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# Barriers to consumer acceptance of innovative building technologies for low-cost housing

**Shweshwe Ndlovu**

**15352252**

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**Abstract**

Low-income subsidy housing production is not satisfying the current housing need, leading to increasing backlogs and significant impacts on many poor people's health and safety. Traditional methods for producing these houses have not been sufficient for meeting the low-income housing need, particularly in aspects concerning time, cost, and quality of construction. There has been enough evidence supporting the adoption of innovative building technologies to enhance the South African government's ability to deliver low-income housing by reducing the times and costs of construction while substantially improving the quality of construction products. However, the implementation of low-income housing produced using innovative building systems has been primarily unsuccessful owing to the low levels of acceptance by South African communities.

This study explored consumers' attitudes and perceptions towards low-income housing produced using innovative building technologies. Data was collected from seventeen semi-structured interviews with potential low-income housing beneficiaries. The results showed that participants had limited knowledge about housing constructed with innovative building technologies. The lack of knowledge enhanced participants' perceptions of risk and led them to develop negative attitudes towards the housing systems. The negative attitudes primarily were related to increased perceptions of performance, financial and psychosocial risk. However, the results also showed that participants were still willing to accept housing produced using innovative building technologies because of their potential to improve participants' living conditions.

The study contributes new knowledge to the debate about the role of innovative building technologies for improved housing delivery in South Africa. The study also helps the government, decision-makers, and stakeholders formulate effective strategies for developing and promoting housing produced with innovative building technologies.

**Keywords**

Innovative building technologies, low-income housing, consumer acceptance, consumer attitudes and perceptions

**Declaration**

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.


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Shweshwe Ndlovu
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# Chapter 1: Problem definition and purpose

## 1.1 Introduction

Innovative building technology (IBT) is a generic term used to describe a range of alternative technical processes, materials, and methods used to construct buildings and infrastructure (Olojede, Agbola, & Samuel, 2019; Yang, Pan, & Pan, 2019). Some of these innovations include construction automation and robotics, additive manufacturing (Attaran, 2017), and modular and prefabricated construction (Xu, Zayed, & Niu, 2020). Innovative building technologies are used in several developed countries such as the United Kingdom, China, Singapore, and Australia (Li, Qiping, & Xue, 2014) to increase housing delivery speed and reduce construction costs. In Hong Kong, China and Singapore, innovative building technologies have become widely popular for their application in public housing projects (Jiang, Huang, Peng, Fang, & Cao, 2020; Zhang, Lee, Jaillon, & Poon, 2018). The technologies are also increasingly gaining popularity in developing countries such as South Africa, Ghana, Kenya, and Malaysia for their potential to reduce the time and cost associated with the construction of low-income and social housing (Eyiah-Botwe, Aigbavboa, & Thwala, 2018; Grady, 2019; Ngigi, 2016), while simultaneously improving the quality, efficiency, and environmental performance of construction products (Nadim, & Goulding, 2011; Steinhardt & Manley, 2016; Zhang et al., 2018).

Despite these advantages and the extraordinary advances in construction innovation capabilities, implementation of innovative building technologies for the delivery of housing remains low in countries such as United Kingdom, Hong Kong, and the United States (Georgiev & Schlögl, 2018; Olojede et al., 2019; Steinhardt & Manley, 2016; Zhang et al., 2018). In South Africa, low levels of consumer acceptance of innovative building technologies by communities have arguably been the single most significant contributor to the lack of utilisation of these technologies to deliver low-income housing (Olojede et al., 2019). A result of this has been the increasing interest in understanding the role of consumer acceptance to improve the implementation success of these technologies (Oliver, 2019; Olojede et al., 2019). This study explores South African consumers' attitudes and perceptions to identify the barriers to acceptance of low-income housing produced using innovative building technologies. This chapter provides a synopsis of the context and background that frames the study and then explains the research problem. This is followed by a

description of the purpose of the study and the research questions that will be addressed in the study.

## 1.2  Background

Access to adequate and affordable housing is a problem faced by many countries around the world. (King, Orloff, Virsilas, & Pande, 2017) indicated that more than one-third of the urban population lives in informal settlements in the global South, suggesting that affordable housing is not an issue that is unique to South Africa. However, in South Africa, Turok and Borel-saladin (2016) noted that rapid urbanisation and population growth have resulted in difficulties in providing enough housing. This lack of housing subsequently contributed to the extensive production of informal dwellings and backyard shacks. In South Africa, an excess of 1.2 million households live in the 2700 informal settlements across the country, and an additional 600 000 households live in backyard shacks (Ratshitanga, 2017). The inadequacy of housing provision presents a challenge for the South African government, given that access to affordable and adequate housing is necessary for the well-being of communities and offers economic productivity and financial security (King et al., 2017; Manomano, Tanga, & Tanyi, 2016). Additionally, Mzini, Masike, and Maoba (2013) highlighted that housing is a basic human right "enshrined in the South African constitution, making it incumbent upon the state to take reasonable legislative and other measures within its available resources; to achieve the progressive realisation of this right."

This constitutional imperative also forms the basis of all other housing policies and acts. It has led to the introduction of multiple programs directed at providing poor households with adequate housing opportunities. One such program in South Africa is the National Housing Subsidy Scheme. The program's purpose was to directly address the housing crisis through the large-scale delivery of government subsidised housing for low-income households by providing a once-off capital subsidy to qualifying households. Qualifying households included residents with dependents who received a monthly household income less than R 3500 (Cirolia, 2015; Ratshitanga, 2017). According to Rust (2006), it was projected that approximately 86 percent of households in South Africa fell into this income bracket. The provision of the housing subsidy was to accelerate poverty alleviation through the provision of a startup home. The expectation was that the homes would function as both promoters

of social mobility (Ronald & Doling, 2013) and a provider of financial security and wealth creation as the houses appreciated over time (Herbert & Belsky, 2008; Muhoro, 2015).

A negative consequence of this state delivery approach to housing was that it created incredible pressure on the government to meet the rising urban populations' housing needs. A consequence is that although an excess of 3 million housing units were delivered since the inception of the National Housing Subsidy Scheme in 1994, the housing backlog continued to grow to an estimated 2.3 million units that still needed to be delivered to low-income households (Chakwizira, 2019; Turok & Borel-saladin, 2016). A further obstacle to the effective delivery of low-income housing was the lack of suitable and affordable land (King et al., 2017; Manomano et al., 2016; Tissington, Munshi, Mirugi-Mukundi, & Durojaye, 2013; Turok & Borel-saladin, 2016). The high cost of land within cities placed the government in the position of always having to trade off the cost of acquiring land against the cost and quality of the housing structures produced (Turok & Borel-saladin, 2016). A result of this was increasing complaints among housing beneficiaries about the poor quality of low-income housing (Ratshitanga, 2017; Tissington et al., 2013). Residents stated that the windows, walls, floors, roofs, and doors and windows were breaking, pulling off, and crumbling due to the poor quality of the material used in producing them (Manomano et al., 2016).

The challenges affecting low-income housing delivery in South Africa are still numerous. The concerns regarding the need for the speedy delivery of low-income housing appear to be difficult to resolve through policy options that focus predominantly on traditional construction methods. Furthermore, the growing concern about the financial feasibility of delivering millions more low-income houses has led to the realisation that conventional methods of construction would no longer be sufficient to meet the ever-growing demands of the low-income housing market (Lojanica, Colic-Damjanovic, & Jankovic, 2018; Van Wyk, 2015). Thus, the South African government introduced innovative building technologies as a cost-effective and prompt response to this housing crisis (Olojede, Agbola, & Samuel, 2019). In addition to the potential to increase the number of housing units delivered per annum, innovative building technologies appeared to have technical attributes that were superior to traditional brick and mortar housing. These attributes included low

construction thermal comfort, performance, and superior aesthetic quality, as well as energy efficiency (Lähtinen, Harju, & Toppinen, 2019; Olojede et al., 2019).

However, the subsequent investment of billions of rands in donor and government funds towards research and development of innovative building technology housing did very little to help the market penetration of these technologies (Department of Human Settlements, 2017). In 2009, only 17 000 low-income housing benefits (0.74 percent) were produced using innovative building technologies out of the 2.9 million low-income housing units delivered. This number has not improved significantly over the years (Lategan, 2012).  South African consumers' reluctance to accept innovative housing was cited as "a major reason for this low usage" (Olojede et al., 2019). This minimal utilisation of innovative building technologies was also observed in developed countries such as the United States, Hong Kong, and the United Kingdom due to consumer acceptance problems (Steinhardt, Manley, & Miller, 2013).

A study conducted by Steinhardt and Manley (2016) developed an overview of innovative building technologies for housing in Australia, the Netherlands, the United States of America, Germany, the United Kingdom, Sweden, and Japan. The paper determined that much like South Africa, most of these countries demonstrated low acceptance of innovative building technology despite their developed economies. A similar study found that many African countries were still heavily reliant on conventional construction materials (Dosumu & Aigbavboa, 2020). South African consumers' resistance to accepting housing produced with innovative building technologies Lategan (2012) argued was due to communities' perceptions that the houses were of low quality because they looked different from traditional brick and mortar housing. This shows the importance of perceptions on consumers' decisions to accept housing produced using innovative building technologies. Perceptions are defined as the belief or opinion about something based upon how it seems (Arch, 2019). Perceptions influence how something is understood, interpreted, or regarded (Arch, 2019). Therefore, the study intended to explore consumer perceptions and attitudes towards low-income housing produced by innovative building technologies.

## 1.3  Problem statement

In South Africa, low-income housing production does not satisfy the current housing need, and the backlog for low-income housing continues to grow (Gunter & Manuel, 2016; Lojanica, Colic-Damjanovic, & Jankovic, 2018; Turok & Borel-saladin, 2016).

There has been sufficient evidence that low-income housing delivery can be significantly enhanced through the adoption of innovative building technologies (Arch, 2019; Olojede et al., 2019; Van Wyk, 2015). However, implementation of these housing systems has been mostly unsuccessful due to the low acceptance of these technologies by South African consumers (Department of Human Settlements, 2017; Olojede et al., 2019). The majority of studies that focus on innovative building technologies broadly address the systematic, technical, and performance-related aspects of the innovations neglecting the critical aspect of consumer acceptance (Zhao, He, Johnson, & Mou, 2015).

Verdegem and De Marez (2011) noted that "new technological innovations often fail because too much attention is still given to (technical) product-related features without taking into account the most important parameters of user acceptance." These parameters are referred to as attitudinal determinants to consumer acceptance and are related to the individual's perceptions and attitude towards the technologies (Lowe & Alpert, 2015; Talke & Colarelli O'Connor, 2011; Talke & Heidenreich, 2014; Verdegem & De Marez, 2011). However, despite the numerous studies that have highlighted the need to focus research efforts on understanding consumer perceptions and attitudes and their influence on the consumer's acceptance decisions, there remains a significant gap in the literature. An appreciation of consumers' acceptance decisions through context-specific reasoning serves as an essential linkage between consumers' perceptions, attitudes, and acceptance decisions. It will be useful for understanding the barriers experienced by consumers to accepting low-income housing constructed using innovative building technologies (Claudy, Garcia, & Driscoll, 2015) to help promote housing produced with innovative building technologies among consumers.

## 1.4  Purpose of the research

This study aims to explore why consumers are resistant to low-income housing constructed using innovative building systems. This study will examine consumers' critical perceptions and attitudes towards innovative building systems for low-income housing, which is a necessary construct for acceptance (Verdegem & De Marez, 2011; Lowe & Alpert, 2015). The slow rate of market penetration of these technologies means that accurate insights into acceptance barriers as a starting point for practical introduction and targeting strategies are necessary for both marketing and industrial purposes (Didiza & Raw, 2015; Pan et al., 2020). Based on

the literature review and an exploratory study of current and potential innovative building technology users, the research intends to answer the research question: what are the attitudes and perceptions of potential subsidised housing recipients towards low-cost housing constructed with innovative building technologies?

## 1.5  Justification of the study

The South African government has resolved to employ innovative building technologies for 60 percent of targeted social infrastructure projects (Eyiah-Botwe, Aigbavboa, & Thwala, 2018). Social infrastructure includes hospitals, government accommodation prisons, educational institutions, and other projects constructed to serve communities; facilitate social development, and enhance life quality (Hussain, Fangwei, Siddiqi, Ali, & Shabbir, 2018). Achieving this target calls for enhancing innovative building technologies' profile as sustainable, high-performance low-income housing alternatives. Further, it is necessary to recognise that innovative housing implementation issues are not likely to be resolved only with technical solutions. A thorough understanding of the public's needs (as customers and end-users) is necessary as a critical step towards acceptance and successful implementation (Ponce, Polasko, & Molina, 2016; Verdegem & De Marez, 2011).

## 1.6  Significance of the research

This research intends to explore consumers' barriers to accepting low-income housing produced using innovative building technologies by examining consumer's key perceptions and attitudes. Research on the consumer acceptance problems regarding innovative building technologies is still in its early stages (Zhao et al., 2015), so the findings of this study are expected to provide an exciting contribution to the discussion on the challenges of acceptance of innovative building technologies for the development of low-income housing. This study aims to help innovative building technologies decision-makers and stakeholders formulate effective strategies for promotion. Further, this study is relevant to stakeholders involved in the design and development of innovative building technologies. Technology developers need to understand the challenges faced by low-income consumers to create technically viable, economically feasible, and desirable innovations (Georgiev & Schlögl, 2018; Ponce et al., 2016). Furthermore, the study intends to contribute new knowledge to the debate about the role of innovative building technologies for improved housing provision in South Africa.

## 1.7 Scope of research

The research scope was limited to an exploration of consumer acceptance based on consumer perceptions and attitudes (Dabholkar & Bagozzi, 2002; Reddy et al., 2017; Talke & Colarelli O'Connor, 2011; Talke & Heidenreich, 2014) regarding housing produced using innovative building technologies for the delivery of low-income housing. The study focused on perceptions regarding material preferences of low-income housing constructed using innovative building technologies (Tshivhasa & Mbanga, 2018). The study also explored consumers' risk perceptions related to the performance, finicial and psychosocial aspects of innovative housing (Claudy et al., 2015; Lowe & Alpert, 2015). The study also explored consumers' perceptions of what government can do to improve promote acceptance in South Africa.

# Chapter 2: Literature Review

## 2.1 Introduction

The first chapter presented the problem the current research intendeds to solve. The chapter also presented the research question that formed the basis of the study. In this chapter, literature on the barriers that prevent consumers from accepting low-income housing constructed using innovative building technologies will be explored. According to Boote and Beile (2015), reviewing literature allows the researcher to demarcate "what is and what is not within the scope of the investigation." The purpose is also to identify what still needs to be known within the scope of the investigation.

## 2.2 An overview of innovative building technologies

### 2.2.1 The application of innovative building technologies

Azhar et al. (2013) attributed the development of innovative building technologies as a response to sporadic demand for buildings and facilities following the colonial era and the commercial development of new large-scale public housing developments, suburbs, and towns in the early 1970s. Nadim and Goulding (2011) highlighted that the use of innovative building technologies is not new and that many of these technologies arguably date back to as early as the twelfth century. However, despite the long history and numerous examples of successful implementations of innovative building technologies, the stigma related to past practices made these technologies unattractive to end-users and businesses in the construction industry (Nadim & Goulding, 2011). Azhar et al. (2013) noted that the significant advances in technology have dramatically increased the scope of innovative building technologies in recent times. Li et al. (2014), in their review of research on the management of prefabricated construction, argued that innovative building technologies should be regarded as good alternatives for the timely meeting of the increasing housing demands. Furthermore, they should be used to shift the construction industry away from reliance on labour-intensive methods that prevent it from developing into a knowledge-based industry (Li et al., 2014). Hwang, Shan, and Looi (2018) recognised the application of innovative building technologies as a good strategy to address labour shortages and the unavailability of skilled construction workers caused by an aging workforce in the countries like the United Kingdom. Gan et al. (2018) also highlighted a shortage of available skilled onsite construction workers

that has emerged in China due to intensive workloads, long working hours, and poor living conditions that have made the construction industry unattractive to skilled workers. In recent years, many regions and countries have shown a growing interest in innovative building technologies as a strategy for addressing environmental problems associated with construction inefficiencies in the uses of energy, water, resources, and human capital (Lu et al., 2018). Furthermore Zhang et al. (2018) noted that homes constructed using prefabrication innovative techniques have become increasingly common in the urban areas of Japan because of the improved quality, design, speed and compactness that can be achieved with the application of innovative building technologies, as well as due to lower costs of construction and ease of repair of housing after earthquakes.

According to Mpakati-Gama, Wamuziri, and Sloan (2012), the promotion of innovative building technologies in developing countries has resulted from the rising concern over the inefficient use of construction resources. In their study, Van Wyk (2015) highlighted the importance of innovative building technologies for addressing the growing focus on green construction, innovation-driven sustainable development, and the growing concern about construction workers' safety and health in South Africa. Although innovative building technologies have not been explored in-depth in the context of South Africa, Olojede et al. (2019) noted several external drivers that could set in motion the uptake of housing produced with innovative building systems. These drivers impact the low-income housing market and include changes in residential customer demands, expectations of better quality of housing, and tighter delivery timeliness. While these drivers indicate a call for increased attention towards innovative construction technologies in South Africa, Kamali and Hewage (2016) argued that the application of innovative building technologies has not been as extensive in developing countries as that of developed countries. Sahil (2016) echoed this observation by stating that developed countries have exceeded countries in Africa in the deployment of innovative materials because African countries are still heavily reliant on traditional materials for construction projects.

Dosumu and Aigbavboa (2020) affirmed that developed nations have used methods such as adopting green building certification on alternative building technologies to reduce the public's reluctance to accept innovative building technologies. However, this initiative that could help address low uptake issues has not been applied by many African countries, including South Africa. In view of this, Gan et al. (2018) noted that

developing countries should derive lessons from countries experienced in applying construction technologies on how to improve adoption as this is essential if developing countries are to meet their growing housing demands. Although the adoption of conventional building methods broadly characterises South Africa, the wider adoption of innovative building systems has the desired goal (Grady, 2019). According to  Van Wyk (2015), the South African government has seen innovative building systems' benefits. Furthermore, that the low-income housing sector has identified innovative building technologies as a critical vision for improving the development and dissemination of low-income and affordable housing in South Africa in the future (Department of Human Settlements, 2017).

### 2.2.2  Benefits of innovative building technologies

Kamali and Hewage (2016) noted that because site preparation and construction activities take place simultaneously when using innovative building systems, houses can be constructed quickly. Furthermore, reductions in building costs can be achieved due to the mass production capabilities of innovative building technologies. Increasing the pace of delivery is especially important in the context of low-income housing delivery in South Africa. Tissington et al. (2013) noted that South Africans have to wait many years for their name to progress to the top of the housing list and that years spent waiting causes tension and agony for those living under challenging circumstances. The implementation of innovative building technologies can reduce this pain for many low-income South Africans. Lategan (2012) further argued that the financial savings often realised by the adoption of innovative building technologies can significantly influence the availability of additional funding, which could then be used to introduce larger stand sizes, improved housing delivery, and better quality housing.

The issue of better quality housing has been extensively noted in the literature. Charlton (2009) contended that low-income housing in South Africa has become synonymous with the expectation of poor construction quality. This poor quality undermines the value of the housing received by beneficiaries. It also undermines the government's ability to realise its plan for providing low-income households the opportunity to participate in a vibrant housing market where subsidy housing beneficiaries can buy and sell their housing units among each other (Charlton, 2009). Manomano et al. (2016) further pointed out that most of the materials used in the production of low-income housing have resulted in increasing reports from

beneficiaries about issues with their housing benefits due to the poor material used in making them. Meaning that while the gesture of awarding beneficiaries with these houses is respected, the concerns around the houses' poor quality diminishes the value of these benefits. Furthermore, the chase for quantity and acceleration of housing delivery has meant that the housing quality continues to fall short of beneficiary expectations (Ratshitanga, 2017).

Manomano et al. (2016) further stated that some beneficiaries had attributed the poor housing material to causing beneficiaries to suffer from illnesses such as lung infections and tuberculosis. Innovative building technologies have a significant potential to restore hope and confidence to low-income and subsidy housing recipients and ensure efficient implementation of housing projects. Auti and Patil (2019) stated that innovative building technology could significantly increase the products' precision and allow superior control over each aspect of quality during construction. In addition to increased precision, innovative building housing systems also show little variation and divergence during mass production of housing units such as that involved in the construction of subsidy housing. Furthermore, with the increased quality associated with innovative building technologies, low-income beneficiaries have the advantage of reducing the added investment they would otherwise have to make towards constantly repairing and maintaining poorly constructed houses (Pan et al., 2012).

The other benefit of innovative building technologies compared to traditional construction methods are their potential for improved environmental performance. Steinhardt et al. (2013) state that housing produced with innovative building technologies can meet wide-ranging and more stringent sustainability goals. Innovative building techniques such as modular construction methods can generate less waste during construction activities because building components are produced in a factory (Auti & Patil, 2019; Azhar et al., 2013; Lu et al., 2018; Rahman, 2014). Also, building components can be disassembled, refurbished, and relocated for use in other projects instead of being disposed of at the end of the building's life cycle (Amado & Lisboa, 2016; Arif & Egbu, 2010; Jiang et al., 2020; Kamali & Hewage, 2016). Further benefits include enhancing skills development in the construction industry. Auti and Patil (2019) contended that applying innovative building technologies required accuracy and precision, meaning that skills development is necessary for successfully implementing innovative housing projects. According to

Van Wyk (2015), technologies that create opportunities for skills development and support job creation are some of the strategies that are necessary to promote economic growth opportunities for communities. Therefore, the potential for innovative building technologies to improve labor skills and the construction labour force's productivity is thus another benefit in the South African context.

### 2.2.3 Challenges of innovative building technologies

The literature indicates that the slow adoption of innovative building technologies can be attributed to various factors. In South Africa, the most significant causes for concern regarding innovative building technologies are labour and social aspects (Lategan, 2012; Olojede et al., 2019). Considering the high unemployment rate in South Africa, which is approximately 30.1 percent according to the recent census (Statistics South Africa, 2020), reductions in active labour resulting from the implementation of innovative building technologies would be undesirable. Botes (2013) noted that communities' reluctance to accept housing produced using innovative building technologies was because communities often relied on local housing construction projects to help uplift them economically, and adopting innovative technologies would reduce opportunities for communities to benefit from these projects. Pan Gibb and Dainty (2008) noted that the negative perception from the insurance and financial institutions were also hampering the adoption of innovative building technologies. Steinhardt and Manley (2016) supported this view by observing that there was a reluctance from financial providers to support housing produced using innovative building technology.

Furthermore, that the lack of support by financial institutions arguably made the problem of financing and insuring innovative housing a challenge for the owners. This further inhibits their potential for successful implementation. Although the South African government has made strides in developing policies to support the adoption of innovative building technologies, these efforts have not yet yielded visible outcomes, and South African consumers continue to prefer housing benefits produced with traditional materials (Olojede et al., 2019).

## 2.3 Theoretical Foundation

### 2.3.1 The process of consumer acceptance

Consumer science research has dedicated a significant number of studies to understanding, describing, and predicting how consumers respond to innovations.

According to Claudy et al. (2015), consumer responses to innovations have usually been presented as the adoption decision process. Frambach and Schillewaert (2002) described consumer acceptance as a process of evaluating an innovation by an individual or organisation and the subsequent decision to commit to the full utilisation of the innovation. According to Rogers (2003), the process of adoption occurs in a sequence of five stages through which a potential adopter must pass before acceptance of a product can occur. The stages include awareness, consideration, evaluation, trial, and adoption (Rogers, 2003). Kollmann (2004), on the other hand, divided the process of consumer acceptance into three phases: attitude, adoption, and acceptance. However, Kollmann (2004) and Rogers (2003) agreed that the innovation adoption process begins when consumers first gain knowledge and become aware of new technologies. They also agreed that consumers then form an attitude toward the innovation based on the information they receive during this stage. According to Rogers (2003), the decision to accept or reject an innovation follows this attitude. Kiwanuka (2015) argued that in the attitude phase, consumers assess the technology and develop a mental visualisation of their expectations. The evaluation phase is linked to the formation of an attitude about the technology and involves awareness on the part of the consumer (Kiwanuka, 2015). It is likely for this reason that Claudy et al. (2015) observed that much of the research innovation acceptance has focused on the awareness stage, aiming to understand how a consumer's likelihood to accept an innovation is influenced by their knowledge, attitude, and perceptions of the characteristics of the innovation.

### 2.3.2 Knowledge and awareness, and consumer acceptance of innovations

The first phase of the consumer acceptance process begins with knowledge and awareness. It is, therefore, no surprise that research has shown that a common barrier to the acceptance of housing produced using innovative building technologies is the lack of knowledge by potential recipients. Coughlan et al. (2012) suggested that consumers' initial decisions about whether to accept or reject an innovation will take place soon after their made knowledgeable of the technology. In their study on consumer resistance behaviour towards innovation, Cornescu and Adam (2013) highlighted that consumers sometimes do not accept an innovation based on their existing knowledge and awareness of the technology, making prior judgments that the technology is not appropriate for them. Azhar et al. (2013) highlighted an important point regarding the non-availability of innovative building technology

housing units within the vicinity of housing development locations as a significant contributor to the lack of knowledge and personal experience consumers have with these housing innovations. In a later study, Rahman (2014) echoed this view when they also noted that consumers generally have relatively low and sometimes no experience with housing produced using innovative building technologies.

The importance of knowledge and awareness was significant. According to Talke and Heidenreich (2014), when a consumer becomes aware of an innovation through an information channel or by actual use of the innovation before acceptance, it encourages them to seek further understanding of the innovation's attributes to supplement the information they have already acquired. The information they receive then helps them form favourable or unfavourable attitudes toward the innovation based on their evaluations, which informs their acceptance decisions (Talke & Heidenreich, 2014). Goulding et al. (2015) supported this observation. However, they highlighted that it was not a lack of awareness but rather a lack of awareness of the benefits that contributed to consumers' reluctance to adopt housing produced with innovative building technologies. Jonsson, Lindberg, Roos, Hugosson, and Lindström (2008) further noted that benefits related to the pleasant consequences of accepting the innovation that prompt consumers to develop positive attitudes towards them

Furthermore, according to Koklič (2011), the more benefits consumers perceive about housing produced using innovative technologies, the more effort they are willing to exert in the search for additional information. The study by Kamali and Hewage (2016) on modular buildings' life cycle performance also cited a lack of awareness of the benefits and the various options offered by innovative building techniques as having a significant influence on the market demand for innovative housing. Further, it indicated that this lack of awareness of the benefits contributed to consumers' negative perceptions of these innovations. In a later study, Lu et al. (2018) found that the increased levels of knowledge and awareness about innovative building technology housing systems are positively related to the acceptance of innovative building technologies and actual adoption. These findings are of particular interest to this study. Firstly, knowledge and awareness are associated with learning about the technologies and their benefits (Kamali & Hewage, 2016). Secondly, that increased levels of knowledge and awareness are positively related to positive attitudes and favourable acceptance decisions by consumers (Lu et al., 2018).

Lastly, a lack of knowledge and awareness of the benefits can contribute to consumers' negative perceptions (Kamali & Hewage, 2016).

### 2.3.3 Consumer attitudes and perceptions of risk

Herzenstein et al. (2007), Claudy et al. (2015) as well as Lowe and Alpert (2015) highlighted the importance of the perceived risk function as a component of consumers' response to new technologies. Lowe and Alpert (2015) defined perceived risk as the subjective expectation of loss that occurs when consumers feel uncertain about possible negative consequences resulting from accepting an innovation. Claudy et al. (2015) explained that it is primarily in the early stages of the adoption process when consumers lack awareness of the technology that they perceive higher risks associated with acceptance. The heightened perception of risk causes consumers to postpone their acceptance decision until they have more information about the benefits of the technology or reject the innovation altogether. Literature has shown that perceived risk plays a significant role in consumer's decisions to adopt and accept innovations (Claudy et al., 2015; Heidenreich & Kraemer, 2016; Hubert, Blut, Zhang, & Koch, 2018; Laukkanen, Sinkkonen, Kivijärvi, & Laukkanen, 2007; Talke & Heidenreich, 2014). The consideration of the effect of perceived risk is relevant for the current research because of the risks of uncertainty and discomfort that consumers may feel they will be exposed to if they accept housing constructed using innovative building technologies. Hubert et al. (2018) argued that consumers who assess innovations as risky are less likely to accept them, more likely to have a negative attitude towards them, and be more critical when assessing them.

Ram and Sheth (1989) made an important observation that innovations in the space of social change, as in the case of introducing innovative building technologies as government subsidy housing, face the highest risk of resistance because of consumers' strong prior habits and increased risk perceptions. These technologies are referred to as dual resistance technologies and are subject to the highest potential for failure. Although housing produced using innovative building technologies possess substantial relative advantages because they can be easily perceived as high-risk innovations, the acceptance process is slower in terms of time taken to accept and the mental processes related to consumer attitudes changes (Ross, 1975). Ram and Sheth (1989) further argued that the key to overcoming the failure of such dual resistance technologies is to understand the psychology of

consumers' acceptance decisions and then develop programs that will help overcome their risk perceptions.

Laukkanen et al. (2007) further emphasised uncertainty as an inherent characteristic of innovations, which implies that consumers' acceptance of innovations always entails at least some degree of perceived risk. An exciting relationship to come up in literature is the one between awareness and risk perceptions. Shuhaiber and Mashal (2019) defined awareness as an understanding of an innovation by the consumer that allows them to reduce their levels of uncertainty. Mutahar et al. (2018) argued that individuals were more likely to avoid uncertainty than to maximise the benefits and value of an innovation. Highlighting perceived risk is a powerful determinant in consumer acceptance and influencer of perceptions associated with the innovation. Furthermore, Mutahar et al. (2018) stated that although reducing consumer's perceptions of risk was likely to promote acceptance, knowledge about the benefits and attributes of an innovation was most likely to reduce consumers' perceptions of risk associated with their acceptance decisions. Furthermore, that increased knowledge about innovative building technologies would also increase consumer's preferences in favour of innovative housing applications over traditional methods (Høibø, Hansen, & Nybakk, 2015).

The relationship between the constructs of awareness, risk perceptions, and acceptance was one of the primary reasons that the current study chose to utilise aspects of literature on perceived risk to evaluate consumers' perceptions and attitudes regarding the acceptance of housing constructed using innovative building technologies. The literature proposed three types of perceived risks based on the characteristics of innovative building technology housing, namely performance risk, financial risk, and social risk (Claudy et al., 2015; Heidenreich & Kraemer, 2016; Hubert et al., 2018; Laukkanen et al., 2007; Lee & Song, 2013; Talke & Heidenreich, 2014). The aspects were selected because housing serves different and sometimes conflicting purposes to sufficiently satisfy the needs of consumers. Furthermore, above the physical and performance aspects, which are essential, a house is a capital good whose economic and financial quality is also important to consumers (Høibø et al., 2015).

### 2.3.3.1    Consumer attitudes attributed perceptions of performance risk

Talke and Heidenreich (2014) stated that consumers experience performance uncertainty when perceiving new technology attributes as dysfunctional or

inadequate to meet their personal needs. In a later study, Claudy et al. (2015) then found that perceptions of performance risk often arise when consumers cannot evaluate the functionality of the technology. The concept of performance risk, which is also known as functional risk, is thus concerned with consumers' uncertainty regarding the quality of new technology and the perception that the technology is below their usage expectations (Claudy et al., 2015). Hubert et al. (2018) argued that performance risk refers to the chance that the technology may be flawed and therefore not provide the promised advantages. Ram and Sheth (1989) noted that consumers wanted to know whether a technology has been proven or thoroughly tested before making acceptance decisions because of fear that new technologies may not be reliable. Considering that the application of innovative building technologies for low-income housing is still in its early stages, consumers may have concerns about their performance. Consumers may experience uncertainties about whether the house will be of good quality (Hwang et al., 2018; Lategan, 2012), function as expected, and fully meet their personal needs (Arch, 2019; Steinhardt et al., 2013).

According to Grady (2019), housing produced using innovative building technology systems can often look different from housing constructed using traditional methods. The difference in appearance from houses produced using conventional methods can incite consumers to perceive functional risks associated with accepting the innovative housing systems. Furthermore, consumers perceive aesthetical differences in houses produced with alternative materials compared to houses produced with conventional materials causing them to become unwilling to live in those houses (Lähtinen et al., 2019). Rahman (2014) noted that many components of innovative building technology systems are incredibly lightweight, which can lead to the perception that houses are less durable and of low quality. According to Steinhardt and Manley (2016), innovative building technology housing systems are also often associated with temporary structures such as emergency housing (Eyiah-Botwe et al., 2018) and demountable school classrooms (Olojede et al., 2019). Arch (2019) stated that this might give consumers the impression that the buildings are of lower quality and have a limited life-cycle expectancy.

Tshivhasa and Mbanga (2018) also highlighted that consumers feared that innovative building technology would require them to change their lifestyle patterns, expressing that consumers felt that innovative building technology housing was

uninhabitable and would pose a risk to their health and safety. Considering that one of the significant reasons for innovative building technology housing uptake in South Africa is to meet the demand for increased quality in low-income housing, the construction quality should guarantee efficient structural performance and high quality over a prolonged period (Arch, 2019). Furthermore, Steinhardt et al. (2013) observed that consumers want to have the freedom to change and modify their homes according to their needs and future spatial requirements. According to Van Oorschot et al. (2019), the challenge with innovative building technology systems is that they apply the principles of mass-production and standardised work procedures to achieve short lead times and low construction costs. According to Bildsten (2011), it is often challenging to realise low construction costs and enhanced consumer acceptance because of the need to balance efficiency in standardisation against customisability. Furthermore, the need for customisability is often neglected in favour of process efficiencies in innovative housing systems. Consumers may therefore raise the issue of customisability of their innovative building technology housing benefit and indicate the need to have flexible and unique housing that allows them to perform structural changes, renovations, and extensions that create lasting value as a requirement for acceptance (Jensen, Hvejsel, Kirkegaard, & Anders, 2019).

### 2.3.3.2 Consumer attitudes attributed to perceptions of financial risk

Conchar, Zinkhan, Peters, and Olavarrieta (2004) defined financial risk as the adverse monetary outcomes for consumers after accepting an innovation. Hirunyawipada and Paswan (2006) further stated that when consumers feel that the financial implications of accepting an innovation is not worth the investment, they may develop unfavourable attitudes toward the technology. Goodman and Mayer (2018) advocated for homeownership's importance as more than simply providing residents with a place to live, but that homeownership presents a valuable investment. Goodman and Mayer (2018) further pointed to the lack of evidence to demonstrate alternative savings instruments that can successfully encourage low-income households to accumulate substantial savings outside of owning a home as housing assets often represent a significant proportion of their wealth. Charlton (2014) argued that in South Africa, the aim of the government housing programme was to make a positive contribution to the alleviation of poverty by allowing homeowners to use their subsidy houses as collateral for bank loans. The bank loans can then be used for renovations and home improvements or starting a small

business. According to Bildsten (2011), the challenge with housing produced using innovative building systems is that it can be quite difficult to determine the value of the components used in the house's production, which makes consumers fearful of committing to something with an unknown value.

Arch (2019) observed that consumers who already perceive increased performance risks due to their inability to assess the housing systems' attributes might also feel accepting these housing technologies will pose a financial disadvantage. Arch (2019) further noted that the financial disadvantage could result from loss of resale value of the property or increased costs of repairs, or both. Numerous studies show that asset accumulation through house value appreciation is the leading financial benefit of homeownership for low-income households  (Goodman & Mayer, 2018; Herbert & Belsky, 2008; Ronald & Doling, 2013; Wainer & Zabel, 2020). According to  Charlton (2014), in South Africa, the provision of low-income housing has the benefit of initiating the process of households moving progressively up the property ladder. It was expected that households would eventually sell their subsidy housing and purchase better housing as lifestyle and financial circumstances improved. However, Steinhardt et al. (2013) noted that consumers are concerned about their ability to progress through the property ladder and question the resale value of houses constructed using innovative building technology systems. Furthermore, housing also provides a tremendous financial opportunity for inheritance. Tshivhasa and Mbanga (2018) noted that consumers often worried that houses produced using innovative building systems could not be passed on to their relatives as inheritance, thus posing a risk to their families' future financial security.

### 2.3.3.3  Consumer attitudes attributed to perceptions of psychosocial risk

Psychosocial risk refers to the combination of consumers' perceptions of the psychological risk and social risk associated with accepting an innovation. Hirunyawipada and Paswan (2006) described social risks as the conflicts consumers experience when their social networks respond negatively to their decisions to accept an innovation. Ram and Sheth (1989) argued that consumers often do not accept an innovation because they feel that they will face ridicule or ostracism by family members and peers. Frambach and Schillewaert (2002), in their research on organisational adoption of innovations, highlighted the importance of social norms as determinants of consumers' acceptance behaviour. Lategan (2012) noted that acceptance of innovative housing occurs at both the individual and community level.

This indicates that the effects of social norms may play a significant role in consumers' acceptance decisions, particularly when individuals feel the need to go along with decisions made by others (Frambach & Schillewaert, 2002). The effect can also be indirect in how it affects consumers' attitudes due to the social identification processes (Frambach & Schillewaert, 2002).  Cotte and Wood (2004) argued that family influence could shape its members' decisions and influence their willingness to try innovations. In a later study, Simpson, Griskevicius, and Rothman (2012) further noted that in some instances, an individual's decisions might not reflect their interests, but the interests of their families and communities. Furthermore, that some decisions, although taken independently, can still be directly or indirectly influenced by the beliefs, attitudes, perceptions, and preferences of others. The aspect of social norms in the diffusion of innovations has also been demonstrated in consumer behavioural frameworks such as reasoned action theory. Kulviwat, Bruner II, and Al-Shuridah (2009) stated that the reference to social norms in literature gives a further indication that consumers often depend on the opinion of relevant reference groups when deciding to accept a new technology. According to Mani (2018), this is particularly apparent when a new technology forces consumers to deviate from deeply entrenched social norms which can lead to strong adverse responses from consumers resulting in protests and boycotts (Claudy et al., 2015; Cornescu & Adam, 2013; Kulviwat et al., 2009).

Claudy et al. (2015) described psychological risk as the conflicts consumers experience when innovations require them to break their norms and traditions and abandon their beliefs. Hirunyawipada and Paswan (2006) further indicated that consumers could perceive psychological uncertainty associated with acceptance if an innovation does not exhibit the sensory attributes they expect.  Høibø et al. (2018) found a relationship between consumers' traditions and material preferences from a lifestyle perspective. Furthermore, consumers' material choices are also related to social identification and the idea that the exterior of a house conveys meaning to others (Høibø et al., 2018). In the context of housing produced using innovative building technologies, if consumers' perceptions of performance risk are high, they may fear that innovative housing systems will be seen as inferior by other community members. Consumers may also fear that the innovative materials used in the production of their housing benefit will cause them to be associated with low social status. Furthermore, Steinhardt et al. (2013) also found that consumers perceive the exterior of a house as conveying meaning about the owner to others; this then causes

consumers who prefer housing produced with conventional methods to a greater extent express more negative attitudes regarding the housing produced using innovative building technologies.

Rohe and Lindblad (2013) argued that a home might also build a sense of community and belonging. Zavisca and Gerber (2016) further indicated that houses could also equally introduce or amplify the stratification among individuals in a community based on wealth. Furthermore, unlike other financial assets, housing presents both an investment value and use value that represents an extension of the individual capable of allowing membership to social groups and promoting an individual's social standing (Zavisca & Gerber, 2016). In this case, these effects can also be a consequence of the methods and materials used to build the housing. Communities may favour housing produced using traditional methods and stigmatise individuals who choose to accept housing produced using innovative building materials leading to feelings of inequality and result in the formation of housing classes (Zavisca & Gerber, 2016). In their study, Tshivhasa and Mbanga (2018) indicated that consumers felt that innovative building technology housing would compromise their sense of well-being if other community members perceived the houses to be cheap or unusual. Further, Grady (2019) observed that consumers do not want to be viewed by community members as unconventional or inferior because of the perception that innovative building technology housing is of reduced quality. Therefore, consumers who perceive the risk that housing produced with innovative building technologies will negatively impact how community members perceive them might, to a greater extent, express negative attitudes towards the housing systems and a reluctance to accept them (Grady, 2019).

### 2.3.4  Resistance to change and consumer acceptance of innovations

The considerable amount of literature on consumer acceptance has assumed that innovations present an improvement in consumers' lives and thus should be readily accepted by them (Laukkanen et al., 2007). However, the high failure rate of new product and service innovations indicates the contrary (Talke & Heidenreich, 2014). Ram and Sheth (1989) argued that the high levels of failure in new product innovations are not surprising, as the nature of adoption necessitates that consumers accept the innovation.  Claudy et al. (2015) added that this acceptance of innovations by consumers requires that they be willing to accept the changes in design and performance of products to which they have become accustomed. Furthermore,

these changes also push consumers to change their routines and behaviours, which frequently disrupts norms and traditions. Resistance to change then occurs because consumers perceive the risks of the changes to their norms and traditions as greater than the benefits (Cornescu & Adam, 2013). Kleijnen et al. (2009) defined norms and traditions as those behaviours that relate to the societally-relevant context in which acceptance decisions are made and stated that any behaviour that is contrary to the group and societal norms incites reluctance by consumers to accept the innovation. The idea of traditions and norms is distinct from personal norms, routines, and habits of individual consumers, in that they relate to existing usage patterns. However, they too constitute a barrier to consumer acceptance of a technology.

Høibø, Hansen, Nybakk, and Nygaard (2018) revealed that consumers prefer specific construction materials and attitudes towards innovative materials. Consumers express more positive attitudes towards the buildings materials that are familiar to them (Vasanen, 2012). Lategan (2012) also observed that communities often considered any type of housing that is not constructed using traditional brick and mortar as substandard and unpleasant causing them to be reluctant to accept low-income housing project proposals that incorporate innovative building systems and technologies. This reluctance to accept innovative building technologies by consumers can be seen more generally as a form of resistance to change. According to Talke and Heidenreich (2014), "consumers have an intrinsic desire for psychological equilibrium and any change imposed has the potential to disturb this equilibrium so, consumers prefer to resist change rather than engage in a disturbing process of readjustment.". Claudy et al. (2015) highlighted that the type of change brought on by accepting an innovation results in resistance because it conflicts with consumers' normative structures and forces consumers to change from what would otherwise be considered a satisfactory status quo.

Kleijnen, Lee, and Wetzels (2009) also cited the importance of compatibility, which is described as the extent that the consumer perceives an innovation to be consistent with their current habits, past experiences, and values when considering the factors that influence the acceptance decisions of potential adopters. Talke and Heidenreich (2014) describe compatibility as an innovation-specific factor that describes consumers' perceptions about the new technology's attributes and states that compatibility barriers to a consumer's acceptance of an innovation emerge if an innovation is perceived as incompatible with familiar past products. In this context,

since consumers have become accustomed to receiving housing constructed using traditional materials, they compare the current innovation and perceive them as incompatible with their norms (Heidenreich & Kraemer, 2016). Tshivhasa and Mbanga (2018), in their study, also suggested the acceptance of innovative building technologies by South African consumers can be understood as a process of social change where innovations are not instinctively accepted even if they present the prospect of positive change. Grady (2019), in a later study further added that the reluctance demonstrated by consumers to accept housing constructed using innovative building technologies is due to the cultural attachment that South Africans have towards brick and mortar housing. Furthermore, that these attachments lead beneficiaries to expect their houses to be built using these conventional methods. Another issue is that in south Africa waiting to become a beneficiary of a state-funded house is a process that can take many years, people often attach an intrinsic value to the houses they receive (Oldfield, 2015; Tissington et al., 2013), and the value of finally receiving a subsidy house is embedded in traditional culture (Oldfield & Greyling, 2015). Furthermore, that consumers traditional expectations are to receive the type of housing to which they have become accustomed which is housing produced with conventional materials.

Rapoport (2000) highlighted a close relationship between culture and housing and implied that housing might often also communicate identity. Furthermore, Rapoport (2000) also indicated that housing could play an essential role in communicating status. When that is the case, such communication is partly through materials and styles such as concrete, and metal window frames used in the construction of the house. Furthermore, the type of materials used in the production of a house has intrinsic and cultural meaning. Consumers may also be reluctant to change the social meanings associated with certain building materials. According to Rapoport (2000), the social meanings of these materials are also used to define social identity. Thus indicating the potential of low-cost housing projects constructed using innovative building technologies to change beneficiaries' social identity as potentially undesirable. Horgan (2020), in his research on housing stigmatisation advocates for the consideration of housing as more than just a material necessity but rather as a concept whose symbolic ability to incite resistance. Furthermore, that changes to housing traditions can produce inequality and exclusion Horgan (2020). The implication of this then perhaps necessitates the consideration of resistance to

housing constructed by innovative building technologies as a normal response by consumers that needs to be understood not as a reluctance to accept the new innovation but rather, as form of resistance to the changes caused by the innovation (Claudy et al., 2015). Furthermore, in the context of the scope of the research, it brings to light the important observation made by Claudy et al. (2015) on the importance of the construct of consumer resistance in evaluating consumer acceptance of innovations when looking at factors that prevent consumers from accepting innovations. Furthermore, it is in recognising resistance to change as an attitude that decision-makers can help consumers overcome this resistance.

### 2.3.5  Strategies to promote consumer acceptance

The low levels of acceptance of housing produced using innovative building technologies among low-income consumers and the complexity inherent in the South African low-income housing sector. As a result, the need to satisfy multiple stakeholders indicated that extensive research was necessary to define strategies that could promote the acceptance of housing produced using innovative building technologies. Mutahar et al. (2018) highlighted the importance of educating community members where innovative building technologies for low-income housing projects are introduced. Furthermore, the nature of education should inform the potential recipients and community leaders regarding both the advantages and disadvantages of the housing systems. Usadolo and Caldwel (2016) also highlighted the importance of raising awareness through education. The most effective form of education should encompass engaging communities through the direct participation of the potential recipients throughout the planning and eventual implementation of housing projects that employ innovative building technologies. Important to education, Lauff, Kotys-Schwartz, and Rentschler (2018) highlighted the use of prototypes as a valuable strategy for increasing knowledge transfer, enhancing communication, and improving the prospect of people making more informed decisions. The construction of prototype houses will allow community members to increase their knowledge and awareness of housing produced using innovative building technologies through personal experience and allow a shared understanding amongst the community members (Azhar et al., 2013; Talke & Heidenreich, 2014). Lauff et al. (2018) also highlighted the importance of prototypes for enhancing product experience and reducing misunderstandings and misguidance among community members. Deininger, Daly, Lee, Seifert, and Sienko (2019) noted that

designers could also use prototypes primarily in the early design stages to elicit input from stakeholders. Pan et al. (2012) highlight that another strategy that could be applied in promoting the acceptance of housing produced using innovative building technologies among low-income consumers may include integrating innovative technologies with traditional building methods and conventional house designs.

Aggressive strategies can also include the mandatory use of innovative building technologies in social infrastructure production (Eyiah-Botwe et al., 2018). Lang, Goodier, and Glass (2016) argued for increasing pressure through government legislation. In this case, continuously monitor and ensure alternative housing structures meet Agrément certification requirements and in line with the National Home Builders Registration Council standards could also increase acceptance (Olojede et al., 2019). Finally, research efforts could also be improved to increase understanding of consumer perceptions and uncertainties related to specific innovative building systems. As the current research intends to demonstrate, an understanding of consumer attitudes and perceptions prior to implementation can help reduce the chances of the adverse reactions of rejection by community members (Verdegem & De Marez, 2011). It can also help implementers strategically plan how to best promote the use of innovative building technologies for low-income housing delivery in South Africa.

## 2.4  Conclusion

This chapter has established that South Africa faces enormous challenges in achieving its mandate to deliver low-income housing for the poor. Moreover, conventional construction methods are ineffective in producing low-income housing in a way that will adequately address the current housing backlog in terms of construction cost-effectiveness, quality, and construction times. However, numerous obstacles are noted in the use of innovative building technologies for housing delivery, more so the influence of consumer attitudes and perceptions restricting the market penetration of innovative building technologies for low-income housing in South Africa. The section classified the attitudes and perceptions related to the knowledge, performance, financial and psychosocial aspects of innovative building technologies and highlighted strategies that can be used to help overcome the barriers that prevent communities from accepting housing produced using innovative building technologies. The following section proposes a research methodology to answer the research questions discussed in section one.

# Chapter 3: Research Questions

## 3.1 Introduction

The current study examined consumers' key perceptions and attitudes towards innovative building technologies for low-income housing delivery as a solution to addressing the housing backlog in South Africa. The research explores the barriers that prevent consumers from accepting subsidy housing produced using innovative building technologies. It focuses on aspects of consumers' awareness and their attitudes and perceptions about the performance and quality of low-income housing produced using innovative building technologies. The research aims to answer three questions. Each of the questions has been established from the literature review. The main research question is: What are the attitudes and perceptions of potential subsidised housing recipients towards low-cost housing constructed with innovative building technologies? In order to obtain the desired results, the following research questions were developed:

## 3.2 Research question 1

**What do consumers know about innovative building technologies for low-income housing delivery?**

Research Question 1 sought to explore consumers' knowledge and awareness of housing produced using innovative building technologies. Furthermore, the research question set out to discover consumers' knowledge and understanding of the attributes and benefits (Kamali & Hewage, 2016; Mutahar et al., 2018) of housing produced using innovative building technologies. This was intended to help the researcher understand the influence of consumers' current knowledge on their perceptions towards the housing produced using these building systems and their attitudes towards acceptance (Goulding et al., 2015; Lu et al., 2018).

## 3.3 Research question 2

**What are consumers' attitudes and perceptions towards low-income housing constructed using innovative building materials?**

The literature indicated that consumers perceived housing produced using innovative building technologies as having inherent risks (Claudy et al., 2015; Lowe & Alpert, 2015; Talke & Heidenreich, 2014). Research Question 2 sought to explore the performance, financial and psychosocial aspects of risk concerning consumers'

perceptions and attitudes towards housing produced using innovative building technologies. The study further set out to uncover whether the risk perceptions distilled from the literature were the main barriers that prevent consumers from accepting housing constructed using innovative technologies. Furthermore, the research question will seek to unearth new insights regarding other barriers which have not been considered in the literature.

## 3.4  Research question 3

**What are the challenges that the public believes the government still needs to overcome to reach greater consumer acceptance of innovative building technologies for low-income housing?**

The literature highlights the importance of defining strategies that can be used to promote consumers' acceptance of housing produced using innovative building technologies (Mutahar et al., 2018). Research question 3 set out to uncover the measures that consumers believe the government should take to promote the attractiveness of housing constructed using innovative building technologies for low-income consumers to improve the acceptance levels.

## 3.5  Conclusion

This chapter presented the research questions that form the basis of the study. Answering these questions will provide insights into what can be done to address the barriers that prevent consumers from accepting housing constructed using innovative techniques and making strides towards improved implementation of alternative housing projects, and alleviating the current low-income housing backlog. The following chapter presents the research methodology adopted in the research.

# Chapter 4: Research Methodology

## 4.1 Introduction

This research sought to explore consumer perceptions and attitudes to understand the barriers that prevent low-income consumers from accepting housing constructed using innovative building technologies. The current chapter describes the development of the research methodology by which the individual understandings, attitudes, perceptions, and perspectives of consumers were obtained concerning this phenomenon. The study utilised a qualitative approach, and data was collected through semi-structured interviews with individuals from low-income households.

## 4.2 Research design

The underlying philosophy that guided the research was the interpretivist paradigm, which Saunders and Lewis (2012) describe as a philosophy that promotes the importance of understanding human behaviour distinctions as humans come together to create unique social experiences. The core idea of interpretivism is to capture the subjective interpretations and meanings that people ascribe to social experiences (Leitch, Hill, & Harrison, 2010). An interpretive philosophy was an appropriate approach to this study, as it allowed the researcher to discover reality through participants' perspectives and perceptions regarding innovative building technologies for low-income housing (Thanh & Thanh, 2015). This approach was imperative to the study as the aim of engaging with consumers was to explore the attitudes and perceptions that influence their innovative building technologies acceptance decisions. An inductive research approach was used in this study and involved reviewing the research observations to reveal dominant themes emerging from the data (Saunders & Lewis, 2012; Thomas, 2006). The research used an explorative design that was appropriate to uncover new insights in a research area that had not been thoroughly investigated in the past (Saunders & Lewis, 2012). This design was appropriate for this study due to the limited research focusing on consumer acceptance of innovative building technologies and the influence that attitudes and perceptions have on acceptance decisions. Given the available research timescales, which were relatively short-term, the study adopted a cross-sectional method which is described as a snapshot where the data is collected at a single point in time (Saunders & Lewis, 2012).

According to Jebreen (2012), interviews are a suitable technique for exploring people's inner perceptions and attitudes, providing access to their understanding and experiences. Since this research was centred around exploring the attitudes, perceptions, and understanding of community members regarding housing constructed using innovative building technology, semi-structured in-depth interviews provided the most suitable inquiry technique. McIntosh and Morse (2015) highlight that semi-structured are unique among the interviewing techniques for the degree of relevancy they give to the research. While responses are directed to specific areas of inquiry, semi-structured interviews allow the research to remain responsive to the participants (McIntosh & Morse, 2015).

## 4.3 Population

The study population comprised individuals from households that earn a household (joint spouse) monthly income of R3500 or less who are twenty-one years of age and older. These individuals would be eligible to register on the national housing needs register for a government subsidy house. Since innovative building technologies are typically used for government subsidy housing developments, these individuals were most likely to become beneficiaries and consumers of innovative building technology housing. The area for the study was narrowed to South African townships. This was because townships have a significant presence of informal settlements and high concentrations of the urban poor who were more likely to have households that meet the monthly threshold income, thus qualifying them to be placed on the housing waitlist (Aigbavboa, 2014). Soweto township was the chosen area of study. As the largest South African township, Soweto had many households to draw participants for the study (Kambule, Yessoufou, Nwulu, & Mbohwa, 2019).

## 4.4 Unit of analysis

The unit of analysis describes the fundamental objects or processes the study intends to describe or interpret (Ritella, Rajala, & Renshaw, 2020). The unit of analysis in the current study comprised individuals from households that earn a household (joint spouse) monthly income of R3500 or less who were twenty-one years of age and older and living in the Soweto township. These individuals were eligible to register on the national housing needs register to receive government subsidy housing.

## 4.5  Sampling method and size

Two non-probability sampling techniques were used in this study, namely purposive and snowball sampling (Saunders & Lewis, 2012). According to Saunders and Lewis (2012), non-probability sampling techniques are appropriate when a complete record of the population is not accessible to the researcher. This meant that the sample could not be chosen using random selection methods (Bell, Bryman, & Harley, 2018). In this study, some individuals were more likely to be chosen than others. Furthermore, criteria such as ensuring that participants are aged twenty-one years and older with a monthly household income of is R3500 or less meant that probability or random sampling method would not be appropriate (Muhoro, 2015). Snowball sampling was used in the study. The researcher initiated contact with individuals in Soweto who are within the population of interest; these residents were either referred by a contact person or were known to the researcher (Muhoro, 2015). The researcher also asked respondents to identify other known individuals who fell within the desired income bracket who could form part of the sample for further data collection (Muhoro, 2015).

Purposive sampling was also used where the researcher relied on their judgment in choosing a sample that included members of a population. The research phenomenon was particularly salient (Stevens, Moray, Bruneel, & Clarysse, 2015). This sampling method was used to enhance the representation of the population under investigation and optimise the validity of the study's findings (McIntosh & Morse, 2015). The study continued with data collection until twenty interviews were conducted. However, the final sample size was not determined by saturation (Dahm, Kim, Glomb, & Harrison, 2019) but rather by the number of interviews conducted on account of the limited time in which the study needed to be carried out. This approach was in line with studies that have followed a similar research methodology (Dahm et al., 2019; Fisher, Pillemer, & Amabile, 2018; Veresiu & Giesler, 2018). The final number of usable interviews was seventeen interviews. Three interviews were discarded when it emerged that the interviewees did not fit the sample description.

## 4.6  Measurement instrument

The current study employed the use of in-depth face-to-face semi-structured interviews in the collection of data. A predetermined interview schedule was used to guide the interviews. The interview schedule covered the study's main topics based

on the literature review and the research questions, which formed a conceptual basis (Saunders & Lewis, 2012). This structure ensured consistency between the literature review, research questions, and the interview question (Owens, 2016). The interview guide was not strictly followed, but it was used to ensure a focused structure for the dialogue and provide the participants with guidance on what to discuss. The interviews intended to explore the research area and allowed for new insights to be uncovered (Turner III, 2010).

When formulating the interview schedule, the researcher intended to keep the structure flexible to allow for the chance to alternate the order of the questions whenever necessary and ensure a smooth transition between questions (Cridland, Jones, Caputi, & Magee, 2015). Questions on the interview schedule were set according to two levels: main theme questions and follow-up or probing questions (Kallio, Pietilä, Johnson, & Kangasniemi, 2016). Questions on main themes covered the study's leading content. They included open-ended and formulated responses to stimulate unstructured responses from participants and encourage participants to speak openly and freely about their experiences and perceptions (McIntosh & Morse, 2015). All participants were questioned on the main themes (Cridland et al., 2015). According to McIntosh and Morse (2015), follow-up questions were included in the interview schedule appearing after the main question, and some were unscripted, resulting from the dialogue. The objective of the semi-structured interview process was to elicit detailed materials that can be used in the qualitative analysis. The interviewer also used unscripted prompts to encourage participants to keep talking and allow the interviewer to steer the interview and elicit more detailed and more transparent responses from participants (McIntosh & Morse, 2015). According to Leech (2002), prompts can be just as important as the interview questions and can help the interviewer ensure that the responses have covered the necessary points. The current research prompts were also used as a last resort when it was evident that the participant was struggling with a particular question and moving on with the interview. In an effort to ensure consistency, the literature and the research questions formed the basis of the questions developed in the interview schedule. It should, however, be noted that apart from the main questions, not all the questions presented in the interview schedule were asked to participants.

Furthermore, the objective of the semi-structured interview method employed in this study was to explore rather than to determine the frequency of predetermined themes

known to the researcher. As a result, the questions varied slightly from one interview to the next as the interviewees' responses largely determined the interview process. The semi-structured interview schedule that was used during the interviews is presented in Appendix 2.

The interview schedule was piloted before the study's commencement to ensure coverage of relevant content in the schedule and make adjustments to the interview questions (Cridland et al., 2015). The interview schedule was tested with potential participants to allow the researcher to decide how much time will be needed for each interview session (Saunders & Lewis, 2012). Before commencing any interview, informed consent was obtained from the participants by completing and signing a consent form to ensure that individuals understand and agree to the study's commitment and ensure that data was collected ethically. Interviews were conducted at a time and location convenient for participants (Saunders & Lewis, 2012). All interviews were recorded on an audio-recorder with the permission of the participants.

## 4.7   Data gathering process

Data was collected through face-to-face semi-structured interviews with individuals from households that earn a monthly household income that R 3 500 or less who are twenty-one years of age and older and are eligible to register on the national housing needs register. The objective of the interview was in line with the study, which was exploratory. It was intended to elicit various perceptions, attitudes, and experiences from participants by encouraging them to speak openly (Owens, 2016).   The interviews were conducted within the homes of the participants. The benefit of this approach was that it promoted familiarity and encouraged participants to relax to conduct a productive interview (Cridland et al., 2015). However, the drawbacks included issues of safety and travel for the researcher and confidentiality issues for the participant. In some interviews, the family members of participants were present in the home during the interview (Cridland et al., 2015) as homes were too small. There was no possibility of conducting interviews in a private area. In the instance that participants did not recognise the importance of conducting the interviews in private, the interviewer made an effort to ensure that they discuss participant confidentiality (Cridland et al., 2015).

Another drawback of the chosen sample population was that the interviewer had to conduct interviews in South African vernacular to help participants understand the

interview questions. Participants found it easier to answer the interview questions in vernacular as most struggled to speak English. The interviewer had to make provisions for differences in languages during the interviews. According to Polkinghorne (2005), people commonly use narratives and metaphors to capture the richness of their experiences, and these metaphors can be language-specific. Furthermore, people's experience of their social reality is also said to be unique to an individual's language (Polkinghorne, 2005). Since the nature of the current study was to capture those experiences, the interviewer needed to allow interviewees to answer questions in a language that felt comfortable. As a result, the majority of the interview conducted needed to be translated into English. The drawback of translating between languages is that it introduces potential issues regarding the validity of the findings due to potential losses of meaning that may occur during translation.

During the interviews, the interviewer explained the purpose and format of the interview and addressed confidentiality with the participant (Cridland et al., 2015). The interviewer ensured that participants knew how long the interview should take. The interviewer then asked participants if they had any questions and provided the participants with the interviewer's contact details should they wish to contact the interviewer at a later stage (Turner III, 2010). The researcher used an audio-recorder in the collection of data (Saunders & Lewis, 2012). The recordings were then translated into English during the transcription process, which was conducted as soon as possible after each interview (Sutton & Austin, 2015). The shortest interview lasted for 17:33 minutes, and the longest interview was 45:48 minutes and the average time per interview was determined to be 30:02 minutes.

## 4.8  Analysis approach

The data analysis process was concerned with finding and linking key themes that emerged from the data and used these themes to form a coherent narrative, otherwise referred to as thematic analysis (Rowley, 2012; Saunders & Lewis, 2012). McGrath, Palmgren, and Liljedahl (2019) suggested that the interviewer should listen to and transcribe the interview recordings as soon as possible after the interview was completed and use these early thoughts to familiarise themselves with various key themes emerging in participants responses which is what the researcher did. Once the audio recordings were transcribed, the researcher used excel to facilitate the data analysis process and help manage, code, and organise the text

(Rowley, 2012; Saunders & Lewis, 2012). The researcher then conducted a structured reading of the text while noting key codes or themes (Saunders & Lewis, 2012). According to (Turner III, 2010), themes are consistent expressions or phrases common among participant responses. During the structured reading process, the researcher is encouraged to reflect on the information they want to identify as main themes (Rowley, 2012). In this particular research, the main themes were pre-figured from literature and the research questions, which sought to explore influencing factors, perceptions, and experiences (Muhoro, 2015; Rowley, 2012). Inductive reasoning was also used. The researcher then coded the text and grouped codes featuring similar content, yielding sub-themes used to describe the main themes answering the research questions (Raufelder et al., 2016; Rowley, 2012).

## 4.9  Quality controls

Reliability in research refers to the degree to which research methods can be repeated and produce the same results. Saunders and Lewis (2012) refer to reliability in the context of consistency concerning how methods have been undertaken to ensure that independent researchers arrive at comparable or similar findings. Saunders and Lewis (2012) further refer to validity as an indication of the accuracy in which the findings represent the data, also known as the truth value (Noble & Smith, 2015). Validity in research was related to the recognition that there were multiple perspectives on realities and that the researcher's viewpoints and experiences may result in methodological bias (Noble & Smith, 2015). In qualitative research, researchers must include strategies to improve the credibility of the study and ensure that measurements used can be trusted (Gray, 2018; Noble & Smith, 2015).

Noble and Smith (2015) suggested that all semi-structured interviews be audio-recorded to allow the researcher to repeatedly revisit the data and check that the themes emerging from the data remain true to accounts provided by the participants. Revisiting the audio recordings helped the researcher avoid systematic errors introduced by researcher biases and enhance the data's reliability. The researcher also used quotations from interview data to help the reader make their own decisions regarding the final themes identified and accurate to the participants' accounts. Quotations also help limit observer bias. Participants were also be asked to comment on the themes and research findings to enhance their validity. Gray (2018) suggested that the interview questions should directly focus on addressing the

research objectives. The researcher also ensured that interviews were long enough to allow subjects to be explored in-depth and to allow participants to sufficiently expand on their perceptions, influencing factors, and experiences. The researcher also ensured that questions included in the interview schedule are informed by literature and research questions (Gray, 2018; Rowley, 2012). According to Polkinghorne (2005), qualitative research is considered valid when the meanings as experienced by the participants are as close as possible to the interpretation in the research findings. Furthermore, validity is improved when the research findings can be communicated in such a way that the reader understands the meaning as it was expressed in the research findings that originated from the collected data in the source language. Since much of the recordings needed to be translated during the transcription process, it can be argued that the process of translating between languages involved interpretation as well. In order to reduce the challenge of validity through translation, the interview ensured that the translator was fluent in the languages spoken by interviewees to reduce the possibility of disjunction between the interviews and the translated transcripts. Furthermore, the transcriber was careful to translate the recorded interviews in a way that minimised loss of meaning

## 4.10 Limitations

The limitations of the study are presented as follows:

In qualitative research, subjectivity was an integral and limiting element. As such, the researcher acknowledged that the researcher's personal biases that result from the researcher's background, perceptions, and experiences may not have been avoidable and could have influenced the research findings (Saunders & Lewis, 2012). The study's findings were limited to the South African context, which meant that the researcher could not be sure of the generalisability of the research findings in other settings (Muhoro, 2015). However, since qualitative research was concerned with transferability and whether the research findings could be applied to contexts other than those in the current study, the researcher could have enhanced the applicability of the findings by providing rich detail of the context within which the data was collected (Noble & Smith, 2015). Using semi-structured in-depth interviews as the measurement instrument relied on participant accounts, which may have been limited by subject bias, unreliable information, exaggeration, and poor articulation due to language barriers (Saunders & Lewis, 2012; Muhoro, 2015). However, the researcher acknowledged that interviewing was a process that regards the

researcher as the one who receives knowledge while the participant is the expert. This was necessary to reduce researcher bias. Polkinghorne (2007) argues that "the validity threats arise in qualitative research when the language descriptions given by participants of their experienced meaning is not a mirrored reflection of this meaning." Considering that the interviews were conducted in South African vernacular and the transcriber had to translate the recorded interviews into English to enable the receiver of the message to understand the message, it arguably called for some level of interpretation on the transcribers part. This may have introduced the limitation of language differences and the potential reduction in the transcriber's ability to capture the complexity and depth of the participants' experiences, resulting in the loss of meaning (Polkinghorne, 2007). However, to reduce the challenge of validity through translation, the interview ensured that the translator was fluent in the languages spoken by interviewees to reduce the possibility of disjunction between the interviews and the translated transcripts. Lastly, while some researchers encourage the use of prompts as an effective way to elicit more information from participants during interviews (Leech, 2002), other researchers find that respondents express their perspectives in response to the prompts (McIntosh & Morse, 2015), which may be perceived as supplying leading questions to the participants thereby limiting the research findings (Fylan, 2005). To reduce these potential limitations, the interviewer used unscripted prompts to ascertain and optimise the information sought through interview questions and maintain congruency with the research objectives.

# Chapter 5: Presentation of Results

## 5.1 Introduction

The previous chapter presented the methodology used to collect data. In this chapter, the results of the study are presented concerning the aim of the study, which was to explore the attitudes and perceptions of potential recipients of subsidised housing towards low-cost housing constructed with innovative building technologies. In this chapter, the themes and codes developed during the qualitative analysis were examined as they relate to the research questions and the key constructs outlined in the literature. These key themes and codes were then used to provide insights into participants' knowledge and awareness of housing produced using innovative building technologies. Secondly, the data was examined to explore participants' attitudes and perceptions towards low-income housing constructed using innovative building materials; and finally, to explore participants' opinions regarding what the government needed to do to promote acceptance.

## 5.2 Description of participants and context

The participants of the study were drawn from three different townships in Soweto. As the largest township in South Africa, Soweto was identified as having a large concentration of informal settlements and extensive housing backlogs (Kambule, Yessoufou, Nwulu, & Mbohwa, 2019). It was thus chosen as the study area as it presented many households from which to draw participants. The participants were selected using the snowball and purposive sampling techniques. All of the interviews were conducted face-to-face. Twenty interviews were conducted. However, three interviews were discarded when it was discovered that the participants did not fit the sample description. The participants of the study were drawn from three townships. Thirteen participants were drawn from Naledi Township, three participants from Tladi township, and one participant from Zola township. The researcher identified three groups of respondents, namely: nine participants lived in traditional four-roomed houses produced using traditional brick materials, three participants renting backrooms also constructed with traditional brick and mortar materials, and five participants who lived in informal settlements constructed with corrugated iron sheets, wood, and other materials. In selecting the participants, particular attention was given to the participant's registration status. It was compulsory for all participants to be part of the low-income group and either registered or eligible to register to become a beneficiary of the low-income housing benefit through the South African

Subsidy scheme. In total, fourteen participants were registered beneficiaries, and three were eligible to register although not formally registered to become a subsidy housing beneficiary. One of the participants was identified to have a structure in their backyard produced using innovative building materials. The participant indicated that the structure functioned as backrooms they would lease out to tenants. The participant indicated that the structure had been installed by the local counsellor of Zola township for those individuals who volunteered and registered to receive the structures. They indicated that the structures were given to them at no cost and that although they were not sure of the age of the structure, the structure was at least five years old.

## 5.3   Research question 1

**What do consumers know about innovative building technologies for low-income housing delivery?**

The literature suggests that a common barrier to accepting housing produced using innovative building technologies is the lack of knowledge and awareness by potential recipients (Goulding et al., 2015; Rahman, 2014). Thus the purpose of the research question was to explore participants' awareness of housing produced using innovative building from an individual perspective. Additionally, the literature also highlighted that consumers' lack of knowledge as having a significant contribution to consumers' negative perceptions towards these innovations (Kamali & Hewage, 2016). As a result, the question also sought to uncover whether consumer's existing knowledge of innovative building technologies had positively or negatively influenced their perceptions of the technologies.

### 5.3.1   Consumer's knowledge and awareness of low-income housing constructed using innovative building technologies

The findings of the study indicate that individuals have varying levels of knowledge and awareness regarding low-income housing produced using innovative building technologies. The quantitative analysis of the interview data uncovered four subcategories: participants who knew about the low-income housing constructed using innovative building technologies but had never seen them inside; participants who knew about them and had seen them on the inside; participants who were aware but had never seen any; and those who did not know about them. Table 5.1 presents

findings on consumers' knowledge and awareness of low-income housing constructed using innovative building technologies.

Table 5.1: Knowledge and awareness of low-income houses constructed using innovative building technologies

| Rank | Knowledge | Frequency |
|------|-----------|-----------|
| 1 | Aware but have never seen them on the inside | 8 |
| 2 | Aware and have seen them on the inside | 5 |
| 3 | Aware but never personally seen any | 2 |
| 4 | Not aware | 2 |

The results of table 5.1 indicate that most of the participants were aware of low-income houses constructed using innovative building technologies while few participants were not aware. Two participants expressed to have little knowledge regarding the housing systems.

> **Participant 2** *:"For me personally, I would wait for a brick house, that's what I'm used to. Because I have not seen the board house and what kind of material is used and how strong is the house..."*

> **Participant 6** *:"I wouldn't be able to comment about the alternative material because I haven't been inside or lived in them"*

Some participants were aware of housing produced using innovative building technologies and had personally seen them, while other participants were aware but had never personally seen them. Some participants had personal experience with housing produced using innovative building technologies. In their personal experience, these participants were able to give of other social infrastructure projects they knew were produced using innovative building technologies in their communities such as clinics, schools, and backrooms. Some of the participants explained as follows regarding the houses:

> **Participant 11***: "…like those container houses whereby they just ship them in so they will just come and install the house, that's where we're headed because you can put those kinds of houses anywhere even in the desert, you don't need foundation …that's where we are headed"*

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> **Participant 13**: *"Yes, in Zola, Jabulani, the ones they build at the back? Yes I have seen them"*

> **Particiapnt 5:** *"I am a bit aware because there is this foam thing, they do foam and they plaster… I don't know what the technology is and there is also this guy from Cape Town who takes cold drink bottles and puts cement inside them and builds with those things…"*

Some of the participants who had personal experience with particular innovative housing systems and had seen the houses inside expressed positive attitudes and indicated that they found the innovative housing systems aesthetically pleasing. The results indicate that participants also used various names such as board houses, matchboxes, and containers to describe innovative housing systems and the materials used to produce the housing systems they knew. Some participants also indicated that they would not mind living in such houses, expressing that the houses were acceptable to them.

> **Participant 1:** "They're very nice rooms (referring to the "board" outside rooms), if I had a key for that one I would like open for you guys so you can see. It's even more nicer than this one (referring to the brick house), if I can tell you something you don't know."

> **Participant 3:** *"Yes, yes I have (seen them). I wouldn't really call it a house as such. It's a room, like the rooms in Zola? They are built with boards, and they look really good. I don't want to lie… if they told me to live there, I certainly would. I really like them; I don't want to lie."*

Some participants who were familiar with the systems did, however, express negative attitudes. One participant who described the material used to produce the house as a board-like material recalled a negative experience they had with an alternative structure in the past. Thus, this participant assumed a negative attitude towards housing constructed using innovative building technologies due to these past experiences.

> **Participant 9:** *"…the board I am speaking about is from the school from back home then it started raining frequently that's when the board was damaged that's the first time I knew about the board house …I first saw it (board houses) at home, not here."*

In describing their perceptions of the appearance of an innovative housing system they were aware of, one participant indicated that they could not see any difference between the house produced using innovative materials and houses produced with traditional brick materials.

> **Participant 5** "*Truly, truly speaking from what I've seen from these houses, I don't see that much difference between a brick and … and an alternative… unless they, they know... They definitely look the same, if I don't tell you that it's made out of alternative material you wouldn't even know*"

The findings also indicated that two participants who were aware of the innovative housing systems were also open-minded about these innovations' future as housing benefits. Another participant indicated they initially had negative perceptions about alternative housing systems before seeing one in person. This participant indicated that once they had seen a specific innovative building technology, it changed their negative perceptions towards alternative structures. They then began to have a more positive attitude towards the housing systems.

> **Participant 11***: "Yeah hey, the future of houses, hey! I see it minimising using bricks… and we are going to transition to 3D printing which will be used in almost everything, even bricks"*

> **Participant 14:** *"I've seen structural flats that were built from containers. I loved it, and at first do you know when someone told me about it, I was like "hell no", but when I saw it, it's lovely. And there is actually one other structure, I think it's further down the road there in extension 2."*

In one instance, a participant who described the alternative houses as matchboxes expressed their knowledge of the current low-income housing crisis and awareness of the government's intention to use innovative building technologies to address the issue.

> **Participant 16:** "*I heard it from the news that the government says there is too many people without houses. In some cases, they even gave people stands and bricks… to build for themselves…Yes, I have seen them, yes but I've seen the matchboxes that were built when Lefereng was being developed, do you remember? Those are the matchboxes that were built like bricks but its boards.*"

### 5.3.2  Summary of findings for research question 1

The results obtained indicate that participants had varying degrees of awareness of housing produced using innovative building technologies. Most of the participants had seen but never been inside a house constructed using innovative building technologies. Only two participants indicated that they had never seen or heard about housing produced using innovative building technologies. The results also indicated that participants were primarily only aware of the kinds of materials and innovative technologies they had been exposed to but did not have a broader awareness of other types of materials and innovative building technologies available. The results also brought forward the issue of different types of materials used to produce innovative building technologies. These results indicated that participants might have different preferences on the materials used. It also implies that the type of alternative material used may also be an acceptability issue. The results further indicate that although participants were aware of examples of alternative materials used in the production of houses, participants lacked the kind of knowledge that, according to Kamali and Hewage (2016), is associated with learning about the technologies' attributes and their benefits. The results indicated that the participants' lack of knowledge might have also significantly influenced the overwhelming negative perceptions participants expressed about housing produced using innovative systems, as revealed in more detail in the upcoming sections.

### 5.4  Research question 2

**What are consumers' attitudes and perceptions towards low-income housing constructed using innovative building materials?**

The current section presents results for research question 2. This section compared the themes developed during the qualitative analysis of the interview data concerning participants' perceptions of risk as outlined in the literature. The quantitative analysis of the interview data uncovered four themes regarding consumers' risk perceptions and attitudes about low-income housing constructed using innovative building technologies. The themes included: general perceptions, perceptions about performance, perceptions of financial aspects of alternative housing, and finally, psychosocial attitudes and perceptions that consumers hold towards housing produced using innovative building technologies.

### 5.4.1 Consumers' general attitudes and perceptions regarding low-income housing constructed using innovative building technologies

The theme 'consumer's general perceptions of low-income housing produced using innovative building technologies' had two categories: consumers attitudes and perceptions regarding the materials they prefer; consumers perceptions about whether innovative housing would improve their living conditions.

#### 5.4.1.1 Consumer attitudes and perceptions and personal preferences

Considering the variety of building materials that can be used to produce low-income housing, participants expressed their preferences regarding the type of material they would select to produce their housing benefits. Table 5.2 presents findings on participants' preferred material for producing housing.

Table 5.2: Participants' preferred material for producing housing.

| Rank | Material Preference | Frequency |
|------|---------------------|-----------|
| 1 | Bricks | 6 |
| 2 | Any material | 4 |
| 3 | Boards (alternative materials) | 3 |

The results presented in Table 5.2 show that most participants favored housing produced with traditional brick and mortar materials when given a chance to choose. Participants indicated that they perceived brick houses to be more sustainable than housing produced with alternative materials such as wood and boards.

> **Participant 5:** *"but imagine if you are building with wood… hai it's not…it won't sustain. I think brick is sustainable."*

> **Participant 8:** *"I'd like it to be built with face bricks. It's stronger than other bricks, I prefer it. If it were up to me, I would build with face bricks."*

> **Participant 12***: "I don't like it, why should they build people houses made from board. Because a house should last you a lifetime right, so now if it's made of board, how long will it last? I prefer the brick material."*

Three participants openly stated their preference for brick housing and stated that they would accept housing produced using innovative materials because they were open-minded to trying alternative housing systems. Another participant indicated that if they could afford to buy a house, they would prefer a brick house but indicated that

they would accept a house produced using innovative materials because it had been given to them. These results indicate that these participants would be open to accepting housing produced using innovative technologies but would not be their principal preference.

> **Participant 6:** "*Eh, truly speaking eh… I wouldn't… I wouldn't be able to comment about the alternative material because I haven't been inside or lived in them. So preferably for me it would be bricks. But I'm, eh open minded. I'm, I'm open minded to new things.*"

> **Participant 7:** *"Well as people we can make choices…If I was buying, I would definitely choose a brick house, but if a house was being given to me for free, then I would be happy with any material."*

As discussed in the literature review, some participants expressed their preference for brick housing due to traditional generational norms and strong cultural attachments to housing produced with brick and mortar. One participant indicated that even though they know that houses can be produced with different materials like mud, people continued to prefer bricks. Furthermore, that participants associated housing that is good with housing that was produced with bricks.

> **Participant 7:** "*I think me living in a board house would be a problem. Because brick houses are durable, our grandparents lived in them from the '90s but they are still standing strong.*"

> **Participant 11:** "*Yes…It's more like culture. It's the way we have been raised that when one wants a house, it must a brick house. I mean, people from rural areas have been building mud houses which is like a brick house you understand? So yeah, it's like that. It's within that bracket of culture to say when you want a good house, build with brick."*

> **Participant 14:** "*Like we, we are not that well informed, you know, we are used to the same thing over and over again. That a structure has to be built with bricks, cement, sand and whatsoever, forgetting that structure of a house, it can be made from like ordinary like corrugated iron or even a container you know."*

A few participants did however, indicate a preference for housing produced with alternative materials. One participant who had backrooms produced with innovative

building materials in their yard mentioned that they would choose to have a house produced with innovative materials given a choice. They indicated that this was because they found the houses aesthetically pleasing. Furthermore, that housing produced with the type of innovative materials used to produce the structure in their back yard was better than the traditional brick materials used to build their main house.

> **Participant 1***: "They're very nice rooms, if I had a key for that one I would like open for you guys so you can see. It's even more nicer than this one (brick house), if I can tell you something you don't know"*

One participant explained that they would prefer to have their housing benefit produced with innovative building materials because of their negative experience of the poor quality of current conventional low-income housing produced using brick and mortar. They indicated that perhaps housing produced with alternative materials would offer better workmanship and be of better quality.

> **Participant 7:** "Well, the materials used to build the classrooms, clinics and police stations… I can say it's much better than the RDP's that they're building nowadays. Because the RDP's now, you can even have a look and go to Tshepisong… they're not interesting, they're not like the older RDP's. Yeah so, I would rather go for alternative materials… because I already know that the RDP is not good*"*

One participant expressed no particular preference of the type of material used to produce their subsidy housing benefit but highlighted that they would consider accepting innovative housing if they could receive some form of guarantee on the house's durability. The finding was an exciting addition to the research as no guarantees are currently given on any housing benefits. They indicated that giving guarantees on housing benefits produced using innovative building technologies might help participants form better attitudes towards accepting the housing systems.

> **Participant 10:** "I would be happy with any as long as it is built with a guarantee"

In summary, the results indicated that participants show an overwhelming preference to have their housing benefits produced with traditional brick and mortar materials. Participants indicated that they have become accustomed to traditional materials, citing reasons which include a lack of knowledge of innovative systems; concerns

about the durability of innovative housing structures. Participants also cited a long and trusted history with conventional brick materials that have become generationally embedded into their cultures and provide a basis for their preferences. Interestingly, the participants who had indicated their preference for innovative housing were among the participants who demonstrated higher personal experience levels more knowledge about the housing systems. This included the participant who had an innovative housing structure installed as backrooms in their yard. This finding is significant to the literature that indicated a relationship between increased levels of knowledge and positive attitudes (Lu et al., 2018). Another interesting revelation is giving consumers guarantees on housing produced using innovative building technologies, which could potentially help increase consumer's confidence in the quality of an innovative housing benefit.

### 5.4.1.2 Consumers attitudes and perceptions on improvement to current circumstances

Participants ' responses varied when asked to express if they perceived receiving a housing benefit produced using innovative building materials as an improvement to their current circumstances. Table 5.3 presents findings on participants' attitudes towards housing produced using innovative building technologies as an improvement to their current circumstances.

Table 5.3: Innovative housing systems as an improvement to participants' current circumstances.

| Rank | Innovative housing would be an improvement to current circumstances | Frequency |
|------|---------------------------------------------------------------------|-----------|
| 1    | Yes                                                                 | 7         |
| 2    | Yes, because we have no other options                               | 4         |
| 3    | No                                                                  | 4         |

The results in Table 5.3 indicate that the majority of participants perceived housing produced using innovative building technologies to be an improvement to their current circumstances. Many participants also expressed that their reasons for accepting or rejecting innovative housing benefits were primarily due to their current circumstances. Participants cited reasons such as feeling stranded and destitute to find housing constructed using innovative building technologies acceptable to them. Some participants believed that housing produced with innovative building systems

would be acceptable to them because it would improve their current living circumstances.

> **Participant 8**: *"Yes, they would accept them (innovative building technology housing) because they are stranded and poor"*

> **Participant 10**: *"It's a house right? Yes as long as it is a house. It will just depend on what material is used, and we will accept it. All we want are houses"*

One participant added that their preference would be for the government to continue providing the brick houses they had given other beneficiaries in the past. They, however, expressed that they would accept houses constructed with innovative building technologies as a result of their difficult current living circumstances, although it would not be prefereable to them.

> **Participant 16:** *"I want the government to build brick houses. Yes. Just like what we are used to. So, these boards I don't like them but if we have to occupy them, I don't have a choice just in the name of getting out of this place...Sisi, you know what, if they said I should move in to a house and I realise the next morning that is a board house, you know what us as black people are suffering so I would stay in those houses"*

Furthermore, similar to aspects drawn upon in the literature review, two participants expressed that housing produced using innovative building technologies would be acceptable to them if that would improve their chances of receiving a house sooner. They had already been waiting a long time to receive their housing benefit.

> **Participant 3**: *"I wouldn't mind. I would accept it (innovative building technologies), because of the situation I am in. I would appreciate it, as long as I have shelter that belongs to me. I don't see myself waiting, I would never. The situation I am in right now, doesn't allow me"*

> **Participant 17**: *"I would not mind because that at least does not take a whole month… because other people like myself have been waiting for a long time for RDP houses and I am growing old, so you see it will be a long wait long wait"*

Other participants mentioned that they would accept innovative housing systems because it would allow them access get a piece of land (stand/plot). This seemed

was more important to them than the actual house and the material used to construct the house. As some of the participants mentioned:

>**Participan 13***: "Not like now even when we have homes, we know the homes are not permanent. But they will give us our own stands? Oh okay rather say it like that, I understand that. If they give us all our own sites, then from there on we will see for ourselves"*

>**Participant 16***: "You just accept that this is a stand because they will not receive houses anymore"*

One participant mentioned that they would not accept the housing constructed using innovative building materials as it would not improve their current living conditions.

>**Participant 4***: "Yoh, I would be disappointed, I wouldn't actually even want the house, I would actually be complaining. I would actually be there at the municipality or whatever government institution there is, complaining. Because I would not be happy about the material that they have used"*

The previous section indicated that some participants expressed that they would accept housing produced with innovative building technologies because they feel that they have no other option due to their current desperate circumstances. Some participants expressed they would find them acceptable because, at the very least, it would provide them with access to a piece of land they would own. Regarding whether low-income housing built using innovative building technologies would improve their living conditions, most respondents except four indicated that their living conditions would be improved due to innovative building technologies.

### 5.4.2 Consumer attitudes and perceptions the performance of low-income housing constructed using innovative building technologies

The results indicated that participants' perceptions of the performance of houses constructed using innovative building technologies had three categories where participants articulated their perceptions regarding the quality, structural durability, and safety of housing produced using innovative building technologies. Each of these categories had two subcategories, as presented in Table 5.4.

Table 5.4: Perceptions of quality of houses constructed using innovative building technologies

| Rank | Attitudes and Perceptions | Frequency |
|------|---------------------------|-----------|
| 1 | Poor quality | 15 |
| 2 | Good quality | 2 |
| 1 | Poor structural durability | 13 |
| 2 | Good structure durability | 4 |
| 1 | Poor safety | 15 |
| 2 | Good safety | 2 |

### 5.4.2.1  Perceptions and attitudes regarding quality aspects of innovative housing

Most participants believed that low-income housing constructed using innovative building technologies would be inferior in quality to those constructed using traditional brick and mortar methods.  Participants thought that the materials used in the production of innovative housing would be of an inferior quality to bricks and would require significantly more maintenance to keep the structure in good condition, as evidenced by the following statements. Furthermore, the results again raise the issue regarding the type of materials as an acceptance issue for participants.

> **Participant 4***: "I was actually disappointed. Because of the material, you see? The durability of the material, because the material would not be durable and another thing you get that boards get damaged after some time then you have to fix them again, you see? So it's just a waste of money unlike you know having something that's solid like bricks"*

> **Participant 4***: "…it might come out cheaper at first but then coming to the person who would be having the house and having to maintain the house, like for instance steel how do you maintain steel and how much would it cost you so you look at such things you look at those factors. Uhm… would it be durable for a period of twenty years or something like that you see it's that thing."*

> **Participant 7:** "*I would be concerned about that, leaving a brick house that's a 100 years old… how long will the new house last? And obviously we're black people, we grew up knowing that wood or board is not strong*"

> **Participant 14**:*"Oh well, that one is a very tricky one but I'll be honest. Brick is quality you know at the end of the day, like brick is quality cause in order for it to be shattered it has to be broken down, you see. So in terms of drywalling and so forth, it can also be quality but comparing it to the current structure of bricks and whatsoever. So bricks."*

One participant also alluded to an aspect highlighted in the literature review and stated that they believed innovative building technologies should instead be used as temporary structures rather than a permanent solution for low-income housing. Furthermore, the participant indicated their perception of houses produced with materials other than bricks as cheap housing that would symbolise regression and not progression in participants' lives.

> **Participant 4:** "*I think in terms of other materials like wood, steel or the boards let it be something that's actually temporary and then as you are there maybe be on a waiting list to say proper houses made with bricks are coming and it will be roof tiles and not steel sheets, IBR sheets…because if you will be using material like that it will be cheaper and you'll be using them now and probably in five years or three years then they give you a problem and you actually go back to buy such materials in order for you to fix that house, so we're going backwards in such things and another thing… what can I say? How can I put it?... I would just prefer people to get proper houses instead of getting cheap houses because we are going to be working backwards.*"

However, some participants indicated that they thought the quality of the materials used in the production of innovative housing systems would be equivalent to that of bricks.

> **Participant 11**: *"It is quality because it is equivalent to bricks"*

> **Participant 15:** "*The quality is the same… It's the same as bricks*

The above statements indicate that participants' attitudes and perceptions regarding the quality aspects of housing produced using innovative building technologies are largely negative.

### 5.4.2.2 Perceptions and attitudes regarding structural aspects of innovative housing

The discussion around the structural aspects of housing produced using innovative building technologies indicated that participants were concerned that the houses may not be structurally suitable for varying weather conditions such as rain and wind.

> **Participant 4:** *"…like when it was raining the boards at the bottom, uhm… what do they do?... they develop fungi and whatnot, and then they start rotting so it's easy to get rotten, and obviously it is easy because we are in South Africa, you know, even in Cape Town or here in Soweto … obviously it rains a lot here so obviously they get damaged easily, you get me? So it's that thing and it bothers me."*

> **Participant 6:** *"I think most of the problems arise eh, due to our weather conditions. I think they will start... it depends on, on the material that you'll be using as the alternative structural material- let's say with boards, I think my main concern with boards will be rotting especially here at the bottom you know? They'll get... They get damaged easily. Ya, cos I don't think we have nice water drainage systems"*

In the above comments, although participants indicated their uncertainties regarding the structural durability of alternative housing when exposed to harsh weather conditions, participants again highlighted that some materials might be better than others. However, some perceived innovative housing structures present a variety of structural benefits such as ease of extension and appealing appearance.

> **Participant 7**: *"I think it's much easier with boards or planks if you want to extend because as I said, renovation for a brick house will cost more. Because you need cement and other materials, but with planks or boards I can just buy that or get people who specialise with such materials to do it for me"*

Some participants believed that low-income houses constructed using innovative building technologies were more structurally sound than conventional brick and mortar low-income houses they had observed because of the shoddy workmanship used to build them.

> **Participan 5**:*"(The alternative structures) they don't crack, they don't collapse uhm... the RDP houses that are built with bricks that I know have a lot of cracks and others collapse, if there is a serious weather condition they just*

*collapse. The roofing is not good, their cement is not enough, all that…the plaster is just falling after a couple of years, two or three years especially the ones that I know from Braamfischer, they're not good …The alternative ones. The alternative ones they are making sure because it's a new thing, they need to make a stamp…they make sure, sure, sure that people are getting the best"*

**Participant 14***: "It's very frustrating, it was and also the thing is sometimes my mom is at work, I'm at work and he's at school, he comes back the house is flooded, you see? It's traumatic, so the RDP houses, the foundation that was laid no, I don't know maybe they were in a rush or were they under pressure cause a lot of things, the pipe structures. So, I would go for alternatives, I haven't heard any sagas about alternative houses, so that's why I'm saying it's the new era of housing."*

Although some participants did express positive attitudes towards the structural aspects of housing produced with innovative building technologies, the results indicated that most participants indicated high perceptions of risk resulting in negative attitudes regarding the structure of innovative housing.

### 5.4.2.3 Perceptions and attitudes regarding the safety aspects of innovative housing

When discussing safety aspects, most of the participants thought that the houses were not safe, primarily because of the perceived poor quality of materials used to produce them. Participants cited issues related to the structural durability of alternative housing as a source of uncertainty regarding the structures' safety, while others indicated that alternative structures would make it easier for burglars to t break-in.

**Participant 7***: "When I look at them, they don't look so strong compared to the ones that were built in Braamfischerville, Tshepisong some years ago. Some are still standing strong unlike these recently built ones. Some of the recent ones where damaged by floods, some people feel they're not safe in them… if a fire starts the whole house burns down, we don't know whether it's because of the material of the bricks or the planks… so if the government can just change the material, we would feel better."*

**Participant 7***: "Burglars can break in easily…some of them get destroyed by rain. If a building can be destroyed by rain it means that it's not safe."*

> **Participant 11**: "*Because of, like I have said there are people who do crime so if they can go in a shack, just imagine if it's a board…I feel like people still forcefully enter. So, for such reasons… They can just cut in… they can just cut through.*"

The participants who perceived that innovative housing would be safe cited reasons such as personal experiences with alternative materials in schools and clinics and having no prior negative experience with the materials as a basis for their positive perceptions of safety about the innovative housing systems.

> **Participant 6:** " *Yes, because eh, there are schools that are built out of all of those alternative materials, and yes accidents do happen but they are not a common thing that will find that every time when there's a building that has been built out of alternative materials it has collapsed or… no…I will feel safe.*"

> **Participant 13**: "*I would feel safe, because even if I go to the clinic and there is wind and it's raining I've never seen the clinic blowing away. So based on that, I think that it's safe*"

Some of the participants were trusting of the government. They believed that government would not give the go-ahead for the houses to be constructed using innovative building technologies without ensuring that they were safe to occupy. As one of the participants explained:

> **Participant 14**: "*Yes because I feel that the safety protocols would have been initiated and followed and yeah, cause I doubt that government would just want to build based on experimental purposes, forgetiing that there are human beings that are going to be living there. So safety protocol has to be followed, there has to be a team that has to be responsible for that; they run test runs or whatever it is you might call it, that surely it is conducive enough, like we can live in it. They will never just take people and put them in those houses yet the protocol and those measures were not followed, because they know that should anything happen it's gonna backfire on them*"

In summary, participants disclosed overwhelmingly negative perceptions regarding the quality, structural durability, and safety aspects of housing produced with innovative building technologies. Participants who perceived alternative housing structures to be safe relied on knowledge from past personal experiences as

influencers of their favourable attitudes. This could imply that the dissenting views expressed by participants regarding their uncertainty about the performance aspects of innovative housing could also have been a reflection of strong personal opinions rather than reflecting views based on particular knowledge or experience with the housing systems as indicated in the literature.

### 5.4.3 Consumers' attitudes and perceptions regarding financial aspects

The theme that covered participants' attitudes and perceptions of risk regarding the financial aspects of housing produced with innovative building technologies housing had one category and six sub-categories, as indicated in Table 5.5.

Table 5.5: Consumers' perceptions regarding financial aspects of low-income housing constructed using innovative building technologies

| Rank | Attitudes and Perceptions | Frequency |
|---|---|---|
| 1 | Alternative housing would impact the value of the housing benefit | 6 |
| 2 | Can extend/improve alternative housing to increase value | 3 |
| 3 | Alternative housing will save more money to maintain | 3 |
| 4 | Housing benefits should not be sold thus the resale value is not a concern | 3 |
| 5 | Alternative housing will cost more money on maintenance | 2 |
| 6 | Alternative housing will present no financial implications | 1 |

The results indicated that most participants perceived financial risks and expressed negative attitudes regarding the value of innovative housing. They expressed that they believed these houses would fetch a lower value than those constructed using traditional brick methods. One participant expressed that the value provided by innovative housing would be assigned to the land it was built on rather than the actual house itself. They further expressed that investing money into the property would not improve the value of the house.

> **Participant 4:** *"I personally in terms of the value of the house feel like it would depreciate because it's not built with bricks and strong materials I would feel disappointed. It would actually bring down the value that I have and wanted to have. It (the value) would be less because here you are spending money but in terms of the value of the property does not go up. It (alternative housing)*

*would increase because you have the stand already but it's not that much as compared to concrete and bricks… the rate will differ"*

**Participant 6:** *"Maybe I may not get the very same value that I would get from a brick house…"*

**Participant 10:** *"One person getting a brick house and another getting a board house then they try telling me it values the same amount of money. I wouldn't agree, I would tell them that they are not being truthful..."*

One participant explained that housing constructed using innovative building systems would be less valuable than brick housing because living in an alternative house was equivalent to living in a shack.

**Participant 13:** *"It would be less (value) than the one built with bricks, cause even if I left here and sold this house, it wouldn't be the same as selling an RDP, because this is a shack it won't be the same. I know it won't be the same."*

Some participants, however, also indicated that they did not believe that receiving a house produced using innovative building technologies would impact the value of their benefit. One participant explained that their lack of concern regarding the value of their alternative housing benefit would be based on the perception that financial institutions would recognise alternatives and value them accordingly. They indicated that having many other people occupying innovative housing would also reduce the negative financial impacts on their housing benefit.

**Participant 3**: "*No, there is no such thing as a house with no value. It doesn't exist, even a stand has value. There is no house that is not valuable.*"

**Participant 6:** *" I don't have to worry about that because I think government is going to.. Has to, has to make sure that we all shift in one way, even our banks even our estate agents we have to move towards whatever government is trying to achieve. So it's not like I will be the only person who will be having that house. Maybe the whole of Soweto will be built out of alternative material, so I don't see me having a problem because I won't be alone. So, it's something that all of us have and the bank or whatever financial institution, we will have to move towards that."*

**Participant 14:** *"You know in terms of that, I feel okay, there won't be any financial implications as such… Yes, cause one thing that I know is that, okay land and buildings they do not depreciate, they appreciate as time goes by… irrespective of the material, yes land and buildings appreciate, so the value of it now in comparison to the next 5 plus years is not going to be the same. Yes, exactly (the value will increase)."*

**Participant 14**: *"No, there is no way, I wouldn't worry because it's a newly introduced era of housing which right now might not be in demand as projected for the future. However in the future, it's going to be like the in-thing, so everyone is going to be wanting to have one, and that point in time it's not gonna... people are not going to be selling at that kind of price as when it was first built or we moved in. Yes, so that's why I'm saying 5 plus years going forward it's going to be like something that everyone wants, so if I were to sell, it wouldn't be at a loss, none whatsoever."*

Participants also mentioned some aspects accounted for in the literature regarding their perceptions of the cost of innovative building technologies. The perceptions regarding the cost of renovations and maintenance relative to traditional brick housing did vary. Three participants highlighted that they perceived that the cost of maintaining or renovating an innovative house produced with certain materials would cost less.

**Participant 7**: *"if a brick house gets damaged, and you don't have money, it might take you 10 years to save up enough money just to repair it. But if a plank or board gets damaged I can replace it within a shorter space of time. Even if I don't use the same material but the fact that it's a plank, I would be able to make a plan to replace it, I think a plank or board is much better than a brick… And boards would cost less than bricks (for renovation). So when it comes to people here in the township, bricks can cost a bit too much. That's why you find some houses since they were built in 1993 and they still look the same in 2021 because the brick is costly."*

**Particiapnt 11:** *"Well I don't see any (financial) affects because they are using cheaper material of which if I want to grow the house using the very same material, it's going to be easier for me. I don't see it having any problems even for disadvantaged people in terms of capital. Yes I feel like that it's going to*

*be more cheaper to extend such houses, even though maybe it won't be that durable I don't know about the duration and how you sustain it but I think it will be cheaper. And it will excite people.*"

Two participants expressed that they felt it would be more expensive to maintain a house produced using certain innovative building technologies than traditional brick and mortar houses.

> **Participant 4:** *"Yes, you wouldn't actually (get your value back in the long run) … you would somehow but not really because like when it comes to wood you will have to buy those things and when you do buy them they're much more expensive."*

Some participants expressed that the value of their benefit would not be a concern to them. One participant expressed that it was because the house was given to them to improve their current circumstances. Another participant highlighted that financial implications would only matter if they had intentions to sell the house in the future. Participants indicated that they had no intention of selling their subsidy house once they received it but would keep it for the next generations to inherit.

> **Participant 5:** *"Remember, eh, financially I can't afford to buy a house, you know? So the type of, the type of house I would own or will be given to me, won't have that much impact on my financial status because already my financial status is not good you know? So I wouldn't say it would… it's going to be better than where I come from"*

> **Participate 15:** *"if I'm going to get a house now it's not for sale because my great, great, great, grandchildren (will inherit it)."*

These results indicate that participants had varying perceptions and attitudes regarding the financial implications of accepting a low-income house constructed using innovative building technologies. Some participants expressed concerns that the alternative houses produced with certain materials would fetch a lower price because they were produced using materials participants perceived to be of a lower quality than traditional brick materials. Other participants believed that the use of certain innovative building technologies was the future of building low-income housing and that value of their houses would not be compromised. Participants also highlighted the cost of maintenance and renovations as a financial consideration for the acceptance of houses produced with certain types of innovative building

technologies, with some participants finding the structures favourable and citing low maintenance and renovation costs as a potential benefit. A few participants expressed that they were not concerned about the impact that having a house produced with alternative materials would have on their homes' value because they had no intentions of selling them.

### 5.4.4  Consumers' attitudes and perceptions of psychosocial risk

Psychosocial attitudes towards low-income housing constructed using innovative building technologies had three categories: whether participants thought their families would be happy for them if they knew they had received housing constructed using innovative building technologies; whether participants thought their community would accept or reject such housing; and whether participants thought the type of material used to build a house reflects their social status or wealth. These categories each had two sub-categories, namely negative and positive attitudes and perceptions. Table 5.6 presents attitudes ranked by frequency.

Table 5.6: Social attitudes towards low-income housing constructed using innovative building technologies

| Rank | Perceptions and Attitudes | Frequency |
|---|---|---|
| 1 | Family would be happy to see me living in an innovative building technology house | 6 |
| 2 | Family would be unhappy to see me living in in an innovative building technology house | 6 |
| 1 | Community would accept innovative building housing project | 8 |
| 2 | Community would reject innovative building housing project | 1 |
| 1 | Type of material does not reflect social status | 9 |
| 2 | Type of material reflects social status | 4 |

### 5.4.4.1  Social acceptance and family approval

When asked if they thought their families would be happy for them if they had received an innovative house, some participants expressed that they thought their families would be happy. The reasons they cited did, however, vary. One participant expressed that they felt their families would be happy for them simply because they had finally received a house, irrespective of the type of material used to produce the house. The participant further stated that living in a house produced with alternative materials would feel no different from living in a traditional brick house.

> *Participant 7: "They would be happy for me because the aim is not for me to live in a brick house, the aim is for me to have shelter. You see? Whether its brick or anything else, as long as I am happy then my family would be happy for me too."*

One participant highlighted that they believed their family would be happy for them because their family trusted them to make the best decisions for themselves and trust their decision to accept a house produced using innovative building technologies.

> **Participant 5:** "*Yeah knowing ...my family knows me, and that I don't go for less so they would be very happy. Yes, they would be (happy for me). Because they know that if I make a decision, that it would be a sound decision. It's not because of someone else did that, or that I saw it from someone else no.*"

Two participants expressed that they believed their families would be happy for them because receiving the housing benefit would improve their lives even though the house would be constructed using alternative materials. One participant further stated that they believed their family would be happy but that it would be because they had no other choice. They highlighted that their happiness would stem from gratitude that their lives were improving, which they would otherwise not afford.

> **Participant 10***: "They would have to be satisfied, because I am satisfied. They don't have a say, because they live with me. I share everything with them. If we could, then we would have done everything ourselves, let's just accept what we get, in other words just be grateful for what you get because you did not do it for yourself. If you could have done it for yourself, then you would have…"*

> **Participant 15:** *"Definitely I think they would be happy for me…because at least it is a step forward unlike standing in one place and not knowing where you are going, its progress…"*

Some participants expressed that they believed their families would not be happy for them. Two participants expressed that their families' lack of happiness would stem from a lack of understanding about the alternative housing structures and fear for their safety due to the negative perceptions about the structural performance and durability of alternative housing.

> **Participant 1:** *"Maybe like, I think maybe they won't be happy because they don't understand how boards are. And I know what they are like. Maybe they would think that the house would collapse on me, so they don't know what they're like."*

> **Participant 7:** *"…You might build us houses with boards, someone who is used to a brick houses might make an assumption that a board is fake material, that you won't live well in a board house. Some people are destroyed by their mentality."*

> **Participant 8:** *"No, they would prefer I live in a strong brick house, not one that is likely to collapse due to weather conditions."*

One participant expressed that they felt their family would not be happy because the family would not see it as an improvement to their current circumstances.

> **Participant 3:** *"No, I know they won't be happy for me... Do you know why I'm saying they won't be happy for me? They'll wonder how come I got a board house, while they live in brick houses? You know in family there's always those critical people, while there are those who are just happy that you finally got a house."*

> **Participant 4:** *"No they wouldn't (be happy for me). Because you know that they have expectations about you as a person, they take you to school so that you can better your life but here you are you actually not doing anything with your life so it's a problem they would be disappointed."*

Some participants expressed that they would need to educate their family members to get them to be more accepting of them living in housing produced using alternative technologies. Further, that it would take education to encourage their families to become more accepting to change, citing an observation made in the literature regarding peoples rejection of innovation as an aversion to change rather than a rejection of the actual innovation (Claudy et al., 2015).

> **Participant 5:** *"Obviously old people are stereotypical, they don't believe in change, they don't believe in new things. But with a bit of education, I think they would understand, they would stigmatise and say "you will be sick or it is not right what if, what if, what if…" but with a bit of knowledge and education they will definitely understand."*

> **Participant 14:** "*It's shelter, to start off with, it's shelter they would be happy but they would pose questions here and there and whatsoever. And which is, I feel like it would be my duty to keep them well informed…. Come on there's got to be change somewhere somehow, however like keeping them well informed and well educated, that no it's still the same type of you know structures but, using alternative materials you see.*"

The results indicated that the number of participants who believed their families would be happy for them was equal to those that did believe their families would not be happy. The results also indicated that participants perceived that family members would not be happy for them not because of the house itself but because they would not want a loved one living in a house that conflicts with their normative structures. Furthermore, the results indicate that participants would feel forced to change from the ideal of brick housing, which was a satisfactory status quo (Claudy et al., 2015).

### 5.4.4.2  Social acceptance and community approval

Participants were asked if they believed their community members would accept housing projects that used innovative building technology. Table 5.7 presents findings on participants' attitudes and perceptions regarding the community acceptance of housing produced with innovative technologies.

Table 5.7: Perceptions and attitudes regarding community approval of housing produced with innovative building technologies

| Rank | Perceptions and attitudes | Frequency |
|------|---------------------------|-----------|
| 1 | They need to be educated/informed | 7 |
| 2 | Yes - they have no choice/they need | 5 |
| 3 | Yes - they are open-minded | 2 |
| 4 | No - because of materials | 2 |

The results presented in Table 5.7 indicated that participants' responses varied but that most participants believed that community acceptance would depend on the level of information given to them before implementation to increase community acceptance.

> **Participant 2:** "*That's why I said education, firstly when you introduce something you teach people about it, you see? if they introduce a new system in a company they will teach you first on how it works and by doing so you are taking out what is going to be a stigma to people because of immediately if I*

*live in a board house people are going to say I live in a board house but not having education of why I am living in a board house, what is the good side of board houses so by teaching people they will take out what is going to be a stigma for people to understand that this is a new thing that's coming up in South Africa and it is not a bad thing but it's a new thing that our South African government has introduced and it is to enhance people's lives, and it's not to degrade people's lives and it is to give more to people because now we have a back log of houses that's costing a lot of money to build so the government system has tried to come up with new ways of doing that so education is important."*

**Participant 5:** "*Yes, they would be (willing to accept). Provided that they are more informed. Because people like to be given that chance, you know... to know and to choose. Yah, unlike you know just to push them inside…Yah I think the more we are being informed, the more we will be at ease…*"

**Participant 12:** *"I don't know, maybe if they spoke to them, our community leader, and we heard what they had to say, do you understand. Because someone will bring their suggestion, then another and so forth, do you understand? It's better if we all meet up and they come with you guys too, then they tell us and you also tell us. Otherwise, it won't work out..."*

These statements indicated that participants believed communities would accept houses built using innovative building technologies as long as they are knowledgeable about them. Some of the participants explained that they believed members of their communities would accept housing produced with innovative building technologies because they presented an improvement to their current living circumstances. Furthermore, the pressing issue was to be allocated a piece of land that would belong to them, even if no house was provided because participants ran the risk of being forcefully removed from informal settlements.

**Participant 7:** *"Most of them would be happy to accept them. The project would be helping a lot of people because many people want housing. And people are not choosy these days… It's because they are unemployed, as you can see now, we are in the middle of a pandemic, people have been retrenched and are now all over the township. So, when there's 7 of you living in a house with no food, it's a problem… so you see things like that, people are living in poverty, so some people can't reach their goals. And most*

*people's goals involve having a house and kids and a family, so giving someone a house is like giving them a life you see? Most would appreciate them, that's what I think. Some people live in shacks, if you live in a shack you would not turn down a newly built house…"*

**Participant 13:** "*I think the ones here would take them, because what we want is formal settlement, we're not okay here. Like I said we have to steal here, the water and electricity is stolen, do you understand? So, if they refused those houses, I would be surprised, but what they would need, because one party once came here and said why don't move away from this place and we asked where we would stay? We said no because we don't just want to move, we want our own places, whether there are houses or not, we just want our own places.*"

**Participant 16** *:"We will occupy them because it's removing me from my current situation at the end of the day you are in that house and you won't go back to your old living arrangements. On my side I will live in the house because I would not know that the house is built out of board material because I am poor I won't reject it.*"

**Participant 17:** "*You can't say no, because it's better than a shack.*"

Another participant highlighted that because their community had many young people living in it, they would be more likely to accept innovative housing structures. The participant added that they would also be willing to seek out information, gain knowledge on the systems, and be happy to accept provided that the information they received did not allude to any adverse effects of the system.

**Participant 5:** "*Uhm, knowing my community it is really young people who are open minded and… I think they would accept them. Because young people they don't just agree, they do research and technology allows us to do more research. So as long as the research is positive…so if they find out that this thing is sustainable and it will last, it's safe and it won't get people sick, they would agree.*"

One participant indicated that those who rejected the houses did so because they were not in need of housing. As one of the participants explained:

**Participant 6***: "People who reject these things, I can say they think they're too special or they don't appreciate what they are getting. Uhm, I mean you*

*get a house out of nothing but still you reject it... I mean, if you don't want it you can destroy it and build you own; it shows that they don't appreciate. And those who accept are in need of houses and they are not choosy because if you are choosy it means you are not in need"*

A participant indicated that community members would accept the houses because it would enable more people to access housing. Another participant added that they thought their community would choose to accept alternative housing if it would allow them to receive a housing benefit sooner instead of waiting to receive a traditional brick house.

**Participant 11:** "*Yes they would be happy to accept it, because I think it takes less labour to build that house and with the quality of material government will be able to buy more and supply people with houses than these actual bricks."*

**Participant 15:** "*Yes, it's better, it's better than waiting for something you do not know when it will happen.*"

Some participants believed that members of their communities would not accept housing produced using innovative building technologies. One participant expressed that because of their beliefs that a house must be constructed using bricks, they would not accept the housing.

**Participant 14:** "*No, out of 100 I can say 8 can be open to that idea…You know, I said only 8 will be open to that idea because a lot of people have this, I don't know I'm looking for the right word, they have this concept that a house needs to be made of bricks you see, and a house can be made out of glass, it can be made out of steel, it can be made out of board you see, that's why I'm saying that only 8% will be open to the idea, you see, so the 92% they will beg to differ. Why such houses? Why us? Failing to be informed, failing to do research, failing to be willing to be educated about this new type of venture."*

In summary, the results indicated that participants believe that their communities would be open to accepting houses produced using innovative building materials given enough information. Furthermore, that they would be willing to accept because it would improve their current circumstances. The findings also showed that those participants who would not accept alternative housing systems would be because they did have enough information about the systems. Furthermore, they would not accept that they were holding onto personal preferences for traditional brick houses

or did not need housing. The findings again indicate cultural and traditional norms as well as an aversion to change as a reason that communities may reject housing produced using innovative building technologies (Claudy et al., 2015; Grady, 2019; Lategan, 2012; Olojede et al., 2019; Tshivhasa & Mbanga, 2018).

### 5.4.4.3 The type of materials and psychosocial attitudes about wealth and social status

The participants were asked to comment on whether they believed the type of material used to build their house would reflect their wealth or social status. Table 5.8 presents the categories related to this theme ranked by frequency.

Table 5.8: Type material and psychosocial attitudes about wealth and social status

| Rank | Perceptions and attitudes | Frequency |
|------|---------------------------|-----------|
| 1 | Yes, can be viewed negatively | 4 |
| 2 | No, shouldn't matter/I don't care | 4 |
| 3 | Yes, as advanced/trendsetter | 2 |
| 4 | Yes, beauty of house reflects status | 2 |
| 5 | Yes, but don't have a choice | 1 |

The results presented in Table 5.8 showed that most participants believed that the type of material used to build a house would be a reflection of their social status and wealth and that it may reflect negatively on them by others. One participant articulated that a house's attractive appearance was an important factor for social acceptance (Lähtinen et al., 2019). Other participants agreed that it would reflect their social status, but they did not have much of a choice. Another participant indicated that community members often used the type of material used to build a house to judge their social status.

> **Participant 2:** "*No one wants to live in a house that does not look beautiful, so it makes you feel good about yourself first and foremost as we normally say first impressions last. I believe a house is like a car, when someone looks at your car it resembles the person that you are so if you are living in a beautiful house it resembles the person that you are it boosts you lifestyle if I may put it that way so if our government could try to build beautiful structured houses that will make people happy because unfortunately we are living in a society that is judgmental.*"

**Participant 2:** *"If you have a beautiful house automatically people recognise you, you have status and your self-esteem is higher because of where you live and then your friend next door lives in a shack or RDP house, their self-esteem will be low."*

**Participant 4:** *" Yeah, of course… It's demeaning. Actually to be quite honest we judge people because of how they live or were they live but I don't really think that judging someone in terms of where they live or something like that has sense, I would not really judge that person but when coming to the community and how we grew up that's how they judge or see other people."*

**Participant 14:** *"I can say so, because obviously like a lavish, like a big house made out of bricks and solidity, have you seen, the fanciness, it gives you some sort of status or respect, "like wow they have money over there."*

However, some participants who indicated that it would not be perceived as a reflection of their social status indicated that their current circumstances were already unpleasant and that alternative housing would present an improvement.

**Participant 6**: *Not really, not really because if the house is built neatly and if it's safe, I don't see any difference between a brick house and an alternative material house…You know, I've seen worse. I've been living in an outside room with my family for four years and then when I'm given a house I think the reflection on my status… I would feel proud because I have a house. Compared to not having a house, but living in a shack you know? Yeah I will have structure, a solid structure. So I wouldn't think that you'd care that much on my social status or how people see me, I wouldn't.. No.. I would be happy. Because where I come from is worse…"*

One participant highlighted that wealthy people also used alternative materials to build their homes, citing an example of other places they know to use materials other than bricks to produce housing furthermore, that these people appeared wealthy despite having homes produced with alternative materials.

**Participant 7**: *"No I don't think so, as you can see now… I've never been to the States but when you watch TV you see that their houses are built with boards and they are beautiful. And those people look like they have money, you get me? So I don't see anything wrong… a house is just a house. People*

*thinking that you are poor because you live in a board house, no… I don't think so."*

Participants also expressed that it shouldn't matter or that they would not care if people perceived them negatively for living in a house produced with innovative building technologies. Participants also expressed that by accepting an innovative house, people would perceive them as ahead of their time and as trendsetters, thereby encouranging others to want to use alternative materials in their homes.

> **Particiapnt 5:** "I think it would be a… I would be a trend setter because at the end of the day if I agree on those things, then people will know that those things are reliable."

> **Participant 11:** "People would think I'm actually advanced. Because people like new things, they love being introduced, you understand? So they would think I'm a trend setter, they would see me as a trend setter…"

The results show that most participants expressed that they believed the type of materials used to build a house would be a reflection of their social status. Some participants expressed that it will reflect negatively on them and that other community members would judge them. Furthermore, because producing a house with bricks is expensive, other community members would deem them wealthy when they have a brick house. Other participants indicated that it would positively reflect them as trendsetters, causing other members of their communities to want to follow suit and use innovative materials to build their own homes. However, some poarticipants indicated that because they were already in desperate financial situations, needing a subsidy house already indicated that they could not afford to buy their own house.

## 5.4.5 Summary of findings for research question 2

This section explored participant's perceptions and attitudes towards low-income housing constructed using innovative building technologies. Firstly, the results indicate that when allowed to choose, many participants would prefer their housing benefit to be produced using traditional bricks and mortar methods. Participants who chose innovative building materials over traditional methods had personal experience with innovative materials by having an innovative material structure in their home or seeing the structures in their neighbourhood used as social infrastructures such as clinics and school classrooms. Participants who expressed a

preference for alternative materials also cited the negative experiences and shoddy workmanship on traditional brick and mortar low-income housing structures as a reason for their favourable attitudes towards innovative housing. However, although many of the participants expressed that they would prefer their housing benefits to be produced using traditional brick and mortar methods, an overwhelming majority of the participants expressed that they would accept the houses produced using innovative building technologies. Some participants highlighted that they would accept them because it would improve their current living conditions as many expressed that they were poor and felt stranded. Some participants mentioned access to land as a reason for accepting innovative housing. Others expressed that although they would be disappointed, they would accept them because they had already been waiting for a long time to receive their housing benefit and would accept if it presented an opportunity to receive housing sooner.

Participants' perceptions about the quality of housing produced using innovative building technologies revealed that the majority perceived the houses constructed using innovative building technologies to be of more inferior quality than those constructed using bricks. Participants also expressed that they perceived them to be less structurally durable than brick housing. Participants, however, alluded to some perceived benefits of innovative housing, such as cheaper maintenance and renovation costs. Regarding safety, most of the participants perceived houses constructed using alternative materials to be less safe than brick houses. Safety concerns included perceptions that the walls would not be strong; furthermore, it would be easier for buglers to break-in.

Participants also perceived that houses produced with innovative materials would be easily destroyed by harsh weather conditions such as heavy rain and strong wind. There were, however, those who perceived innovative housing to be safe, more specifically, that they would be safer than living in shacks and crowded squatter camps. Furthermore, the government would not introduce innovative houses to communities if they were not safe.

Participants' social attitudes regarding housing produced using innovative building technologies revealed a split between participants who felt that their families would be happy to see them living in housing produced using innovative building technologies. Some participants expressed that their families would be happy to see their lives improve. Some participants also indicated that they believed their families

would not be happy for them because of a lack of understanding of what innovative building technologies are and a fear for their loved ones' safety. Participants also expressed that they believed their communities would be willing to accept housing produced using innovative building technologies because their communities needed housing. Other participants expressed that community acceptance could only be achieved if communities were educated and informed about the housing systems before implementation.

When asked about innovative building technologies' financial aspects, most of the participants perceived innovative housing systems to have a lower value than brick houses. However, some participants expressed that the house's value could be improved through renovations and extensions. Many participants also expressed a lack of concern about the value of their housing benefits. These participants expressed that they had no intentions to sell their house. Furthermore, that they believed subsidised housing benefits should not be sold but instead kept for future generations to inherit. Some participants expressed concerns about the cost of renovations and maintenance, stating that they perceived the houses to be less durable and would increase maintenance costs. Other participants believed that low-income housing constructed using innovative building technologies was the future of low-income housing delivery. Furthermore, that demand for innovative houses would grow and lead to the improvement of the houses' value.

Finally, when asked if they felt that living in a house produced using innovative building materials would reflect their social status or wealth, participants demonstrated varying attitudes. The majority of the participants agreed that the material used to build a house did reflect on a person's social status. Some participants believed that innovative housing would reflect negatively on their social status. Others thought it would improve their social status as people would perceive them to be trendsetters, while others expressed that what others thought about them did not matter to them as long as they were satisfied with their decision.

## 5.5  Research question 3

**What are the challenges that consumers believe the government still needs to overcome in order to reach greater consumer acceptance of innovative building technologies for low-income housing?**

This question set out to uncover the measures that consumers believe the government should take to improve the acceptance of housing produced with innovative materials. Table 5.9 presents consumer recommendations.

Table 5.9: Consumers recommendations for government to promote greater consumer acceptance

| Rank | Recommendations for government | Frequency |
|------|-------------------------------|-----------|
| 1 | Consultation, education, information | 9 |
| 2 | Provide a show/prototype house | 8 |
| 3 | Introduce gradually | 5 |
| 4 | Do more research | 5 |
| 5 | Ensure good construction | 5 |
| 6 | Use alternative materials | 2 |
| 7 | Ensure attractive buildings | 2 |
| 8 | Give stands for self-building | 1 |

Recommendations had eight sub-categories, as shown in Table 5.9. The sub-category that occurred most frequently was that the government should embark on an educational campaign and provide educational workshops to inform the public about the housing systems. Secondly, the government should build prototype houses to observe their longevity and quality.

> **Participant 5:** "*Proper, proper education on those things. They should do workshops and invite those people and teach them about those materials, how it works and where it comes from. I think the problem is the government does not consult, they do things according to them. But if they could consult the community, they can do the right thing.*"

> **Participant 6:** "*Eh, knowledge again, information. More information, more information. Information on top of information. They shouldn't just build the houses and leave the people there…*"

> **Participant 7:** "*Some people want to witness others doing if first. If government built 10 houses in a specific place and people can see them and how people live in them, they would also want to apply for those houses.*"

> **Participant 8:** "*We would want to see for example what kind of wood is being used, how it can withstand different weather conditions. We would want them to explain exactly what the durability of the material would be. Because I think for aunty to make an informed decision, she needs sufficient information*"

Other participants recommended that government introduce alternative housing projects gradually so that others can have the opportunity to see how the houses hold up over time.

> **Participant 6**: *"Maybe they can start by introducing the houses piece by piece. Gradually you know, ten houses at a time, give them two years and after two years or even in ten months go back to those owners and interview them you know? Just to let people see that these are not bad houses"*

> **Participant 14**: *"Education is the key element. They need to educate them, they need to inform them, they need to invite them you see, for instance let's say , what can I say, let me just choose a random location. Lets say maybe in Zach Park or wherever they will be building... to educate them, they have to invite them, you know at the place where the project will be taking place"*

Two participants highlighted that since this was a new initiative, the government should ensure that houses are structurally sound and look like actual houses. This implies that participants do not want houses that look like shacks but that the houses should look like the brick houses they have become accustomed to. The participant highlighted the importance of the type of material used in the house's production and that the houses need to have an attractive appearance to gain increased acceptance.

> **Participant 7:** "*I think using any other alternative material, government would need to ensure that those houses are neat and look like proper houses Just make sure they look beautiful, they should look like homes. Not small little rooms that don't feel homey. You need to be able to look at that house and feel that this a home… Yes, I do think materials are important but how the house looks, is more important. Because obviously when you judge a house from the outside you can tell if it's a home, or if this is shack…*"

Another participant highlighted government should ensure that going forward, everyone should have their house built using innovative materials as it will ensure equality among beneficiaries.

> **Participant 9:** "*They should build the same for everyone, if it's board houses, then it must be board houses for everyone, if its brick houses then it should be for everyone…*"

### 5.5.1 Summary of findings for research question 3

This section sought to uncover the measures participants believe the government should take to increase the acceptance of innovative building housing among low-income consumers. Many respondents highlighted that they need to be made aware of innovative housing through education. Others expressed that they preferred to gain awareness of the alternative through personal experience with the housing and proposed that government should initiate prototype projects where they would have the opportunity to assess the housing for themselves. Participants also indicated that government should introduce the innovative housing projects gradually as a way to get consumers accustomed to the structures and allow them to evaluate the durability of the structures over a prolonged time. Participants also highlighted that acceptance would improve if the government could demonstrate that the houses' workmanship shows good quality construction. Participants also highlighted that acceptance would increase if the houses were aesthetically appealing and did not look like shacks or look different from traditional brick and mortar housing. Finally, participants highlighted that they would recommend that the government officially have all housing projects produced using innovative materials to prevent inequality among beneficiaries.

## 5.6 Conclusion

This chapter presented the research findings as they pertained to the three research questions outlined in chapter three. The findings indicate that participants demonstrated varying levels of awareness regarding housing produced using alternative materials. The findings showed that participants were aware of but were generally not well-informed about other innovative building systems other than those to which they had been exposed.

When exploring participants' perceptions based on the perceived risk theory, the results indicate that participants perceive many unsatisfactory aspects regarding the performance, financial and social attributes of housing produced innovative building technologies. The results also alluded to material preferences as an important acceptance issue for participants. Specifically, that material preferences are part of the long-standing history of experiences that participants hold onto. The findings also

highlighted factors such as the attractive appearance of housing as an important social factor for participants and a significant influencer of their acceptance decisions. Surprisingly, the results also show that despite consumers' preference for traditional brick housing and the overwhelmingly negative perceptions expressed by participants about housing produced with innovative building technologies, most participants expressed that they would accept housing produced with innovative building technologies.

The findings closed off with an exploration of participant's opinions of what they think the government should do to increase acceptance of housing produced with innovative building technologies in their communities. The findings indicated that participants want information on the housing systems. Participants also sighted the importance of gaining personal experience with the housing systems. They believed that the government should introduce prototypes they can interact with to gain personal experience. The next chapter presents a detailed discussion of the findings.

# Chapter 6: Discussion of results

## 6.1 Introduction

In this chapter the results of the study are discussed in detail with reference to the aim of the study, which was to explore the key attitudes and perceptions of potential recipients of subsidised housing towards low income housing constructed with innovative building technologies. The results are discussed in relation to each research question and present a comparison of the research findings with the extant literature.

## 6.2 Discussion of research question 1

**What do consumers know about innovative building technologies for low-income housing delivery?**

This research question sought to explore consumers' knowledge and awareness of housing produced using innovative building technologies. The question further sought to explore whether consumers' knowledge of innovative building technologies influenced their perceptions and attitudes towards housing produced using innovative building systems.

### 6.2.1 Knowledge and awareness

Talke and Heidenreich (2014) highlighted that one of the barriers to the acceptance and adoption of housing produced using innovative building technologies was the lack of knowledge and awareness of the benefits obtained from the housing systems. The results of the study showed that the overall level of awareness among the participants was high. However, the variation in personal experiences, individual backgrounds, and how participants became aware seem to have had a significant impact on the level of knowledge demonstrated by participants regarding innovative housing. This, in turn, may have corresponded to variation in perceptions and attitudes expressed by participants regarding these housing structures.

Talke and Heidenreich (2014) noted that once a consumer becomes aware of an innovation, it encourages them to seek further understanding of the innovation's attributes. This finding was confirmed by participant six, who indicated making an effort to seek further information about alternative housing systems after becoming aware of them and found that housing could also be produced with material such as cement-filled bottles and foam. Lu et al. (2018) noted that the information consumers receive about an innovation helps them form a favourable or unfavourable attitude toward the innovation. Furthermore, that increased awareness about innovative

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building technology housing systems is positively related to favourable attitudes and the acceptance of innovative building technologies. This finding was also confirmed by participant eleven, who indicated that they became optimistic about innovative housing after finding out more information on alternative housing. The participant described that after seeing an innovative house produced with shipping containers, they sought further information and found that houses could also be produced using other technologies such as additive manufacturing technologies. The participant also indicated that their positive attitude also came from realising that innovative building technologies were the future of housing construction. The study's findings reveal that the theme among the participants who expressed positive attitudes towards housing produced using innovative building technologies was their knowledge which was higher than the other participants.

Kamali and Hewage (2016) described knowledge as a process associated with learning about the technologies' attributes and their benefits. The study's results show that although participants were aware of houses produced with innovative building technologies, participants were largely unfamiliar with these technologies, such as aspects of reduced construction times, indicating that most participants demonstrated no knowledge about these housing systems. This finding also corresponded to observations made by Rahman (2014) that consumers generally have relatively low and sometimes no knowledge regarding innovative building technologies. Talke and Heidenreich (2014) also noted that when a consumer becomes aware of an innovation through an information channel or by actual use of the innovation before acceptance, it encourages them to seek further understanding of the innovation's attributes supplement the information they have already acquired. The study's findings did not support this observation and showed that participants did not seek further information about the housing systems once they became aware. The findings rather supported the argument made by Cornescu and Adam (2013) that rather than seeking out further understanding, consumers sometimes do not accept an innovation based on their existing awareness, making prior judgments that the technology is not appropriate for them.

### 6.2.2 Lack of availability

Azhar et al. (2013) noted that the lack of innovative building technology housing units within the vicinity of housing development locations contributes significantly to the lack of personal experience consumers have regarding these housing systems. The

results strongly indicated a lack of availability of such structures as a possible contributor to participants' lack of knowledge regarding the housing systems. Only one participant could cite their awareness of housing produced using innovative building technologies from a local housing project. The majority of participants indicated having gained awareness of these housing systems through individual initiatives such as social media. One participant stated that they follow a social media page focused on innovative housing produced using corrugated iron. Li et al. (2014) highlighted that the increased awareness about innovative building technology housing systems is positively related to acceptance. Kamali and Hewage (2016) noted that awareness required learning by acquiring information related to the attributes and benefits of the innovation. The process of gaining knowledge about innovative building housing systems was likely to be hindered by the lack of innovative technology housing developments within the vicinity of where participants reside.

### 6.2.3  Uncertainty and risk perceptions

Shuhaiber and Mashal (2019) defined awareness as an understanding of an innovation by the consumer that allows them to reduce their levels of uncertainty. It arguably implies that the lack of knowledge and awareness of the benefits obtained from housing produced using innovative building technologies might have led to higher risk perceptions among participants. The study results indicated that participants' uncertainty about housing produced using innovative building technologies might have also been very closely related to their lack of knowledge. This lack of knowledge might have subsequently corresponded to the increased perceptions of risk. Equally, participants' largely negative perceptions regarding innovative housing on aspects of performance, quality, and financial security might also be false perceptions predicated on participant's overall lack of knowledge about the housing systems. Participant's perceptions of risk are discussed further in the next section.

### 6.2.4  Summary of the discussion of research question 1

The research findings indicate that the participants were aware of housing produced using different types of material but demonstrated a general lack of knowledge of such structures. The findings supported the notion that participants formed their attitudes based on their existing awareness without seeking further information (Cornescu & Adam, 2013). Furthermore, this might have resulted in participants'

largely negative attitudes and perceptions about the housing systems (Lu et al., 2018). However, participants who sought further information once they became aware of the housing systems expressed more positive attitudes and perceptions about the housing systems (Goulding et al., 2015; Li, 2014). This finding was in support of the literature. Furthermore, the findings also indicated the lack of housing developments that use innovative materials within the vicinity of where participants reside as a contributor to participants' lack of knowledge regarding the systems (Azhar et al., 2013). Lastly, participants' uncertainties regarding housing produced using innovative building technologies were very closely related to participants' lack of knowledge.

## 6.3   Discussion of research question 2

**What are consumers' attitudes and perceptions towards low-income housing constructed using innovative building materials?**

The question sought to explore the performance, financial and psychosocial aspects of the perceived risk theory in relation to consumers' perceptions and attitudes towards housing produced using innovative building technologies. The question also sought to uncover new insights regarding the risks that have not been considered in the literature.

### 6.3.1   Consumer attitudes and perceptions and personal preferences

Høibø, Hansen, Nybakk, and Nygaard (2018) noted a relationship between consumers' preferences for specific construction materials and attitudes towards innovative materials. More specifically, consumers express more positive attitudes towards the building materials familiar to them (Vasanen, 2012). The results supported this observation and indicated that if allowed to choose the type of material they would prefer to be used to produce their housing benefit, participants would choose traditional brick materials. The results revealed that familiarity and personal experiences with particular materials played an important role in the participant's preferences for traditional materials (Azhar et al., 2013; Jonsson et al., 2008; Talke & Heidenreich, 2014). The results showed that participants who grew up in homes produced using traditional materials showed higher preferences for the same materials. The results further showed that participant's preferences for traditional materials might also be predicated on increased knowledge and subsequently reduced uncertainty regarding traditional materials (Heidenreich & Kraemer, 2016;

Hubert et al., 2018; Lowe & Alpert, 2015; Mutahar et al., 2018; Shuhaiber & Mashal, 2019). Participants cited that brick had favourable attributes such as increased durability when describing reasons for their material choices. However, an interesting finding is despite participants' insistence that their preference for bricks was based on the favourable attributes of bricks. The results indicate that without sufficient knowledge about the attributes of alternative materials, participants were less likely basing their preferences for traditional materials on actual differences in material attributes and characteristics. Rather the results show that participant's preferences stemmed purely from familiarity and a strong aversion to change (Jonsson et al., 2008; Mutahar et al., 2018; Talke & Heidenreich, 2014). The findings also indicated a general reluctance among participants to take on the risk of trying new materials as indicated by the little variation in the participants' preferences for traditional building materials.

Lähtinen et al. (2019) noted that sensory attributes distinguish alternative materials from traditional materials. Furthermore, this distinction also influences consumers' preferences and acceptance decisions towards housing produced using alternative materials, more specifically that consumers perceive aesthetical differences in houses produced with alternative materials, causing them to become unwilling to live in alternative houses. The results found that participants did not base their material preferences on the association of brick housing with increased aesthetical qualities. Contrary to these observations, the findings showed that participants alluded to aesthetic qualities primarily when considering the acceptance of innovative housing. Participants who preferred housing produced using innovative building technologies favoured them because they found them aesthetically more attractive than traditional brick housing, indicating the importance of aesthetic qualities as a motivator for participants' willingness to accept alternative housing (Lähtinen et al., 2019; Olojede et al., 2019).

In summary, the results confirm the claims made in the literature regarding the preferences of South African low-income housing beneficiaries for traditional brick and mortar materials. The findings also confirm that these preferences stem from various reasons, including familiarity, personal experience, increased knowledge, and reduced uncertainty regarding traditional materials. Furthermore, that participant's material preferences also stem from opposition to changes. Lastly, that

aesthetic qualities contribute significantly to participants' willingness to accept alternative housing.

### 6.3.2 Consumers attitudes and perceptions of improvement to current circumstances

A new insight to the study was that most participants who expressed positive attitudes towards innovative housing expressed that their reasons for accepting the innovative housing structures the innovative housing benefits would result from their current circumstances. The findings indicate that participants' willingness to accept generally originated from a place of appreciation for having received a house. Participants cited reasons such as feeling stranded and destitute to find housing constructed using innovative building technologies acceptable. Many of the participants lived in poor and uncomfortable conditions. These results indicated that despite their preference for traditional brick and mortar housing, these participants would be willing to accept housing produced with innovative building housing systems because it would improve their living circumstances.

The results indicated that participants' acceptance of housing produced using innovative building technologies might have also been based on the negative experiences and poor qualities of conventional low-income. Participants highlighted their negative experiences of conventional low-income housing having poor performance aspects and workmanship (Charlton, 2009; Manomano et al., 2016; Ratshitanga, 2017; Tissington et al., 2013). Participants' dissatisfaction with the quality of the material used in making subsidy housing could indicate that participants favour innovative materials may not necessarily be a direct preference for alternatives but rather a preference for the indirect benefits that could be received through alternative housing structures. Furthermore, participants might recognise the potential of innovative materials to improve the workmanship and quality of their housing benefits. It also indicated that some participants may not necessarily hold specific material preferences but will accept housing to avoid their present negative experiences.

### 6.3.3 Consumer attitudes and perceptions of the performance of low-income housing constructed using innovative building technologies

Rahman (2014) noted that the type of materials and components used in the production of innovative housing systems often lead consumers to perceive that the houses were less durable and of inferior quality. The findings confirmed this

observation and showed that participants believed that low-income housing produced using innovative building technologies would be of more inferior quality than those produced using traditional brick and mortar methods. Zhang et al. (2018) noted the advantage of innovative housing for ease of repair and maintenance. However, contrary to this observation, participant four expressed that since they perceived that the materials used in the production of innovative housing would be inferior to bricks, the houses would require constant maintenance to keep them in good condition. Eyiah-Botwe et al. (2018) and Steinhardt and Manley (2016) noted that consumers associated innovative housing produced with temporary structures. Furthermore, this had the effect of giving consumers the impression that the buildings had a shorter life-cycle expectancy than buildings produced with traditional materials. This finding was consistent with the study results. It was supported by participant four, who expressed that housing produced innovative building technologies should only be used as temporary structures rather than a permanent solution for low-income housing.

Talke and Heidenreich (2014) noted that consumers experienced performance uncertainty when they perceived a technology's attributes as dysfunctional or inadequate to meet their personal needs. The study's findings indicated that participants had concerns regarding functionality aspects of innovative housing, such as the structural durability of the houses. Participants expressed that they were uncertain that houses produced with alternative materials would be suitable for harsh weather conditions. Participants also expressed that they perceived the houses would easily collapse when exposed to heavy rains and strong winds. Furthermore, most participants believed that the innovative houses were not safe because of the perceived poor quality of materials used. The results showed that participants also perceived that the structures would be inadequate to keep burglars from breaking into their homes. Furthermore, participants also expressed that they perceived alternative structures as highly flammable and would not allow them to continue cooking on gas stoves.

Bildsten (2011) noted that consumers expressed that performing structural changes, renovations, and extensions would challenge when houses are produced with innovative technologies. This study's findings indicated that contrary to this observation, participants expressed largely positive attitudes about aspects of customisation of housing produced using innovative building materials. Participants

indicated that they perceived it would be simpler to extend and renovate innovative housing because of the perceived ease of availability of the materials that would be used to produce them. This finding indicates that acceptance issues might arise once participants realise that innovative building systems do not allow for easy customisability.

Arch (2019) noted that consumers' perceptions regarding housing produced using innovative building materials were largely negative. The findings of the study supported this observation to a great extent. The findings indicated that participants generally have negative perceptions regarding innovative housing performance related to aspects of quality, structural durability, and safety. Participants also perceived high risks associated with the acceptance of innovative housing as a result of these perceptions. The results, however, also indicated that some participants expressed positive attitudes and perceptions towards innovative housing. These participants, although significantly fewer, alluded to aspects such as safety. They indicated that they perceived innovative housing to be safe because they had never heard of or personally experienced an incident where an innovative school or clinic structure was said to have collapsed. The importance of this finding again indicates the influence of personal experiences on participants' attitudes. More specifically, positive personal experiences with alternative materials are a determinant of future positive perceptions and attitudes.

The study's findings indicated varying but overwhelmingly unfavourable attitudes and perceptions about the performance of innovative housing. Most participants indicated high perceptions of risk and unfavourable attitudes towards the quality, structural durability, and safety of housing produced using innovative building technologies. The findings agreed with the literature and indicated that participants place quality as an essential condition for their material preferences and, ultimately, their willingness to accept housing produced with innovative technologies. The effects of knowledge and awareness may, however, also have some bearing on these results. Particularly, participants' uncertainties about the quality, structural durability, and safety of housing produced using innovative building materials might have been amplified by participant's lack of knowledge about these housing systems. The results indicate correspondence with observations that Claudy et al. (2015) made, stating that it is primarily in the early stages of the adoption process when consumers

lack knowledge of the technology that they perceive higher risk associated with the innovations.

### 6.3.4 Consumers' attitudes and perceptions regarding financial aspects

Steinhardt et al. (2013) noted that consumers were often concerned about the resale value of houses constructed using innovative building technology systems. Furthermore, Arch (2019) observed that consumers who already perceived risks associated with alternative housing performance were also more likely to believe that accepting housing produced with innovative technologies would pose a significant financial risk. The findings of the study supported this observation. The results showed that in addition to their high perceptions of risk associated with the performance aspects of innovative housing, participants also perceived high financial risks associated with accepting innovative housing. The results indicated that participants expressed largely negative attitudes about the value of a house produced with innovative materials and stated that they perceived the houses would be of a lower value than those produced with traditional methods.

Furthermore, participants expressed that the value of an innovative house would be assigned to the land it was built on rather than the actual house itself because of the materials used to produce it (Arch, 2019; Steinhardt et al., 2013). Bildsten (2011) noted that consumers were uncertain about the potential value of the components used in innovative housing production. Bildsten (2011) further stated that this uncertainty caused consumers to become fearful of committing to something with an unknown value. Participant four supported this finding by indicating that they believed investing money into an innovative house through renovations and upgrades would not help improve the house's value. They further indicated that this was the case because they perceived the materials used to produce innovative housing to be inferior and of little value. Participant thirteen went on to say that innovative housing would be less valuable than brick housing because, living in a house produced using alternative materials was equivalent to living in a shack, thereby assigning no value to innovative houses on account of the materials used to produce them.

Charlton (2009) noted that the purpose of the subsidy housing programme was to enable beneficiaries to move progressively up the property ladder by selling their house and purchasing better housing as their lifestyle and financial circumstances improved. The study results indicated that contrary to the above literature, although participants perceived alternative housing to be less valuable than brick housing,

they expressed that the resale value of their house was not an immediate concern. Participants highlighted that financial implications related to an innovative house's resale value would only matter to them if they had intentions of selling their house in the future. The findings indicated that participants had no intentions of selling their houses once they received them, contrary to the literature. Participant fifteen went on to say that they believed subsidy houses should not be sold but should be passed down to generations that follow.

An additional theme that emerged in the findings regarding perceived financial risks was concerned with financial institutions, specifically with observations made by Pan, Gibb, and Dainty (2008) that insurance and financial institutions hold negative perceptions about housing produced using innovative building materials. Participant six indicated that financial institutions' support of innovative housing would be an essential factor for their acceptance decision. This finding was important because it implied that if participants became aware of financial institutions' resistance to recognise innovative housing, it would potentially discourage recipients from accepting the houses (Charlton, 2014; Olojede et al., 2019; Pan et al., 2012).

The findings discussed above indicated that participants generally perceived high risks associated with the value of houses produced with innovative technologies. The interview data analysis also uncovered additional findings where participants expressed positive attitudes and perceptions towards the financial aspects of innovative housing. These participants, although significantly fewer, alluded to aspects such as costs of maintenance. Hubert et al. (2018) noted that one of the benefits of housing produced using innovative building technologies was their lower cost of maintenance due to the improved quality and design associated with these structures. This observation was supported by participant seven, who highlighted that they believed the cost of maintaining or renovating an innovative technology house would be less because of the perceived ease of availability of the materials used to produce them.

In summary, the findings indicate that participants hold negative attitudes and increased perceptions of financial risk regarding housing produced with innovative building technologies. More specifically, participants perceived housing produced with innovative building technologies to be of a lower value than houses produced with conventional brick materials. However, the findings indicated that participants would not have an immediate concern regarding their subsidy house's resale value

because they had no intentions of selling the houses they receive. Considering that participants indicated high perceptions of performance risk and negative perceptions regarding the quality, structural durability, and longevity of housing produced using innovative building technologies. It was interesting to note that, contrary to Tshivhasa and Mbanga's (2018) findings, participants did not express concerns that the housing systems would pose a threat to their financial security because it would not last long enough to be passed on as an inheritance.

### 6.3.5  Consumers' social attitudes and perceptions of psychosocial risk

#### 6.3.5.1  Psychosocial attitudes and family approval

Ram and Sheth (1989) noted that consumers often do not accept an innovation because they feel that they will face ridicule or ostracism by family and peers. Furthermore, Cotte and Wood (2004) highlighted that an individual's family could influence the decision and willingness to accept an innovation. The findings showed a balance between participants who expressed that they thought their families would be happy to see them living in an innovative house and those who thought their families would not be happy for them. The most highly cited reason was that they felt their families would be happy to see them finally receiving a house, irrespective of the type of material used to produce the house. The results indicated that despite the overwhelmingly negative perceptions concerning the performance, safety, and financial aspects of housing produced using innovative building technologies, most participants would accept housing produced using alternative materials, and their families would be happy for them.

Among the participants who indicated that they believed their families would not be happy for them, a few expressed that their families' lack of happiness would stem from a lack of understanding of alternative housing structures. Furthermore, their families would fear for their safety due to the negative perceptions about the structural performance and durability of alternative housing. These findings indicated that participants also understood the importance of knowledge and awareness for improving the attitudes and perceptions expressed by their families. Participants expressed that they would need to educate their family members to get them to be more accepting of them living in innovative housing systems. Participants also expressed that they felt their families would not be happy because the family would not see it as an improvement to their current circumstances. Simpson et al. (2012)

noted that individuals could be directly or indirectly influenced by others' beliefs, attitudes, perception, and preferences even when their decisions would be made independently. Furthermore, Frambach and Schillewaert (2002) noted that the effects of social norms might play a significant role in consumers' acceptance decisions, particularly when individuals feel the need to go along with others' opinions. However, the study results found that contrary to this literature, participants felt that although their families would not be happy for them, they firmly believed that it would not influence their decisions to accept the innovations.

In summary, most participants indicated that they thought their families would be happy for them. That contrary to the literature, participants did not believe that they would face ridicule or ostracism by families if they choose to accept innovative housing (Ram & Sheth, 1989). Furthermore, contrary to the literature, their families' opinions would not influence their decisions to accept innovative housing. The results also indicated that although participants hold negative perceptions regarding housing produced using innovative building technologies, the potential to improve current circumstances would significantly influence their decision to accept than their increased perceptions of risk (Laukkanen et al., 2007).

### 3.3.5.2 Psychosocial attitudes and community approval

Lategan (2012) noted that the acceptance of innovative building housing was a process that occurred at both the individual and community level. Furthermore, Frambach and Schillewaert (2002) highlighted the effects of social norms as significant influencers of consumer acceptance decisions. Steinhardt et al. (2013) also found that because communities considered anything which is not traditional as substandard, they would be uncertain about accepting housing proposals that incorporate innovative building systems and technologies. When participants were asked if they believed their community members would accept housing projects that used innovative building technology, participants indicated that they believed other members in their community would accept them. The reasons were largely because participants believed that it would present an improvement to their current living conditions and enable more people to have access to housing sooner.

However, some participants believed that members of their communities would not accept housing produced using innovative building technologies. Claudy et al. (2015) noted that new technologies often forced consumers to deviate from deeply entrenched social and traditional norms, leading to strong adverse responses from

consumers. Participant fourteen supported this and indicated that they believed their community would not accept housing produced using innovative building technologies because of their beliefs that a house must be constructed using bricks.

Rohe and Lindblad (2013) also noted that a home might also build a sense of community belonging. Furthermore, Zavisca and Gerber (2016) indicated that houses could also equally introduce or amplify the stratification among individuals in a community based on wealth where communities favour housing produced using traditional methods and stigmatise individuals who choose to accept innovative housing. Zavisca and Gerber (2016) further highlighted that this stratification among community members often led to feelings of inequality. This finding was supported by participant nine, who indicated that if the government intended to introduce innovative housing into communities, it should ensure that all community members are given the same type of house. The participant indicated that they would feel marginalised if they discovered that they had been given innovative housing systems while other community members had received traditional brick housing. This finding also highlighted the importance of the community identification processes. It showed that although indirect, community identification could significantly impact participants' attitudes and acceptance decisions (Frambach & Schillewaert, 2002). Furthermore, forcing some groups to violate their traditional norms and not enforcing the same changes on other groups would evoke adverse reactions by community members (Claudy et al., 2015).

In summary, the findings indicated that most participants believed that their community members would accept housing produced using innovative technologies because it would improve their current living conditions and enable more people to have access to housing. The findings indicated that participants recognised the attachment that their communities had towards traditional brick materials and their unwillingness to deviate from these traditional norms. The results also indicated that participants would feel marginalised if they discovered that they had been given innovative housing systems while other members of their communities received traditional brick housing, supporting the literature that indicated that housing could introduce or amplify stratification among community members, leading to feelings of inequality (Rohe & Lindblad, 2013; Zavisca & Gerber, 2016).

### 6.3.5.2 Type material and perceptions of wealth and social status

Zavisca and Gerber (2016) noted that housing presented both an investment value and use value to consumers that represent an extension of themselves, unlike other financial assets. Furthermore, the use value of a house can allow individuals membership to social groups and thereby promote their social standing. The study's findings were in agreement with the literature and found that participants perceived the type of materials used to produce their house as a reflection of their social status. The literature was supported by participant two, who expressed that when others perceive their house to be beautiful, these perceptions enhance their social status within their community and self-esteem. Rapoport (2000) also indicated that housing could play an essential role in communicating status. Furthermore, the type of materials used in the production of a house has intrinsic and cultural meaning and might often also communicate identity. The findings indicated that participants believed that the type of house they lived in signaled to others who they are. Furthermore, traditional brick materials functioned as a communicative aspect, gesturing to others that they are part of society's upper classes because building with bricks was perceived to be expensive (Rapoport, 2000). The results also indicated that participants associated the type of materials used to produce their house to show distinctiveness from other people according to social status and wealth. Furthermore, the type of materials used to function as visual clues that influence how participants view themselves and others, further illustrating the connection between participants' materials preferences and their identity (Frambach & Schillewaert, 2002; Høibø et al., 2015).

The findings, however, indicated that some of the participants believed that the type of material had nothing to do with social status stating. Reflecting on their current circumstances, some participants expressed that accepting an innovative house would not be any more detrimental to people's perceptions of their social status and wealth, indicating that their circumstances were already dire.

In summary, the findings indicated that participants associated the type of materials used to produce their housing benefits with social status and wealth, and self-esteem. Furthermore, social identification would significantly influence participants' attitudes towards housing produced with innovative building technologies and their decisions to accept or reject them.

### 6.3.6 Summary of the discussion of research question 2

The results confirm the literature claims regarding the preferences of South African low-income housing beneficiaries for traditional brick and mortar materials. The findings also confirm that these preferences stem from personal experience, increased knowledge, and reduced uncertainty regarding traditional materials. Furthermore, that participant's material preferences also stem from opposition to changes in traditional norms. The findings correspond to the literature regarding the varying but overwhelmingly unfavourable attitudes and perceptions about innovative housing performance, as most participants indicated high perceptions of risk and unfavourable attitudes towards the quality, structural durability, and safety of housing produced using innovative building technologies. Again, these uncertainties about housing produced using innovative building materials might have been amplified by participants' lack of knowledge (Mutahar et al., 2018).

When exploring participants' attitudes and perceptions concerning financial aspects of housing produced using innovative building technologies, results indicated that participants perceived high financial risks regarding low-income housing produced using innovative building technologies. Participants expressed negative attitudes regarding the value of alternative housing. However, contrary to the literature, participants had no intention of selling their housing benefits. Though participants expressed that they perceived alternative housing to be less valuable than traditional brick housing, this was not an immediate concern. Regarding the cost of renovations and maintenance relative to traditional brick housing, participants had varying perceptions. However, they primarily indicated that they perceived the cost of maintaining or renovating an innovative technology house would be less than for a traditional brick house.

When exploring participants' social attitudes, the findings indicated that participants believed their families would be happy for them. Contrary to the literature, they did not feel that they would face ridicule or ostracism by families if they choose to accept it (Ram & Sheth, 1989). Furthermore, while participants might have held negative perceptions regarding housing produced using innovative building technologies, the potential to improve current circumstances significantly influenced participants' acceptance decisions. Participants also indicated that communities would accept housing produced using innovative building materials. Again, it would present an

improvement to their current living conditions, enable more people to have access to housing, and reduce lengthy waiting perioids they would otherwise have to endure.

The findings on the impact of innovative housing on perceptions of their wealth and social status indicated that participants associated the type of materials used to produce their housing benefits with social status, wealth, and self-esteem. Furthermore, that social identification would function as a significant influencer of participants' decisions to accept housing produced with innovative technologies.

The results also revealed that participants would be grateful to receive innovative housing. Participants would choose to accept housing produced using innovative building technologies because they prioritise improving their current circumstances over maintaining traditional and social norms regarding materials preferences. Moreover, that the opportunity to improve their circumstances overshadows their increased perceptions of risk and influences of their acceptance decisions to a greater extent.

## 6.4  Discussion of research question 3
**What are the challenges that the public believes the government still needs to overcome to promote and achieve greater consumer acceptance of innovative building technologies for low-income housing?**

The question sought to determine consumers' opinions on the measures that government needs to take to promote the attractiveness acceptance of housing constructed using innovative building technologies.

### 6.4.1  Strategies to improve consumer attitudes
Mutahar et al. (2018) noted the importance of educating community members where innovative building technologies for low-income housing projects are introduced. Usadolo and Caldwel (2016) further highlighted that the nature of education should inform the potential recipients and community leaders regarding both the advantages and disadvantages of the housing systems. The study's findings corresponded to the literature and indicated that participants required that government increase its efforts in educating potential recipients about innovative housing systems. The findings indicated that the nature of education that participants perceive as valuable is the kind that informs them on aspects such as quality, the types of materials used in the production of components, and the durability of the structures in bad weather conditions.

Participants also indicated that they wanted to be informed about the structures' maintenance and if the structures would be customisable (Arch, 2019; Bildsten, 2011; Jensen et al., 2019; Steinhardt et al., 2013). These results indicated that participants required the sort of information that will allow them to reduce their levels of uncertainty (Claudy et al., 2015; Heidenreich & Kraemer, 2016; Hubert et al., 2018; Lowe & Alpert, 2015; Mutahar et al., 2018; Shuhaiber & Mashal, 2019). Participants alluded to the belief that raised awareness through active and engaged participation is often neglected in social transformation programmes projects. Participants also indicated that they believed that government often takes the process of raised awareness for granted. That little consideration is given to the individual challenges and contexts experienced by participants. The findings also indicated that participants do not want to feel pushed into accepting projects without knowing how these structures might alter their lives.

Lauff et al. (2018) highlighted the importance of prototypes as a valuable strategy for increasing knowledge transfer, enhancing communication, and improving people's prospects of making more informed decisions. The findings in the study corresponded to the literature as a significant number of participants highlighted the need for government to build prototype houses to help them physically interact and assess the housing systems. Participants indicated they also wanted to witness other people living in the systems before making their acceptance decisions. The findings indicated that in addition to wanting more information on the systems to increase their knowledge and awareness of innovative housing, participants wanted these housing systems made available to initiate the process of gaining personal experience (Azhar et al., 2013).

Pan and Goodier (2012) noted that incorporating innovative technologies with traditional building methods and conventional house designs could also be an effective strategy for promoting acceptance among potential recipients. The study results supported this finding and indicated that it was necessary to participants that their housing benefits look like actual houses and not shacks. Considering participants' strong preferences for conventional brick materials, it might be worth considering ways to use conventional materials such as plaster on the exterior surfaces of housing to help make alternative housing structures appear more like traditional structures. Furthermore, the results showed that participants needed to know that government would ensure that innovative housing were structurally sound.

The results also showed that participants want the government to ensure that innovative housing reduces poor workmanship issues generally associated with low-income housing. This finding also indicated that increasing acceptance requires the government to be strict in monitoring alternative housing structures and ensure that they meet Agrément certification requirements and National Home Builders Registration Council standards (Olojede et al., 2019).

Interestingly, despite the indication that personal material preferences are also an acceptance issue for beneficiaries, participants did not express that they wanted to have a say on the types of material and technology used in producing their housing benefits. Instead, a few participants highlighted the issue of ensuring that the buildings are aesthetically appealing. However, the participants' requirement for aesthetic appeal might deal with the issue of personal preferences raised in previous sections. It potentially indicates the need to involve participants in selecting the materials and technologies they find most suitable to meet their personal preferences of aesthetic quality. This finding also supports Lähtinen et al. (2019), who noted the importance of aesthetics and sensory attributes as an influencer of consumers' acceptance decisions regarding housing produced using alternative materials.

### 6.4.2 Summary of the discussion of research question 3

In summary, the findings validate a significant number of the claims found in the literature. These results indicated the need for government to increase education efforts. Furthermore, that participants require the kind of information that will help them reduce their levels of uncertainty and perceptions of risk about the housing systems (Claudy et al., 2015; Heidenreich & Kraemer, 2016; Hubert et al., 2018; Lowe & Alpert, 2015; Mutahar et al., 2018; Shuhaiber & Mashal, 2019). The results also indicated the need for government to build prototype houses that individuals can physically interact with to gain personal experience with the housing systems (Azhar et al., 2013).

## 6.5 Conclusion

This chapter presented a discussion of the findings of the study. The findings supported the insights gained from the literature. They showed that participants were aware of housing produced using different types of material but demonstrated a lack of knowledge about the relevant benefits and attributes of housing produced using innovative building technologies (Kamali & Hewage, 2016). The findings further

revealed evidence supporting the literature that alluded to the idea that participants formed their attitudes based on their existing awareness without seeking further information (Cornescu & Adam, 2013). However, the findings extend the literature by indicating that although participants lacked knowledge regarding housing produced with innovative building technologies, their lack of knowledge did not function as a strong enough deterrent to their acceptance decisions. The results indicated that participants were willing to accept innovative housing despite their high levels of uncertainty predicated on their lack of knowledge about the systems.

The chapter then proceeded with a discussion of participants' material preferences. The results revealed a strong link between participants' acceptance decisions and the type of materials used in the production of their housing benefits (Høibø et al., 2018; Tshivhasa & Mbanga, 2018). The results supported the literature by explicitly revealing that South African low-income housing beneficiaries prefer traditional brick and mortar materials (Grady, 2019; Lategan, 2012; Otieno, Liyala, Odongo, & Abeka, 2016; Ratshitanga, 2017; Tshivhasa & Mbanga, 2018). The findings also confirmed observations from the literature that indicated that participants' preferences stem from a cultural attachment to traditional materials and a strong reluctance to change traditional norms (Claudy et al., 2015; Talke & Heidenreich, 2014).

The chapter then discussed participants' attitudes and perceptions of the performance, financial and social aspects of housing produced with innovative building technologies. The findings correspond to the literature regarding the overwhelmingly unfavourable attitudes and perceptions about the quality, structural durability and safety of housing produced using innovative building technologies. Participants also perceived high financial risks and expressed negative attitudes regarding the value of alternative housing. However, the findings extend the literature through the insights that contrary to the literature, participants had no intention of selling their housing benefits and although they expressed that their alternative housing benefits would be less valuable than traditional brick housing, this was not a significant concern for most participants. The findings also revealed that the largely negative perceptions expressed by the participant's regarding housing produced using innovative building technologies on aspects of performance, quality and financial security might also be false perceptions predicated on participant's overall lack of knowledge about the housing systems.

The findings showed that participants believed that communities would accept housing produced using innovative building materials when exploring participants' social attitudes. However, participants indicated that they believed the type of materials used in the production of their houses would influence people's perceptions of their social status and wealth. Generally, the results indicated that although participants held negative perceptions regarding the performance, financial and social aspects of housing produced using innovative building technologies, they would still accept housing produced with alternative materials because it would improve their current circumstances.

This was then followed by discussing what the government can do to promote low-income housing produced with innovative technologies. The findings supported the literature and indicated that most participants cited the need to increase education efforts. The results also highlighted the need for government to build prototype houses. Furthermore, that participants required that their houses be aesthetically appealing and ensure quality workmanship to promote acceptance.

The following chapter presents the conclusions of the research paper.

# Chapter 7: Conclusion and recommendations

## 7.1 Introduction

The study was predicated on the discovery from the literature that low-income housing was not satisfying the housing need in South Africa (Gunter & Manuel, 2016). The options to remedy the situation included the adoption of housing produced with innovative building technologies. However, implementation of these housing systems has been largely unsuccessful due to South African consumers' low levels of acceptance (Department of Human Settlements, 2017; Olojede et al., 2019). Therefore, it was essential to directly explore consumer attitudes and perceptions of housing produced with innovative building technologies to understand the reasons behind their reluctance to accept these housing systems.

This chapter presents this research paper's conclusions by summarising the findings and their implications for government, business, and theory. The limitations of the research are also discussed, together with recommendations for future research.

## 7.2 Summary of the research findings

This research successfully answered the research problem as outlined in chapter one regarding attitudes and perceptions of potential recipients towards low-income housing constructed with innovative building technologies. The key findings can be summarised into three major areas as outlined by the research questions proposed in chapter three, namely that participants were aware of housing produced using innovative building technologies, but they had little knowledge about the attributes and benefits of housing produced with these technologies. Secondly, consumers perceived high risks associated with accepting innovative housing. Finally, the most important strategy to promote innovative housing would be for the government to educate communities about the housing systems and build prototype houses to allow consumers to gain personal experience with the housing systems.

### 7.2.1 Knowledge and awareness on consumer attitudes and perceptions

The main reason for consumers' reluctance to accept housing produced with innovative building technologies stems from the lack of knowledge about the housing systems technologies (Goulding et al., 2015). The findings indicated that rather than seeking further information, participants formed negative attitudes towards innovative hosing based on their existing knowledge and awareness of the

technology, making prior judgments that the technology is not appropriate for them before seeking information on the systems (Cornescu & Adam, 2013). The findings indicated that knowledge concerning the benefits and challenges of the technology plays a crucial role in participants' attitudes and perceptions. Furthermore, the large proportion of participants who expressed predominantly positive attitudes towards housing produced with innovative building technologies also demonstrated higher levels of knowledge about the housing systems. The findings provide crucial insight, namely that the low levels of knowledge about innovative housing systems are likely to be the reason behind participants' lack of regard concerning these technologies. Equally, the need to overcome the lack of knowledge to enhance consumers' attitudes and reduce their perceptions of risk towards these housing systems among consumers.

### 7.2.2  Attitudes and perceptions of risk

The study showed that consumers perceive high risks associated with accepting housing produced with innovative building technologies. These findings are in line with most previous empirical studies (Claudy et al., 2015; Hubert et al., 2018; Lowe & Alpert, 2015; Talke & Heidenreich, 2014). The findings indicated that participants' risk perceptions are mainly related to performance aspects such as quality, structural durability, and safety. It was found that participants perceived the houses constructed using innovative building technologies to be of inferior quality, more prone to structural defaults when exposed to harsh weather conditions, and pose increased safety risks to residents. The findings also indicated that participants' material preferences might be related to quality and durability (Steinhardt & Manley, 2016). Participants perceived conventional brick materials to be more durable than materials used to produce innovative housing. Participants also perceived housing produced with innovative building technologies as less valuable than housing produced with brick and mortar.

The study provides some key insights, firstly that although participants perceived the value of innovative housing to be less than that of brick housing, that this would not significantly affect their willingness to accept innovative housing as consumers believe that the value of the house is only important if one intends to sell it. As shown in the results, participants expressed that they had no intentions of selling their housing benefit and thus the resale value thereof would not be an immediate concern. Secondly, although participants expressed increased perceptions of

performance and social risk associated with innovative housing, these negative attitudes would not prevent them from accepting alternative housing. The findings indicated that consumers value alternative housing for its potential to improve their living conditions and would thus be willing to accept the housing on that basis. Equally, the heightened risk perceptions and negative perceptions were likely to be false perceptions predicated on participants' overall lack of awareness about the housing systems.

The study found that participants have strong preferences to have their houses produced with bricks. This finding was in accordance with the observations of Tshivhasa and Mbanga (2018), Lategan (2012), and Grady (2019). The study also confirmed participants' preferences for specific materials related to their personal experiences, familiarity, increased knowledge, and reduced uncertainty regarding traditional materials. Furthermore, that participants' material preferences also stem from opposition to changes in traditional norms. The findings further indicated that participants' material preferences also stem from aspects related to psychosocial factors where brick materials are perceived as indicators of their social status and wealth. These findings provide a few key insights Firstly, certain types of materials may increase acceptability levels for different consumers and potentially signal that consumers will be more likely to reject housing produced using innovative building that appears significantly different from those produced with bricks and mortar. Secondly, there is an incogruency between participants' preferences for traditional materials and their perceptions of the benefits offered by alternative housing, which leads them to be reluctant to accept alternative housing. Lastly, this incogruency is likely influenced by a lack of knowledge rather than an outright rejection of innovative housing (Heidenreich & Kraemer, 2016).

### 7.2.3  Strategies to improve consumer acceptance

A recurring theme has underpinned the study's findings, namely that knowledge and awareness were an essential influencer of participants' attitudes and risk perceptions. Secondly, these attitudes and perceptions played an essential role in determining consumers' willingness to accept housing produced using innovative building technologies. The findings of this study also indicated that participants value education as an essential promotion strategy to increase their willingness to accept. The findings also indicated that giving participants more information on aspects such as quality and durability of the housing would effectively address some of their risk

perceptions and may allow them to have increasingly more favourable attitudes towards innovative housing. The findings also suggested that participants valued the type of knowledge they could gain from interacting with the alternative housing through prototypes that supported claims found in the literature.

## 7.3  Contributions to theory

Previous research focused on adopting innovative building technologies based on the technical and systematic variables for innovation adoption decisions (Lowe & Alpert, 2015; Verdegem & De Marez, 2011). A significant contribution has been made by focusing on consumers, particularly on aspects of consumer attitudes and perceptions concerning low-income housing produced with innovative building technologies. The application of the perceived risk theory within the broader context of knowledge and resistance to change, the research was able to identify that the attitudes and perceptions consumers held towards housing produced with innovative building technologies remained primarily negative. A further contribution was the addition to theory regarding consumers' reluctance to accept housing produced using innovative methods where the findings highlighted that consumers' reluctance to accept was primarily based on low levels of knowledge and understanding rather than an outright active rejection of the actual housing. The research was also able to show that a lack of knowledge can enhance consumers' perceptions of risk concerning housing produced with innovative building technologies. Furthermore, providing the kind of education that enables consumers to reduce their perceptions of risk can improve their willingness to accept innovative housing.

## 7.4  Implications for government and technology developers

Chapter one highlighted that the study intended to help innovative building technologies decision-makers and stakeholders formulate effective promotion strategies. Several practical implications can be drawn from this study. Implementers of innovative housing projects are advised to focus their efforts on ensuring that they provide sufficient education to potential recipients. Furthermore, project implementers should ensure educational efforts address the different aspects of risk expressed by consumers. The increased levels of knowledge and awareness will help reduce beneficiaries' risk perceptions regarding innovative housing. Another proposal for project implementers is to create prototypes and allow potential beneficiaries access to these prototypes before the commencement of alternative

housing projects. In the study, participants indicated the importance of prototypes in supplementing the process of gaining knowledge to gain personal experience with the materials used and the design of alternative housing.

The study gathered information about consumers' perceptions and attitudes towards different aspects of risk, including performance, financial, and psychosocial risk. This approach can also be adopted before project implementation. Project managers could work with researchers to formulate a profile of beneficiary risk perceptions and use it to adjust their implementation activities. The advantage of measuring beneficiaries' attitudes and perceptions of risk is that it will allow for improved segmentation and positioning, enhancing promotional strategies. It could also help project implementers develop an adjustable marketing mix based on participants' perceptions of risk and attitudes. The deeper the knowledge of a consumer's risk perception, the easier it is to propose personalised marketing activities.

As the study and the existing literature showed, consumers have strong preferences regarding the type of materials used in the production of their housing benefits (Claudy et al., 2015; Grady, 2019; Mani, 2018; Oldfield, 2015). This study's findings showed that certain types of materials might not be desirable for different consumers. The results also indicated that ensuring that the housing structures' aesthetic qualities and appearance meet the expectations and preferences of consumers could significantly enhance their willingness to accept. In other words, technology developers should aim to enhance the preferred attributes that consumers place importance on during product development and emphasize these enhanced attributes during promotional and educational efforts.

## 7.5 Limitations

As mentioned in chapter four, the qualitative and exploratory nature of the study lent itself to a few limitations. Firstly, the researcher acknowledges the potential for subjectivity from the researcher's personal biases to have influenced the research findings. Further limitations include:

- The sample consisted only of participants from Soweto, which could have had an impact on the generalisability of the research findings to other settings as the sample population might not be representative of the larger low-income market in South Africa (Muhoro, 2015).

- The researcher was not expertly trained in interviewing, which may have impacted the quality of the data collected.
- The nature of the data collection method utilised semi-structured interviews. It relied on participants' accounts, which may have been subject to poor articulation due to language barriers.
- Translating the interviews into English from vernacular may have resulted in the loss of meaning of interview data during the transcription process (Polkinghorne, 2007).

## 7.6  Suggestions for future research

Through the insights gained from the findings of this research, the following suggestions are made for future research:

- Since housing projects are implemented at a community level and require collective acceptance, research could explore the role of social influence on consumers' attitudes and perceptions of alternative housing.
- The study also identified material preferences and potential acceptance issue for participants, research could further investigate consumers' willingness to accept housing produced with specific materials such as wood or corrugated iron sheets

## 7.7  Conclusion

The literature highlighted that "innovations often failed because too much attention was still given to technical aspects without considering the most critical parameters of consumer acceptance" (Verdegem & De Marez, 2011). The potential for innovative building technologies to improve South Africa's housing delivery has not been realised, and implementation remains low due to low levels of consumer acceptance by communities (Grady, 2019; Lategan, 2012; Olojede et al., 2019). Despite this, little comprehension exists on consumer attitudes and perceptions and how they affect consumers' willingness to accept housing produced using innovative building technologies.

The current research set out to close this gap. The findings from 17 interviews with potential low-income housing beneficiaries uncovered that knowledge, attitudes, and perceptions related to housing produced using innovative building technologies differed among participants. The findings indicated that consumers' attitudes and perceptions regarding housing produced with innovative building technologies were

largely negative due to increased risk perceptions. The results also showed that despite these negative attitudes and perceptions, participants were still willing to accept housing produced using innovative building technologies because of their potential to improve many participants' living conditions. Lastly, the negative attitudes and perceptions might have been primarily predicated on a lack of knowledge about the housing systems rather than an outright active rejection of the housing systems themselves. Thus the evidence provided in this study emphasizes the need for project implementers to increase their efforts in educating consumers about innovative housing to promote and increase acceptance.

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# Appendices

## Appendix 1: Participant consent Form

<table>
<tr><td><strong>PARTICIPANTS INFORMATION &amp; INFORMED<br>CONSENT DOCUMENT</strong></td></tr>
</table>

**Study Title:** Barriers to technology acceptance: building technologies for low-cost housing

**Principal Investigators:** Shweshwe Ndlovu

**Institution:** Gordons Institute of Business Science

**DAYTIME AND AFTER-HOURS CONTACT NUMBER:**

**Cell number: (+27) 79 581 0736   email: 15352252@mygibs.co.za**

**DATE AND TIME OF FIRST INFORMED CONSENT DISCUSSION:**

| | | | | : |
|---|---|---|---|---|
| **day** | **month** | **year** | | **Time** |

**Dear  Prospective Participant**

**Dear Mr. / Mrs. ...................................................................................**

## 1.   INTRODUCTION

You are invited to volunteer for a research study.  I am doing research for a Master of Business Administration degree at the Gordons Institute of Business Science. The information in this document is to help you to decide if you would like to participate.  Before you agree to take part in this study you should fully understand what is involved.  If you have any questions, which are not fully explained in this document, do not hesitate to ask the researcher.  You should not agree to take part unless you are completely happy about all the procedures involved.

## 2.   THE NATURE AND PURPOSE OF THIS STUDY

The aim of this study is to explore the attitudes and perceptions of South African consumers towards low-income housing produced using innovative building technologies. By doing so we wish to learn more about what influences consumers' acceptance decisions regarding low-income housing constructed using innovative building systems. This study will examine critical perceptions and attitudes of consumers towards innovative building systems for low-income housing.

## 3.   EXPLANATION OF PROCEDURES AND WHAT WILL BE EXPEXTED FROM PARTICIPANTS.

This study involves answering some questions with regarding your understanding of innovative building technologies and the perceptions, and attitudes you have towards these building systems for tlow-income housing delivery.

## 4.   TIME COMMITMENT

The interview will take approximately 40 minutes to complete

## 5.   POSSIBLE RISKS AND DISCOMFORTS INVOLVED

There are no risks associated with the study.

## 6. POSSIBLE BENEFITS OF THIS STUDY

Although you may not benefit directly. The study results may help us understand how best to enhance the profile of innovative building technologies as sustainable high-performance low-income housing alternatives.

## 7. COMPENSATION

You will not be paid to take part in the study. However, any cost you have incurred because of taking part in the study, for example such as transport costs will be paid back to you (reimbursed). You will not be paid to take part in the study. There are no costs involved for you to be part of the study.

## 8. YOUR RIGHTS AS A RESEARCH PARTICIPANT

Your participation in this trial is entirely voluntary and you can refuse to participate or stop at any time without stating any reason.

## 9. ETHICS APPROVAL

This Protocol was submitted to the University of Pretoria Ethics Committee, telephone numbers 012 356 3084 / 012 356 3085 and written approval has been granted by that committee. You may request a copy of the approval from the researcher should you wish to review it.

## 10. INFORMATION

If you have any questions concerning this study, you should contact my supervisor:

Mr. Jabu Maphalala cell: (+27) 71 679 2770

email: jabumaphalala88@gmail.com

**11.  CONFIDENTIALITY**

All information obtained during the course of this study will be regarded as confidential. Each participant that is taking part will be provided with a participant identity code. This will ensure confidentiality of information so collected. Only the researcher will be able to identify you as participant. Results will be published or presented in a way that participants remain unidentifiable. The hard copies of all your records will be kept in a locked facility at The Gordons Institute of Business Science.

**12.  CONSENT TO PARTICIPATE IN THIS STUDY**

• I confirm that the person requesting my consent to take part in this study has told me about the nature and process, any risks or discomforts, and the benefits of the study.

• I have also received, read and understood the above written information about the study.

• I have had adequate time to ask questions and I have no objections to participate in this study.

• I am aware that the information obtained in the study, including personal details, will be anonymously processed and presented in the reporting of results.

• I understand that I will not be penalised in any way should I wish to discontinue with the study.

• I am participating willingly.

• I have received a signed copy of this informed consent agreement.


_____     _____     _____
Participant's name (Please print)        Participant's Signature         Date


_____     _____     _____
Researchers name (Please print)        Researcher's Signature         Date

**AFFIRMATION OF INFORMED CONSENT BY AN ILLITERATE PARTICIPANT**

(if applicable)

I, the undersigned, …………………………………....., have read and have explained fully to the participant, named ……………………… , the informed consent document, which describes the nature and purpose of the study in which I have asked the him/her to participate.  The explanation I have given has mentioned both the possible risks and benefits of the study.  The participant indicated that he/she understands that he/she will be free to withdraw from the study at any time for any reason without penalty.

I hereby certify that the participant has agreed to participate in this study.

_____        _____        _____

Participant's name (Please print)        Participant's Signature        Date


_____        _____        _____

Researchers name (Please print)        Researcher's            Date
                                        Signature


_____        _____        _____

Name of the person who                  Witness Signature        Date
witnessed  the informed consent
(Please print)

**Appendix 2: Interview Schedule**

## Interview Guide

**Introduction**

Thank you for taking the time to participate in this interview. In our conversation, I am really interested in understanding your perceptions regarding alternative housing. In this interview, I am interested in uncovering your perceptions related to financial, quality, performance and social attitudes regarding housing constructed using alternative materials.

The interview is expected to take roughly 45 minutes, depending on how much we talk. I would like to you know once again that your participation is completely voluntary and you have the right to choose not to answer any questions or opt out at any time for any reason. As I indicated in the consent form, your identity will not be disclosed in the results of this research.

Lastly, I would like to ask for your permission to record the audio from our interview, this is for my personal use in case I struggle to remember everything we speak about in the interview. The audio recording will only be shared with a transcriber who will sign a confidentiality agreement not to share the recording with anyone else. The transcript and notes from the interview also be kept confidential and will only be accessible by myself and my immediate supervisors. Do you have any other questions before we begin?

**Preliminary Questions**

1. Please tell me about yourself, where you live and the type of housing structure you live in at the moment
2. Have you registered to be placed on the subsidy housing waiting list? Didi you qualify to register?
3. How many people do you live with you at the moment, do you have any children?

These are introductory questions to confirm that the participant is my desired sample population. The questions also help to break the ice and make the participant feel more relaxed.

**Interview Questions**

1. **What do individuals understand about low-income housing constructed using innovative building technologies?**

    1.1. Can you please start by telling me about the different types of subsidy housing the government provides?

    1.2. Have you ever seen or heard of government housing that has been build using alternative materials?

2. **What are consumers' general perceptions of low-income housing constructed using innovative building technologies**

    2.1. What type of material would you like your house to be constructed with?

    2.2. How would you feel if your house was constructed using material other than your preferred materials i.e. materials such as sheet metal, wood or concrete blocks?

    2.3. Do you think living in a house constructed using alternative materials would be an improvement to your current living conditions?

    2.4. Would you be happy if government gave you a house that was built using materials other than brick and mortar?

    2.5. What are your thoughts when you compare these alternative houses to traditional brick and mortar houses?

**Participants will be probed further on the basis of their responses**

3. **What are consumers' perceptions regarding quality and performance of low-income housing constructed using innovative building technologies?**

    3.1. If you were to compared housing built using innovative building technologies to traditional brick and mortar housing, do you think the quality of innovative building technologies housing is better, worse, or the same as traditional housing?

    3.2. What are your thoughts/understanding regarding the structural issues related to innovative building technology housing if any?

    3.3. Would you be happy and feel safe living with your family in a house constructed using innovative building technologies?

**Participants will again be probed further on the basis of their responses**

4. **What are consumers' social attitudes regarding housing constructed using innovative building technologies**

   4.1. Do you think your family would be happy for you if they saw you living in a house constructed with alternative material?

   4.2. If this type of housing was implemented in your community, do you think community members would accept or reject IBT housing? Please expand on why you think they would accept or reject the housing.

   4.3. Do you think that the type of material someone's house is constructed with reflects that person's social status or wealth?

**Participants will again be probed further on the basis of their responses**

5. **What are consumers' perceptions regarding financial aspects concerned with accepting low-income housing constructed using innovative building technologies?**

   5.1. What do you think would be the financial implications of accepting a house constructed using alternative materials?

   5.2. Do you think these houses would make a good investment for you and your family's future?

**Participants will be probed further on the basis of their responses**

6. **What are consumers' recommendations regarding what government can do to reduce rejection of these technologies for low-income housing delivery?**

   6.1. What do you think should be done to ensure the acceptance of housing constructed using innovative building technologies in your community?

**Participants will again be probed further on the basis of their responses**

**Conclusion**

I think that concludes our interview. Do you perhaps have anything else that you would like to share with me that you feel we may not have covered in the interview? Then, I would to once again thank you so much for taking the time to speak with me today. If you happen to think of anything else or you have any further questions, you are welcome to get in touch with me. I also would like to ask if I can contact you again should there be any other questions I may have or to clarify some things. Would that be alright with you?

**Appendix 3: Ethical clearance letter**

Gordon Institute of Business Science
University of Pretoria

**Ethical Clearance**
**Approved**

Dear Shweshwe Ndlovu,

Please be advised that your application for Ethical Clearance has been approved.

You are therefore allowed to continue collecting your data.

We wish you everything of the best for the rest of the project.

Ethical Clearance Form

Kind Regards

This email has been sent from an unmonitored email account. If you have any comments or concerns, please contact the GIBS Research Admin team.