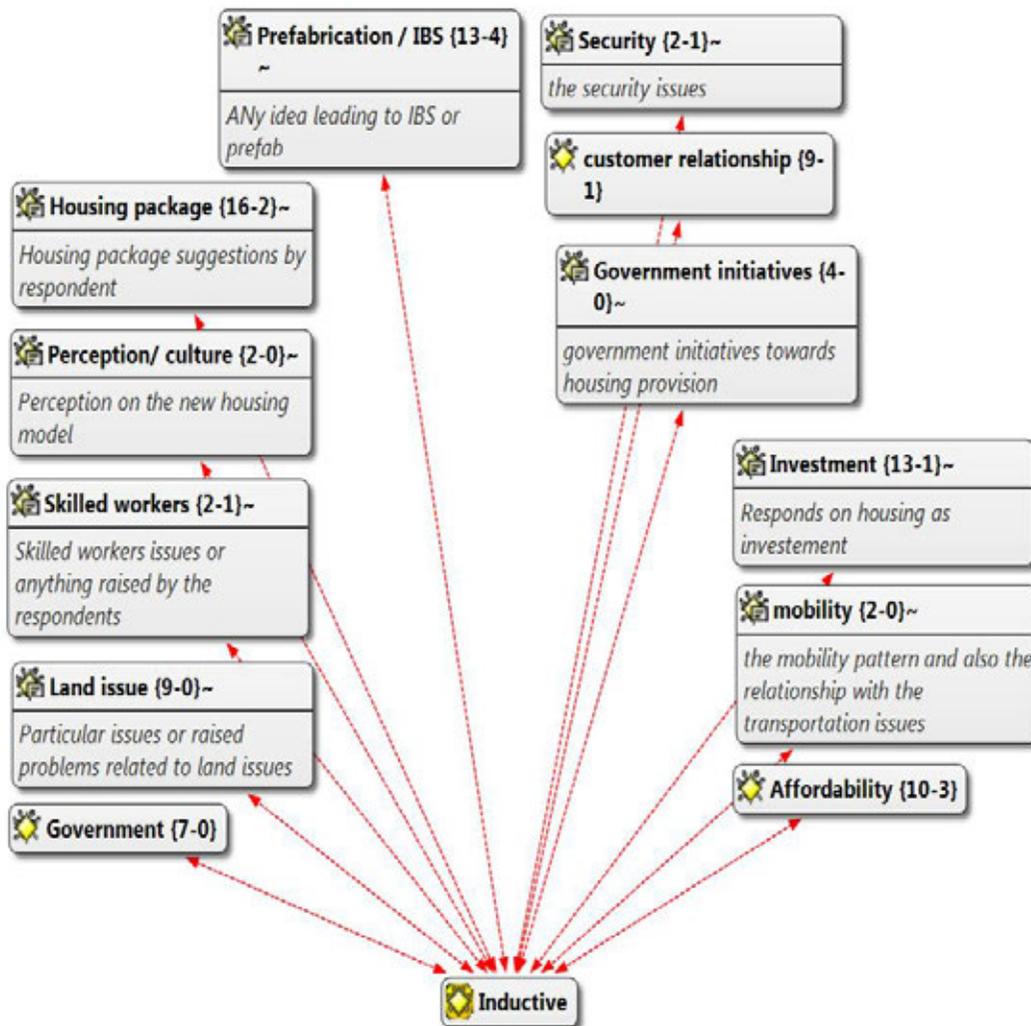


FIGURE 5.10 Network view for inductive (emerging codes)

QUOTATIONS	CATEGORY	THEMES / CODES
How about labours? And skilled workers to handle this new technology? At present, we have many problems associated with issues related to unskilled workers [incompetency] (FG6)	Skilled workers, resources, quality, prefabrication, key resources	Technical & technology
How about the resale value? Is it the same as normal housing?(FG 6)	Resale value	Investment
Loyalty programme for 5 years is interesting, is it possible for me to get the house for ownership after only 2 years? (FG2)	Housing programme, ownership	Housing programme
We can setup a facilitation fund perhaps and put it in one fund [security deposit]. Meanwhile they will start renting first. When they have enough capital, they can buy the unit. It is similar to the rent-to-buy option. (FG 6)	Ownership, rent-to-buy, facilitation fund	Housing programme
Is there a possibility that I can sublet the house? FG2)	Investment, sublet	Investment
Can I sublet the house? To get additional income, especially [to lease to] students who interested to lease and have additional needs.(FG 3)	Investment, sublet	Investment
People will argue, we have plenty of lands [available], but we have a governance issue, state land issues, Putrajaya rights [on certain land] and some land issues related to state matters.(FG6)	Authorities' requirements, procedures	Authority
[We] Need a full consideration before implementing or else it will became like other (IBS system in the country)...(FG6)	Key resources, IBS, investment	Technical / technology
Experiences in handling is important, then the quality will be secured... (FG 6)	Customer services, key activities, IBS	Technical / technology
[You will] need to heir an architect, designers, a planner, logistics and partners to deliver and maintain the unit.(FG6)	IBS, key resources, supply chain, delivery	Technical / technology
Not only that, [the IBS needs to] involve the tendering process too, start from beginning and mostly done offsite [planning] (FG6)	IBS process, key activities	Technical / technology
Most people wants to buy to seek for rental [investment] returns..(FG6)	Investment, ownership	Investment
Project fails because of lack of manpower and not enough experience. (FG6)	IBS, barriers to implementation, resources, partnership	Technical / technology
We must have enough infrastructure to run this business.. cooperation from the federal government and the state (land matter) is also important to ensure it iwll be successful... (FG7)	Authorities' requirements, land issues	Authority
They made it in module, bring to the site by lorries, and the units will be sealed to ensure the quality. ..the process include panel casting and how they arrange it to bring to the site...(FG6)	Key resources, key activities, IBS	Technical / technology
I am looking this on the socio culture aspect. Have you done any survey on the perception among Malaysian [on the new BM]? (FG6)	Perception, culture	Culture & Market
Most Malaysians still prefer ownership over leasing...(FG3)	Perception, culture	Culture & Market

TABLE 5.11 Theme and category classification for emerging codes

The above table (5.11) shows how we connected the themes and patterns we discovered in the data. It illustrates the process of connecting the category and identifying themes. Similarities and differences between the separate groups of data were emerging at this stage, showing the agreement in response to the areas of new discovery. Note that some of the themes were already established in the deductive process (i.e. investment and housing programme). It is important to note that the coding is interrelated but can also become independent on its own. Finally, we corroborated the term used to describe the process of confirming the final theme as follows:

- 1 Technical & Technology
- 2 Investment
- 3 Housing programme
- 4 The authorities
- 5 Culture/ Market

This section described the steps involved in the process of thematic analysis and the approach that we took to identify the emerging codes. The studies revealed the balanced work of the thematic analysis using both deductive analysis (based on literature) and inductive analysis (new themes emerging from empirical projects). Through this process, it was possible to uncover certain meanings, problems, concerns and feedback on the participants' reactions towards the new BM, which is discussed in the section 5.8.1.

§ 5.8 Discussion

Based on the formulation of the new BM, the answers we obtained from the sessions contributed to the following.

QUESTIONS	KEYWORDS	CONTRIBUTION TO BM COMPONENTS	SESSION CONTRIBUTION
What type of products can be offered to young starters?	Design, customer services, Type of products / services	Value propositions, target customers, customer relationship	Design workshop, focus group with young starters
How much are customers willing to pay? What are the mechanisms to pay? What are their options to pay?	Payment mechanism, affordable rate, when to pay, pay for use, how to pay	Cost structure, revenue streams, key resources	Focus group with young starters, industry key players, professionals
How does the business reach the customers? How long does it take to be delivered? How does it differ from current conventional housing?	Delivery process, quality assurance of the product, waiting time, lead time, supply chain	Key resources, revenue streams, partnership	Focus group with young starters, industry and government agencies

TABLE 5.12 Contribution of the empirical to the formulation of the new business model

Pertaining to the customization option, we found that the housing need among young starters is high and demanding. But we agree that some demands are unrealistic. Therefore, we suggest that the flexZhouse could provide a design customization option for young starters from the available options and selection supplied by the company. We concluded that the target group for the new BM should include involve many segments, namely single occupants (people who need a basic model to start with, people who have a pet), couples (whether or not married), couples with children, etc. We received feedback on ownership options. This could relate to some of the respondents in the financial part who suggested rewarding loyal customers.

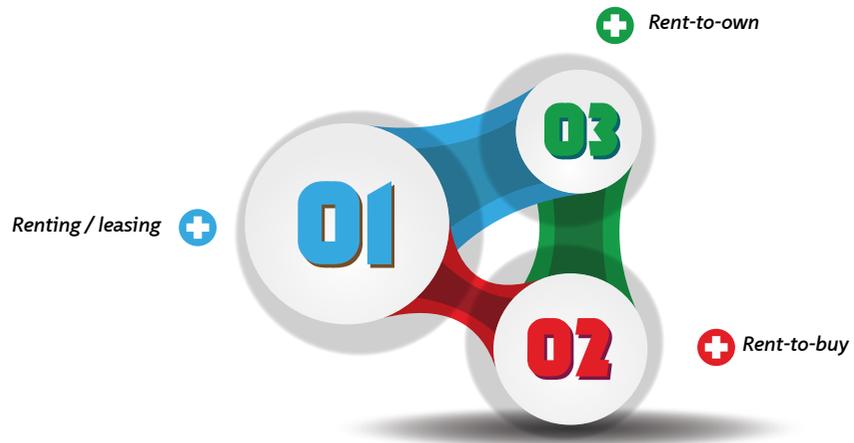


FIGURE 5.11 Suggestions for housing tenures for the flexZhouse

On the affordability aspect, we received many responses on how the payment mechanisms could work and how the current affordability issues can be solved. We posit the 30% of salary rule of thumb should be adhered to. The monthly commitment for the users should not be more than the given 30% median salary income. Although we agreed that the cost of the unit will depend on the location, we think the price of the rental should be at least 20% lower than average properties in the surrounding the area.

As regards the supply chain, the finding suggests that the delivery time for the units should not exceed 4 months. The quality of the unit should be the suppliers' top priority. It is important that the partnership the company builds with suppliers should ensure this at an early stage. Several recommendations and improvements from current conventional construction should become the strategy for the new business model.

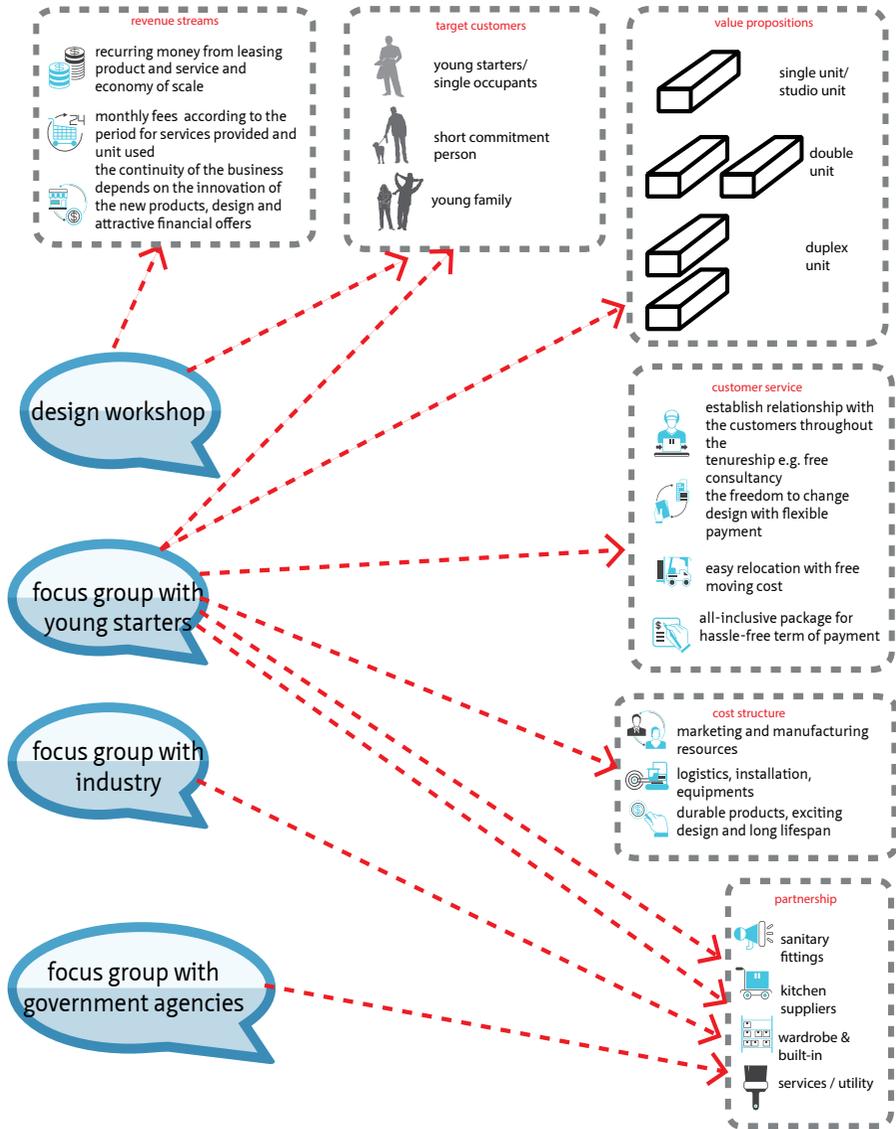


FIGURE 5.12 Contribution of the chapter to the new business model

In summary, we posit that private sectors/developers would likely reject the new concept (initially) merely because they do not like dealing with uncertainty, especially when the new BM is introduced. However, we received good feedback from the government agencies indicating the potential to solve the issues of affordability among young starters in Malaysia. At the beginning of this thesis, we proposed the new BM as a private initiative for the industry; however, after the empirical work we suggested that the new BM should be supported by the government and subsidized as part of the government's programme for affordable housing. The new flexZhouse BM was also seen as having the potential to support the government's effort, especially by PR1MA to increase the demands for affordable housing.

Hence, all the feedback was needed for the formulation of the final BM and to include in the business framework presented in the following chapter. In that chapter, we look closely at suitable and appropriate case examples that we found elsewhere in the world and that can support the flexZhouse. Our emphasis is on the technical knowledge and the technology required to operate this, and especially to support the key resources and partnership component of the BM. We were interested in finding best practices that had already established the circular economy as part of their BM. In the following chapters, we take a closer look at how all these examples could contribute to strengthening and supporting the flexZhouse BM.

§ 5.8.1 **Creating meaning from the research**

Next, we sought to understand and explore the young starters' needs, aspirations and issues in relation to current housing policy, and issues related to housing provision. The underlying factor of the research was to understand 'why' and 'how' questions and to go deeper into questions such as 'Why did they respond in this manner?' We used the memo tools in the ATLAS.ti to create meanings out of the transcription script from the focus group studies. The meaning reveals the relationship between the feedback and the goals of the research. This relationship explains the connection that cannot be answered through the process of survey and other quantitative methodologies. The memo in ATLAS.ti helps researchers to create additional notes like a diary and spaces for reflection during the process of analysis. The meanings of the research were divided into three factors: 1) the understanding of housing needs among young starters, 2) the rejection by private developers and 3) the difficulties related to the authorities' requirements. For each of the factors, several new theoretical insights emerged and helped the theory building for the thesis.

§ 5.8.1.1 Factor 1: The understanding of housing needs among young starters

The findings show that although young starters desperately want to find suitable housing, they lack sufficient experience in dealing with financial situations. In general, the respondents have a minimum understanding of how the mortgage system works, legal procedures, terms and conditions in the sales & purchase agreement (S&P), interest rates offered by banks and what constitutes the housing contract. Most of the respondents made an attempt to buy a property without realizing the consequences of having more debt in their lives. This further explains the alarming debts among young Malaysians (Cagamas Berhad, 2013; Omar et., al). The importance of the 30% ratio for the affordability rate particularly shows a weak understanding and, as a result, respondents have no idea about the importance of the ratio as a prerogative to purchase a house. Further, we found that most respondents had unrealistic demands concerning 'ideal' housing, the house location and the facilities that should come with the house. Respondents wanted housing specifications that were far beyond their means. This is similar to the finding by Bruce and Kelly (2013) about the unrealistic housing expectations among young Australians.

Among other salient findings, the ownership option still plays an essential role among young Malaysians, particularly the Bumiputera ('sons of the nation'⁵) figure 5.15. The necessity of ownership is no longer an option: it is considered mandatory. The choice for ownership caused by the insecurity of the Bumiputera against other races in the country further strengthens the concept of sense of belonging. Home ownership suggests a better rank in society and thus creates security for them and future generations.

The support for customization is high among young starters: it is part of Malaysian culture to have an extended family. Although most respondents agreed with the idea of customization, the female respondents had a tendency to be participative and to have more idea about their current and future needs. Married respondents tended to contribute more ideas for the design propositions compared to single respondents. This shows that married people or people with commitment tend to favour the idea of customization and extended family. We found there is an increasing trend among Malaysians to stay single and unmarried for so many reasons that are not relevant to the study.

5

In Malaysia, private developers are required to put aside 10–15% of every housing development for the Bumiputera, who also get a 10–15% discount. Malaysia is therefore unique in terms of 'cultural ownership' and has created its own theory of ownership.

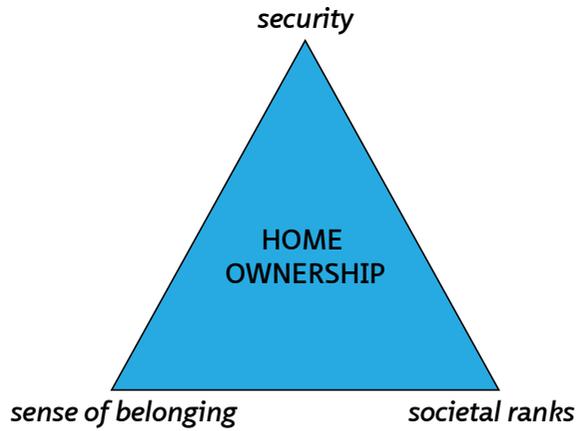


FIGURE 5.13 Theory on home ownership in Malaysia

§ 5.8.1.2 Factor 2: Rejection by private developers

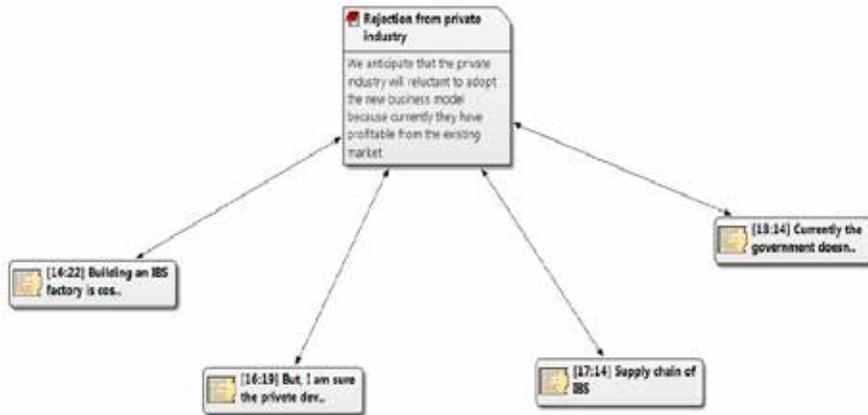


FIGURE 5.14 Rejection by private developers

The findings show the reluctance of private developers to accept the idea of the flexZhouse BM. This is in line with the theory of resistance to change put forward by Hon, Bloom, and Crant (2014). The findings also show that private housing developers are reaping benefits from the existing BM and have few or no competitors in the market. Private developers are keen to concentrate on high-end properties in order to make more profit. They are keen to maintain the status quo as they know that the proposed changes would lower their survival chances in the current business (Jones & Education, 2010). To be adopted, the flexZhouse BM needs to not only prove it can help meet societal needs, but also justify the massive financial investment require. Given the limitation of the study, we are doing our best to test the new model and to get reactions and responses from industry key players concerning the new ideas, and to further why there is rejection or approval.

It would therefore be more appropriate for the flexZhouse BM to be adopted by the government-linked company that handles housing projects. The reason is because the research problems start with issues that are associated with society, not from management and organization standpoints.

§ 5.8.1.3 Factor 3: The barriers posed by the authorities' requirements

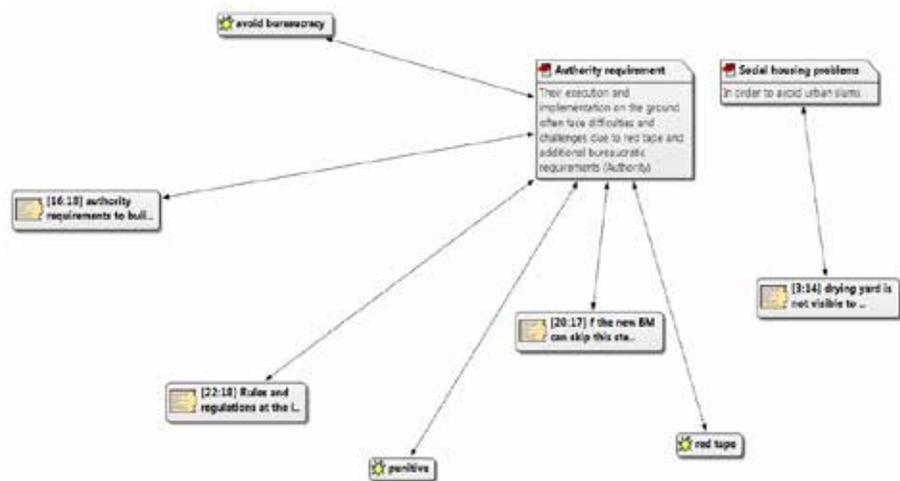


FIGURE 5.15 Responses related to the authorities' requirements

In the third factor, the discussion relates to the topic of the land issues and governmental bureaucracy concerning existing laws, local jurisdiction, Malay reservations, housing privilege and several other matters pertaining to the housing provision for the new BM. The private developer and the government agency dealing with housing complained about unreliable and vague requirements at the local authority level. This discussion is particularly significant because current housing development needs to go through a very long period (as long 6 years) from land purchase until the end of the defects liability period. Although there are several steps taken to reduce the time taken for the development, the new BM needs a different set of rules to begin with.

The flexZhouse needs to be supported by new measures and regulations through the introduction of new laws and policy. This will help the sustainable efforts promoted by the new BM. At the same time, the flexZhouse needs support from the authorities in terms of understanding on the procedures and steps for the local authority to increase their knowledge to approve the new BM of flexZhouse. The training and awareness will help to shorten the long and tedious process of current supply chain and increase the mass housing productivity.

It is hoped that the flexZhouse BM will assist the government to achieve sustainable housing development. The industry is expected to change its conventional approach from construction to a manufacturing strategy with concern for environmental impact and collaborations in green construction.



6 Examples of practices as inspiration for the flexZhouse BM

§ 6.1 Introduction

In the previous chapter, the empirical work used data gathered from the design workshop and focus groups. Ideas from the design workshop with the architects and the focus groups have helped to refine the flexZhouse BM for the housing industry in Malaysia. The sessions contributed to answering the questions about the type of products and services that can be offered to young starters (design/customization); how much the customers are willing to pay, a mechanism to pay and options to pay (financial); and ways to improve the supply chain and the quality of the product and services (production/supply chain).

This chapter discusses examples of practice elsewhere that have proven to be successful in the housing sector or other fields. The examples provide inspiration, supporting materials and information that can be adopted by the flexZhouse BM. The data were obtained through primary data collection and interviews with company's personnel (Sekisui House) and secondary data collection from company websites, YouTube and archives. Examples that were gathered help to support the idea in terms of what can be learnt from Sekisui Heim's industrialized housing BM (value propositions, customer relationship, activities) and from the Hickory group (resources and activities).

The challenging part of the flexZhouse BM is to provide evidence that some of the components of the BM have been practiced elsewhere, not necessarily in the housing industry but also in other fields. The idea of flexZhouse started from innovative thinking on industrialized housing production that is already available in the market outside Malaysia, specifically in Japan, Australia and other developed countries. The examples that we chose for this chapter might not provide one-size-fits-all solution for the flexZhouse, but it does give some insights into how some of the elements in the BM could possibly be adopted in the flexZhouse BM. We also encountered some difficulties in attaining some of the information from the company due to the company policy and the confidentiality of the information (Sekisui House). The presentation in this chapter focuses on the BM components that we extracted from the companies' policies, strategies and BMs.

We selected the examples because they followed a more or less similar approach to the flexZhouse, and other examples because they were expected to teach us something about a specific component of the flexZhouse BM. This also meant that some cases were investigated in a comprehensive way and the discussion concerned all or most of the BM components, while others were discussed more specifically, focusing mainly on a certain component of the BM. The reasons for selecting the different cases are as follows:

- 1 The Sekisui House BM is more or less similar to the flexZhouse BM. All the components of this BM were discussed as much as possible within the practical boundaries of obtaining the necessary data through the interviews, observation and secondary resources from the company archives.
- 2 Sekisui Heim was mainly selected because of its 'heim' system, which uses the box production similar to our flexZhouse housing unit. We therefore focused mainly on the production, key resources and the company's recycling of the heim for future use.
- 3 The Hickory group was selected mainly because of the resources it uses for the production, and the activities they perform as part of the company's value propositions.

§ 6.2 Lessons learnt from the cases of industrialized housing

In this section, we look at the industrialized housing industry (represented by Sekisui House, Sekisui Heim and Hickory Group) and try to formulate the company strategy using the BM components. The data gathered shows the variety of the BMs based on each company's focus and mission. Towards the end, the masterplan of the BM components is formulated to give an overview of the examples and how they can contribute to the revised flexZhouse BM in the next chapter.

§ 6.2.1 Sekisui House

Sekisui House is one of the prefabricated housing leaders in the Japanese housing market. The company has been successful in promoting complete customized and personalized house options for its customers. However, the customers are mainly from the middle and upper classes of society. Nevertheless, we are interested with the company's resources and other strengths, such as customer relationship, company's partnership and networking, that we can adopt in the flexZhouse BM.

A case study on Sekisui House detached housing BM was conducted in 2013 in Nara prefecture and Osaka, Japan. The data collection involved interviews with two employees from Sekisui House, which was supported with literature, direct

observations and company archives. During the visit, no photographs were allowed. However, we managed to get permission to use some images that we obtained through websites and the company's archives for our study.

In the following, we summarize the BM components that we obtained based on the interview, the company's archives and observations conducted during the visit. It is important to note that information that was not relevant for the study has been excluded.

CUSTOMIZATION	Value propositions	Fully personalized and customized houses according to the customer's wishes
	Target customers	Customer-specific design flexibility policy, e.g. customers with pets, customers who enjoy music, housing for aging society, families with children, families with parents working, customers with high-income, professional
	Customer relationship	1) Personalized homes 2) Supporting homeowners after they move 3) Manufacturer warranty for a longer period of time 4) Allocating 10% of the employees to after-sales service at customer centers
AFFORDABILITY	Revenue streams	House selling, sale and purchase, asset sales, usage fees, subscription fees, lending, renting, leasing and licensing
	Cost structure	Maintenance, resources location, manufacturing technology, resources, crane facilities, designers, technical personnel
	Key resources	Manufacturing plant, computer-controlled automated manufacturing process, trucks, trailers
SUPPLY CHAIN	Channel & Network	Public facilities for visitors, hands-on experience called SUMUFUMULAB, large-scale experience based facilities across Japan (Nattoku Kobo Studio) Comprehensive housing R&D institute, Sumai-no-Yume-Kojo (R&D institute)
	Partnership	Sekisui House partner associations, suppliers, partner contractors
	Key activities	1) Modular housing (flat pack) 2) Housing revitalization 3) Relocation programme 4) Housing revitalization 5) Design consultation/design customization

TABLE 6.1 Summary of business model component for Sekisui House

Value propositions

Sekisui House offers a highly customized exterior and interior, which distinguishes them from its competitors in terms of choices and individual customization. The products they offer come with high assurance and are always of high quality. The housing is normally earthquake resistant to reassure customers.

According to respondent A, the customer has always been the priority of the company, and the type of product the company offers must match the customer's needs for a longer period. He later added:

It is important for the customer to experience how the final design will look like; that's why we set up a special lab in Nara prefecture to allow customers to experience the options that they want to choose and to feel satisfied before they commit to purchasing (interview)

Under the 'customer-specific design flexibility' policy, respondent B added:

We have developed a variety of construction methods and housing models, ranging from a steel frame to a wooden frame and both two-storey and three-storey, thus creating detached houses specifically tailored to site conditions and climate, family composition, life stage and customer's lifestyle. (interview)

Therefore, the unit size depends on the client's brief and requirements to suit the plot size. The exterior and interior finishes are decided in the factory upon agreement on the design. The customers co-evolve with the design from day 1 and are fully responsible for the final design of the house.

Lesson learnt: One of the most important aspects of the value proposition by Sekisui House is the high tech associated with the house. The sophisticated high technology is bundled together as part of the company's services to the customers. The design is also not fixed and is hardly to be compared to flexZhouse BM. In summary, the Sekisui House BM is a good example of what we perceived as 'pure customization.' However, we have found that total customization is always associated with high cost and high value. Furthermore, the Japanese prefabricated housing market is targeting high-income earners, and it is reflected in the value propositions for the customers.

Target customers

In a country that have among the highest aging population, a declining birth-rate, a trend toward late marriage, the family lifestyles in Japan have changed and diversified. In order to meet the needs stemming from these changes in family structures, Sekisui House publishes a brochure titled Kazoku to Kazoku ('Family for the family') that offers tips for joint family households to live pleasant lives, including ideal distances to be kept to maintain good family relationships. Obviously, family structures change with the passing of time, which is why Sekisui House offers a home for customers from different walks of life or with different needs, such as families with young children, families with both parents working and couples whose children have left home. This was supported by respondent A, who quoted from the book:

'As the meaning of happiness varies from person to person, the sense of ideal housing varies from family to family.' (archives)

Respondent B added:

We (Sekisui House), have continued to study new lifestyles that arise from time to time to meet the needs of customers under our proprietary 'customer-specific design flexibility policy', thus helping them realize their family's dreams and wishes... (interview)

Lesson learnt: Despite the varied demographics as the target customers, the focus is more on the high-income bracket of society. Nevertheless, we take into consideration the variety of products and services that the company produces for different types of customers. The input on different customers' needs helps to strengthen our ideas on producing multiple sizes to serve different groups for the flexZhouse BM.

Customer relationship

For Sekisui House, building a house is about building a relationship. The strategy of the company is to improve the quality of the houses so that they will be handed down to another family and from generation to generation. This is a strategy to preserve the house as capital belongs to the family. To maintain its quality, the company has ensured that all Sekisui House Group companies have adopted the integrated accountability system, whose role is to ensure the highest quality products and to satisfy the criteria of 'Long-term Quality Housing Certification', as approved by the Ministry of Land, Infrastructure, Transport and Tourism. According to respondent A:

After-sales support is provided by our customer services centers, which conduct an inspection and after-sales maintenance of existing Sekisui House homes. To maximize the longevity of Sekisui Houses, we offer our original 20-year manufacturer's warranty programme, as well as the U-trus system that provides an extended warranty after the expiration of the initial warranty period. (interview)

Another striking feature is that Sekisui House provides assistance for a remodeling solution for both Sekisui and non-Sekisui houses. Respondent B added that:

Through the Everloop programme, we help the customer to repurchase the Sekisui House homes and completely renovate them for subsequent sale. Through this, we offer a long-term customer service and support through a relationship that we establish once they decided to purchase our product until next generations. The company shows its commitment to customer relationship by allocating 10% of employees to the after-sales customer centers. (interview)

Lesson learnt: Sekisui House spends many hours with its customers and provides extensive pre-sales, sales and after-sales services. This is perhaps why the houses built by the company

are relatively expensive in comparison with a normal house (own observation). The lesson learnt from this section for the flexZhouse is to improve current customer relationship in the housing industry and to include not all but perhaps some of the characteristics of the Sekisui House BM in dealing with its customer.

Revenue streams

For Sekisui House, the customers represent the heart of the company, whereas the financial means are its arteries. A business that operates for profit must always ask itself how it can generate income from the business and how much the customers are willing to pay for the products and services it offers. The company generates revenue through asset sales, usage fees, subscription fees, lending, renting, leasing and licensing. It is interesting to figure out some mechanisms that can allow the financial scheme for the customers to be flexible so as to help the customers pay for the products and services that they have acquired. We asked the respondents how much customers are willing to pay, how customers prefer to pay, and how much each revenue stream contributes to overall revenues (CSR, report)

According to Respondent A:

It is important first to understand that the Sekisui House business is focusing on high-income earners. We sell high-quality products, and it comes with a high price of maintenance and production costs. As for the financial means, Sekisui House is still using the conventional process which goes through a sales & purchase process with part of the finance made through a loan from financial institutions. The customers benefit from the current low mortgage rates, which are lower than 1% nationwide. (interview)

Thus the market for the housing for this group is not explorative in terms of revenue streams. It is still dominated by the sales & purchase system and several renting activities.

However, there are several ways in which the company can help the customers to finance their house. Respondent A:

There are some cases that the house is built for the purpose of renting, where the customers constructed the house with the idea of staying and renting their house at the same time. In this way, the income from the renting will help the customer make repayments on the house. This can be made through a proper initial discussion on the layout of the house to avoid renovation at a later stage. At the initial design, the customers will request spacious rooms and to accommodate one or two additional facilities for rental purposes. (interview)

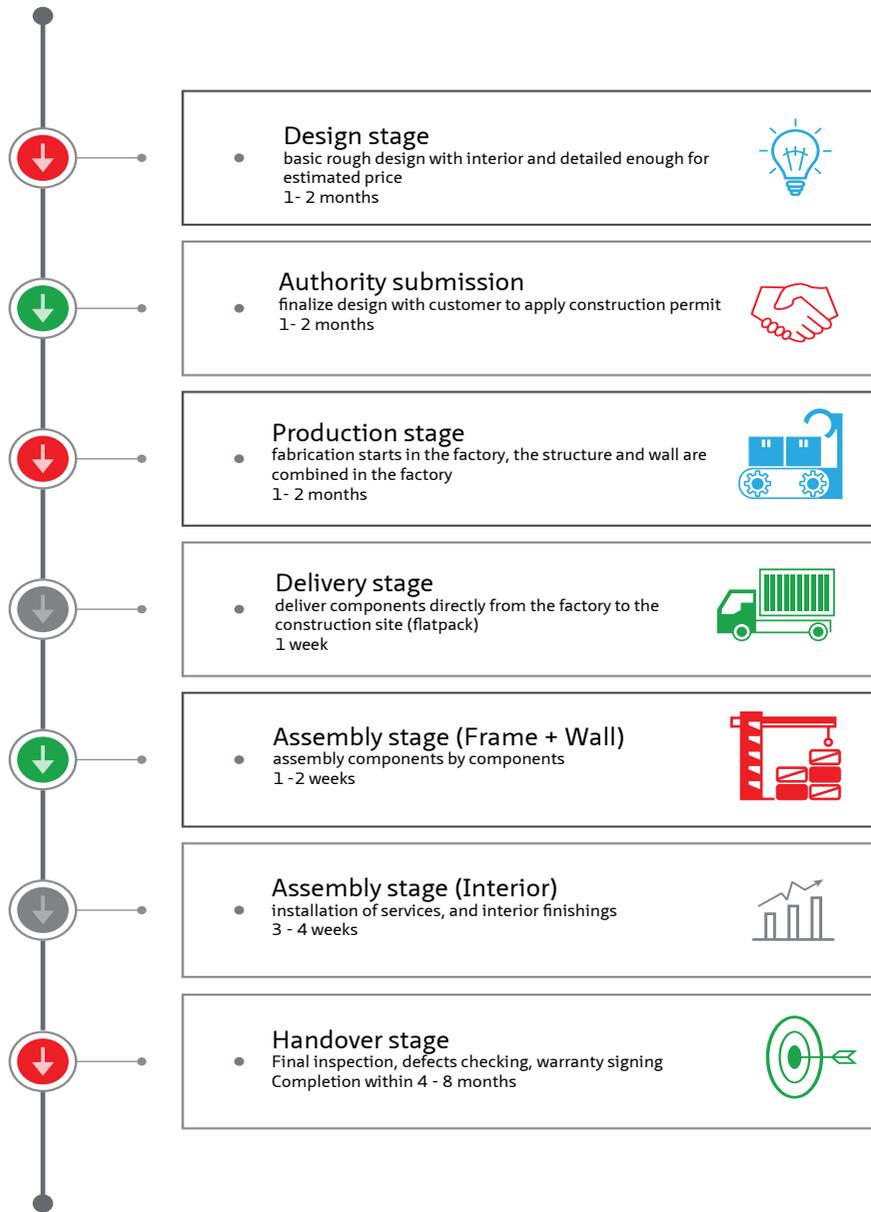


FIGURE 6.1 Sekisui house production timelines (adapted from Sekisui CSR report, 2015)

Lesson learnt: The main revenue of Sekisui House comes from the house selling activities. The selling activities normally use the mortgage system and are supported by a financial institution. The lower mortgage rates in Japan promotes the buying activities for the industry. Nevertheless, we took note of the company's production timelines to learn how the houses are produced in the factory so fast.

Key resources

Every BM requires different key resources. Some BMs require a substantial physical resources while others might need significant intellectual, human or financial resources to operate. In the case of the Sekisui House BM, to set up 30 facilities that play an important role in developing advanced technologies for Sekisui House, for instance the Structural Trial Laboratory, Environmental Simulation Laboratory, Anechoic Room, and Experimental Laboratory for Water and Wind Resistance. The existence of the R&D lab is consistent with the mission of Sekisui House to offer its customers unique proposals. In response to this, respondent A said:

'Through R&D activities and market requirements, we respond to various customer needs and prepare our superior quality of housing to meet their requests.'(interview)

Among the vital facilities of Sekisui House is the nationwide Nattoku Kobo Studio (Home Amenities Experience Studio). The studio was established to survey the needs of the market through individual experience, not only by seeing but also by utilizing the other four physical senses. This accommodation facility was set up to allow visitors and potential house buyers to experience for themselves the real feeling of the dwelling spaces by touching with the hand and feeling with the body. The results were later used to give feedback and support the propositions for a healthy way of living.

Japanese house builders make huge investments in physical assets, which are often capital-intensive. Respondent A:

This is necessary [R&D institute] as a continuous effort to develop our technologies of housing method, interior and exterior materials, and verify our performance at the same time. As a result, it strives for the improvement of occupant comfort. Sekisui House is researching many diversified themes in response to a different value of living and relates every dweller to create its affluent living. (interview)

Lesson learnt: We were interested in learning from multiple key resources that are used by the company to produce the products in the factory. During the site observation, the company was focusing on the high quality of production, and this can be seen from the investment in the expensive and robotic equipment in the production line. The house was also supervised by highly-skilled workers during the production, and there is minimal human input during the production in order to increase the quality and minimize defects and error. However, skilled workers are crucial to operate this sort of machines.

Cost structure

In terms of cost structure, Sekisui House is basically generating its revenue and structuring its cost through three types of offerings, namely product & service offerings, process technologies and enabling technologies to support the business.

Product and service offerings

A radical change to a product and service is an easily recognized approach in any business, but this poses risks. In today's fast-changing market, consumers are expecting a new technological approach that stands out from the existing market. In this case, Sekisui House homebuilding achieves its brand vision – 'Slow & Smart' – with its state-of-the-art technologies and the Sekisui House Group's organizational strength. In terms of the housing values, Sekisui House uses several approaches, that is, smart universal design, slow living, green first, family structure and personal style.



FIGURE 6.2 Lifecycle of a Sekisui House detached home. Source: Sekisui CSR report

Something that can be learnt from the Sekisui House is that the house is built with robust structural frames that will protect the occupants from any natural disaster. The house is promoted as having advanced home facilities that will enable the users to live comfortably for a long period of time. Another salient factor for Sekisui House is that it offers a flexible design that caters to the changing needs of the household over time through its remodeling programme. This feature supports the idea of flexibility in terms of structure and design alternatives for the customers.

Along with the product, the company offers regular maintenance that ensures comfortable living for its clients. The maintenance services are warranted for 20 years or more, depending on the product. Under the Everloop programme, Sekisui House provides proprietary remodeling solutions that restore the home to a new condition should the customer decided to move out. In the event that the client decides to stay in the existing home, the company offers continuous support in terms of technical

assistance and maintenance in order to ensure comfortable living for years to come. The company offers a resale service whereby it refurbishes and renovates the house for subsequent sale to a new home buyer.

Process technologies

A change to the product or service is the most visible form of technology change that is apparent to customers, competitors and others. Likewise, in line with the 'customer-specific design flexibility' policy, Sekisui House promises to meet the unique needs of each of its customers. With the help of its technologies, the company has been working to enhance the production lines in their Shizuoka factory. Respondent A:

'In 2010, we installed robot-equipped production lines in our Shizuoka factory, and this has enabled us to automate 95% of the production process in the factory.' (interview)



FIGURE 6.3 Robot-equipped technology at Sekisui House factory. Source: Sekisui CSR report

Enabling technologies

The enabling technologies or supporting technologies are important for, for example, quality or inventory control. However, Sekisui is aware that its competitors often quickly match their technology, thus creating a competitive churn with little or no competitive advantage. Therefore, the technical skills of the technical staff in the factories nationwide are crucial. Respondent B:

We take various measures to ensure the stable production and supply of building components, such as inspecting raw materials upon delivery, sampling inspection at the production lines, quality inspection, and regular assessment of the skills of technical staff at our factories. (interview)

Lesson learnt: The cost structure set by the company relies heavily on the technology they use on the production line. Therefore, the flexZhouse BM could learn from the company and strike a balance between skilled workers and investment in resources (e.g. sophisticated machines) to ensure the cost structure can be reduced for the end users.

Channel/Network

Channel and network refer to how a company relates to its customers. It describes the distribution and communication and how sales reach its customers. Channel and network are customer touch points that play an important role in the client experience. Channel and network create awareness of the type of products and services offered to the customers; provides a mechanism to purchase products and services; delivers a particular product and services to its clients; and helps to obtain feedback on the products and services.

For awareness and evaluation, Sekisui House has made a significant effort to enhance customer satisfaction. It has established various projects for advanced R&D and testing, as well as the Nattoku Kobo Studio at the Nationwide Housing R&D Institute, offering opportunities for visitors to learn about home building through various hands-on experiences. We observed that the data obtained from the customer's experiences are used to develop new technologies and solutions to enhance comfortable living.

In terms of purchase of the product and the services, Sekisui House has established six Sumai-no-Yume-Kojo (large-scale, experience-based facilities) located throughout Japan to allow customers to learn about housing and lifestyles firsthand and to check technical aspects of housing that cannot be seen in model homes, such as structure, foundations and even the ground, before they commit to purchase. After that, the customers sit down with the sales personnel and the architect and decide on their requirements for the house. Subsequently, the invoice for the house is generated from the drawings and approved by the customers before the delivery of the house to the site. Excerpts from CSR report:

At Sekisui House, customers are never asked to choose from among a limited number of pre-designed housing plans. Instead, we take the time to discuss housing plans with clients face to face through our housing consultation service, and act from a customer's viewpoint across the entire homebuilding process from initial contact, design, production and construction to after-sales support. (CSR, report)

Further, when discussing the design with the customers, the salespersons first listen to the customers' needs attentively, consider the preferences, housing tastes, lifestyle and the current life stage of the customers. During the site surveys, the technical person ensures that the environment in the vicinity is inspected, to ensure that the customer will continue to live a pleasant life for a longer period. Excerpts from CSR report:

In the process of developing plans, we use the latest systems we developed independently, such as an environmental simulation tool to determine which environmental technologies are best suited to the specific conditions of customers, and a structural planning system to ensure the safety of housing structure. (CSR, report).

The Japanese housing suppliers provide outstanding customer service: they provide choice of design and specifications and long-term, group-wide support to their clients, ensuring that the high-quality homes will last for generations. This can be seen from the investments the key players in the industry are making to attract potential customers, for example establishing show villages and company-specific customer services throughout the country.



FIGURE 6.4 Japanese housing suppliers' (Sekisui House and other competitors) show villages in Nara Prefecture. Source: Zairul (2015)

Lesson learnt: The idea of attracting potential customers to the show village and show units could be included in the flexZhouse BM in order to reach potential customers. The flexZhouse BM could also learn from Sekisui House by having experience studios and experience-based facilities to help the customers to make choices before purchasing or renting units. Such an investment would also have the benefit of increasing customer confidence in the idea and in the durability of the company providing it.

Partnership

Partnership is closely related to the capabilities and network of shareholders that make the BM work. Companies make partnerships for many reasons, be it to strengthen their BMs, reduce risks or acquire more resources. This means they need to obtain and exploit their partner's and shareholders' expertise within their own supply chain or partnership that is active in the process of housing production from supplying the raw materials to the disposal of its components (Ofori, 2000). The Sekisui House group engages in operations that encompass the process of production, construction and after-sales service to remodeling, which requires partnerships with many parties outside the organization. In relation to this, Excerpts from CSR report:

Unless every individual involved in the process is working with the same intention, we cannot fulfil our mission to protect the lives and possessions of our customers by creating comfortable and healthy living environments with the highest quality living environments with the highest quality products and state-of-the-art technology.(CSR, report)

Excerpts from CSR report:

'This is why the Sekisui House Group is fostering relationships of trust among all our partner building contractors and business partners, as a community united by a common destiny.'

Respondent B added:

That is why companies within the supply chain have to manage the complex boundaries so that the products and services delivered to the customers not only depend on a single company but from the entire multidisciplinary. (interview)

Further, respondent A stressed that

'Actually we have some many partners to pursue this business, but maybe you can read more about Sekiwa from our report. We work closely to provide assistance to one another. And also we have the Sekisui House association, that especially train to provide assistance during hardest time for example after the earthquake or any to other disaster.. (interview)

Later, he added:

It is not something shameful to say, without the collaborators of the partnership it is almost impossible for us to develop our various construction technologies ourselves... (interview)

In the Sekisui House organization, there is an association called the Sekisui House Association. The association are responsible for the construction and partner building contractors. The association also actively promote various program related to the company and also program to improve staff's welfare (CSR report).

The partnership network is imperative and crucial for Sekisui House because of the potential for earthquakes and other natural disasters, especially in the affected cities. In addition to the active participation of the partnership, the Sekisui House Association continues to make meaningful contributions to a group of construction professionals. Respondent A:

Actually we have some many partners to pursue this business, but maybe you can read more about Sekiwa from our report. We work closely to provide assistance to one another. And also we have the Sekisui House association, that especially train to provide assistance during hardest time for example after the earthquake or any other disaster.. (interview)

In Sekisui House Ltd., the employees are categorized as internal partners who play important roles in ensuring the success of the company. Respondent A added:

This is also important asset to the company, we support their family, and provide incentives for them to return to work if they leave the company for certain reasons.. (interview)

During the data collection, we found a text written by one of the internal staff who had just qualified as the chief instructor:

I qualified as a chief instructor in April 2012, as a result of the questionnaire responses given by customers, branch offices, Sekiwa Construction, partner building contractors and customer centres, as well as the evaluation of my ability to conduct quality control, I am jubilant that the efforts I have made have been rewarded. I constantly ask myself if I can do more than is required of me. I am very attentive to detail, and I perform every task assigned to me. I will continue to make efforts to show that I deserve this qualification while striving to create an environment that facilitates the growth of younger construction workers. (archives)

Lesson learnt: Partnership is a good way to minimize and distribute business risks. Therefore, for the flexZhouse BM, a partnership with other companies such as suppliers, contractors and maintenance companies could provide an opportunity for the flexZhouse to focus onprefab production and build quality.

Key activities

The key activities building block describes the most important things a company must do to make its BM work. Some BMs have different key activities to support their business operations. Likewise, they are required to support products and services, help to reach target markets, maintain customer relationship and earn revenues. For Sekisui House, the operations and the activities encompass a wider range of business fields, including rental housing, condominium construction, the sale of subdivision lots, large-scale urban redevelopment and community development in various parts of the world. However, our study focused on the BM for detached housing.

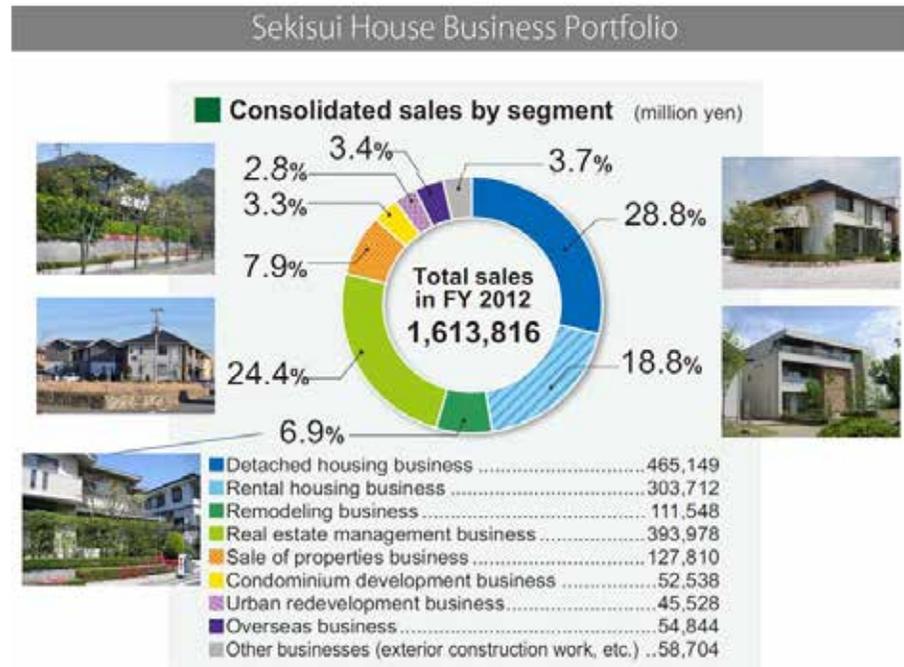


FIGURE 6.5 Sekisui House key activities and business portfolio. Source: Sekisui CSR report

Lesson learnt: Sekisui House is not a newcomer in the housing industry in Japan. Therefore, the activities show its commitment to its clients, which involves not only the local market but also the overseas market in dealing with housing and related business.

The Sekisui House activities might not be the best examples for flexZhouse, but the idea of selling, renting and remodeling could be appropriate for our purpose.

§ 6.2.2 Sekisui Heim

Our second example is Sekisui Heim. Data on Sekisui Heim were gathered during secondary data collection. The primary sources are the company's websites, archives and annual report. Therefore, the data collection is very limited. Nevertheless, we looked at the company's value propositions and other strengths, such as customer relationship, and activities that we could adopt in the flexZhouse BM.

CUSTOMIZATION	Value propositions	Modular housing, factory production system, barrier-free design. Partly customization and partly standardization
	Target customers	High-income, professionals
	Customer relationship	<ol style="list-style-type: none"> 1) Customer information & consulting services and Hayamimi network 2) Customer satisfaction level survey 3) 'Customer and Top' (CAT) meetings 4) After-sales support 5) (20-year warranty, 60 years scheduled diagnosis system) 6) Proposal for maintenance 7) Proposal for functional renovation 8) Proposal for addition and improvement
AFFORDABILITY	Revenue streams	Selling houses and mortgage through financial institutions
	Cost structure	Manufacturing plant, assembly plant, crane for logistics, engineers, designers, trucks, trailers
	Key resources	Maintenance, resources location, manufacturing technology, resources, crane facilities, people, designers, technical personnel
SUPPLY CHAIN	Channel & Network	Showhouse, roadshow, websites
	Partnership	Co-creation of next generation, alliances with outside parties, industry-academic partnerships, mergers with competitors
	Key activities	<ol style="list-style-type: none"> 1) Manufacturing container size house 2) Sales and Lease 3) Demolition work 4) Design consultation 5) Design customization / Engineering/ Piping works

TABLE 6.2 Summary of business model component fill

Value propositions

In terms of value propositions, Sekisui Heim housing production is focused on environmentally responsive housing. The house projects undertaken by the company can be divided into seven categories: 1) steel frame housing, 2) wooden frame housing, 3) complex housing, 4) housing environment business, 5) refurbishing, 6) real estate and 7) overseas housing projects. The company value propositions encompass the fabrication and sale of heim series and Two-U home modular houses, and interior and exterior housing products and services for the renovation of existing houses. The Heim boxes are made of factory fabricated units which can be combined to make a complete house. The box type or 'units' are produced in the plant and sometimes require 30,000 components to complete one house on a production line. However, for this research, we focused on Sekisui Heim's steel housing BM (Furuse & Katano, 2006).

In terms of user customization, although the company allows freedom in floor plan selection, it provides standardized customization and only allows customers to choose from the available options.

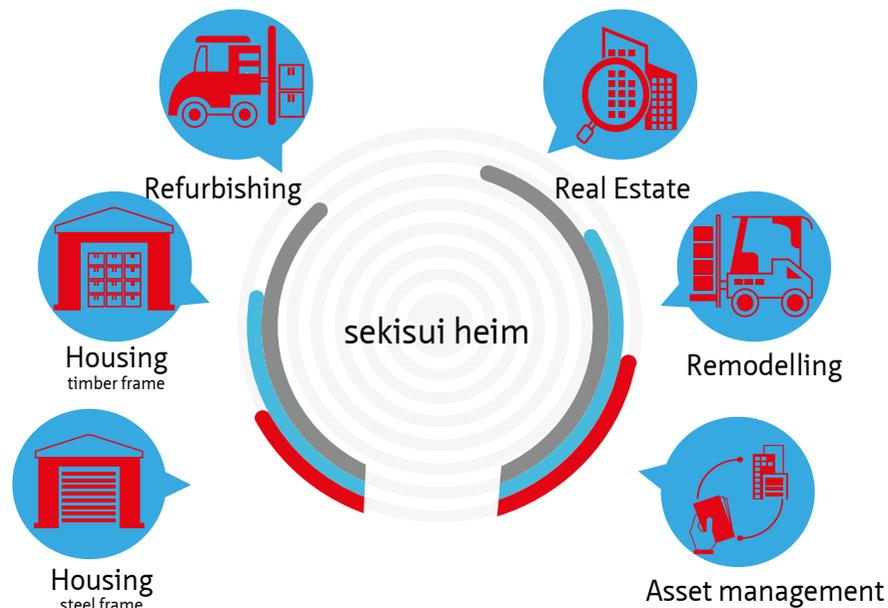


FIGURE 6.6 Sekisui Heim value propositions



FIGURE 6.7 Box type 'unit' production for steel frame housing by Sekisui Heim. Source: (Furuse & Katano, 2006)

Lesson learnt: We are interested in the company's heim production and the logistics planning from the factory to the site. The company uses the steel frame box production that is similar to the container size but not the ISO container (20' or 40'). The typical 'box' can be easily transported on trucks and delivered to the site. Multiple boxes could be used to meet the customer's design requirement. The 'box type' gives an idea for flexZhouse for the housing module. We are also interested in the company's 'standardized customization' option, in contrast to 'fully customization' from Sekisui House.

Target customers

Like Sekisui House, Sekisui Chemical Group (or better known as Sekisui Heim) provides services mainly to baby boomers, professionals and the higher segment of the housing market. As part of its mission, the company strives to attend to the customer's needs as much as necessary and to ensure the customer will return to their business again.

Lesson learnt: Similar to the Sekisui House case, no additional data were found to assist flexZhouse in terms of providing affordable housing. The target customers for Sekisui Heim are mainly in the high-income bracket.

Customer relationship



FIGURE 6.8 Sekisui Heim customer relationship diagram. Source: Sekisui Heim corporate website

As regards the customer relationship, the company strives to satisfy its customers. This includes a CS management focusing on customer satisfaction. In 2004, the company launched a CS programme and quality management focused on their value propositions. The aim of the programme is to progress and create a longer relationship with the customers so that they will return to the company for the right services. The company values continuous feedback from customers and utilizes that feedback and other information received from customers. The company strives to maximize the client relationship by prolonging the warranty on the product and providing a proposal for the maintenance, renovation and improvement of the product.

Lesson learnt: One important aspect of customer services that can be learnt from Sekisui Heim is the use of customer's feedback to improve products and services. This could help flexZhouse BM to enhance the loyalty programme to encourage customers to stay with the company for longer time.

Revenue streams



FIGURE 6.9 Recycled Sekisui Heim frame structure. Source: Sekisui Heim corporate website

The company generates its revenue by selling its goods and services. The contribution from the housing segment is mainly in the form of the buyers' mortgages from financial institutions. We noted that the company provides a service to return the demolished steel frame structure for trade-in purpose. The units that are returned go through the cleaning and anti-corrosion process before being used again as Heim units. This process could be regarded as a sustainable approach and creating a loop of the production.

Lesson learnt: Sekisui Heim gets its revenue in the same way that Sekisui House does. However, the example of recycled frame structures provides an idea of the circular economy already practiced by the company. This could extend the lifecycle of the units and increase the revenue by reducing the consumption to produce a new unit.

Key resources

The process of Heim production normally involves 10,000 structure elements and parts to build a single Heim, involving various kinds of high technology. In particular, connecting elements are produced by specialized machines to ensure the accuracy and quality of the production. The prefabrication activities are mainly conducted off-site in a big manufacturing plant. All the processes involved in the manufacturing unit are carried out using computerized automated machine tools.



FIGURE 6.10 Assembly line at Sekisui Heim. Source: Sekisui Heim corporate website

The Heim factory assembly process relies on skilled workers to operate the business. Human resources are crucial especially where human senses and skilled techniques are needed. The accuracy of 16 welded and finished box units of various sizes is measured to ensure the quality of the product.

Lesson learnt: The company's main human resource is skilled workers operating the automated machine tools. One of the aims of the flexZhouse BM is to reduce dependency on cheap and unskilled labour in the housing industry in Malaysia. Therefore, hiring high-skilled workers who equipped with knowledge to handle the automated machine could provide a good resource for the company.

Cost structure

In the case of Sekisui Heim, the business involves a big investment in the key physical and human resources. As far as the data are concerned, we have no structured information to support this. However, the huge investment the company has made in technology indicates why the product is mainly targeted at the high-income group.

Lesson learnt: No data found to support the cost structure by Sekisui Heim. Therefore, no additional data were obtained to support the flexZhouse BM.

Channel & Network

The company is working hard to reach its customers through several kind of programmes and to create awareness of its product and the quality of its goods and services. This is evidenced by its continuous customer social responsibility (CSR) programme. For this case, we assume the company is reaching its customers by providing useful services and establishing show houses to promote its products and services.

Lesson learnt: No further data were obtained from Sekisui Heim to assist flexZhouse in terms of channel and network.

Partnership

The company emphasizes its relationship with the stakeholders and alliances with external parties, industry–academia partnerships and mergers with competitors to deliver the products.

Lesson learnt: A similar strategy could be used by flexZhouse to extend the relationship to reliable partners.

Key activities

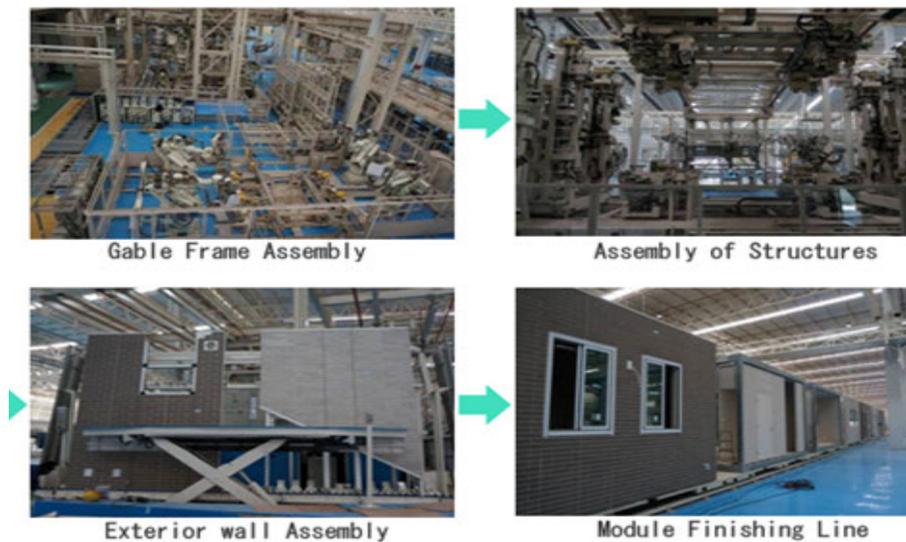


FIGURE 6.11 Activities of the company (Sekisui Heim): Source: Sekisui Heim archives

The parent company, Sekisui Chemical Group, develops and provides a wide variety of goods and services that are used in various applications in both industry and daily life. Its activities range from housing products, through urban infrastructure, to high-performance plastics. In the housing sector, the company's activities involve steel frame and wood frame modular housing. Other activities include refurbishing and real estate. However, our focus was on the steel frame modular housing produced by the company.

Lesson learnt: Company activities that we could relate to flexZhouse are the real estate activities, demolition work, design consultation with the customers and customization of the product.

§ 6.2.3 Hickory group

Information about the Hickory Group was mainly obtained from the company's websites. The data were supported by photos and videos obtained from the website on the information related to its BM components. We were mainly interested in the resources the company use and the activities in its BM.

CUSTOMIZATION	Value propositions	Standardized modular apartment blocks, facades, bathrooms design
	Target customers	Middle to high-income
	Customer relationship	No data
AFFORDABILITY	Revenue streams	Selling houses and mortgage through financial institutions
	Cost structure	Maintenance, resources location, manufacturing technology, resources, crane facilities, people, designers, technical personnel
	Key resources	Manufacturing plant, assembly plant, crane for logistics, engineers, designers, trucks, trailers
SUPPLY CHAIN	Channel & Network	No data
	Partnership	No data
	Key activities	<ol style="list-style-type: none"> 1) Producing building structures (in-house formwork structures) 2) Prefabricating building systems 3) Producing modular bathrooms 4) Design and built facades 5) Carpentry services 6) Plant hiring 7) Design & engineering services 8) Crane logistics services

TABLE 6.3 Summary of business model component for Sekisui Heim

Value propositions



FIGURE 6.12 Images of the housing production from Hickory group. Source from Hickory corporate website

The Hickory Group produces standardized modular apartment blocks, including medium- and high-rise residential, hotel and healthcare projects. The company uses a unified system, that is built off-site but parallel with on-site works. The building components are engineered concrete flooring, load bearing columns, designated wet areas, and building façade and service penetration chute. The designs mainly use a series of predesigned but interchangeable components. The flexibility of the system comes from the interchangeable components that can be scaled from medium- to high-rise and from large to small aspect ratio, as required.

Lesson learnt: The unified system used in the construction has inspired flexZhouse in terms of the building system. The sanitary, electrical and other services could be designed as part of the unit, or be independently attached to the building structure. The important lesson involved how the company use manufacturing model and applies it on the construction process. The construction involves the building of various components of design and assemble it in particular sequence on site.



FIGURE 6.13 The installation of the module on the site. Source Hickory corporate website

Target customers

Part of the company slogan is to provide affordable housing for Australians. However, the available data do not offer any connection between the housing and young starters for its business niche. It appears from the information on the websites that the company builds for urban dwellers.

Lesson learnt: No additional data related to young starters or middle-income groups.

Revenue streams

Based on the information obtained, the revenue for the company is mainly obtained from selling the products, leasing and renting the plants, and mortgages from financial institutions.

Lesson learnt: No additional data related to innovative leasing or 'circular economy.'

Key activities

The company specializes in 1) producing concrete structures and formwork, 2) designing facade and installation, 3) plant hiring, 4) crane logistics leasing, 5)

carpentry and fit out, 6) design and engineering, 7) prefab housing, 8) design & built modular bathrooms. The company mainly deals with different phases of construction services. The company strives to reduce the cost of the building by providing its own in-house operation. In terms of the structure design, the company's principal activity is providing a high-quality structure design with a precise quality control. The company is involved in façade design and consultation on façade design, backed by a skilled installation team.

Lesson learnt: The flexZhouse could use similar activities which involve producing modular bathrooms, unit installation in the factory, carpentry and fitting out of the unit and also design and engineering aspects. The work sequence involves completely planning everything upfront, build the components in the factory in a control environment and bring it to the construction site. This will ensure the construction efficiency in terms of time, quality and cost. It makes the building more sustainable and less waste and it is a better way and more efficient way to build mass housing project.

Key resources

In order to avoid the cost of producing plant equipment at short notice. The company has invested a huge amount of money in its physical resources, such as manufacturing plants, alimaks, scissor lifts, booms, semis, scaffolding, elevator work platforms, hoists and generators. Another of the company's resources is the crane equipment to install the units on site. The company's second biggest resources are human resources, namely designers, engineers, surveyors, scaffolders, concreters, steel fixers, riggers, labourers, craftsmen, metal fabricators, and skilled and semi-skilled workers running the daily operation of the company. The company invests heavily on people from automotive background to ensure accountability in the design and engineering. Time management, design and engineering skills are most valuable skills to operate this type of housing industry. High precision in manufacturing and design engineering and R&D capability is something the company are proud of.

Lesson learnt: The flexZhouse could learn from the investment in physical resources, such as manufacturing plant, cranes, alimaks, scissor lifts, booms, semis, scaffolds, elevator work platforms, hoists and generators. The Hickory Group also invests in human resources, that is, skilled workers and high-tech manufacturing that support the high-rise system. The approach is a hybrid between manufacturing and construction, but the design and project management is heavily relies on experts from the automotive background and skills.

Cost structure

The cost structure of the business is mainly derived from the key resources that the company acquired. The company is investing an enormous amount of capital in both physical and human resources to operate its business operations.

Lesson learnt: No additional data in relation to the pricing.

Channel & Network

The business relies on its prestigious and landmark projects to promote its business. The reputation the company has earned in recent years has led to broad awareness of its products and services, as promoted on the company's website and by other advertising means.

Lesson learnt: We did not obtain channel and network from the Hickory Group. Therefore, no input is related to the new BM.



FIGURE 6.14 Installing the unit for the prefab housing. Source: Hickory corporate website

FIGURE 6.15 The manufacturing plant for the Hickory Group. Source: Hickory corporate website

§ 6.3 Summary of BM components from examples and studies of other practices

Some of the approaches adopted by the companies discussed in this chapter are more or less similar to those in the flexZhouse BM. This is because some companies have adopted a similar approach to the proposed BM. Some examples were discussed in a more comprehensive BM components while others provide lesser BM components vice versa. In the following, we summarize some of the insights gained from the examples for the formulation of the revised flexZhouse BM.

Value propositions

Examples from Sekisui Heim are more appropriate for the new BM in terms of the size and the production of the units. Sekisui Heim provides standardized customization that offers several options for the customers to choose from. Based on the previous chapter, the revised BM confirmed the type and size of units as follows:

- studio unit (2.5 m x 5.0 m)
- single unit (2.5 m x 7.0 m)
- long unit (2.5 m x 12 m)
- premium unit (2.5 m x 12 m x 2).

An additional package can include balcony / private places / outdoor garden. Additional services include all-inclusive bills, a laundry area, facilities for social purposes, security services and places of worship.

Target customers

Although the examples that we found target the high-income group, the revised BM learnt from the needs of that target group. The revised BM further confirmed that single occupants, young executives, young couples and young families are the target customers.

Customer relationship

Examples from Sekisui House and Sekisui Heim provide a good lesson for flexZhouse, namely that it should further improve the customer relationship in the housing industry. Lessons from the Japanese companies further confirmed the customer relationship for the new BM, which include:

- Pre-sales activities – design consultation, financial consultations, technical consultation
- During sales activities – advice, consultation, product information

- After-sales activities – maintenance, extended warranty, technical support, moving assistance and providing extended warranty towards housing finishes, accessories and built-in furniture inside the unit and moving assistance from one level/place to another level/place.

Revenue streams

The revenue for the Japanese manufacturers and the Hickory Group come mainly from the house selling activities through real estate activities. Nevertheless, the recycling and remodeling of in circular economy literature further strengthen the revenue for flexZhouse, which includes leasing and selling activities, capping bills and all-inclusive utilities, a capital fund, maintenance of the products and unit refurbishment.

Key resources

The investment in resources by the Japanese manufacturers shows that it is important to invest in appropriate physical and human resources. However, the Japanese companies are investing in sophisticated machines to produce the housing units which might influence the cost structure for flexZhouse. Examples from Hickory Group suggesting employing skilled workers with automotive background. Nevertheless, the revised BM will adopt some of the resources that are suitable for the project, which include;

Physical resources: factory, resources, crane facilities, mobilization facilities, trucks, trailers. Human resources: engineers, architects, designers, skilled and semi-skilled workers (automotive personnel).

Cost structure

The resources used by the company will very much affect the cost structure offers to the customers. Inputs from the Japanese housing manufacturers involve a huge investment in resources and, therefore, produce expensive housing for the customers. Therefore, for the revised BM, the proposal confirmed the following; the resources will be a combination of skilled and semi-skilled workers. Industrial production will be handled by partners. The cost control will be handled by increasing the module / stock through reducing resource consumption by means of a re-modelling strategy.

Channel & Network

Sekisui House spent a great deal on the learning centre and show houses to promote awareness of its product. This could be a good example for the new BM to select few examples of the strategy by establishing a show house and learning centre to encourage potential customers to experience the house before committing themselves. The revised BM further confirmed the establishment of the house prototype and promotion through social media.

Key activities

Examples from the Japanese housing manufacturers suggest several activities, including modular housing, housing revitalizing, consultation on design and financial matters, real estate business and other housing-related activities. Examples from Hickory Group suggest designing and building a module bathroom, unit installation in the factory, carpentry and fitting out of the unit and also design and engineering aspects. The work sequence involves completely planning everything upfront, build the components in the factory in a control environment and bring it to the construction site. This will ensure the construction efficiency in terms of time, quality and cost. Therefore, for the revised BM, the proposal further confirmed the activities that related to the flexZhouse, which include house fabrication, selling and renting activities, remodeling activities. design & build, building unit offsite and installing it onsite.

Partnership

Sekisui House's partnership with the steel suppliers and building contractors has inspired the flexZhouse BM to collaborate with maintenance companies, SMEs, suppliers and local contractors.

In the following, we summarize the BM component insights from the examples that contributed to our revised BM.

CUSTOMIZATION			
	Value propositions	Target customers	Customer relationship
Sekisui House	Truly customized and personalized for the customer	Customer-specific design flexibility policy e.g. customers with pets, customers who enjoy music, housing for aging society, families with children, High-income, professional	Personalized homes Supporting homeowners after they move Longer manufacturer warranty Allocating 10% of employees to after-sales service at customer centers
Sekisui Heim	Modular housing, factory production system, barrier-free design. Partly customization and partly standardization	High-income, professionals	Customer information & consulting services and Hayamimi network Customer satisfaction survey Customer and Top (CAT) meeting After-sales support (20-year warranty, 60 years scheduled diagnosis system) Proposal for maintenance Proposal for functional renovation Proposal for additions and improvements
Hickory group	Standardized / customized modular apartment blocks, facades design, bathroom design	Middle to high-income	No relevant data

AFFORDABILITY			SUPPLY CHAIN (PRODUCTION)		
Revenue streams	Key resources	Cost structure	Channel & Network	Key activities	Partnership
Housing selling, Sales & Purchase, asset sales, usage fees, subscription fees, lending, renting, leasing,licensing	Manufacturing plant, computer-controlled automated manufacturing process, trucks, trailers	Maintenance, Resources location, manufacturing technology, resources, crane facilities, people, designers, technical personnel	Public facilities for visitors hands-on experience named SUMUFU-MULAB, Large-scale experience-based facilities across Japan (Nattoku Kobo Studio) Comprehensive Housing R&D Institute, Sumai-no-Yume-Kojo (R&D institute)	Modular housing (flat pack), Housing revitalizing, Relocation programme, Housing revitalizing, Design consultation	Sekiwa construction (steel suppliers) Sekisui House association Sekisui House partner associations, Supplier chains, partner building contractors
Selling housing through financial institutions, mortgages	Manufacturing plant, assembly plant, crane for logistics, engineers, designers, trucks, trailers	Maintenance, Resources location, manufacturing technology, resources, crane facilities, people, designers, technical personnel	Show house, roadshow, websites	Manufacturing container size house Providing real estate business Demolition work activities Providing design consultation Providing design customization Providing engineering and piping work	Co-creation of next generation, alliances with outside parties, industry-academic partnerships, Mergers with competitors
Property selling, leasing of the plants / equipment	Manufacturing plant, assembly plant, crane for logistics, engineers, designers, trucks, trailers, automotive personnel, The approach is a hybrid between manufacturing and construction, but the design and project management is heavily relies on experts from the automotive background and skills.	Maintenance, Resources location, manufacturing technology, resources, crane facilities, people, designers, automotive personnel	No relevant data	Structures (in-house formwork structures) Prefabricating building systems Producing modular bathrooms Designing and installing facades Carpentry works Hiring plant Design & engineering Providing services on crane logistics	No relevant data

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	CUSTOMIZATION		
	Value propositions	Target customers	Customer relationship
Revised flexZhouse model	<p>Standardized customization</p> <p>Type of unit studio unit (2.5 m x 5.0 m), single unit (2.5 m x 7.0 m), long unit (2.5 m x 12 m), premium unit (2.5 m x 12 m x 2 units),</p> <p>Services for the unit, balcony / private places/ outdoor garden All-inclusive bills, laundry area, facilities for social purposes, security services, places of worship</p>	<p>Different needs and demographics</p> <p>Single occupants Young executives Young couples Young families</p>	<p>Services for customers</p> <p>Pre-sales Design consultation financial consultation, technical consultation</p> <p>During sales Advice, product consultation, information</p> <p>After sales Maintenance, extended warranty, technical support, moving assistance extended warranty on housing finishes, accessories and built-in furniture inside the unit and moving assistance from one level/ place to another level/place.</p>

TABLE 6.4 Summary of BM components from examples from practices

AFFORDABILITY			SUPPLY CHAIN (PRODUCTION)		
Revenue streams	Key resources	Cost structure	Channel & Network	Key activities	Partnership
Source of income	Resources needed to operate the company	Resources to determine the cost	How to reach customer	Main activities	Collaboration
Leasing and selling activities	Physical resources Factory, resources, crane facilities, mobilization facilities, trucks, trailers	Combination of skilled and semi-skilled workers	Show house, learning center, house prototype, social media	House fabrication	Maintenance company, SMEs, suppliers, house components contractors, local suppliers
Capping bills and all-inclusive utilities		Some of the tasks will be handled by partners		Selling and renting activities	
Capital fund	Human resources Engineers, architects, designers, skilled and semi-skilled workers	Increase stock, reduce resource consumption		Remodelling activities	
Maintenance of the products, refurbishment activities					

§ 6.4 Contributions of this chapter to the thesis

The examples presented in this chapter helped to strengthen the formulation of the final revision of the flexZhouse BM. Examples of primary and secondary data helped to further refine the draft BM. The chapter answered and explained the business motivations, propositions for the products and services, financials and revenues, and resources needed to operate each businesses.

In comparison, the previous examples show that the present BM of industrialized housing available in the market focuses on high-income bracket customers. The technology and resources used require sophisticated high-tech machines and skilled workers from the automotive background. Therefore, this presents a gap in the housing industry in Malaysia, where the technology and the system are relatively new. Nevertheless, examples from Sekisui Heim and Hickory will help flexZhouse to plan its own resources to operate a similar business. It is interesting to learn from companies that have adopted the circular economy in their business operations. The innovative leasing concept helps to integrate the financial choices and ways to minimize the cost of operation from a different business strategy that could be useful for the flexZhouse BM.

The research presented in this chapter presents several challenges to the overall research project. The main challenge is the limited information and the confidentiality of that information. In the case of Sekisui House, we were granted access to the facilities but not allowed to take photographs, and the data were mainly obtained from the interviews and the archives and first observations on site. Other companies also provided limited information. Most information came from websites, YouTube and other digital sources. Furthermore, the BM strategy is not something that every company wants to share and make available to the public. Nevertheless, we managed to find the information needed to support the formulation of the flexZhouse BM. The information we used came from interview sessions, a presentation by company personnel, company reports and archives, videos on YouTube and comments from customers about the products.

The information that we found was worded using different terminologies and definitions, and we therefore reproduced it according to the BM components and elements that are related to our focus and objective. Most of the examples were associated with people in the high-income bracket and therefore poses challenges to the idea of affordable housing. Nevertheless, the idea of reducing consumption by introducing the circular economy helped to remodel the pricing strategy and the cost structure for the customer. The feasibility of the revised model is explained in next chapter, which presents the final revision of the flexZhouse BM.

PART 3 Results and Conclusions



7 Revised business model and proof of concept

§ 7.1 Introduction

In Chapter 4, we established a conceptual framework to resolve issues in the mass housing industry in order to shape our draft BM. However, more refinement is needed to detail various aspects of the BM. We mentioned earlier the data collection used ‘feeding information’ techniques to gain feedback from one session to another. This chapter builds on findings from Chapter 5 (design workshop/focus groups) and Chapter 6 (examples from practice) and draws up the revised BM with the integration of circular economy principles.

Central to this research is the potential solution that a new BM has to meet the need of young starters for affordable housing. Basically, the gap in Chapter 2 shows the urgent need for a new direction and alternative to the existing BM of the mass housing industry. Therefore, to solve the primary problem of this research, the main objective of this chapter is to provide the final revision of the flexZhouse BM and feedback from industry and government experts.

The flexZhouse BM addresses some of the key issues in the Malaysian housing market concerning affordability and accessibility for young starters. In the conceptual model, the idea of flexibility and choices for the customers were elaborated. Financial options and revenues for the the new BM were described to relate the affordability problems, and finally the industrial production and supply chain were discussed to address the production issue.

In order to achieve the goal of the study, we organised focus groups and design workshop with architects and studied examples from selected corporations to help us formulate the revised flexZhouse BM. Feedback from the target group such as young starters and architects help to answer the question ‘How can the BM address the customization of housing?’ Sessions with practitioners, private developers and entrepreneurs contributed to answering the question ‘How can the new BM make it affordable and contribute to improving the quality of the housing?’ And government agencies contributed to new policymaking by answering the question ‘How will the new BM affect current housing policy in the country?’ In this chapter, the proof of concepts

through the development of the feasibility study is demonstrated. The information on price and cost that we obtained during the sessions with prefab housing manufacturers in Malaysia helped us to make a preliminary estimate of how the new BM could be materialized in the future.

Hence, the research had two sub-objectives, namely to develop knowledge for science and to contribute to a new theoretical insight. Through the BM components, we linked the existing problems established in Chapter 1 and matched them with the items from the revised flexZhouse BM in figure 7.1. In essence, the final revised BM is a potential solution for the problems established in Chapter 1.

§ 7.2 The revised flexZhouse BM

Although flexZhouse benefits from container technology, they are not necessarily shipping container. Each module will be developed and manufactured according to the client's requirements in terms of room number, internal fit-out and external facade (based on standardized dimensions and structure). In this system, the user will be able to change the design after an agreed period of time. In terms of sequence, customer will place order at the factory after choosing from the available designs and customizing the internal and external features. The rental fees will then be determined, after both parties have agreed to the terms and conditions. At an agreed time, the unit will be transported to the site and the user will moves in. After certain time, (e.g. 18 months) the user will be able to change both the internal and external feature of the unit. The design of each module will take into consideration the customer demand for changes over time. Standardized customization is the term that we used for the flexZhouse that allows freedom in floor plan selection and allowss customer to choose from the available options.

The revised flexZhouse BM covers all components that signify the changes that are needed in the new BM. In the following figure, we show the revised flexZhouse BM and elaborate the decision that we made, leading to the final revision of the model.

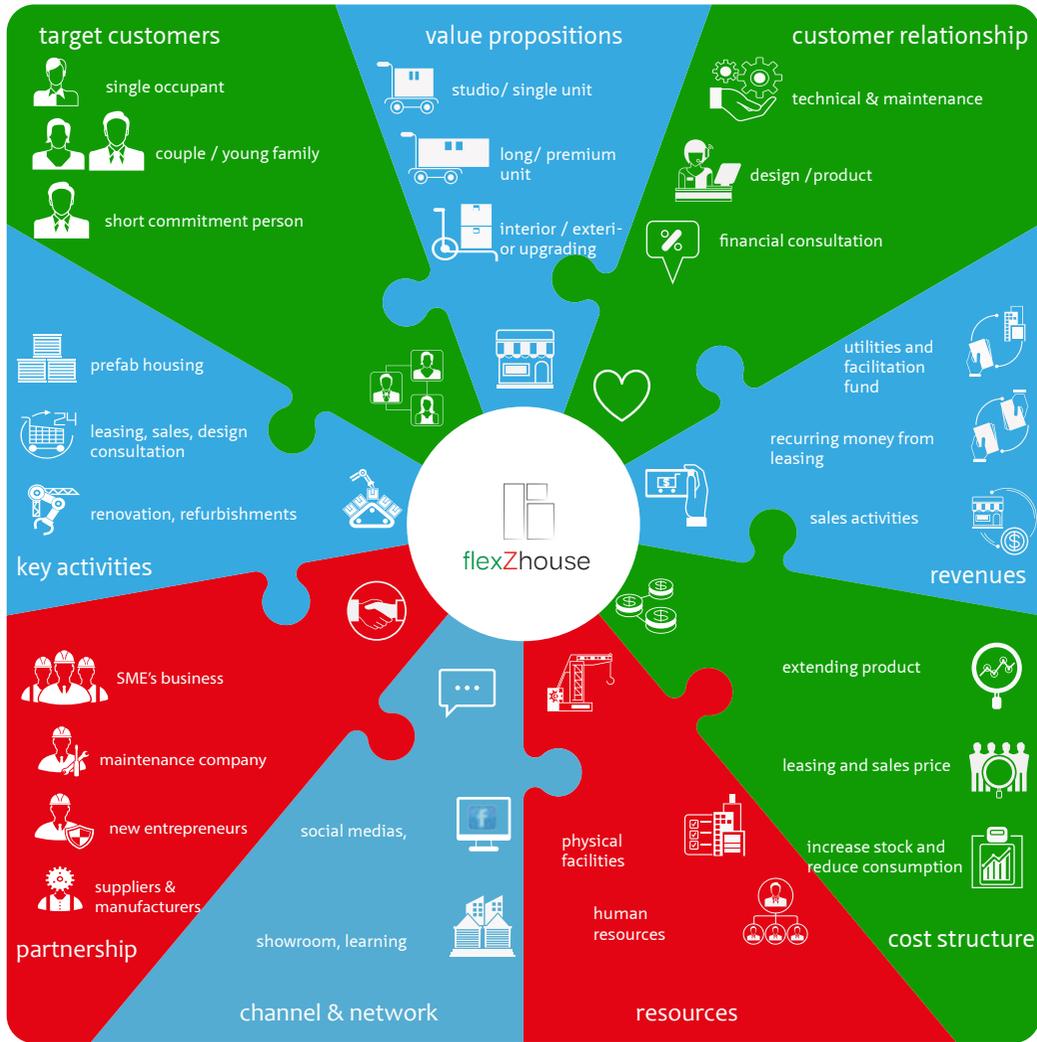


FIGURE 7.1 The revised BM of flexZhouse

§ 7.2.1 Value propositions

The draft BM specified a module/unit that is adaptable to both present and changing needs. The size of the module is an appropriate size for logistics and transport, namely 3.5 m (w) x 6.0 (l) m x 2.5 m (h). The size would be offered in two types: 1) single unit with bedroom/ studio unit without bedroom (both 21 m²) and 2) double unit (horizontally)/ duplex unit (vertically) (both 42 m²) with a subdivided floor and a staircase as part of the circulation area. The proposed interior includes choices of bedroom, bathroom, kitchen types, living area and choices of balcony design. During this preliminary stage, the draft BM was not fixed to either box type or flat pack type. The preliminary design suggests that although the technology benefits from container technology, they are not necessarily shipping containers. Each unit will be designed and manufactured according to customer's needs in terms of number of rooms, façade and internal fit-out. The idea was to implement 'standardized customization', as a lesson learnt from Sekisui Heim.

Next, we presented the draft BM at the design workshop with the architects. The workshop started with a brief about the products and services that we want to offer to young starters. We presented the preliminary design, and the brief asked for more design and refinement of the earlier concept. During the workshop, the discussion on the unit shape and size was further elaborated. The architects came up with three conceptual designs based on the brief. After the workshop, the findings suggested three types in terms of size, namely type A: 2.4 m (w) x 12 m (l) x 2.5 m (h) (28.8 m²); type B: 2.4 m (w) x 6.0 m (l) x 2.5 m (h) (14.4 m²); and type C: 7.2 m (l) x 2.4 m (w) x 2.5 m (h) (17.28 m²). The width was reduced from 3.5 m to 2.4 m, because the width of containers allowed on Malaysian highways is limited to 2.4–2.6 m. The interior remains the same as in the preliminary design. However, the design input suggested a unit with extra ventilation and extra natural lighting, and additional features, such as garden and private spaces, were discussed during the session. The concept of standardized customization was agreed by all respondents.

We then brought suggestions from the design workshop into the three focus groups with young starters. We gathered feedback and additional information pertaining to sizes, accessories and services. The feedback suggested an additional unit, namely a studio unit measuring 2.5 m (w) x 5.0 m (l) x 2.5 m (h) (11.88 m²). We further confirmed the sizes of other units. Single unit: 2.5 m (w) x 7.0 m (l) x 2.5 m (h) (16.90 m²); long unit: 2.5 m (w) x 12 m (l) x 2.5 m (h) (29.1 m²); and premium unit (58.31 m²). The box sizes were changed because they would then accommodate the furniture better and be more convenient for the users. Discussion on additional items was added after the session, which includes additional options to add a garden and extra private spaces and further reconfirmed the idea on choices of the balcony from the preliminary design. Feedback on services that came together with the products was discussed and included such as all-inclusive utility bills, laundry area, facilities for social activities,

security and worship areas. The discussion did not address box type or flat pack for the delivery. However, the concept of standardized customization was agreed on by all respondents.

During the focus group with the private developers, (Non-governmental organizations) NGOs and entrepreneurs, the focus was more on the financial aspects of the BM. Therefore, no significant input was obtained. Later, we took the ideas and feedback from all previous sessions to the final focus group with the representatives from the government sectors dealing with housing activities. The participants were personnel from PR1MA and the Ministry of Housing and Local Authority (MHLA). The session further approved the products and services, and agreed that they were suitable for a transition house for young starters until they can secure a deposit for and afford a 'real' house.

Next, we carried out example studies of selected prefab manufacturers in Japan and Australia. The concept of box production of Sekisui Heim and the UB housing concept of the Hickory Group suggested that the box production will help to protect the quality of the units in the factory and reduce activities required during the on-site installation process. For the purpose of this thesis, we further refined the unit based on the earlier feedback into the following module (the original size from factory) and the unit (combination of one or more modules)

Module: (original size from factory)

- Module one: 2.5 m (w) x 2.5 m (l)
- Module two: 2.5 m (w) x 7.0m (l)
- Module three: 2.5 m (w) x 12 m (l)
-
- *Unit: (combination of one or more modules)*
- Studio unit (2.5 m x 5.0 m) (11.88 m²)
- Single unit (2.5 m x 7.0 m) (16.90 m²)
- Long unit (2.5 m x 12.0 m) (29.1 m²)
- Premium unit (2.5 m x 12.0 m x 2) (58.31 m²) vertical / horizontal (combination of two nos of module three)

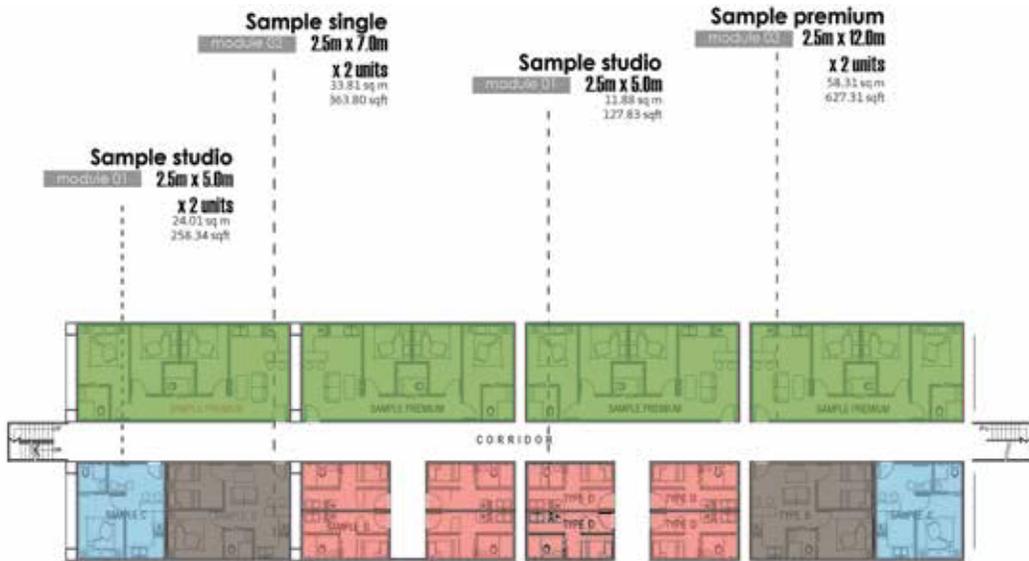


FIGURE 7.2 Revised unit with sample modules

In addition to the proposals made in the previous sections, the lessons from the design workshop, focus groups and case studies concerning the value propositions resulted in the following summary:

DRAFT BM	FLEXZHOURSE
<p>Size: Basic type: 3.5 m (w) x 6.0 (l) m x 2.5 m (h) 1) single type with bedroom and studio type without bedroom (21 m²) 2) premium type; long unit 42 m² (horizontally) or premium unit (vertically)</p>	<p>Size: 1) studio type (2.5 m x 5.0 m; (11.88 m²) 2) single type (2.5 m x 7.0 m) (16.90 m²) 3) long type (2.5 m x 12.0 m x 1 unit) (29.1 m²) and 4) premium type (2.5 m x 12.0 m x 2 units) (58.31 m²) vertical / horizontal (Focus group with young starters / design workshop / own analysis)</p> <p>Units based on container size and easy for relocation, transport and logistics (design workshop, focus group with young starters)</p>
Type: box type / flat type	Type: Box type of production
Choices of units: Standardized customization	Choices of units: Standardized customization options reconfirmed (lessons from Sekisui Heim/Hickory Group)

>>>

Services: Balcony or outdoor spaces	Services: additional options to add a garden and extra private spaces. Reconfirmed balcony / outdoor spaces (focus group with young starters) All-inclusive utility bills, laundry area, facilities for social activities, security and worship areas (focus group with young starters)
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TABLE 7.1 Value propositions

§ 7.2.2 Target customers

In the draft BM, lessons learnt about target customers from three Japanese house builders (Sekisui House, Sekisui Heim and Toyota House) were integrated into the conceptual framework. The initial idea (conceptual stage) helps the draft BM to include young starters and young executives as part of the middle-income group.

During the design workshop, the design brief called for a flexible house for young starters, single persons, young couples and people aged between 25 and 34. Further refinement was made during the focus group with young starters to redefine the target group as single occupants, young executives, short commitment people and young families/couples. However, determining the target customers is not a straightforward matter. The lifetime of the building and the changing demographics of Malaysian society require the housing to be expandable or shrinkable to meet future needs.

The focus group with entrepreneurs and private developers did not lead to any further insight into this component. However, the focus group with government agencies agreed that the proposed idea might entice young starters and middle-income earners (income bracket RM 2999–7999). The group suggested that the proposed flexZhouse could also become transition housing for young starters until they can afford a conventional house in the housing market.

A lesson learnt from the case studies of Sekisui House and Sekisui Heim is that the target customers are crucial in determining customer preferences regarding the one-size-fits-all concept and options for customization or standardized customization for the new flexZhouse. Although Japanese prefab housing is mostly targetted at the high-income group, the most important lesson learnt regarding this components is that one must identify the right product for the right customer. The rule of thumb is to adhere to the price to income ratio. The monthly commitment should not burden the customer and the choices should be made according to the client's affordability. The discussion about target customers was related to our earlier discussion of the value

propositions concerning what type of units are suitable for each group of customers. In addition to the proposals made in the previous sections, the lessons learnt from the design workshop, focus groups and case studies regarding target customers resulted in the following summary:-

DRAFT BM	FLEXZHOUSE
Young starters Young executives Middle-income group	Young starters redefined: Single occupants (FG with young starters) Young executives (reconfirmed) Young couples (FG with young starters) Young families (FG with young starters)

TABLE 7.2 Target customers

§ 7.2.3 Customer relationship

In the preliminary design, the literature on the circular economy suggested that the company should switch from maximizing sales of material products to delivering customer satisfaction. The long-term competitive advantage will become the ability to provide needed service. The current housing industry in Malaysia faces issues such as a lack of maintenance after the defects liability period has expired, meaning that users had to pay to rectify defective work. Lessons learnt from the Japanese manufacturers led us to revise the BM to provide a proper maintenance schedule for the housing units in order to prevent the defects and maintenance problems that affect today's typical housing. The draft BM on customer relationship was discussed further during the design workshop: the issues of maintenance of the unit, cleaning services, centralized laundry, functions area and gathering spaces were raised. The design lies around the facilities that are needed to improve customer services.

The discussion at the design workshop was brought to the next session with the young starters. The focus group sessions with the young starters suggested a more customer-centric strategy. The new BM further reconfirmed pre-sales, during sales and after-sales activities. The focus group session with the young starters suggested improved pre-sales activities and include the design and financial consultation; during sales include advice, consultation and product information; after-sales include maintenance, extended warranty, technical support and moving assistance for the unit.

The idea of customer relationship was further strengthened by taking examples from a case study from Sekisui House and Sekisui Heim. The prefab companies in Japan put the customer first as their slogan, and it is always the top priority. Nevertheless, not all

customer relationships from the Japanese prefab housing industry are suitable for the flexZhouse. As mentioned earlier, Japanese prefab housing is mainly targeted at the high-income group. Therefore, some ideas might be suitable for premium customers. However, the new BM would improve customer relationships in the current industry by providing customers with options and the freedom to co-evolve with the design, and offering them flexible payment terms, as lessons learnt from Sekisui House’s detached housing BM.

Lessons drawn from the case study are that the new customer relationship differs from that of the current housing industry on ways to deal with clients. Sekisui House’s strategic relationship with its customers led to the inclusion in the new BM of a way to handle and take care of customers that will improve the loyalty of customers towards the product. Sekisui House shows its commitment to the customer relationship by extending the warranty on the product. This includes the extended maintenance of the product throughout the leasing period. Thus, in the revised BM the after-sales activity is necessary and significant, and includes maintenance and technical support. Bad experiences with current housing developers regarding quality and workmanship were raised during the sessions with the young starters. In the revised BM, quality and good workmanship will be ensured through the proper care and periodic maintenance provided by the company. Lessons learnt from Sekisui House and Sekisui Heim provided ideas to help improve the customer relationship in the conventional housing industry. In addition to the proposals made in the previous sections, the lessons from the design workshop, focus groups and case studies concerning the customer relationship resulted in the following summary.

DRAFT BM	FLEXZHOUSE
Before and after sales, design and technical consultation and financial consultation	Pre-sales Design consultation, financial consultation, technical consultation (reconfirmed, added during FG with young starters) During sales Advice, consultation, product information (added during FG with young starters) After-sales Maintenance, extended warranty, technical support, moving assistance, extended warranty on housing finishes, accessories and built-in furniture inside the unit, and moving assistance from one level/place to another level/place. (added during FG with young starters and reconfirmed by case studies of Sekisui House/ Sekisui Heim)

TABLE 7.3 Target customers

§ 7.2.4 Revenue streams

In the draft BM, the idea of new leasing benefitting from the circular economy was introduced. The revenues could come from the leasing of units and services for long-life products, continuous maintenance and services, upgrading and downgrading systems. In the draft BM, the revenue was mainly generated from leasing activities.

In the design workshop, no significant input was recorded on the revenue streams. Further, during the discussion with the young starters, the revenues were tied together with the financial capability of the young starters. We asked the participants how much they could pay and what the mechanisms to pay are. The suggestions were automatic deductions from their bank accounts (direct debits), that the commitment should not be more than 30% of their salary, renting the units for the first 5 years, and usage fees for any services provided by the company. Another suggestion was an ownership option, which gave us the idea that the revenue will come from rental and selling activities, usage of the services provided by the company and the maintenance of the units. Participants suggested all-inclusive bills and capping the utilities price as potential revenue that the new BM could exploit. The idea of selling units was eagerly received. The new idea of selling the unit after the moratorium period of 5 years will give additional income for the company to generate revenues from the sales activities.

We brought the ideas we gathered from the design workshop and focus group with young starters to the session with the private developers and entrepreneurs. New ideas were introduced concerning the capital fund for young starters and recurring fees from the leasing (reconfirmed the leasing ideas). Ideas about rent-to-own and rent-to-buy were discussed in the session. Although the original idea came from literature (lessons from new leasing), we further emphasized the idea in the session and suggested more options for loyal customers. Through these activities, the company will profit from the recurring payment for the loyalty programme. This will provide incentives for both parties as well as a win-win situation.

The revised BM emphasizes the idea of the circular economy in relation to how the company creates profits. Lessons learnt from Philips and Ricoh in the literature about remanufacturing and reducing dependency on resources were translated into the revised BM. The idea of selling services rather than the product was inspired by Philips and Ricoh. The new company will generate its revenue from leasing at the beginning of its operation. The monthly payment generated from the leasing will contribute to its profit streams. From time to time, the new BM must focus on how to innovate the product and offer attractive financial schemes to their customers.

In addition to the proposals made in the previous sections, the lessons learnt from the design workshop, focus groups and case studies concerning revenue streams resulted in the following summary:-

DRAFT BM	FLEXZHOUSE
Leasing of the units, leasing of the components Maintenance fees and services of the utilities Remanufacturing and refurbishments works	Leasing and selling activities (reconfirmed and added during FG with young starters)
	Capping bills and all-inclusive utility bills, capital fund (reconfirmed, extended during FG with young starters)
	Maintenance of the products through refurbishment work (reconfirmed, extended during FG with young starters)
	Remanufacturing, modification, refurbishment (reconfirmed by literature from Ricoh and Philips, and study on Sekisui Heim)

TABLE 7.4 Revenue streams

§ 7.2.5 Key resources

The new BM needs radically different resources compared to the current housing industry. In the draft BM, the resources are physical resources and human resources, including manufacturing plant, crane for lifting units, trucks, and trailers for logistics, and human resources (i.e. engineers, designers and semi-skilled workers).

We discussed the idea of key resources for the new BM in the design workshop with the architects. The participants reconfirmed the resources needed mentioned in the previous session and added a customer service centre and a design consultation centre. The session with the architects emphasized the role of architect and designer in the company. The response from the focus group with the young starters also reconfirmed the resources and added two additional ones, namely a project office and a marketing office. Later, during the session with the entrepreneurs and private developers, the resources were further refined into factory resources, crane facilities, mobilization facilities and trucks for logistics.

Next, lessons learnt from the Japanese prefab businesses and the Hickory Group are that the new BM will need a large factory, machines to produce and develop the quality and speed of the fabrication, cranes, equipment, transport means, and automotive personnel as part of the team. A visit to Sekisui House in Nara prefecture in Japan showed that the human resources need support from skilled and semi-skilled workers to run the production line, marketing & sales, and designers to create innovative products for the company.

In addition to the proposals made in the previous sections, the lessons from the design workshop, focus groups and case studies concerning key resources resulted in the following summary:-

DRAFT BM	FLEXZHOUSE
Physical resources: manufacturing plant, crane for lifting units, trucks and trailers for logistics	Physical resources: factory resources, crane facilities, mobilization facilities, trucks, project and marketing offices
Human resources: engineers, designers, semi-skilled workers	Human resources: engineers, architects, designers, skilled and semi-skilled workers with automotive background

TABLE 7.5 Key resources

§ 7.2.6 Cost structure

In the draft BM, the cost structure is determined by the manufacturing and operating costs and the products offered to the customers. The cost structure of the products and the services lies in the company's investment in the resources and the type of activities operated for the business. The cost structure includes the business operating cost that is related to the key resources we discussed earlier. The company activities will affect the cost structure of the unit. However, the major cost for flexZhouse will partly come from the land cost, the structure and the infill components. The associated cost will come from the construction, installation and maintenance of the units and the related promotional activities.

The cost structure was not elaborated in the design workshop. However, in the focus group with the young starters, the lease payment was discussed in one of the groups, namely studio unit: from RM 500; single unit: from RM 1000; double unit: from RM 2000; and duplex unit: from RM 2500. Note that the figures are merely an indication. The focus group agreed that the lease payment should differ according to the location. The focus group with the private developers suggested that the resources needed to

operate the new BM would be costly. The participants did not deny, however, that a government-linked company would have the capacity to operate the new BM and subsidize the operational costs. The session reconfirmed that the cost structure for the unit will be based on the costs of the key activities of the company.

The Sekisui House detached housing and the Sekisui Heim box houses are expensive mainly because both companies invest an enormous amount in sophisticated machines, robots and equipment for their products. The idea of the circular economy suggests reducing resource consumption by increasing stock levels and recycling stock. A lesson learnt from Philips from the literature is that the stock could be increased by extending the lifespan of the units and making them more durable during the lifecycle period. The lesson learnt from Ricoh is that remanufacturing products is both sustainable and profitable. Photocopiers, toner and printers are some of the products Ricoh remanufactures. In the case of remanufactured machines, the old machine is stripped to the chassis and all parts are replaced and all panels resprayed. The firmware and software are then modified, and product is completely rebranded and sold as a new product. Quality control ensures that the product is indeed as 'new' as a new product. This has extended the lifecycle and provides the continuous loop of the products. In our case, the flexZhouse BM could remanufacture the unit, replace the interior parts and rebrand the unit for leasing to a new customer. Therefore, flexZhouse should build into its products more durability, quality and flexibility. Although such changes come under value propositions, the idea of a durable product can reflect the cost structure of the products. Durable means extending the lifecycle of the products by upgrading their components.

In the revised BM, the company initially needs a medium-size operational setup compared to most Japanese prefab housing companies, whose cost structure is determined by the sophisticated technology they use. The new company setup should be based on partnership to reduce the manpower required and to share risks (discussed further under 'partnership'). In addition to the proposals made in the previous sections, the lessons from the design workshop, focus groups and case studies concerning the cost structure resulted in the following summary:-

DRAFT BM	FLEXZHOURSE
Structure + infill + operating cost (factory machines, installation, maintenance, promotion, sales& marketing)	Resources: combination of skilled and semi-skilled workers (added during design workshop with architects and during FG with private developers)
	Leasing of the unit (indication) Studio unit: from RM 500 Single unit: from RM 1000 Double unit: from RM 2000 Duplex unit: from RM 2500 (taken from FG with young starters)
	Revision for proof of concept (leasing) Studio unit: from RM 300 Single unit: from RM 500 Long unit: from RM 750 Premium unit: from RM 1200
	Revision for proof of concept (selling) Studio unit: from RM 40,000 Single unit: from RM 60,000 Long unit: from RM 120,000 Premium unit: from RM 250,000
	Operational strategy: Increase stock, reduce resource consumption (added and reconfirmed during literature on Philips and Ricoh)

TABLE 7.6 Cost structure

§ 7.2.7 Channel

In the draft BM, the literature on Japanese prefab companies suggests several ways to satisfy the customers and to bring the products to the customers. The phases include the awareness of the products, the evaluation, purchase, delivery and after-sales. The draft BM suggested show houses, a learning centre about the products and the use of social media to spread awareness of the product.

We presented the ideas in the design workshop, and the participants suggested a customer service centre to provide customers with information about the products and to get advice about the products. The participants also suggested a showroom and a learning centre (for the evaluation of the clients' experience of the products).

The channel component was not discussed in the focus group with the private developers and the entrepreneurs. However, during the focus group with young starters, the previous ideas were reconfirmed and supplemented with social media,

websites or apps promoting new designs or products available on the market. The participants also suggested delivery timing for the product and said that no more than three weeks should elapse between signing the contract and delivery of the product.

The discussion on the channel was deliberated in the next focus group with the government agencies. The participants suggested that the products could be supported by a roadshow run by government agencies and through websites to reach the target customer. The Japanese prefab housing industry improves the awareness of their products through product exhibitions, learning centres or showrooms that enable potential customers to experience the actual housing units. A lesson learnt from Sekisui House is to use IT platforms to market the products. The Sekisui House learning centre enables potential customers to find out more about the product and to experience the space before committing themselves. This encourages users to use the products and provide feedback for further improvement. In addition to the proposals made in the previous sections, the lessons from the design workshop, focus groups and case studies concerning channels resulted in the following summary.

DRAFT BM	FLEXZHOUSE
Show house, learning centre, social medias	<p>Awareness: learning centre, roadshow, social medias, websites, promotional activities (reconfirmed and added during FG with young starters and by case studies of Sekisui House/Sekisui Heim)</p> <p>Evaluation: show/sample houses, prototype unit, customer service centre, marketing centre (reconfirmed by case studies of Sekisui House and Sekisui Heim)</p> <p>Purchase: websites, online shopping, apps for new products (added during FG with young starters)</p> <p>Delivery: logistics, delivery time not more than 3 weeks (added during FG with young starters)</p>

TABLE 7.7 Channels

§ 7.2.8 Partnership

In the draft BM, a lesson learnt from literature on the Japanese prefab housing industry led to the decision to form a partnership with new entrepreneurs and SMEs that would supply the housing components, sanitary fittings, housing equipment, etc. The cooperation would help the company to move forward, maximize efficiency and share some of the risks.

The idea was discussed in the design workshop with the architects; the idea was further supported by the idea of a partnership with steel manufacturing companies, home suppliers, local component vendors and home accessories companies.

Next, the session with the focus group with the young starters emphasized using local manufacturers, sanitary fittings, electrical fittings providers and component providers. The idea was further refined, and the focus group with private developers and entrepreneurs suggested partnership with SMEs and local suppliers, and to bring in experts with international experience of the technology transfer to support the production. A lesson learnt from Sekisui House is that a further collaboration with a third party is necessary to expedite work and share risks among the shareholders.

In addition to the proposals made in the previous sections, the lessons from the design workshop, focus groups and case studies concerning partnership resulted in the following summary.

DRAFT BM	FLEXZHOUSE
Local manufacturers and suppliers, modular contractors, steel suppliers	Internal: SMEs as suppliers, local manufacturers, contractors/ subcontractors, maintenance company External: Technology transfer, expertise, advice

TABLE 7.8 Partnership

§ 7.2.9 Key activities

In the draft BM, the lessons learnt from the Japanese prefab housing industry suggest that housing prefabrication is the company's main activity. Under the main activities, design and financial consultation, building, and suppliers of the components were listed as the core activities. The activities also include financial advisors and providing customers with design consultancy. The draft BM also listed relocation, refurbishment and moving services as part of the activities.

The draft BM was presented in the design workshop. The activities were reconfirmed and additions were made: the terms 'modular housing', 'mobile housing' and 'industrialized housing' activities, factory-made housing and installation of the unit.

The term industrialized housing production was emphasized along with the possibility to relocate the units and activity that involves the transportation of the units. During the focus group sessions with the private developers and government agencies, the sessions also suggested the improvement of the current industrialized building system (IBS) industry in Malaysia and revisited the use of IBS for industrialized housing production.

Lessons learnt from the case studies of the Sekisui House detached housing BM and the Sekisui Heim box-type BM suggested the remodeling business and renovation services, modification and demolition work for the existing housing stock. The findings from the Hickory Group led to the addition in the revised model of prefab installation of bathroom modules, bedroom modules and the installation of service kit to the components. In conclusion, the activities of the new BM need support from key players in the housing industry. The key activities are crucial to determining the revenue and the cost structure, which are discussed in the following sections. In addition to the proposals made in the previous sections, the lessons from the design workshop, focus groups and case studies concerning key activities resulted in the following summary:-

DRAFT BM	FLEXZHOURSE
Housing prefabrication	Housing prefabrication (reconfirmed during all focus groups)
Design, financial consultation, building, and suppliers of the components	Design & financial consultation (reconfirmed during FG with young starters)
Leasing	Leasing and selling activities (reconfirmed and added during focus group with young starters)
Relocation, refurbishment and moving services	Maintenance and technical support (reconfirmed during FG with young starters)
	Installation of modules (e.g. bathroom, kitchen, service kit) (added during case study of Hickory Group)
	Refurbishments, remanufacturing, reconditioning (added during literature on Ricoh, Philips and Sekisui Heim)

TABLE 7.9 Key activities

§ 7.2.10 Summary of the section

At the beginning of this chapter, we posed the main research questions on the components required for the flexZhouse BM to provide a potential solution to the problems discussed at length in Chapter 2. Below, the findings are summarized and classified according to the BM tool in order to answer the main research questions.

CRITERIA	BM components	flexZhouse
CUSTOMIZATION	Value propositions	Provide customers with a choice of units and products (standardized customization) Enable customization of the product along the lifecycle chain.
	Target customers	The design supplied by the manufacturer will take into consideration every stage and of walk of life, demographic and size of family, and customize the needs at that moment.
	Customer relationship	Improve the client relationship right from the beginning of the project until the end of the lease. The company will provide free technical advice and consultation on design and financial matters.
AFFORDABILITY	Revenue streams	The income for the company will come from three main activities: Normal rental Rent-to-buy Rent-to-own The manufacturer will reap profit through the prolonged lifespan of the products or units.
	Cost structure	The cost structure of the products and services lies in the company's investment in resources and the type of activities operated for the business. Therefore, the principle of the revised BM suggests reducing resource consumption by increasing stock and recycling stock.
	Key resources	The manufacturer will invest in machines and an advanced technology system to produce the housing units using high-quality goods and products.
SUPPLY CHAIN	Channel & Network	Technology already permits many innovations to help the products reach the target customers. The manufacturer will invest in constructing more show units/prototypes, make use of social media, provide better ways to communicate, create awareness, help the customers to evaluate, and arrange delivery and purchase of the products with the customers
	Partnership	The partnership will determine the continuity of the supply chain of the projects. The delivery of the products depends on a good relationship between the manufacturer and its suppliers.
	Key activities	Refurbishment and remanufacturing activities Activities involve leasing and selling to customers, reducing lead-times, helping to maintain the products.

TABLE 7.10 Summary of BM components and contribution to the flexZhouse BM

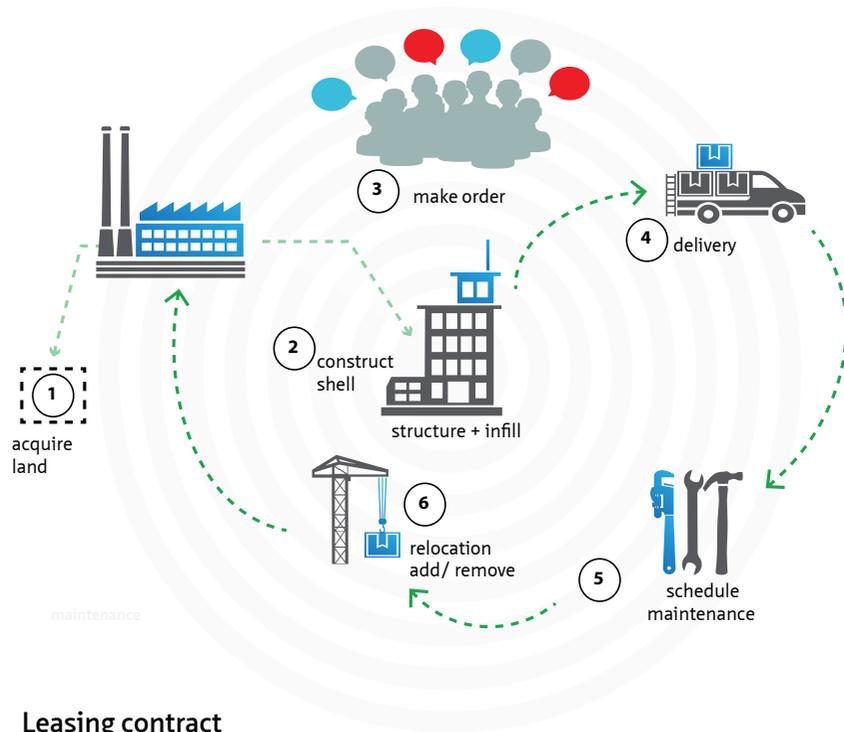
§ 7.3 The revised business lifecycle

This section explains the business lifecycle chain of the revised flexZhouse BM. The finding from the focus group with the government agencies suggests that the government agency dealing with housing has the capacity to adopt this new BM. This is because there is a gap between the government's efforts to provide affordable housing for young starters, and it is the government's social obligation to meet the housing target. The new flexZhouse BM suggests a way to achieve the government's target to build 500,000 units of affordable housing by 2018. Nevertheless, it is important to note the example studies of three Japanese prefab housing companies show that a huge amount of capital is needed to operate this kind of business.

The following Figure 7.3 illustrates the process of the supply chain for the revised model of flexZhouse. The revised BM process starts with (1) acquiring land for the development of the structure for the housing development. In this case, the development requires a piece of vacant land to develop the concept. Next (2), the company begins constructing the structure with the basic services and facilities needed for the medium-rise development. After completion of the structure, the empty slots are filled with the empty boxes that had functioned as advertisements.

In the next step (3), the customers go through the process of design consultation, financial discussion, leasing agreement and confirmation of the date of delivery of the units. The company then starts manufacturing the infill components. After 18 months (step 4), customers are allowed to change or modify the components and revise their monthly payment.

During the focus group with the young starters, the participants agreed that the minimum leasing period for the units would be 12 months. After 12 months, a customer would be allowed to move out or surrender the component(s) to the company. After a further six months (i.e. after a total of 18 months), a customer would be able to upgrade or downgrade the unit. However, a customer would have to inform the company three months in advance to ensure that there is an available slot for a new unit. The early notification would promote the smoothness of the production process in the factory and the delivery. Notifications would be sent to allow existing users at the particular slot to prepare for the relocation of their module to another available slot in order to allow for the reshuffling process.



Leasing contract

Tenant agree for relocation but with minimum 2 months of notification in advance from the company

Tenant obliged to inform company 3 months (at least) in advance to change module/ unit

All maintenance,complaints, services of the unit will be addressed to the company

All maintenance of the general services,common area, public utility will be addressed by the appointed maintenance company.

FIGURE 7.3 The revised lifecycle chain of flexZhouse

§ 7.4 The revised business framework

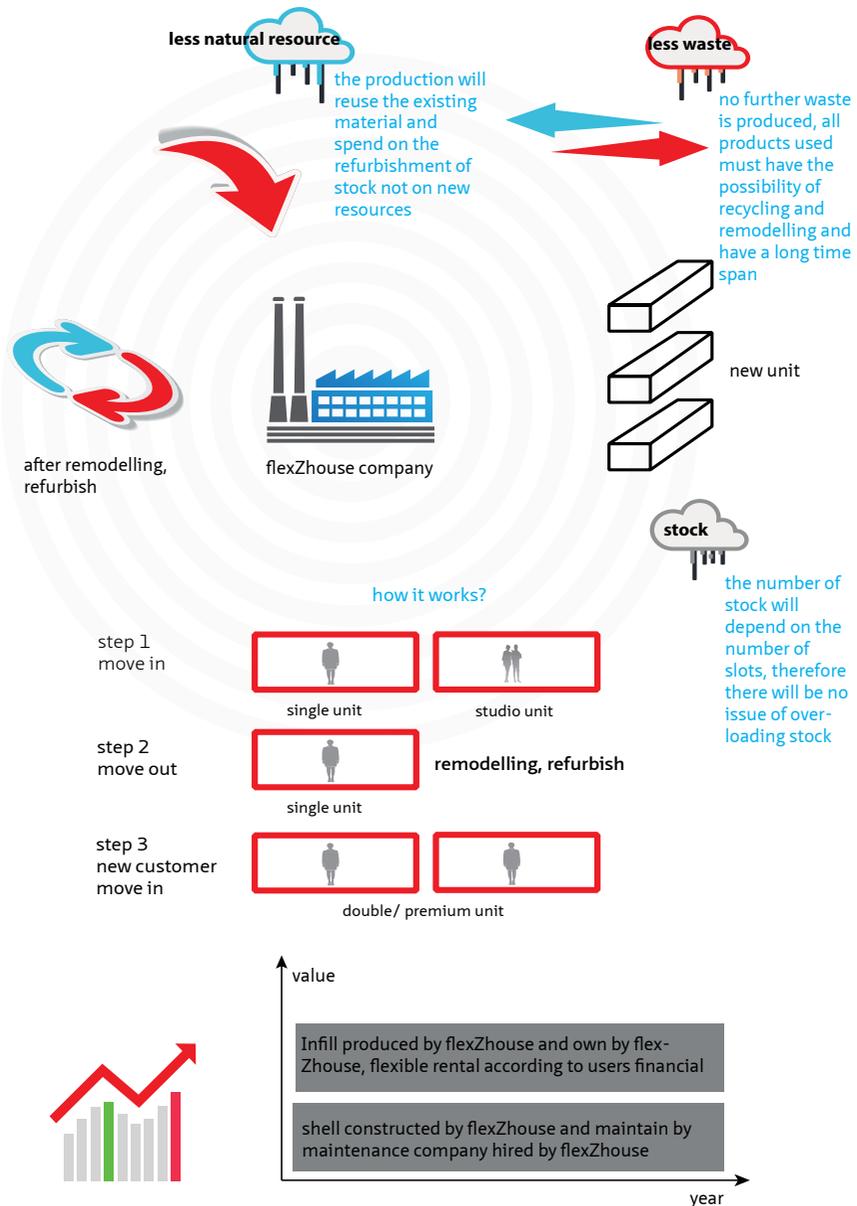


FIGURE 7.4 The revised business framework

In the revised BM, we explained how the company retains ownership of the units. The production, maintenance and refurbishment will be done by the enterprise or the maintenance company hired by the company through a partnership. Since the unit is modular, the walls, ceiling and floor are flexible to allow for expansion and reduction. The unit will be sealed and delivered to the site. This is to ensure the quality of the unit is preserved from the factory.

The revised BM integrates the idea of the circular economy as its principle. Therefore, the production will attempt to reuse as much of the existing material as possible, and spend more on the refurbishment concept rather than investing in new resources. As mentioned, the unit and the furniture will be built for durability and for long-term use. This is to ensure that the lifespan of the products is increased and the idea of recycling will be continuous throughout the lifecycle chain.

The detail of the flexZhouse process is described below.



FIGURE 7.5 Step 1- constructing structure and installing services

Step 1: The company constructs the basic structure of the flexZhouse. The structure is made from either RC(reinforced concrete) or steel and the relevant services (mechanical and electrical conduits, water supply and sewerage piping, and risers for the services and amenities) are installed. The structure is in compliance with the modular sizes for the infill components.



Step 2

choose package
(standardized
customization)

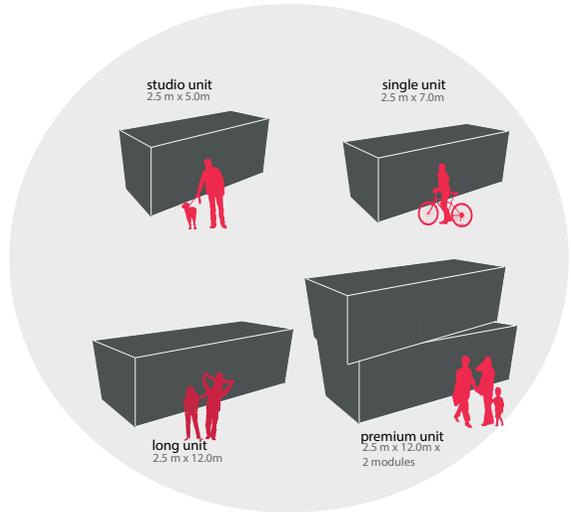


FIGURE 7.6 Step 2- choose package (standardized customization)

Step 2: The customers are helped to choose the type and size of unit they want as well as the lease that is affordable for them.



Step 3

choose component
& finishes

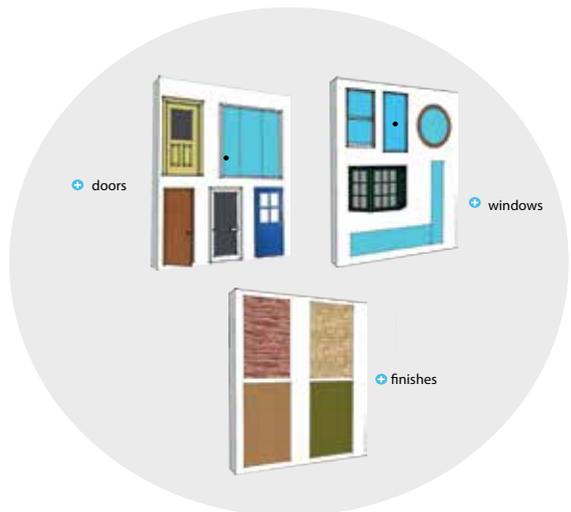


FIGURE 7.7 Step 3- choose housing components and finishes



Step 4

additional +
accessory

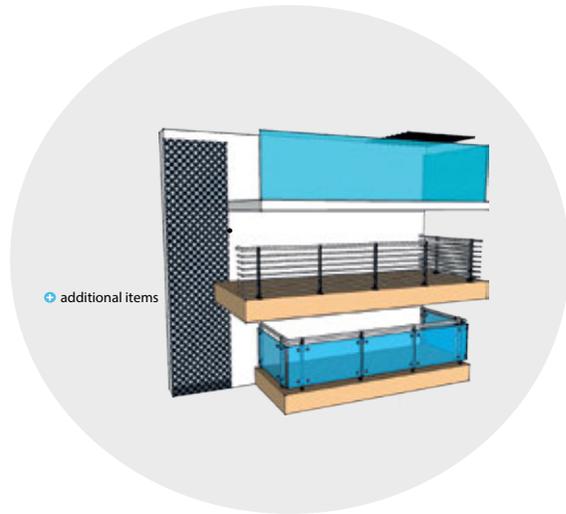


FIGURE 7.8 Step 4: customer able to add accessory

Step 3 & 4: The customers select a unit from the available designs, add the components, furniture and electrical fittings, change the layout of the bathroom, kitchen style, façade, type of windows and doors, and add a balcony as an accessory. A 3D simulation of the unit is provided for easy visualization of the unit.



Step 5

choose location +
levels

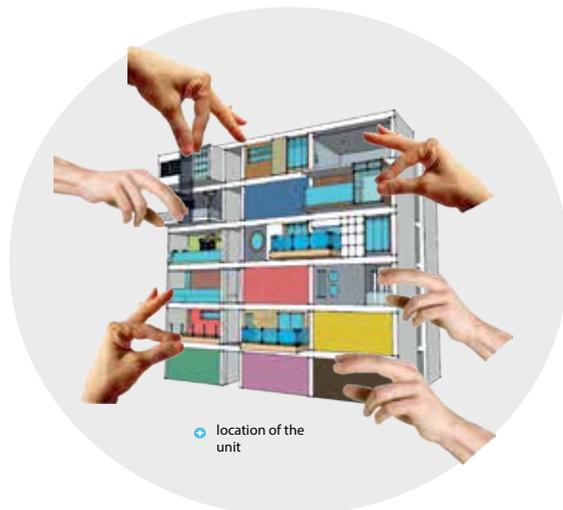


FIGURE 7.9 Step 5: choose location and position of the unit

Step 5: The customers are given slots on a first come, first served basis. The level and position of the unit is subject to the type of units, the sizes and the availability.



FIGURE 7.10 Step 6- Signing agreement and scheduling installation

Step 6: The customers finalize the design with the consultant, agree on the final cost of the products (leasing), sign the agreement, and decide on the moving and delivery day.



FIGURE 7.11 Step 7- Tenant move out after grace period and returning component

Step 7: After a minimum stay of 18 months, the customers can change the components (add/reduce them) and agree to the relocation process to allow another component in the case of unit reshuffling.

§ 7.5 Innovative leasing solutions for the flexZhouse BM



FIGURE 7.12 The supply chain of flexZhouse

In this new strategy, which integrates innovative leasing using the circular economy principles, the housing component is designed to last longer and allow changes. The products (interior + exterior component) will be designed for durability and to make it easy to refurbish and recycle them for the next customer. In the new BM, the more durable product means more income for the company. The new principle suggests that the initial cost of production could be reduced if the product is built for recycling and reconfiguration, and this might change the linear economy as currently practiced in the current housing industry, where housing developers spend huge amounts of resources and money on raw materials. The current lifecycle chain is not built for flexibility and the housing always requires further renovation, changes and reconstruction according to the different needs of the users. The affordability challenge will be addressed if the new company adopts the principle of the circular economy in its business operation. The initial investment could be recouped within 3–5 years and the sustainability of the products will be potentially guaranteed.

The flexZhouse will solve the quality issue through off-site production and a fabrication process that involves high precision and a product installation that has close tolerances. The quality will be assured by the factory and, contrary to conventional construction, the workmanship of the products will be at its best. The supply chain will involve skilled and semi-skilled workers who operate the machines and involves personnel with automotive background. The lesson learnt from the case studies of the Japanese prefab companies suggests using a minimal labour force, adopting high technology and integrating an automation system in housing prefabrication.

The flexZhouse opens up the possibility of customer involvement during the early design stage. This will definitely add a new dimension to the mass housing industry in Malaysia. Customization does not necessarily mean expensive. Lessons learnt from the case study of Sekisui Heim suggest the adoption of 'standardized customization' to allow more input from the customer at an early stage. Different customers have different needs. Therefore, the new BM provides flexibility in terms of design preferences, ways of life and user's affordability.

§ 7.6 Proof of concept (feasibility study)

During our discussions with prefabricated housing manufacturers in Malaysia, the updated lifecycle cost was presented, and inputs and suggestions from the companies regarding the cost of building an initial factory, the cost per unit, the cost of transport and other related costs that could help our estimation were used to provide a preliminary assessment lifecycle cost analysis of the flexZhouse. The purpose of the following calculation is merely to serve as guidelines for the flexZhouse. The costs determined in the following are based on existing practices in Malaysia.

For the purposes of the proof of concept, an actual site was used to illustrate the likely return for the flexZhouse. The site chosen was a piece of vacant land owned by PRIMA, located in the town of Brickfields, just south of the city centre of Kuala Lumpur. The site covers about 7 acres (4 046.85m²). Considering the lettable area is about 80% of the total site, about 6 acres were used for the proposed flexZhouse development.

The first step for the flexZhouse begins with a one-time investment in the factory setup, which is estimated to be about RM 20 million (estimate based on discussions with prefabricated housing manufacturers in Malaysia). The setup of the factory is based on the rough estimate of the key resources needed to operate the business. The size of the initial setup of the factory is about 2000 m², of which 200 m² are used for office and administration department. The factory is sufficient for the production plant and the

storage of stock. The key resources required were discussed earlier and include elevated work platforms, cranes, machines, trucks, prefab area (production) and storage.



FIGURE 7.13 Aerial view of the proposed flexZhouse development

The optimum building height for any building in Malaysia is defined as a height of the building at which an owner gets the most economical rate or return. In other words, developer will build the high-rise as high as possible to get the highest percentage of return from the rental or selling activities (Shuid 2004). However, it is meaningless if the client reaches out to the maximum allowable height according to the plot ratio but the building left unoccupied and unsold. In terms of the planning requirements, there are variations between authorities in respect of plot ratio for the development area. However, the given figure (in section B) serves as a guideline. A modern residential complex is typically developed with an efficiency of 80–90% of the total site area. This includes the green areas and recreational areas for residents. Again, for the flexZhouse the loading area is crucial and must allow the crane to lift and perform installation work.

Another factor is the height of the buildings: the feasible height of the flexZhouse is to be designed up to five storeys. This is because the higher the building, the more expensive the scaffolding and the crane for lifting, and stricter the safety requirements. Any development that constructed more than 5 storeys will require elevator and other means of vertical transportation, therefore it will also incurred cost to the whole development. The wind is an important factor in high-rise building and when cranes are at work.

Finally, the maintenance costs of high-rise buildings are usually higher. Thus, limiting the building to a five-storeys is a good strategy. Affordable housing that gives value for money should, of course, employ the most economical design solution. However, the location and size of the site might mean that the requirements need to be reconsidered to achieve economies of the scale for the flexZhouse. Nevertheless, for a denser populated area, the height of the flexZhouse could be higher and the height-limit will follow the demands and plot ratio requirement from the local authority. Nevertheless, the height is not the priority of the new BM as the module is movable and expandable. The optimum number of units can be produced up to 1050 units at one time taking consideration leasing, sales and moving out activities running at the same time.

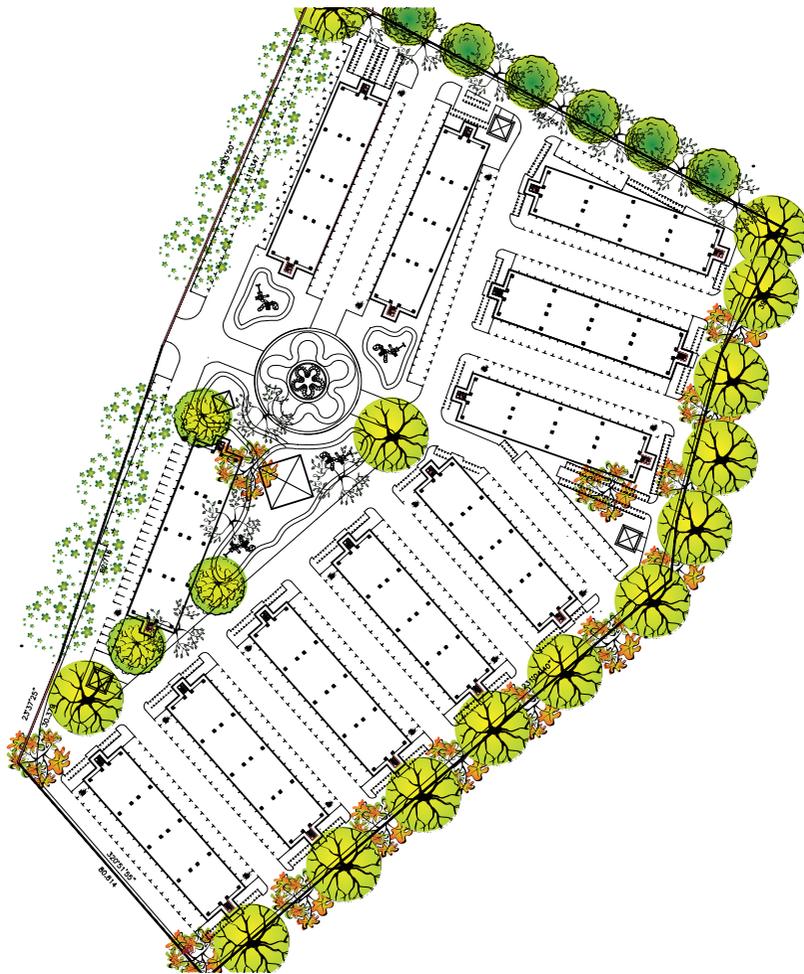


FIGURE 7.14 Site plan of the proposed flexZhouse development

The proposed flexZhouse development (on one site) can accommodate 800–880 units in 11 blocks. Each level in the block can accommodate 16–20 modules. For one block, we estimate around 80–88 units. The lettable area of the entire development is estimated to be around 16,722.55m² while the infill units are estimated to be around 19,509.64m². Rental income is predicted to average around RM 300–1200 per unit, depends on the module and the finishing selected by the customer. Structure costs are estimated to be RM 1076 per m² while the infill units are about RM 1614 per m² In the following table, we illustrate the feasible cost estimate of the proposed flexZhouse development.

A	ITEM PARTICULARS	TOTAL
1	Factory setup for flexZhouse	RM 20,000,000.00
	*Factory size (50m x 40m= 2000 m2)	
	*Office (200 m2)	
	*managerial, administration staffs / designers/ technical personnel + 10-20 pax	
	*facilities in the factory, elevated work platforms, cranes, alimaks, machines, transportation (trucks), production and storage area.	
	Total setting up factory	RM 20,000,000.00

TABLE 7.11 Business setup

B	DEVELOPMENT DETAILS	
1	Land area m ²	24,300m ²
2	Structure GFA (RM 1076 per m ²)	16,722m ²
3	Total unit	850
4	Infill GFA (RM 1614 per m ²)	24,652m ²
5	Infill NFA (m ²)	23,173m ²
6	Building Efficiency (%) item B5 / Item B1	94%
7	Total car parks	850
8	Loading area (m ²)	6,503 m ²
	Total GFA (item B4+B8)	31,155m²

TABLE 7.12 Development details

C DEVELOPMENT VALUE			
1	Infill NFA (m ²)		23,173m ²
	Proposed leasing price		
2		Studio unit	11.88m ² RM 300
3		Single unit	16.90 m ² RM 500
4		Long unit	29.1 m ² RM 750
5		Premium unit	58.31 m ² RM 1200
	Proposed selling price (after moratorium period)		
		Studio unit	11.88m ² RM 40.000
		Single unit	16.90 m ² RM 60.000
		Long unit	29.1 m ² RM 120.000
		Premium unit	58.31 m ² RM 250.000

TABLE 7.13 Development value

D DEVELOPMENT COST (ONE-TIME)			
1	Land		RM 7,000,000
2	Preliminaries		RM 2,370,000
3	Structural		RM 18,000,000
4	New Production	module	RM 15,000,000*
5	Remanufacturing	module	RM 7,000,000*
6	Loading area		RM 4,000,000
7	Amenities & facilities		RM 7,500,000
8	Services package (M&E, Sewer, Greywater, piping)		RM 900,000
9	Piling works		RM 12,000,000
10	Infrastructure works		RM 5,000,000
11	Pre-development cost		
	a Management fees (10% of rental price)		
	b Authority contributions		RM 1,493,100
	c S.I & Survey works		RM 100,000
	d Legal fees, Quit rent & Assesment		RM 497,700
	e Factory setup		RM 20,000,000
12	Promotion and marketing		RM 200,000
13	Financial cost (10% per annum)		RM 7,906,080
	Gross development cost	item D1-D12	RM 86,966,880
	Net development cost	item 1,2,3,6,7, 8,9,10,11(b), 11(c), 11(d), 12, 13	RM 66,966,880

TABLE 7.14 Development cost* (figure were converted to round numbers for easy calculations)

The following depicts the concept and illustrates the potential value of the flexZhouse. With regard to the infill units, the two major instruments of density control are floor space index and plot ratio. However, for this exercise, we assumed the development will build 300 units for the first year of operation and the remaining units in the subsequent years. The occupancy rate is expected to be around 70% in the first year. The formula for the occupancy is based on the following equation;

$$\Sigma = \text{Sum (Np+Rm)} - \text{Sum (Annual sales)} \times \% - \text{Mo}$$

Np = New production (annual)

Rm = Remanufacturing (annual)

Mo = Moving out of unit (annual)

In the subsequent year (after 18 months), the customer is allowed to add or remove components. Based on the illustration below, the remanufacturing activities started in year 2 and the production of the new units is significantly reduced until year 6 because of the remanufacturing activities. The illustration shows that the renting activities will increase each until year 6, when the selling activities are activated (loyalty programme). We also estimate that the cost of remanufacturing will be 50% less than producing a new unit.

E BUSINESS PROJECTION ESTIMATION						
Year	New Production	Remanufacturing	Occupancy	Renting	Sales	Moving out
0	300	0	0.00%	0	0	0
1	150	50	70.00%	315	0	0
2	100	40	95.00%	522	0	0
3	100	20	95.00%	618	0	0
4	50	20	95.00%	665	0	0
5	80	100	95.00%	741	0	0
6	80	120	95.00%	187	580	50
7	80	140	95.00%	313	480	100
8	50	200	95.00%	240	600	100
9	50	220	95.00%	163	625	200
10	50	200	95.00%	150	300	300

TABLE 7.15 Business projection estimation

F ILLUSTRATION ON THE RENTING & SELLING ACTIVITIES (UNIT)				
Year	Studio unit	Single unit	Long unit	Premium unit
Rental activities				
1	100	100	100	15
2	170	200	53	100
3	50	168	300	100
4	80	185	300	100
5	100	250	300	91
6	50	50	45	42
7	120	100	50	43
8	100	50	40	50
9	40	43	50	30
10	50	50	50	0
Sales activities				
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	80	200	200	100
7	80	100	200	100
8	100	200	200	100
9	125	200	200	100
10	100	50	50	100

TABLE 7.16 Illustration on the production

Each infill unit is estimated to cost about RM 15,000.00*⁶ for new production and RM7,000.00 for remanufacturing cost; this also includes an additional 30% for the basic furniture and interiors for the user. As can be seen, the cash flow increases after year 5 because of the selling activities.

Although the revenue is insignificant at the beginning of the company's operations, the flexZhouse is expected to make a high profit after 5 years of operation. Because certain fixed costs connected with the maintenance of the unit and the operating costs of the company do not appreciate proportionately with increases in the size of a building, unit costs are usually reduced as more units or modules are produced. Moreover, more sales activities after 5 years may give a cost advantage to the manufacturer and reduce overall costs. Based on the illustration earlier, we provide the following scenario to illustrate the business projection for 10 years.

6

RM15,000- cost for module one (to cover operating cost and for factory and 30% of basic interior)

Scenario based on table F

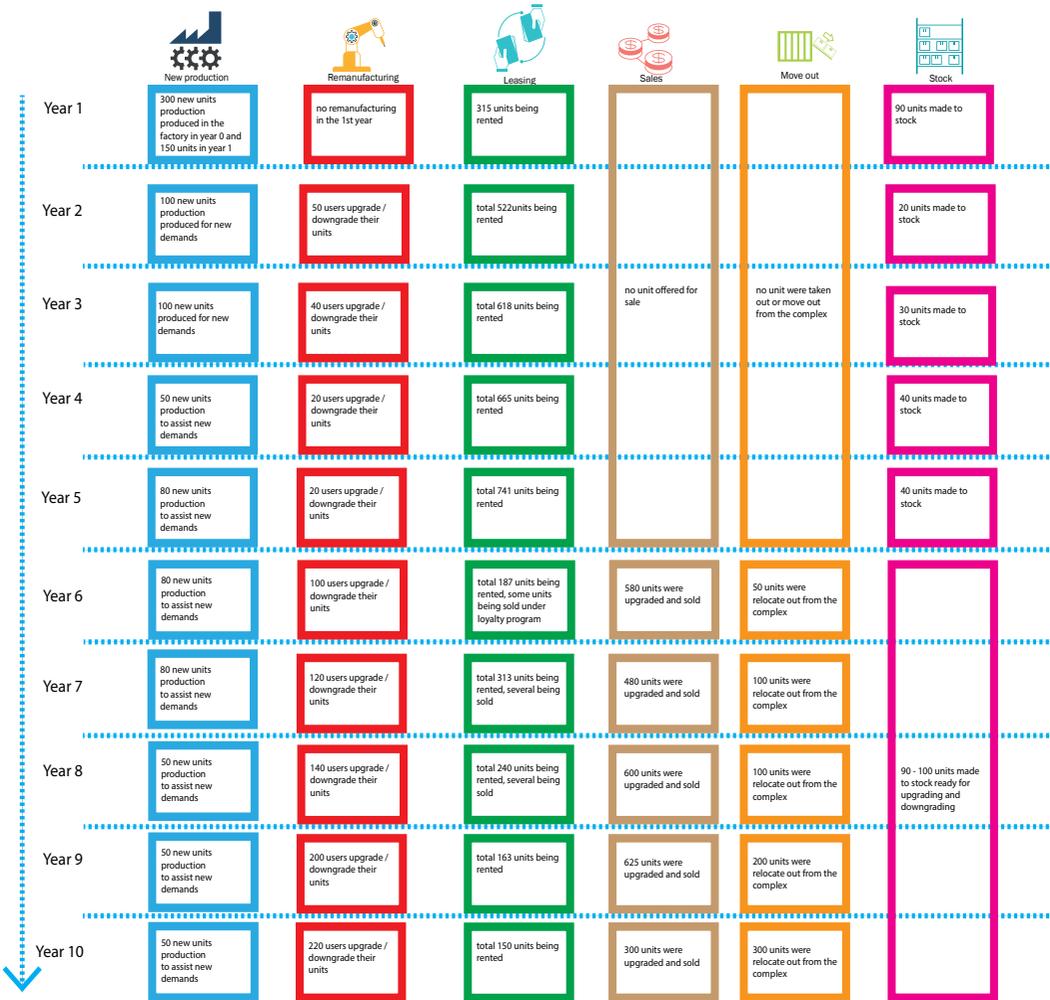


FIGURE 7.15 Illustration on the company's production

For this exercise, considering the demands for the unit based on the illustration (7.16), for the first year, three blocks will be built; the remaining blocks can occupy for the demands at a rate of the production in the subsequent years. The empty slots can be used for advertising purposes, thus creating additional income for the company. In the figure above, we illustrate the 'moving out' of a unit from the complex, which means reducing the number of units in the slot in the development. Moving out could also mean moving to a different complex, a different flexZhouse site or an independent location. By developing the same housing complex in other locations could increase the production and expand the possibility for new occupants in different complexes. If one complex can accommodate 800 units, the similar module could be used in different locations elsewhere and thus upscale the production numbers and address demands from the population.

At the beginning of the operation, the company will be producing a large number of units, starting with 300 units. However, the number of new units will be reduced once the remanufacturing process starts. The principle of the circular economy is to reduce raw materials consumption by increasing remanufacturing and recycling existing products. By the end of year 10, a total of more than 600 units will be leased while the remaining units will be undergoing sales activities. 1110 units will be undergoing the remanufacturing process and a total of 750 units will be moving out of the complex. The maximum number of units in the entire development will be about 880 units. The total production for the entire 10-year period is estimated to be about 1090 units before the new remanufacturing begins again when the unit starts to moving out from the complex. The remanufactured units are expected to be indistinguishable from new products, since the materials used for the exterior and the built-in furniture will be made from durable elements, thus prolonging the lifespan of the products. The process of remanufacturing will undergo rigorous quality control and be certified for reuse and recycling in the future.

G ILLUSTRATION ON REVENUE CALCULATION FOR Y1-Y10						
Year	New Production	Remanufacturing	Rental			
			Studio	Single	Long	
0	RM-5,850,000	RM0				
1	RM-3,012,750	0	RM371,171	RM618,371	RM927,371	
2	RM-2,068,755	RM-468,650	RM649,920	RM1,273,844	RM506,252	
3	RM-2,130,818	RM-386,168	RM196,888	RM1,102,130	RM2,951,543	
4	RM-1,097,371	RM-198,876	RM324,471	RM1,250,064	RM3,040,089	
5	RM-1,808,468	RM-204,843	RM417,756	RM1,739,954	RM3,131,292	
6	RM-1,862,722	RM-1,054,939	RM215,144	RM358,431	RM483,785	
7	RM-1,918,603	RM-1,303,905	RM531,837	RM738,367	RM553,665	
8	RM-1,235,101	RM-1,566,859	RM456,493	RM380,259	RM456,220	
9	RM-1,272,154	RM-2,305,522	RM188,075	RM336,833	RM587,383	
10	RM-1,310,318	RM-2,612,156	RM242,147	RM403,417	RM605,004	
TOTAL		RM-2,445,928	RM3,593,902	RM8,201,670	RM13,242,603	

TABLE 7.17 Illustration on revenue Y1- Y10

H NET PRESENT VALUE (NPV) ESTIMATION					
Year	Operational cost	Maintenace	Cash flow	Present value	Periodical maintenance
0			-RM66,966,880		
1	-RM 396,000	RM213,945	-RM3,710,552	-RM66,966,880	
2	-RM 396,000	RM395,809	RM945,344	-RM3,892,607	
3	-RM 396,000	RM582,448	RM3,755,726	RM945,153	
4	-RM 396,000	RM623,576	RM4,104,945	RM3,785,274	-RM156,900
5	-RM 396,000	RM680,850	RM5,711,124	RM4,332,521	
6	-RM 396,000	RM177,970	RM76,629,601	RM5,463,973	-RM532,000
7	-RM 396,000	RM258,560	RM72,301,711	RM76,411,571	
8	-RM 396,000	RM220,527	RM82,626,955	RM72,108,171	-RM56,100
9	-RM 396,000	RM167,609	RM86,556,268	RM82,451,482	
10	-RM 396,000	RM125,057	RM51,047,357	RM86,135,878	-RM192,000
	Total	RM3,446,352	RM313,001,598	RM50,584,414	
		*PRICE LEVEL T=0	NPV	RM316,447,949	

TABLE 7.18 Illustration on net present value (NPV)

Sales						Estimated revenue
<i>Premium</i>	<i>Studio</i>	<i>Single</i>	<i>Long</i>	<i>Premium</i>		
RM222,536	RM0	RM0	RM0	RM0	-RM3,710,552	
RM1,528,078	RM0	RM0	RM0	RM0	RM945,344	
RM1,573,920	RM0	RM0	RM0	RM0	RM3,755,726	
RM1,621,138	RM0	RM0	RM0	RM0	RM4,104,945	
RM1,519,493	RM0	RM0	RM0	RM0	RM5,711,124	
RM722,343	RM3,820,996	RM14,328,699	RM28,657,327	RM29,851,343	RM76,629,601	
RM761,728	RM3,935,626	RM7,379,280	RM29,517,047	RM30,746,884	RM72,301,711	
RM912,302	RM5,067,118	RM15,201,317	RM30,402,558	RM31,669,290	RM82,626,955	
RM563,803	RM6,523,915	RM15,657,356	RM31,314,635	RM32,619,369	RM86,556,268	
RM0	RM5,375,706	RM4,031,769	RM8,063,518	RM33,597,950	RM51,047,357	
RM9,425,341	RM24,723,361	RM56,598,422	RM127,955,084	RM158,484,835	RM400,914,900	

In the previous table, the net present value takes into consideration the maintenance aspects of the unit. Each tenant will contribute 10% of their monthly commitment towards the maintenance fees (mainly for the maintenance of the common area), while periodic maintenance will be conducted by the company every 2 years to ensure that the quality of the units and the accessories is maintained. The operational cost was also included with an estimates about RM 396,000 per year.

The most critical factor in this development will possibly be rental and sales income. For this exercise, the figures are based on intuitive. Some figures were given during the focus group sessions, the estimates of the rental and sales are based upon comparisons with transactions conducted on similar properties in a similar area but, as stated in the previous chapter, the flexZhouse BM will attempt to offer units at less than market price and to disrupt conventional prices elsewhere. The beauty of this product is that the adjustment and the flexibility of the rental price could be based on size, location, furniture used, chosen modules and lease terms. The flexibility of the unit is the possibility to transfer it elsewhere within the complex, to transfer it to a different site that has a similar structure or to use it on its own as a standalone structure.

The impact of time is very crucial in the circular economy principle, because a huge investment is needed at the beginning of the startup to purchase resources and set up the factory. Assistance from government to fund the initial investment is necessary to reduce the initial cost especially on the land and initial setup of the factory. The initial investment for the project was estimated at 10% to pay interest to the bank. However, this could be omitted with the subsidies from the government to finance the project. Although the method proposed above illustrates the estimated lifecycle cost of the flexZhouse, it still gives only a conceptual indication of value. A detailed discounted cash flow analysis would provide a much better approximation of value. The resale value of the unit is unknown at this moment, but considering the facilities and finishes that flexZhouse is offering, the unit would have the potential to match existing housing industry.



FIGURE 7.17 Main themes for inductive

§ 7.7.1 Legal framework / political and land issues

The main element discussed here is the existence of different legal environments in various states of peninsular Malaysia and Sabah and Sarawak that are governed by each state's authority. Each state has its own regulations and jurisdiction pertaining to building and housing development. The legal and regulatory environment currently do not have provision for prefabricated housing per se. The discussion suggests that a new set of rules and regulations should be formulated to treat prefabricated housing differently from the conventional housing. Current housing law serves as a significant deterrent to a potential company to introduce a new BM to the industry, especially when faced with the conventional housing industry, whose time scale and lifecycle chain are totally different from those of the new flexZhouse. According to Housing Development Acts (Control and Licensing Amendment) Act 2012, housing development in Malaysia currently falls under Schedules G, H, I and J. Any developments that require an advance payment from purchasers will be deemed to fall under any of the schedules (G,H,I or J)"Housing Development (control and licensing) (amendment) act 2012" 2012). However, the flexZhouse will need a different strategy as the units will not require the purchaser to pay a deposit, as during the first five years of operation the focus will be on leasing activities. Therefore, the flexZhouse will not come under the HDA acts, which govern all conventional housing in the current situation

Under the new SIFUS (Certificate of Share Unit Formula) law, which came into force in 2015, developers must obtain a certificate from the Land Office if they wish to subdivide land for property purposes. This has raised the issue of whether the flexZhouse will be bound by this new rule. According to section 6 of the SMA (Strata Management Acts, 2013), developers are not at liberty to unilaterally change the plan or legends. Any amendment to the Schedule of Parcels (SOP) can be made only (i) as per the requirement from the local authority and (ii) with the agreement of all purchasers of the development. If a parcel is amended or a plan is modified, the developers have 30 days to submit an amended schedule of such parcels or the modified building plans. Developing a new flexZhouse BM at the national level will require a lot of help from the federal government, with new sets of rules, submission of the drawings for approval and significant government subsidies to finance the start-up. While the flexZhouse BN does not require substantial resources, it does require adequate support from the government in terms of land procedures, the potential to develop government-owned brown sites and further guidance for the flexZhouse to make young starters aware of its existence. The flexZhouse needs to have clear communication with financial institutions and suppliers in the housing business, as well as tax exemption to promote sustainability in the housing and construction industry in general. Therefore, the big question is what the position of flexZhouse is and how it will respond to the existing laws of HDA (Housing Development Acts), Strata Titles Acts (2013) and Strata Management Acts (2013). And will flexZhouse introduce a shorter timeline for the submission procedure to the local authority and help to expedite the long and tedious process of current law? These questions pose a challenge to the implementation of flexZhouse and can be pursued in future study.

The flexZhouse requires interest-bearing schemes and exemption of legal fees and stamp duty as part of government efforts to introduce the new concept in the housing market. Other meaningful measures include further subsidy as part of the MyHome scheme and helping the young starters through the Housing Facilitation Fund as part of the home ownership programme. In order to assist the flexZhouse, the authorities need to realize that providing an alternative to current housing will create diversity in the housing market, thus helping to reduce soaring prices, supporting sustainable policy, and could contribute to competitive business and innovate the local housing industry.

States that are ruled by the government and those ruled by the opposition must work hand in hand to ensure the need for housing is met to help address the aspirations of the administration and the industry. To support this, new policy related to flexible housing and a review of current law, in particular with regard to the national housing policy, restriction of interest, submission procedures, and fire and safety related issues. Therefore, under this coding and issue, we raised one important proposition for a new set of rules and regulations to counter the present housing development act to promote the flexZhouse for the housing industry in Malaysia.

§ 7.7.2 Market/ perceptions / cultural issue

The flexZhouse BM challenges the Malaysian housing industry to adopt a new perspective. At present, the industry is associated with immobile and inflexible physical units. The flexZhouse shows that housing can be mobile and flexible. The market needs to adjust to the norms of prefab housing concept; they want to have live experience living in the flexZhouse. Another concern is that the market regards prefab housing as temporary structures, thereby leading to insecurity and uncertainty about its potential. Implementing the flexZhouse will require a detailed consideration of the community interaction so as to promote a culturally standard model.

The new market of young starters is said to easily adapt to changes. However, before the new concept can go further, a new market survey should be done to assess whether the concept could be implemented in the industry. Further marketing analysis and strategy could help the introduction of the new BM to the market. The configuration of the housing should take into consideration the cultural, religious and community desires to ensure that the social needs are served and delivered.

Some sceptics among our respondents include the phases that that flexibility is needed in their lives. Customization might not be needed at the very beginning; it can come a bit later once the commitment and needs change in the future. This is the main reason we will introduce the basic unit of what we call the studio unit, with a basic size of 127.83 sq. ft. The basic unit could be a starter unit for young starters and also act as an additional module for an extension package. Therefore, under this coding and issue, the consideration of the value propositions has to include different target customers and different needs in the customer's lifestyle.

§ 7.7.3 Technical aspects, available technology and supports

The flexZhouse requires strong technological support. New skills require technology transfer from other countries. Although not impossible, awareness should be increased and training should be given as part of the development of skilled and semi-skilled workers to operate the new BM. Given the current technology in the IBS system in Malaysia, the flexZhouse needs a new paradigm to shorten the supply chain cycle. Lesson learnt from Japanese house builders on key resources will support the flexZhouse.

Three aspects that involve technical aspects and technology were discussed concerning the type of facilities that will be suitable for the flexZhouse (technical aspects, available technology, mechanism). As mentioned earlier, this research just provides a guideline on the new technology and how it can support the flexZhouse. It is important to discuss in future studies such aspects as the type of machines, equipment, infrastructure and mechanism that will be necessary to operate the new BM to ensure that the new industry moves forward and meets the objectives to provide mass housing for the young starters. Attention should be paid to novel techniques in the new system. The market must be aware of the new technology and how it can improve the modern needs and to create a market that continues to support the new BM. The strategy must take into consideration aspects of sustainability that are emphasized in government policy.

In terms of economies of scale, it is necessary to distribute the network of the suppliers into a larger market. As discussed in the partnership components, the involvement of SMEs and subcontractors can dispel the mistaken perception that the flexZhouse is an expensive product, as well as reduce the problems associated with the presence of unskilled foreign workers in the country. Nevertheless, the scepticism of representatives of the industry concerns the skills required to operate such a new system, the technology and the way of working. This will definitely need time, capital and more resources at the beginning of the operation. Changing the way of working creates serious resistance to the flexZhouse, as the current housing developers will not be keen to change how they work. Sourcing skills workers from outside definitely will cause more to their daily operations. However, some investment is necessary to achieve a successful business. As the financial implication creates the biggest obstacle, initial investment is also necessary to help the business reap profit in a feasible time.

During the early stage of the operation, the factory needs to be built in a suitable location since the logistics of the units is one of the main aspects of flexZhouse. It should be located closer to the main highways and to make it easier to transport the units to the site. The model of flexZhouse will resemble a car manufacturing plant. The housing units will be produced off-site and transported to the desired location once they are ready. Later, the units will be brought back to the factory for remanufacturing and reconditioning. Therefore, the biggest obstacle is the technology and skills required to operate flexZhouse. Another obstacle is a financial one: convincing financial institutions to finance the project, which does not have any precedents in the case of Malaysia.

§ 7.8 Contributions of this chapter to the thesis

In this chapter, the revised model of flexZhouse was formulated to answer the main research question. The reason for the study lies in the fact that we are interested in revising the components that will be necessary for the new flexZhouse BM to find a solution to the problems mentioned earlier in chapter 2.

Conclusions that we derived from the design workshop, focus groups and case studies are presented and summarized in the revised BM. Further, the conceptual lifecycle costing although with preliminary input has been established to give a proof of concept on how the BM creates revenues for the company, and the calculations could be improved in the future. With the combination of the circular economy principle, we tried to remodel the costing to show the possibility of long-life of the products through the process of remodeling and reconfiguration.

During the process of data collection, three main themes emerged. Being a new concept to the country, the new BM needs help and support from and partnership with other bodies, organizations and even government to start its operation of activities. The emerging codes were divided into three categories, namely legal & political, culture & market, and technology & technical support.

We are aware that the new concept of flexZhouse is still new to the country. Therefore, the research serves as an innovative BM for the housing industry in Malaysia. By implementing the term innovative, the new BM seeks to challenge the standard practice of conventional BM, which is the cause of the problems that plague the industry. The flexZhouse aims to change the conventional way of working and to explain how complicated and expensive products such as housing can be converted into simpler products that are affordable for many. This new innovation in the flexZhouse BM supports the theory of disruptive innovation to create competition for the long-established traditional housing business in the country.

In summary, we made an attempt to answer the research question by requesting feedback from the target group, practitioners, housing developers, government agencies and entrepreneurs dealing with related business. The iterative work and 'feeding information' process that was undertaken to provide rich information on how the new flexZhouse will address and offer a solution to the three problems of affordability, customization and quality in current housing. However, we do not make a substantial claim that the proposed BM will solve the problems, but it will provide an innovative way to solve some of them.



8 Conclusions & recommendations for future research

§ 8.1 Introduction

We started this thesis by explaining why there is a shortage of affordable housing in Malaysia for young starters. We focused on three main problems, namely the housing affordability for the young starters, the lack of options for flexibility in housing design and the poor build quality in the current mass housing industry. To solve the problems, we sought 1) a value proposition that would offer flexible housing design but with minimal waste caused by modifications; 2) company revenues based on resource efficiency and longer product lifespans; and 3) logistical streams that focus on quality through an industrialized strategy and the improvement of customer satisfaction.

In the previous chapter, we presented a revised draft flexZhouse business model (BM) for young starters in Malaysia. This BM is intended to provide a solution to the problems of design inflexibility, high housing prices and poor build quality in the current mass housing industry in Malaysia. The strategy of the research was to contribute theoretically and provide proof of concept to support the idea of the flexZhouse BM. This research used the model of 'design sciences' as described by Van Aken (2004). The strategy first helps to understand the problem; the next step is to prescribe alternative solutions for the industry, in this case, the flexZhouse BM. Our mission was to further develop knowledge for the design and realization of artifacts, namely to provide alternative solutions to the problems of affordability in the housing industry in Malaysia for young starters. We aimed at developing knowledge, the application of which would lead to the intended results. Van Aken (2004) used the term 'design research' because the ultimate objective of studies in this category is to develop solid knowledge for designing solutions to problems in the real world.

§ 8.2 Answering the research questions

The thesis answers the main research question, which was formulated in section 1.3:

How can the flexZhouse business model provide a solution to the inflexibility, high prices and poor quality of newly built housing in Malaysia?

The question challenged the flexZhouse BM to solve the problems that contribute to the unaffordability of housing for young starters. Next, we pointed out the new direction for the flexZhouse BM for affordable housing projects in Malaysia, in terms of both theory and practice. The solution suggests the role of the BM as a tool to provide an alternative solution to housing customization by offering mass customization, offering affordable products to young starters in Malaysia through innovative leasing and helping to improve the quality of the built housing by applying an industrialization strategy. The proposal suggested that with the idea of the circular economy, the housing products could be made affordable for young starters. During the explorative journey, the draft BM received input from different stakeholders who might get involved in the new BM.

The findings from the empirical work helped us to formulate the final revision of the revised flexZhouse BM, which includes the following elements:

CRITERIA	BM components	flexZhouse
CUSTOMIZATION	Value propositions	Provide customers with a choice of units and products (standardized customization) Enable customization of the product along the lifecycle chain.
	Target customers	The design supplied by the manufacturer will take into consideration every stage and of walk of life, demographic and size of family, and customize the needs at that moment.
	Customer relationship	Improve the client relationship right from the beginning of the project until the end of the lease The company will provide free technical advice and consultation on design and financial matters.
AFFORDABILITY	Revenue streams	The income for the company will come from three main activities: Normal rental Rent-to-buy Rent-to-own The manufacturer will reap profit through the prolonged lifespan of the products or units.
	Cost structure	The cost structure of the products and services lies in the company's investment in resources and the type of activities operated for the business. Therefore, the principle of the revised BM suggests reducing resource consumption by increasing stock and recycling stock.
	Key resources	The manufacturer will invest in machines and an advanced technology system to produce the housing units using high-quality goods and products.
SUPPLY CHAIN	Channel & Network	Technology already permits many innovations to help the products reach the target customers. The manufacturer will invest in constructing more show units/prototypes, make use of social media, provide better ways to communicate, create awareness, help the customers to evaluate, and arrange delivery and purchase of the products with the customers
	Partnership	The partnership will determine the continuity of the supply chain of the projects. The delivery of the products depends on a good relationship between the manufacturer and its suppliers.
	Key activities	Refurbishment and remanufacturing activities Activities involve leasing and selling to customers, reducing lead-times, helping to maintain the products.

TABLE 8.1 Summary of BM components and contribution to the flexZhouse BM

§ 8.2.1 Answering research sub-question 1

What would be the appropriate components for the flexZhouse BM?

The first thing we did was defining the BM. We discussed the strategy of the new BM to promote affordability for young starters in Malaysia. We used BM as a tool to explain the strategy of flexZhouse to offer the product to the housing market. The new flexZhouse BM is expected to deliver more affordable housing and accessible to sweep away once dominant housing industry with alarming regularity. The answer to this question helped to reconnect the BM components with the problems and issues that became the backbone of this thesis. In order to answer the research sub-question, the appropriate components for the BM were formulated. The BM is a means to an end. It is the backbone of the newly formulated flexZhouse, and also acts as the intervention that we used for the research.

CRITERIA	BM COMPONENTS
Customization	Value Propositions Target customers Customer relationship
Affordability	Revenue streams Cost structure Key resources
Supply chain (Production)	Partnership Channels Key activities

TABLE 8.2 Analytical framework to build flexZhouse BM

§ 8.2.2 Answering research sub-question 2

What are known approaches that may contribute to providing elements that could help to construct the flexZhouse BM?

In order to answer this sub-question, we formulated the conceptual framework and the initial draft flexZhouse BM. The analytical framework helped us to produce a strategy of inquiry to answer the factors of analysis:

CONSTRUCTS	FACTORS OF ANALYSIS	STRATEGY OF INQUIRY
Customization market needs, demographic changes, demands, choices	Design options to support the idea of customization Investigation of the needs and choices of target market, i.e. current and future young starters in Malaysia Type of customer relationship to prolong services to the customer	Design workshop with architects, focus group with young starters
Affordability financial capability, flexible financing, terms of payment, payment options	Exploring the housing problems of young starters, housing affordability, How they can pay (method) and how much they can pay How can the company creates revenue	Focus group with young starters, representative from private developers, entrepreneurs, NGOs and government agencies dealing with housing
Supply chain (production) supply chain, production time, lead times, improving the quality of housing stocks	Exploring the possibility of new model to fill the gap, waiting time, quality and workmanship of the product/unit	Focus group with young starters, representatives from private developers, entrepreneurs, NGOs and government agencies dealing with housing

TABLE 8.3 Constructs for flexZhouse BM

The theoretical framework connects theories that support 1) customization options; 2) scholars' views on affordability and 3) supporting literature on supply chain and production. We were interested in taking the challenge and extending the idea of Schneider and Till (2005) that flexible housing will be more economical (affordable) in the long run, encourages tenant empowerment throughout the tenure (customization) and allows greater exploitation of industrialization in its supply chain process (supply chain). The following are the known approaches that contributed the construction of the flexZhouse BM.

Customization: The first concept of customization was further emphasized by several theories from the open building and flexible housing literature. This further strengthened the type of products and services that the company might offer under the value propositions umbrella. It was important for this element to identify the type of customers for each product for whom the value is being created. When considering this construct, it was important to understand the type of relationship that each of the client segments expects to establish and maintain with them. Theories include several perspectives that support the customization of the housing stock. Options include total customization, standardization and standardize customization. We described the components that related to value propositions, target customers for flexZhouse and customer relationship for the new business. Arguments and support from various theories were discussed, and the answer was summarized with solutions for customization for flexZhouse.

Affordability: In terms of financial avenue, we explored how the revenue streams and the cost structure of the BM could help to provide an alternative to current payments for housing. It involved how young starters are willing to pay, what the problems associated with current payments are, how much they are willing to pay, and the type of pricing that is available to support the system. Secondly, as the key resources that the company invests in will determine the pricing mechanism, it was important to determine what resources would be needed and what element could be outsourced to minimize the resources investment. Thirdly, the cost structure of the business provided an idea of the pricing of the units. Here, we determined the most important costs inherent in this BM. We identified the characteristics of the company and how it can provide long-term return on investment. Main theories on performance economies describe the idea from (W. Stahel, 2010; W. R. Stahel, 2010). The new BM tries to emulate the disruptive, innovative BM suggested by Hwang and Christensen (2008) on how to make existing business more affordable to the target group. Several proposals were suggested for innovative leasing. Terminologies such as normal leasing, service economy, circular economy and reducing consumption from the linear economy were introduced. The financial plan suggested the new innovative leasing would close the loop and that a remanufacturing strategy would reduce dependency on resources consumption. The section describes the revenue streams, cost structure and key resources to operate flexZhouse BM.

Supply chain/production: In terms of quality and workmanship, the theoretical framework suggested the integration of manufacturing process and the industrialized procedure to maintain the quality and workmanship of the products. This section dealt with the supply chain process, which might determine the quality of the production. For example, the partnership will lead to optimization of the production, and reduce risk and uncertainty in the supply chain. This will be further reinforced by the key activities that determine how the supply chain is arranged to support the delivery of the products and to ensure customer satisfaction through channels and network. This is particularly important to ensure that the products will arrive just in time and help the customers, starting from awareness level, evaluation, purchase, delivery and after-sales. Previous studies described the possibility of integrating the new BM with industrialization and options for remodeling to close the loop. Discussion on the supply chain in the construction industry provides insight into the future direction of the new flexZhouse. This is by means of integrating aspects of industrialization through discussion on the corporation partnership, providing channels to the customers and determining the activities that support the supply chain of flexZhouse.

§ 8.2.3 Answering research sub-question 3

What are the meanings, judgments and evaluations of the stakeholders concerning the draft flexZhouse BM?

Feedback on the draft flexZhouse BM provided the answer to this question. We sought to understand people’s attitude, motivation and behaviour (the ‘why’ and ‘how’ behind the ‘what’) during the design workshop with professional architects and during focus groups with young starters, practitioners, housing developers, industrial key players and government agencies dealing with housing, to help us formulate the new BM.

QUESTIONS	KEYWORDS	CONTRIBUTION TO BM COMPONENTS	SESSION CONTRIBUTION
What type of products / services can be offered to young starters?	Design, customer services, type of products / services	Value Propositions Target customers Customer relationship	Design workshop with architects, focus group with young starters
How much the customer willing to pay? What are the mechanisms to pay? What are the options to pay?	Payment mechanism, affordable rate, when to pay, pay for use, how to pay	Cost structure Revenue streams, Key resources	Focus group with young starters, industry key players, professionals
How does the business reach the customers? How long does it takes to be delivered? How does it differ from current housing?	Delivery process, quality assurance, waiting time, lead time, supply chain/ production	Key resources Revenue streams Partnership	Focus group with young starters, industry and government agencies

TABLE 8.4 Constructs for flexZhouse BM

We looked for new criteria that emerged during the sessions for discussion and theoretical insights as the conclusion of the chapter. The initial BM was developed from the problems derived from the literature and problems associated with social phenomena. The draft BM underwent a series of ‘refinements’ during various focus group sessions with the young starters. The refinement process involved a member’s checking procedure that was vital for the validation process of the research.

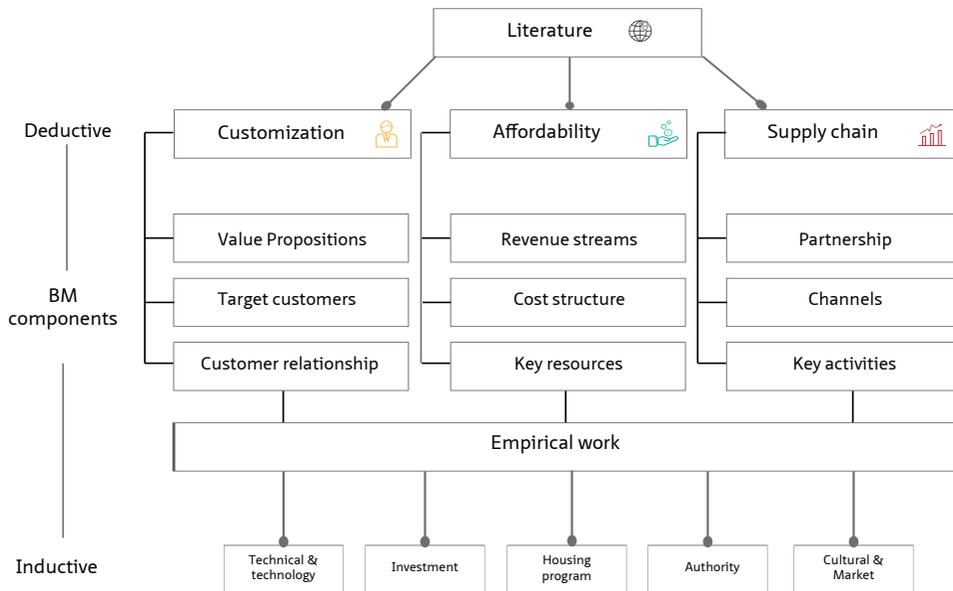


FIGURE 8.1 Summary of research framework

The initial idea from the conceptual stage was brought up for discussion with the architects in the design workshop. Next, the result of the design workshop was used in the series of focus groups with the young starters and industry representatives and was presented in the session with the government agencies. The ‘feeding information’ technique helped to find and add new elements for the revised flexZhouse BM.

In summary, we posit that the private sectors/developers seem to turn cold feet with the new concept merely because they do not deal with uncertainty especially when the new BM is introduced and because of the early stage of the flexZhouse BM (more elaboration in section 8.3.3). However, we received good feedback from the government agencies especially flexZhouse creates an alternative to solve the issues of affordability among young starters in Malaysia. At the beginning of this thesis, we proposed the new BM as a private initiative for the industry; however, after the empirical work, we suggested that the new BM is appropriate to be supported by the government and subsidized as part of the government’s programme for affordable housing. The new flexZhouse BM was also seen as having the potential to support the government’s effort, especially by PR1MA, to increase the supply of affordable housing. Hence, all the feedback helped to strengthen the revised flexZhouse BM.

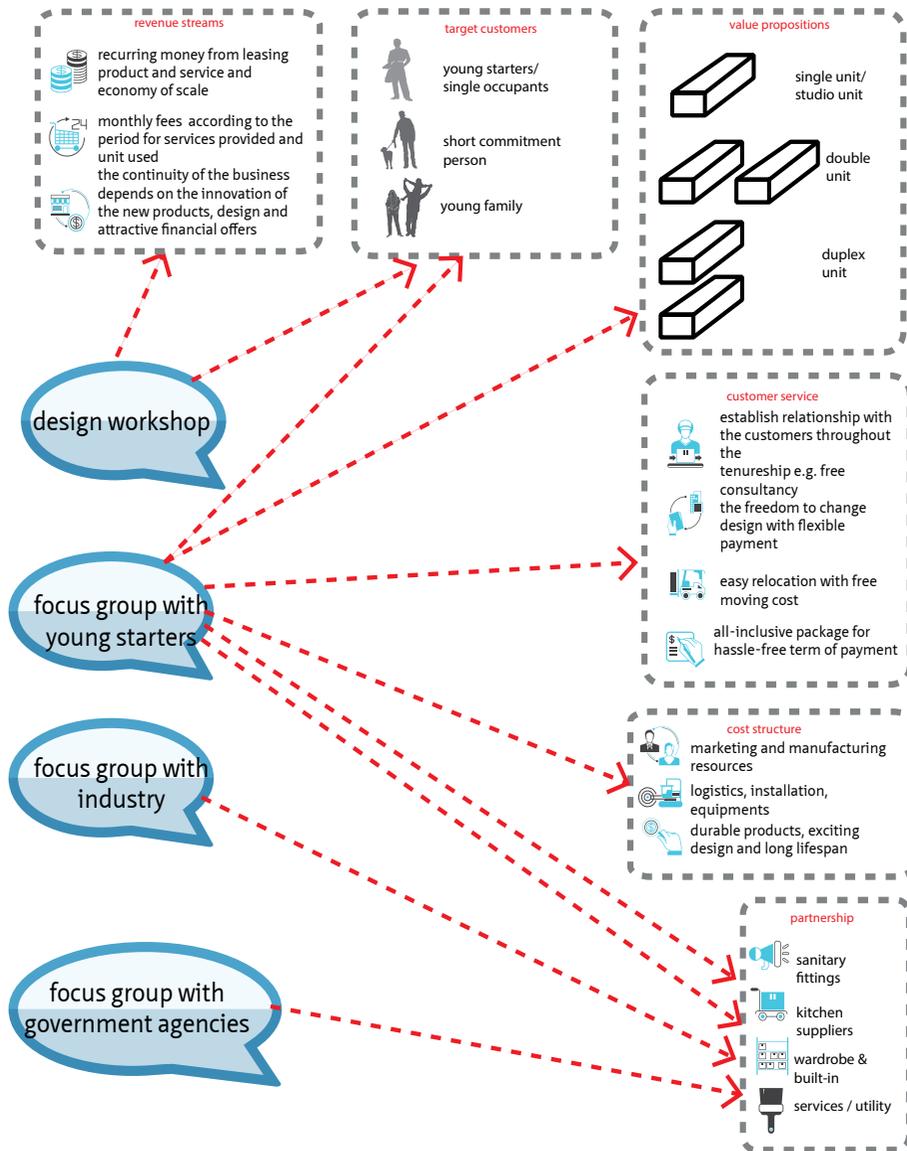


FIGURE 8.2 Sessions contribution to the flexZhouse BM

§ 8.2.4 Answering research sub-question 4

What processes and methods are available to support the delivery of flexZhouse?

The answer to this question strengthened the formulation of the new flexZhouse BM. Relevant examples from primary and secondary data helped to support the revised draft of flexZhouse BM. Data obtained from the empirical works helps to answer and explain the business motivations, propositions for the products and services, financial implications and revenues, and the resources needed to operate each business. It was interesting to learn from companies that had already adopted the circular economy in their business operations (literature). The innovative leasing concept of Ricoh and Philips helps to integrate the financial choices and ways to minimize operational costs from a different business strategy that could be useful for the flexZhouse BM. In order to strengthen the new concept, examples from other countries (particularly Japan and Australia) were used. The idea to implement the circular economy was taken from Philips and Ricoh (literature). The following companies were selected:

- 1 The Sekisui House BM is more or less similar to the flexZhouse BM. All the components of this BM were discussed as much as possible within the practical boundaries of obtaining the necessary data through the interview, observation and secondary resources from the company archives.
- 2 Sekisui Heim was mainly selected because of its 'Heim' system, which uses the box production similar to our flexZhouse housing unit. We therefore focused mainly on the production, key resources and the company's recycling of the Heim for future use.
- 3 The Hickory group was selected mainly because of the resources it uses for the production, and the activities they perform as part of the company's value propositions.
- 4 Ricoh has already adopted the circular economy and it focuses on sustainable production. The main idea is on the remanufacturing of its products for modification and rebranding as new products (literature).
- 5 Finally, Philips is an example of a company that sells services rather than the product itself. The revenue depends on how much power the customer consumes and this helps to reduce the higher cost of ownership (literature).

In comparison, the examples in the market show that the present BM of industrialized housing available in the market focuses on high-income bracket customers. The technology and resources used involve sophisticated and high-tech machines. Therefore, this presents a gap in the housing industry in Malaysia, when the technology and the system are relatively new. Nevertheless, lessons learnt from Sekisui Heim and the Hickory Group concerning resources help flexZhouse to plan its own resources to operate a similar business. The innovative leasing concept of Ricoh and Philips helps to integrate the financial choices and ways to minimize operational costs from a different business strategy that could be useful for the flexZhouse BM.

The answer to this sub RQ poses several challenges to the research. The main challenge faced by the limitation of information and confidentiality of the information. In the case of Sekisui House, although we obtained access and visit to the facilities, the photography is not allowed in the facility, and the data are mainly obtained from the interview and records available in the archives and observation on site. Limited information was also found from other companies. The biggest chunks of the information came from websites, YouTube, and other electronic sources. Furthermore, the BM strategy is not something that every company would share and made it available to the public. Nevertheless, we manage to find information that is needed to support the formulation of flexZhouse BM. Information that we used coming from either interview session, a presentation from the company personnel, company reports, and archives, videos available on YouTube, and comments from customers on the products.

§ 8.3 Theoretical insights

This thesis provides a theoretical concept of the flexZhouse that integrates the idea of the circular economy. The emergent theory suggests theoretical insights into home ownership in Malaysia, the needs for customization in the mass housing industry, the rejection by private developers, and several barriers caused by building regulations. To summarize, the contribution of this thesis can be described as follows (sections 8.3.1–8.3.7):

§ 8.3.1 The new flexZhouse BM provides a better understanding of the needs of and problems faced by young starters looking for their first home in Malaysia

In Chapter 1, we identified the main problems facing the industry in Malaysia, and especially the need for a new BM for affordable housing. We are aware of the problems faced by young starters, especially those in the middle-income bracket, in accessing affordable housing. However, previous research has not led to a BM that will solve the problems. We therefore held several focus group sessions with young starters from different backgrounds in order to gain a better understanding of their needs and problems. The focus group helped to reveal new insights during in-depth discussions and debates on the current situation.

§ 8.3.2 **Young starters in Malaysia are grappling with the issue of affordable housing and have low literacy in financial investment and management**

Young starters in Malaysia are grappling with the issue of affordable housing simply because the current situation does not provide an affordable financial solution for them. Their low literacy in financial investment and management also underlies this problem. The current solution provided by the government does not take a holistic approach to the problem, but focuses on achieving the numbers to satisfy the statistics. The government's current intervention focuses more on a design intervention than a new BM for the housing industry.

§ 8.3.3 **The rejection of the flexZhouse by private developers shows their resistance to change and is also a result of the early stage of the flexZhouse BM proposal**

The focus group with representatives from the industry showed that private developers reject the new concept. Their reaction is partly caused by resistance to change from the conventional method to a new system, and partly by their being cautious about investing in the face of a high degree of uncertainty. Secondly, it shows that the concept needs to be tested in the market before they will accept the new idea. We are also aware that the idea of the flexZhouse is still in the conceptual stage. Thus, more research and a prototype of the system and the unit would help to strengthen the concept of flexZhouse.

§ 8.3.4 **The new flexZhouse BM creates an alternative solution to affordable housing programmes for the mass housing industry in Malaysia**

This thesis promotes the adoption of innovative leasing using circular economy principles. In this new strategy, the housing component is designed to last longer and allow changes. The products (interior + exterior component) will be designed for durability and to make it easier to refurbish and recycle for the next customer. In the flexZhouse concept, the more durable product means more income for the company. In this new strategy, the new principle suggests that the initial cost of production could be reduced if the product is built for recycling and reconfiguration, and this will perhaps change the linear economy as it is currently practiced. In the current housing industry, housing developers spend huge amounts of resources and money on raw materials. The lifecycle chain is not built for flexibility and housing always requires

further renovation, changes and reconstruction according to the different needs of the different users. The affordability challenge will be addressed if the company adopts the principles of the circular economy in its business operation. The initial investment could be recouped in 5-10 years and the sustainability of the products are the main agenda. Nevertheless, the idea of flexZhouse could provide a new horizon for the industry and create competition for the affordable housing in the country. Although it is still new and premature, the idea could be up-scaled and recommended for future research and study.

§ 8.3.5 **The new flexZhouse BM revisits the issue of sustainability in the mass housing industry in particular and in the construction industry in general**

The idea of flexZhouse emphasizes the issue of sustainability in the construction industry in general. The current solution for sustainability normally involves a merely cosmetic solution that ends up sending yet more waste to landfills. By introducing the circular economy, the flexZhouse will revolutionize the way the public looks at housing and make the bulky, immobile and expensive housing stock more liquid, mobile and cheaper in the long run. The flexZhouse resolves the issue of sustainability through its off-site production and fabrication process that involves recycling and remanufacturing.

§ 8.3.6 **The flexZhouse BM integrates the idea of open building and the concept of infill for housing**

The proposed flexZhouse was inspired by the concepts of 'open building' Habraken (2003) and 'flexible infill', that is, the flexibility of the unit or infill to fill the spaces between two load bearing columns within the space of a unit. In this module, the notion of empowerment is reflected in the choices of the infill and the spaces inside the unit. The unit will allow users to take control of their own design during the design stage. This is a way to support the idea of involving the user at the beginning of the design development chain to promote interaction, participation and co-evolvement with the layout (Schneider & Till, 2005). The infill is also flexible in that it can be produced systematically in the factory and is designed for ease of assembly and disassembly. The analogy of the open building for the new concept of flexZhouse was used to support the design. The structure acts as the platform for the services (electrical, etc.), utilities (water supply and sewerage) connection to the infill. The infill is the components of the house mainly presumed to be factory made and managed by

the manufacturers. It can be formulate based on one module. Later, the module can be added to horizontally or vertically. The infill design is subject to customer preferences and is designed for relocation. In this strategy, the infill unit will have a longer time span compared to existing mass housing solution. Longer time span also means the company able to generate more revenues and at the same time reduce the price of ownership to the end users.

Inspired by the theory of BM innovation put forward by Hwang and Christensen (2008), the flexZhouse will provide an economical and affordable alternative to the current bulky and rigid housing stock. In our case, housing developers or manufacturers will provide a performance contract and temporarily grant the users (customers) use of the housing product/module (components) for a period of time agreed upon by both parties. This will give customers more design choices at the very beginning and allow them to enjoy the services and products without having to pay the full costs of possession. Moving towards new BM will require a paradigm shift in the way things are made. In the new situation, housing production will shift to mass and flexible production and profit from the recycling stocks and housing components. The new BM will help developing countries such as Malaysia to advance their industrialization and avoid being vulnerable to resource price shocks, especially those related to construction materials such as cement and steel. The new financial model is a change from normal ownership models and will alter the relationship between manufacturer and customer. The innovative leasing or pay-as-you-use contracts are more suitable to the current condition of young starters in Malaysia.

The flexZhouse emulates the innovative BM that helps to make an existing business more affordable for the target group. Several proposals were suggested for the innovative leasing. Terminologies such as normal leasing, service economy, circular economy and reducing consumption from the linear economy were introduced. The proof of concept suggested that the new icircular economy principles will help to close the loop and reduce dependency on resources consumption. Therefore, the flexZhouse concept is either more flexible, or provides better option than what available in the existing market.

§ 8.4 Recommendations for future research

In light of the limitations of research using a qualitative approach, we make the following recommendations for future studies.

§ 8.4.1 Technology and technical study

This thesis has presented a conceptual design for the flexZhouse. A future study could look into details concerning the construction of the products and further clarify the technology that is available on the market, especially mechanisms for moving the units in and out of the structure. Further study on the technical aspects of the products will help in terms of finalizing the production costs and the price of the unit to be sold on the market. The flexZhouse requires strong technology support. New skills require technology transfer from other countries. Awareness of the new technology and training should be given as part of the development of skilled and semi-skilled workers to operate the new BM. Given the current technology in the IBS system in Malaysia, the flexZhouse will need a new paradigm to shorten the supply chain cycle. Lessons learnt from Japanese house builders on key resources are necessary to support the flexZhouse.

Three aspects that involve technical capability and technology were discussed concerning the appropriateness and the type of facilities that are suitable for the flexZhouse (technical aspects, available technology and mechanisms). As mentioned, this research just provides a guideline about the new technology and how it can support the flexZhouse. It will be important in future studies to discuss such aspects as the type of machines, equipment, infrastructures and mechanisms that will be required to operate flexZhouse BM. Attention should be paid to novel techniques in the new system. The market must be aware of the new technology and how it can improve the existing problems to create a market that continues to support the new BM. The strategy must take into consideration the aspects of sustainability that are emphasized in government policy.

In terms of economies of scale, it is necessary to distribute the network of the suppliers into a larger market. As discussed in the partnership components, the involvement of SMEs and subcontractors can dispel the mistaken perception that the flexZhouse is an expensive product, as well as reduce the problems associated with the presence of unskilled foreign workers in the country. Nevertheless, the scepticism of representatives of the industry concerns the skills required to operate such a new system, the technology and the way of working. This will definitely need time, capital

and more resources at the beginning of the operation. Changing the way of working creates serious resistance to the flexZhouse, as the current housing developers will not be keen to change how they work. Sourcing skills workers from outside definitely will cause more to their daily operations. However, some investment is necessary to achieve a successful business. As the financial implication creates the biggest obstacle, initial investment is also necessary to help the business reap profit in a feasible time.

During the early stage of the operation, the factory needs to be built in a suitable location since the logistics of the units is one of the main aspects of flexZhouse. It should be located closer to the main highways and to make it easier to transport the units to the site. The model of flexZhouse will resemble a car manufacturing plant. The housing units will be produced off-site and transported to the desired location once they are ready. Later, the units will be brought back to the factory for remanufacturing and reconditioning. Therefore, the biggest obstacle is the technology and skills required to operate flexZhouse. Another obstacle is a financial one: convincing financial institutions to finance the project, which does not have any precedents in the case of Malaysia.

§ 8.4.2 Authorities' requirements and regulations for flexZhouse System

The study has identified some of the restrictions in the present building regulations, which have no provisions for prefabricated housing produced in a factory. A study of new regulations and legal implications related to land use is necessary to accommodate the new emerging market. Regulations on the prefabricated building industry are essential to ensure that the idea of prefabricated housing is welcomed by the mass housing industry in Malaysia. The main element discussed under this topic is the existence of different legal environments in various states of peninsular Malaysia and Sabah and Sarawak that are governed by each state's authority. Each state has its own regulations and jurisdiction pertaining to building and housing development. The legal and regulatory environment currently do not have provision for prefabricated housing per se. The discussion suggests a new set of rules and regulations should be formulated to treat the prefabricated housing differently from the conventional housing acts. Current housing law serves as a significant deterrent to a potential company to introduce a new BM to the industry, especially when faced with conventional housing construction that has a time scale and lifecycle chain that are totally different from those of the new flexZhouse. According to Housing Development Acts (Control and Licensing Amendment) Act 2012, housing development in Malaysia currently falls under Schedules G, H, I and J. Any developments that require an advance payment from the purchaser will be deemed to fall under any of the schedules (schedule G, H, I, J). However, the flexZhouse will need a different strategy as purchasers will not be required to pay a deposit because the focus will be on leasing activities in the first five

years of operation. Therefore, the flexZhouse will not come under the HDA acts, which govern all conventional housing in the current situation .

Under the new SIFUS (Certificate of Share Unit Formula) law, which came into force in 2015, developers must obtain a certificate from the Land Office if they wish to subdivide land for property purposes. This has raised the issue of whether the flexZhouse will be bound by this new rule. According to section 6 of the SMA (Strata Management Acts, 2013), developers are not at liberty to unilaterally change the plan or legends. Any amendment to the Schedule of Parcels (SOP) can be made only (i) as per the requirement from the local authority and (ii) with the agreement of all purchasers of the development. If a parcel is amended or a plan is modified, the developers have 30 days to submit an amended schedule of such parcels or the modified building plans. Developing a new flexZhouse BM at the national level will require a lot of help from the federal government, with new sets of rules, submission of the drawings for approval and significant government subsidies to finance the start-up. While the flexZhouse BN does not require substantial resources, it does require strong provision from the authority in terms of land procedures, the potential to develop government-owned brown sites and further guidance for the flexZhouse to make young starters aware of its existence. The flexZhouse needs to have clear communication with financial institutions and suppliers in the housing business, as well as tax exemption to promote sustainability in the housing and construction industry in general. Therefore, the big question is what the position of flexZhouse is and how it will respond to the existing laws of HDA (Housing Development Acts), Strata Titles Acts (2013) and Strata Management Acts (2013). And will flexZhouse introduce a shorter timeline for the submission procedure to the local authority and help to expedite the long and tedious process of current law? These questions pose a challenge to the implementation of flexZhouse and can be pursued in future study.

The flexZhouse requires interest-bearing schemes and exemption of legal fees and stamp duty as part of government efforts to introduce the new concept in the housing market. Other meaningful measures include further subsidy as part of the MyHome scheme and helping the young starters through the Housing Facilitation Fund as part of the home ownership programme. In order to assist the flexZhouse, the authorities need to realize that providing an alternative to current housing will create diversity in the housing market, thus helping to reduce soaring prices, create a competitive market and give more options to the buyers.

States that are ruled by the government and those ruled by the opposition must work hand in hand to ensure the need for housing is met to help address the aspirations of the administration and the industry. Therefore, under this coding and issue, we raised one important proposition for a new set of rules and regulations to counter the present housing development act to promote the flexZhouse for the housing industry in Malaysia.

§ 8.4.3 Market / cultural study

The next step for flexZhouse is to create a prototype and feasible study of the individual unit (single unit with utilities and services). The prototype will enable people to experience the house and to learn about the technologies used to move the units into and out of the structures. The prototype will showcase the remanufacturing process that can be achieved by introducing flexZhouse. The prototype will promote collaboration from the housing industry and the marketing strategy on alternative housing options for young Malaysians. The prototyping will require the construction of the support and the infill, together with the services and utilities.

Secondly, the new flexZhouse BM challenges the Malaysian housing industry to adopt a new perspective. At present, the industry is associated with immobility and inflexible physical units. The flexZhouse shows that housing can be mobile and flexible. The market needs to adjust to the norms of the prefab housing concept; they want to have live experience dwelling in the flexZhouse. Another concern is that the market regards prefab housing as temporary structures, thereby leading to insecurity and uncertainty about its potential. Implementing the flexZhouse will require a detailed consideration of the community interaction so as to promote a culturally standard model. Some sceptics among our respondents include the phases that they need the space flexibility in their lives. Customization might not be needed at the very beginning; it can come a bit later once the commitment and needs changes in the future. This is the main reason we will introduce the basic unit of what we call the studio unit, which has a basic size of 127.83 sq. ft. This unit could be a starter unit for the young starters and also act as an additional module for an extension package. Market research should study the units and designs that the target group desire to suit their lifestyle. The new market of young starters is said to easily adapt to changes. However, before the new concept can go further, a new market survey should be done to assess whether the concept could be implemented in the industry. Further marketing analysis and strategy could help the introduction of the new BM to the market. The configuration of the housing should take into consideration the cultural, religious and community desires to ensure that the social needs are served and delivered.

§ 8.5 Concluding remarks

The research presented in this thesis focused on the shortage of affordable housing for young starters in Malaysia. Although the research emphasized the lifecycle chain of the mass housing development, it did not address the procedures for securing land or applying for planning permission. This means that although the flexZhouse provides proof of concept for the new BM, the notion is still in a preliminary stage of conceptual ideas.

Introducing flexZhouse implies a radical change in the housing market. It is a new strategy, one that the housing industry in Malaysia needs, because many previous proposals have proven unable to deliver affordable housing that offers flexibility and good quality housing to users. Furthermore, the proposed BM could support the government's mission to provide more affordable housing for urban dwellers especially the young starters along with more housing options for future customers.

Finally, the flexZhouse could provide an alternative way for young Malaysians to own their own homes. The flexZhouse could add a new dimension to prefabricated housing and, as its name suggests, offer flexible options right from the beginning of the purchasing process. In contrast to the conventional housing system, the flexZhouse could offer customers a choice of both interior and exterior housing design. The industrialized production could assure the quality of the housing and give customers peace of mind. The flexZhouse BM could be an alternative to current affordable housing and help to meet the needs of the population, especially young starters.

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Curriculum vitae



Zack Zairul M N (*Mohd Zairul bin Mohd Noor*) was born on the November 19th, 1980 in Johor Bahru JDT, Malaysia. He is a Lecturer at the Department of Architecture of Faculty of Design and Architecture at Universiti Putra Malaysia (UPM). He is a member of Lembaga Akitek Malaysia (LAM) and Pertubuhan Akitek Malaysia (PAM). He obtained Bachelor of Science and Bachelor in Architecture from International Islamic University of Malaysia in 2003 and 2005 respectively (top 3 in his class with Honors). He holds Master of Science in Architectural Studies from Universiti Putra Malaysia, Serdang, Selangor. Prior to joining UPM in 2008, he was an Architect at the Ministry of Internal Security under project department supervising RMK-9 projects throughout Malaysia.

Throughout his academic career, he has developed his research interests in the areas of the Open building (OB) which inspired by theory from John Habraken that relates to flexible housing, industrialised building system (IBS) and affordable housing for Gen-Y. His research relates to a new business model for the housing industry that challenges the conventional housing procedure and produced a disrupt business model for the housing industry.

He has published and presented his research work in various journals and proceedings internationally and locally. His work on the flexible housing for the housing industry in Malaysia has received recognition from the international company in Finland during a presentation in ETH, Zurich in 2015. He is a certified Professional trainer for ATLAS.ti (Qualitative Data Analysis software) and an advisor for Mendeley (software for referencing).

Appendix

Focus group with architects, young starters, potential entrepreneurs, housing developers and government agencies

Estimated time 4 – 5 months (Data collection, transcribing, data analysis)

Focus group protocol

There will be 3 groups of four to six people in one group. Refreshments will be provided after the sessions (incentives RM50 per pax- optional)

Step 1

Workshop with Architects on design

Method

The small workshop will be conducted with 3- 5 architects on the feasible, attractive design for the conceptual design of the housing scheme. The output of the design will be formulated into a conceptual design and diagram for the focus group with the young starters.

Step 2 (Focus group)

Group 1	Group 2	Group 3
Young starters	Young starters	Young starters
4- 6 pax	4- 6 pax	4- 6 pax

TABLE 8.5 Step 2-Focus groups with young starters

Group 4	Group 5
Private developers, entrepreneurs, NGO's	Representatives from government
4- 6 pax	4- 6 pax

TABLE 8.6 Step 3 Focus groups

Objective of the focus group

The focus group is set up to have a brainstorming session on the raw model of proposed business model designed by the author.

Method

The focus group will start with an introduction of the study and the purpose of the study. A short presentation on the proposed model will be given on a screen with estimated time of 20 minutes (first session). Next, a big display of existing raw model will be posted on the wall. The respondents were each given markers and shared an A1-sized sheet description of the conceptual business model. The conceptual business model was printed to allow each respondent to provide feedback on the paper. I also gave each respondent different colored Post-it notes to ensure that each respondent could contribute to the discussion and not become excluded (second session).

Setting

A sufficient room for 4- 6 people will be used for this purpose. All actions will be audiotaped and video for recording purposes.

Main Questions

How can the flexZhouse BM provide a solution to the inflexibility, high prices and poor quality of newly built housing in Malaysia?

DESIGN PERSPECTIVE

keywords: customer services, target customers, value propositions

- What will be the appropriate products and services to suit this group of the customer?
- How can the new business model learn from the manufacturing sectors to improve their customer service?
- How can the new business model compete with the existing market in term of value creation?

Estimated time: 30 mins

PRODUCTION PERSPECTIVE

Keywords: supply chain, production time, lead times

- What are the necessary key resources to support this notion?
- What kind of partnership can the new business model establish to ensure the smooth operation and to ensure a good delivery of the product towards the customer?
- What could be the key activities that necessary to support this type of business?
- How can the new housing suppliers create awareness on their products and improve the network?

Estimated time: 30 mins

FINANCIAL PERSPECTIVE

Keywords: innovative leasing, financial capability, flexi-term

- What would be the appropriate duration of contract in order to have good return investment?
- What would be the appropriate time to hold the products from the customer point of view?
- Would there be any option for ownership for a loyal customer?
- What would be the best mechanism for payment? Monthly arrangement of leasing?

Estimated time: 30 mins

At the end of each session, I present tentatively discussed issues, new ideas, and a summary of each discussion based on Post-it notes for further validation and clarification. At this phase, I also summarize session findings and conduct a member's verification using ARC (ask, record, confirm) technique to evaluate strong points and areas for improvement for subsequent sessions. The preliminary results were shown to the research participants to assess the degree of feedback and to incorporate changes where necessary. The focus groups also involved what we called an expert opinion in order to obtain and consolidate the draft model (design workshop / focus groups). Most importantly, 'feeding information' approach was used, whereby results of one session were fed into others. The questions were further developed and the results from the previous focus group(s) were brought up for further discussion in the new session.

The Post-it note intervention helped summarize the transcription process and answered questions related to the study. However, this step also takes into account several emerging codes derived from focus group sessions. For the purposes of the exercise, pictures and videos were taken and all respondents allowed their pictures to be used, to serve as proof that the study had taken place. Based on the transcriptions, I compiled the results into a survey table using Microsoft Excel. The survey form was

created in the Microsoft Excel. In the survey form, I include all background information as guidance for the study. During the focus group session, the main questions posed were single-choice and multiple-choice questions. Each respondent was provided with and instructed to complete an information sheet to provide background and other necessary information.

In the next step, ATLAS.ti reads survey tables and interprets them in different ways. Several prefixes were used to ensure that the survey information fit into the ATLAS.ti document. As an example, prefixes that end with "!" are read as primary documents; therefore, each respondent created his or her own primary document. For the next step, codes were created from information that I added to the survey form earlier on. All information entered after two colons — "::" — was added to the object comment area and results in PD families or as part of the coding process. In the network view, relationships between quotations were created to form active networks between quotations with the same codes. The network view allows the researcher understand the various needs related to major issues and the ways in which each respondent discusses and argues on the same topic.

A summary of the focus group session is presented in condensed form for easier reading. The summary helps one understand how questions were answered during the focus group session. I further divide the sessions into three broad categories: 1) design and value propositions, 2) supply chain and production, and 3) financial and terms of payment. I used a co-occurrence table in ATLAS.ti to analyze the frequency of coding responses that reflected deductive codes that I had found previously. For example, young individuals responded the most to a question related to financial information connected to the design. The co-occurrence table also shows the density results and discussions focused on certain issues. The results also showed the government sessions did not involve any discussions related to design, that the subject may not interested in this issue, or that this issue was already covered in previous sessions.