Testing Applicability of European Financial Models for Sustainable Building Renovation in a Middle Eastern Context

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Abstract

With the current climate challenges that we currently face, we also need to take a look at the existing operation of the systems to which we are so accustomed. Within the EU, there are policies to make the housing stock energy neutral by 2050. However, this sentiment is not shared internationally. Within the EU, there are several options made available for making renovation of existing stock more financially feasible, with models provided by initiatives such as STUNNING, REVALUE, or ABRACADABRA to name a few. Though the EU has options made available, this is not the case for the rest of the world. The research focuses on the applicability of the aforementioned options available in the EU to a Middle Eastern context through the creation of a scenario building using aggregation methods and using a sensitivity and Monte Carlo analysis to check the performance of each financial model. The research also combines the financial with other technical frameworks such as finding optimum insulation thicknesses and its influence on the pay back periods. The research works in 4 parts, creating a model building through aggregate modeling and frameworks, running the financial dashboard based on the characteristics of the model building and doing a sensitivity and Monte Carlo analysis, then finally an interview is conducted with experts, showing them the data of the model building and then asking about the limitations of said financial models. The applications are reviewed in a foreign context, in this case Kuwait, and in addition, the effects of the large scale application of these models are examined in the literature review. The results show that financially speaking, it is completely feasible to apply these models within Kuwait, and in fact they work better than they do in western contexts because of the avoidance of the landlord-tenant conflict since landlords are responsible for paying utility fees. On average, given Kuwait's current inflation rates, electricity prices, water prices and average rental rate per m2, we are seeing an average of a 4 year payback period on a major rehabilitation, without even the need for a real estate re-evaluation. The micro economic results are also compared with studies made on macro-economic knock on effects of mass renovation within the country, and it was found that it was feasible. Through the interviews, however, it was found that though there are few barriers in the financial sense, there is a lack of understanding and need for a larger investigation into the sociological and behavioral barriers found within this context.

Key Words

Economic Feasibility, Sustainable transition, Financial modeling, sustainable renovation, income producing properties

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CHAPTER 1:

INTRODUCTION

1.1 Introduction

As much as 30% of the world's energy consumption and approximately 28% of total carbon dioxide emissions is caused by the building sector (UN, 2017), with a majority of the emissions being a result of the housing sector (UN, 2017). Within Europe we see similar figures, with 40% of energy use and 36% of CO2 emissions being a result of building use (Mlecnik, 2016; EC, 2003; Itard et al, 2008). The EU aims for an energy neutral housing stock by 2050 (EU journal, 2019), which, by definition, would involve a great need for the transition of existing stock to be more sustainable. Transition of existing stock to sustainable stock plays an important role in the 2050 energy neutrality goal when taking into account that the majority of housing has been built in the last century, with as much as 83.3% having been built before 1990. While there were regulations for thermal performance in place since the 1970's (Raue, et al, 2006), there was not a meaningful regulation on the energy performance of buildings until as late as 1990 (Usanove, et al., 2013); (Van Rijn, 2019), and later on with the introduction of adaptive temperature limits guideline in 2004 (Raue et al, 2006).

Further to the consideration of building stock in Europe, we can see differing situations in different contexts, yet with multiple cases in need of a valuable means to finance a sustainable transition. Speaking on a very broad surface-level scope, a few examples that are worth mentioning are those such as Korea, in which a huge building boom means that 88% of the buildings in Korea were built after the 1980's, with the majority of them having been built during the 80's, and without a strong energy performance mandates. Pair this with the housing supply of Korea being at 108%, the "new built" construction sector is slowing down, and instead people remaining in their own homes (Baek, Park, 2012). Another example would be Kuwait, in which the majority of the building stock has been built after the 1952 urban renewal scheme introduced to Kuwait (Al-Ragam, 2016), with an significant percentage of the stock having been built in the 30 year period between 1952 and 1980. (Al-Ragam, 2017). Furthermore, although there has been a mandatory Energy Conservation Code of Practice for buildings since 1983, there has been very little evidence to the impact and implementation of the practice (Jaffar, 2018; Wood, Alsayegh, 2014; Maheshwari, Al-Mula, Al-Hadban, 2009). While these are two very brief examples, they give a basic illustration of the differences between international contexts, and how a need for financing renovation is needed even with different circumstances.

Looking back at the EU, with a closer observation of the CO2 emissions produced by the residential sector, we can see that as much as 57% of the emissions produced in the EU are a related to indoor environmental control (Vorsat et al., 2011). Furthermore, as per the UN global status report of 2017 (Figure 1), technology shift, which is defined by the report as shifting of existing technology to better energy performing technologies, is listed as the second highest contributor towards achieving a 2oC reduction in atmospheric temperature, just behind transition to alternative sources of energy. In the case of environmental performance, a technology shift must be working hand in hand with envelope upgrades in order to achieve the desired performance, hence why this research is focused on the performance of environmental systems (HVAC) in tandem with envelope improvements.

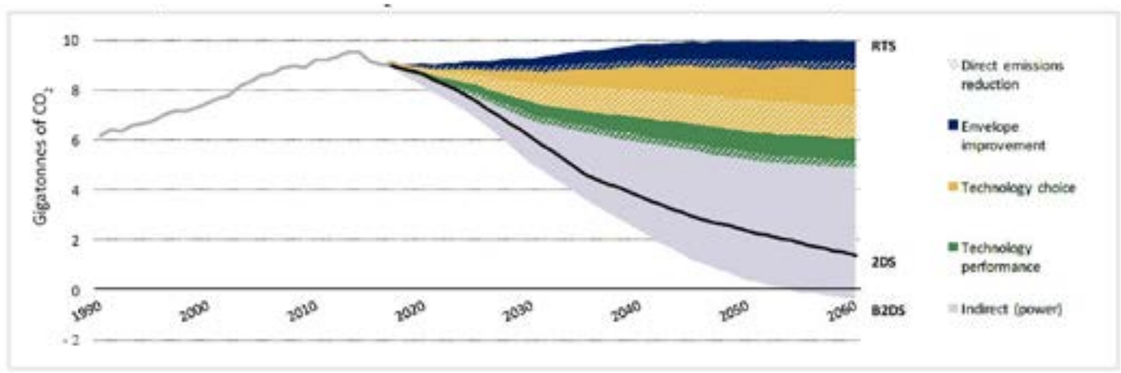


Figure 1 – Key contributions to CO2 emissions reduction in the global buildings sector to 2060 (UN Global status report, 2017)

To further clarify the figure above, the Y axis represents the Gigatonnes of CO2 present in the earth's atmosphere while the X axis represents time. The **Reference Technology Scenario (RTS)** represents the estimated increase in CO_2 levels if we are to continue as we currently are, taking into account existing building energy policies and climate-related commitments. The **2DS** represents the amount of Carbon that needs to be removed from the atmosphere for a 2oC reduction in the atmosphere, and the **B2DS** represents the scenario in which we achieve a beyond 2oC temperature reduction in the earth's atmosphere. The definitions of the labels on the right are as follows: **Direct Emissions reduction** represents a decrease in emissions from reduction in direct fossil fuel consumption in the building sector. **Envelope improvements** include measures (including deep renovation) that improve the energy performance of the building envelope. **Technology Choice** represents the shift of technology use, such as switching to more energy efficient heating and cooling systems. Finally, **indirect** represents reduced carbon emissions from changes in energy generation and carbon capture technologies (CCS).

Furthermore, with the recent Covid-19 crisis, there has been an interesting observation about its relation to climate change in the paper "What can Covid-19 teach us about responding to climate change" (Herrero, Thornton, 2020). What has been found is that in the time of the writing of the paper, world governments had already spent a total of $8.4 trillion dollars on the coronavirus, of which 94% was spent on fiscal measures. What has been noted, however, is the following quote:

"...Governments have found $8 trillion to help combat the spread and effects of COVID-19 in just 10 weeks. Surely, governments can find $1.8 trillion in the coming decade to combat the effects of climate change..."

This insinuates the belief that financially, drastic expenditure for the purposes of averting a climate crisis is possible, yet the problem has a major behavioral component to it.

1.2 The State of the Home Renovation Market

As the global construction capacity increases, it is easy to have a greater focus on new developments, yet renovation is a sector that also requires attention. This is especially true for OECD countries, where 65% of the building stock of 2060 already exists today (UN 2017). In Figure 2 below, we can see a figure showing floor additions to 2060 by region with respect to the existing stock today. In almost all cases except for India and Africa it can be observed that the existing stock is already roughly equivalent, or more than, the estimated 2060 stock. As existing developments get older, an emerging market for renovation begins to take form. As of 2013, TNO produced a research (Usanove et al, 2013) focusing on the potential of the renovation market. The research showed that there was an increase in the renovation market, especially after the financial crisis of 2008 (Figure 3 and Figure 4 below). Although the renovation market is more matured in the EU, there remains the case of talking about the residential market worldwide. According to a 2019 report by GMI (Pulidindi, Pandey 2019), the worldwide home renovation market is starting to experience an increase in growth, and is expected to rise by 4.5% Compound Annual Growth Rate (CAGR), with CAGR defined as being the rate at which the market will grow on a per year basis. This means that the market will experience an average of a 4.5% growth rate over the period of the next 10 years. According to the report, this is a result of the ageing process of the global housing increasing the interest individuals have for upgrading their residential stock.

So far, the focus has been on owner-occupied dwellings, yet there is a substantial portion of dwellings that are income producing properties, i.e. rented properties. Figure 5 below (OECD, 2016) shows the housing tenureship in the EU and some OECD countries, and we see there is a substantial amount that is living in rented properties (OECD, 2016).

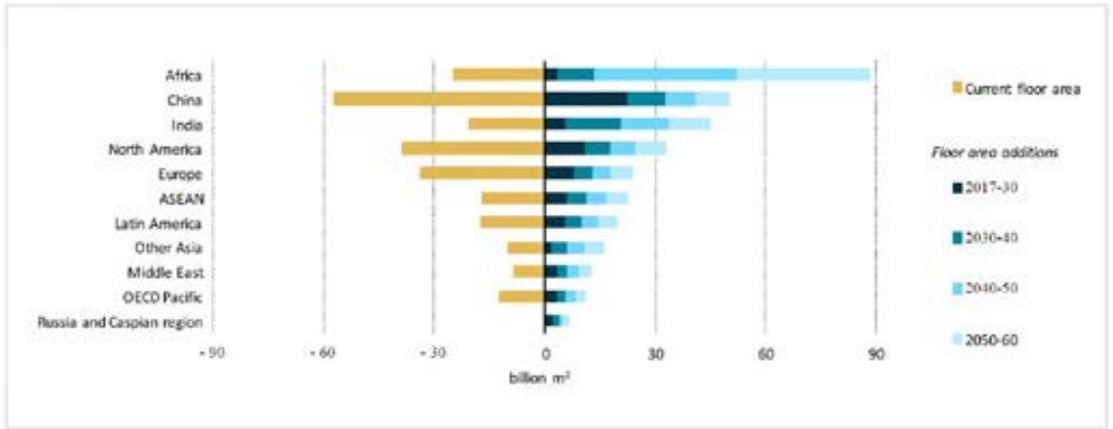


Figure 2 - Floor area additions to 2060 by key regions (UN Global Status Report, 2017)

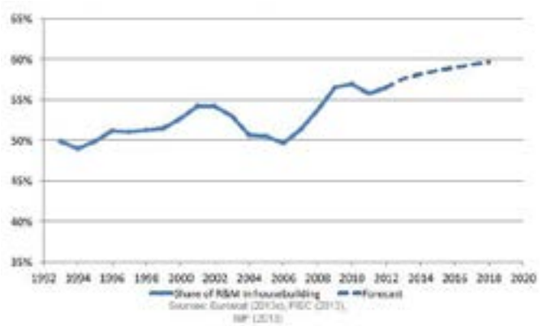


Figure 3 - Increasing share in renovation and maintenance in the EU, assuming “business as usual” scenario (TNO, 2013).

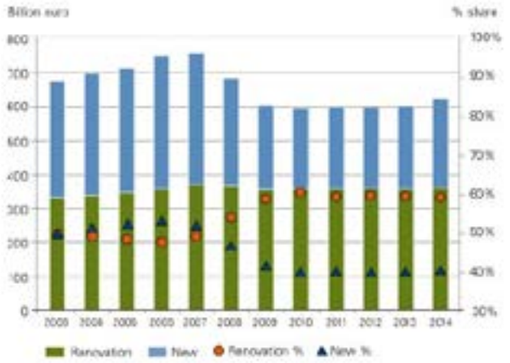


Figure 4 - Shift from new buildings to renovation in the EU (KPMG, 2012)

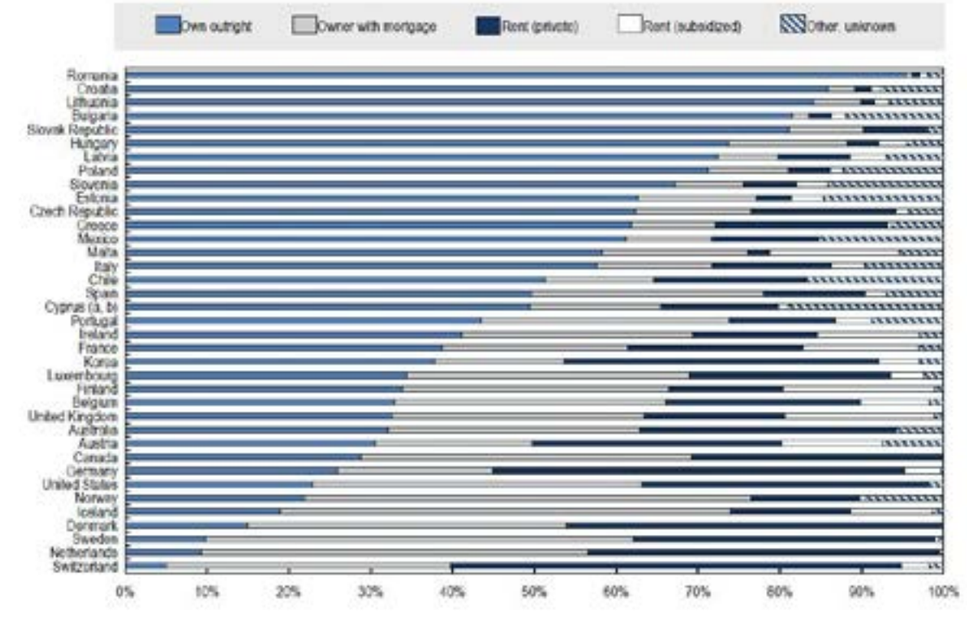


Figure 5 - Share of different households by tenureship, in percent (OECD, 2016)

Rented properties provide an additional layer of complexity, mainly due to the landlord-tenant dilemma (Ástmarsson, Jensen, Maslesa 2013). The landlord-tenant dilemma occurs when there is incongruence between the landlord and the tenant’s views on how sustainability should be approached. One classic example of the landlord-tenant dilemma in terms of sustainability would be that the landlord would not be motivated to pay for a more sustainable technology as it is the tenant who is paying for the gas, water, and electricity bills. Understanding the means in which a landlord can independently finance the upgrade of their property on an object level would be a meaningful step towards reducing the difficulty of taking the initial step into financing their own renovation.

Further than just focusing on the potential financial performance of the incoming rental market, the investigation of energy performance of the individual components of housing is warranted. In the countries where data is available, it can be observed that the majority of the energy consumption is done through the use of space heating and cooling systems. Within the EU, 64.1% of energy consumption in households is utilized for space heating (Eurostat, 2017), and we see similar patterns in international contexts. In China, for example, space heating is the highest consumer of energy use, accounting for 32% of domestic energy use, with the second highest being water heating using 27% of the energy use (Zhou et al, 2007). Within the US, nearly 70% of residential energy use is spent on space heating, water heating, and air conditioning (Berry, 2018), and within Saudi Arabia, a staggering 70% of electricity consumption is used for air conditioning of houses (Demirbas, Hashem, & Bakhsh, 2017). Particular to areas with extreme climates, there is an increase in the use of energy use in the building sector relative to other sectors in the country (Amoodi, Azar, 2018). Based on those figures, the need for improving the energy performance of environmental systems hand in tandem with envelope developments can be drawn. In the following chapter, the means in which the thesis will be explored will be clarified.

1.3 The Case for Kuwait

While the overall trends described above are a more general overview, the need to make a case for Kuwait specifically necessitates itself. While there is a deeper introduction into Kuwait in section 4.2 the brief overview will be given here.

Kuwait is a country that had entered into modernity relatively lately, around 1952 (Al-Ragam, 2015). Since then the country has experienced an unprecedented boom in construction, with the majority of the building stock being from that period. However, much of the buildings built from that period are facing demolition and replaced by newer buildings that are built in a less robust style (Nakib, 2018) (Al-Ragam, 2013). Furthermore the newer buildings that are being built are more akin to the style of buildings that started being developed from the 90’s onwards (Al-Sager, 2020), which are far less robust than their older counterparts. Furthemore, in newer areas, such as Farwaniya or Mangaf, the majority of the buildings follow a particular type, similar to the type that started developing in the 90’s, especially considering that this particular typology had become very successful and profitable. From here onwards, we can see that there is a need for a study on the feasibility of renovating these unit types. Particularly when considering the behavioural barrier that reduces the impetus for quick action, it is likely that this typology of building will continue to be built for quite some time, and if not now, the need for a sustainable renovation will be needed in the future. This typology of building is looked at in greater detail in section 4.

CHAPTER 2:

RESEARCH GOALS, QUESTIONS, AND DESIGN

2.1 Research Problem

With the ambitions for a global transformation towards sustainable housing brings into question the economic feasibility of the procedure. The largest international survey on the subject of transition of homes was conducted by ipsos on behalf of ING looking into the barriers into sustainable transition. The survey concluded that the number 1 barrier was "lack of funds" (ING, 2018). One of the limitations of the survey was that it was only conducted in Europe and Australia, with a sample size of 14,725. With the global scale of the problem, a more international approach is required. There are currently financial models available in the EU, but how well do these financial models apply to other places?

2.2 Research objective

The objective of this research is to explore the financial feasibility of established financial models already set as precedents. The final outcome of this research is firstly to establish a methodology for a general study into the financial feasibility of application of the models described in the literature review. Secondly, the research aims to utilize this methodology to establish barriers and opportunities related to employing such financial models to Kuwait, also as a means of verification of the approach. Finally, once all the information has been gathered, A PESTLE analysis will be used to summarize the pros and cons of the tested models.

2.3 Research Relevance

With the obvious case of climate change into effect, this research has a clear relevance to areas with large amounts of existing stock that are in need of transition to improve their sustainability. This research is especially relevant when taking into account incoming regulations that impose minimum energy performance labels before being applicable to new tenancy agreements, such as England and Wales' Energy Efficiency Regulations of 2015 (Official Journal of the EU, 2019). A need to have a realistic look at how to finance such drastic policy measures with minimal reliance on governmental aid and self-financing of the changes becomes apparent. The financing of these changes from a landlord's perspective also becomes relevant when taking into account the large amounts of inertia that is faced by sustainable transition as a result of the owner/tenant dilemma and the circle of blame (Ástmarsson, Jensen, & Maslesa, 2013). When looking at a more international context, this research is relevant to applying typically western formed ideas into a more international context, especially in areas with a high rental market such as the Gulf Cooperation Countries (The GCC), Korea, Hong Kong, Japan, to see the applicability of these models in a different context. Furthermore, in the Africa region, which has the highest projected build capacity by 2060, there has not been any energy policy regarding new construction as of yet (UN Environment and IEA, 2017), and the issue of transforming existing stock in a non-western context will become much more relevant in the near future. The end product of the research is intended to be an approach which can be used by a financial consultant to be able to assist owner of an income producing property select or generate a scheme for financing their sustainable transition on an object level. The research aims to create bridges for financial consultants with international facing clients in order to be able to approach international clients more effectively. Finally, considering Kuwait's need for transferring to sustainable building stock, and Kuwait's need for sustainability anyway, it would be valuable to identify the barriers that occur in the attempt to do so.

2.4 Research Scope

To denote the scope of the research, the research will be focused on the object level, specifically due to the fact that the research is assuming the feasibility of sustainability interventions on a per-building basis. In addition, from interviews it has been found that many of these buildings are run by independent owners, who solely control the building (Al-Sager, 2020). Furthermore, it will not be looking at a block or area level, because that infers a level of cooperation between the stakeholders within a block which cannot be assumed for all cases. The research will be purely focusing on using Kuwait as a comparison point as a non-western context, and extrapolating that data to more general advice that might be able to be used by financial advisors to other contexts.

2.5 Research Questions

With the above, the need for stock transition and the research objective has been made clear.
This leads us to the main research question:

What are the limitations of applying European Financial Models to Kuwait and how can they be addressed?

What the research aims to do is have an understanding of existing financial schemes and their applicability to a different context, and to test the methods to see where they succeed and where they fail. Firstly, the research is to investigate and present the existing financing models that are currently being used. Next, the research is to investigate the applicability of the financial models into a non-western context,

RQ 1: What are the current available financial models that can be used for renovating the income producing properties?

The first step is to make an examination of the available financial models. This will be done through a literature review, and can be read in section 3. The purpose of the literature review is not only to gather the information, but also observe and compare each model to each other with a critical view. If there are models that are very similar to one another, then they will be consolidated and not considered as two separate models.

RQ 2: What is the feasibility of the application of these financial models to a typical Kuwaiti apartment block?

Part 1: Defining the block

Answering this research question is a multi-step process. Firstly, the "typical Kuwaiti apartment block" must be defined. For this, a model building will be created based on data extrapolated from real estate listings placed online, GIS data provided on the Kuwait Municipality website, and working in tandem with the method and data used by Jaffar (2014) that highlights typical building types, as well as aggregation methods for the creation of a typical model. Furthermore, for the creation of the typical block, the reference for the specifications will be referred to from the minimum specifications mandated in Kuwait building codes.

Part 2: Establishing a minimum baseline renovation level for cost estimation

Once the typical apartment block is defined, the relevant data found from the apartment block will be turned into a quantity survey (defining the number of windows, surface area in need of resurfacing, quantity of mechanical units, etc.). This quantity survey will be used as an aid to estimate the cost of the renovation.

Next is deciding upon the renovation level, however, in order to do so a definition of what the "renovation level" will be has to be defined. In this case, the goal of the project is to approach NZEB, which means "Nearly Zero Energy Building", and a definition for "Nearly Zero Energy Building" will have to be settled upon.

In order to approach a more reasoned cost estimation, the "NZEB" renovation level will be done using a modified version of the 7-step framework established by Paolo Zangheri (2017) in tandem with Fokaides and Papadopoulos' (2014) framework for establishing the most cost efficient envelope. This is further explained in the operationalization part of the paper. The cost estimations are then done by a firm and signed off for verification. The estimations will be provided in 4 levels, minimum, medium, maximum, and maximum with value engineering done by the Fokaides and Papadopoulous (2014) framework.

Part 3: Cost Evaluation

Once the cost estimations are complete, the financial models are each tried and run through excel as a typical cash-flow model typically used in finance. Once each model is done, the cash flow is examined using a sensitivity analysis, scenario analysis, and a Monte Carlo analysis in order to estimate the most sensitive parameters in the model, finding combinations of parameters that work, and the probability of win/loss given a variation of parameters within set boundaries.

Part 4: Further Impacts

Finally, there is extensive literature made on the possible impacts that the changes made in the financial models could imply. To wrap the section up, a literature review will be done looking into the greater effects of the potential changes proposed in Part 3.

RQ 3: What are the non-financial opportunities and barriers to the adoption of such financial models for the renovation of income producing properties?

This research question represents the change of the study from quantitative to qualitative, and will be conducted via interviews. However, prior to the conduction of the interviews, firstly a literature review will be done on the potential non-financial barriers to the proposed financial models.

With the literature review and the data provided in the previous research question, the results will be presented to 3 separate experts, all working in different fields within real estate. This is where the mixed method sequential information (Bryman, 2012) will move from operationalized quantitative data to qualitative data, and the validation of the quantitative data will be provided. The interview method will be described in more detail in section 2.5.

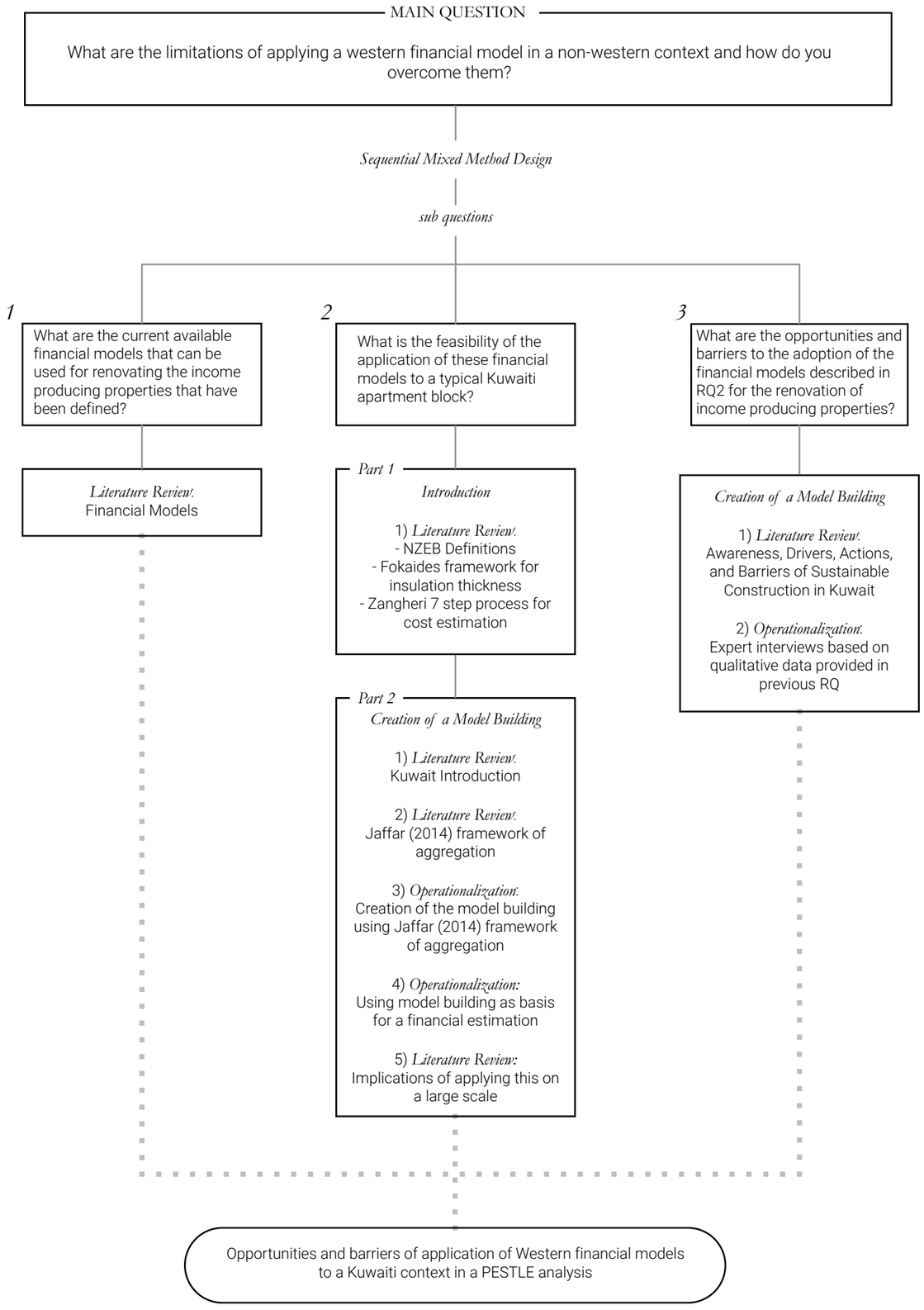
2.6 Research Framework

Research Sequence

The research will begin with the building of the general financial data. The data will be used to create a hypothetical cash flow sheet, from which a sensitivity analysis will be conducted. The sensitivity analysis will be used in order to define which elements are most conducive to changes in the feasibility of sustainable renovations. From this, we can gather data sets which determine boundary conditions in which the sustainable renovation is feasible within the standard 10 year cycle typically used in real estate evaluations. Through the use of scenario analysis and the Monte Carlo method, it is possible to evaluate multiple changing factors at the same time.
The research is following an explanatory sequential mixed method design, as described by Bryman (2012), in which a data is extrapolated and operationalized and then the said data is used to conduct interviews. Therefore, following the completion of the financial study, the interviews will be conducted.

Interview Method

The interviewees selected will be expert individuals who have experience in real estate feasibility planning and rehabilitation projects for real estate clients. Here, the goal of the interviews is to find the barriers for real estate companies in a non-western, more specifically Kuwaiti context to engage with sustainable rehabilitation of existing properties. The interview method will be conducted based on methods described by Moerman (2010), using open questions as much as possible and probing to further extrapolate knowledge. Minimal examples are to be used on behalf of the interviewee, and usage of examples will only be used when clarification is required, with intent care not to use it to influence answers. The interview will be conducted in English as that is the lingua franca between the interviewer and interviewees. Once the interviews are done, the overarching concepts discussed in the interview will be analyzed using Bowen's (2006) framework of inductive reasoning and sensitizing concepts in order to derive the barriers and general opinions of sustainable renovation. Once the interviews are concluded, the pros and cons are weighed and summarized in a PESTLE analysis which will be presented in the conclusion section of the paper.



CHAPTER 3:
OPERATIONALIZATION

3.1

RQ 1: What are the current available financial models that can be used for renovating the income producing properties?

- Literature Review

Literature Review Method

The literature review was conducted primarily by searching for aggregators of financial models, and collecting the groups of information provided. Once the models found in the aggregators were collected, there was a deeper look into each one individually through research and the search of relevant key words for each to have a more robust understanding. In this section, each item is going to be discussed in list form, as well as how the characteristics of each could potentially relate to the greater picture, and how each will be investigated in the operationalizing phase, and its relevance to the specific case study in Kuwait.

Model Aggregators

A possible starting point for identifying business models that are currently being used within the industry can be aggregators of business models. One such aggregator is STUNNING, which props itself as project that builds up a stakeholder community around a knowledge sharing platform (STUNNING, 2019). The STUNNING platform will be used as a starting point towards the literature research.
The STUNNING platform provides multiple different perspectives for financing deep renovations of property, however, for the purposes of this research, only the financing of income producing residential properties will be examined. Model aggregators such as this help in the collection of different means of financing, with aggregators such as this then it is easier to see multiple potential solutions.

One stop shop

One concept which is repeated throughout the models that are shared in STUNNING is the one stop shop, and several variations of the same concept. The one stop is a solution that was derived out of the investigation of opportunities and barriers relating to the market development of nZEB renovations (Mlecnik, 2016). The aim of the one stop shop is the improvement of consumer awareness, and making it easier for consumers to renovate by establishing communication with a single entity to deal with all aspects of the renovation (Mlecnik, 2016). Within the business models of STUNNING, this concept is created and then paired with multiple different forms of funding. Although not related to financial modeling, the One Stop Shop is seen as a key factor that is often referred to as an important player in the effort to renovate (Van De Vyver, 2019). The effectiveness of the one stop shop will be discussed in interviews conducted in the operationalization section of the paper, and it is valuable to use as a means of observing the adoptability of novel approaches to energy renovation.

The one stop shop does not necessarily need to be an entity in and of itself, but can also act as part of a larger whole within the realms of another larger enterprise (STUNNING, 2019). This case could also be interesting to look at as a means of looking at more gradual means of gradually introducing the one stop shop to the already existing fabric of construction culture in Kuwait.

One stop shop provided by public private partnership

Public Private Partnerships (PPP) are in essence a delivery model in which a contract is made between the public sector, private sector, and building owner. Usually, the private sector is in charge of the management and delivery of the building renovation, with management and controlling factors being controlled by all 3 parties. (STUNNING, 2019)

In this collaborative model, private and public partners coordinate their skills and knowledge for long term contracts (usually 20-30 years). The selected contract involves a multidisciplinary team of designers, maintenance providers, and required subcontractors that is led by a contractor, who then acts as the main point of contact for the building owner. This is relates to the rise in popularity in Build Operate and Transfer style projects in Kuwait, and through interviews it would be understandable whether the application of such a thing would be feasible for Kuwait. (Al-Azemi et al, 2014)

PPPs can be used when there is a mutual benefit between both private and public parties, where the public party can also provide a source of financing for the private party, making the financing of the project more financially feasible on a micro-economic scale.

Energy Performance Contr acting (EPCs)

The EPC model is based on financing the renovation through the remuneration of the cost savings made through energy savings. This is by far the simplest and most obvious method of approaching the financing of the change. Though oftentimes paired with the usage of Energy Service Companies (ESCOs), they are not necessarily required for the model to work (Hilke, Ryan, 2012). To put it in its simplest form, what an ESCO does is provide an energy performance guarantee and consulting services for the renovation of the project (RVO NL, 2013). The financial model will be examined in the quantitative section of the thesis, as this is the key method of financing.

In some cases, such as the Assener Model, the total cost of ownership is what is looked at over the lifetime of the property, and is supported by an energy performance guarantee which at the very least provides a baseline guarantee for a certain amount of energy savings over a longer period of time, and thus a guarantee for a certain amount of savings (Rose, 2020).

Add-on business Model

The add-on business Model is done through utilizing an extension to the building, either by adding additional floors or by a building extension. The profits from the building extension are then used as a means to finance the renovation of the existing building. This solution is one of the few designed for income producing properties, yet runs into difficulty when facing the issues of the regulatory context of each region that it is to be applied to. This initiative is promoted in the ABRACADABRA project, which looks at studying the feasibility of volumetric additions in order to finance the sustainable transition of the rest of the building, with a promising case study in Bologna (Semprini, et al. 2017). In the case study, the payback period of the entire project was calculated utilizing the following formula:

$$PBT = \frac{C_r y + C_c x + P x}{R y}$$

Where:

PBT = Pay back time with investment rate of 5% (year)
Cr = Unit renovation costs including RES to set to nZEB the existing building (KWD / m²)
y = floor surface of existing building (m²)
Cc = construction costs of the volumetric addition (KWD / m²)
x = floor surface of additional volume (m²)
P = assistant building's real estate market value (KWD / m²)
R = Energy savings (KWD / m²)

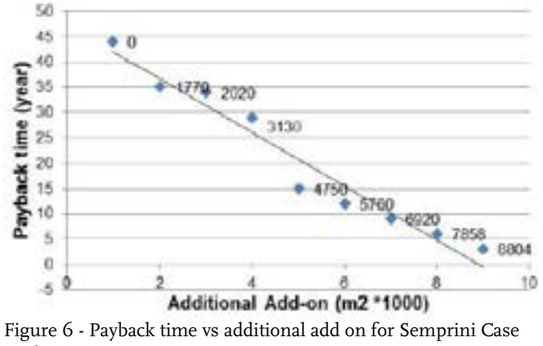


Figure 6 - Payback time vs additional add on for Semprini Case study (Semprini, 2017)

In the figure above from Semprini's (2017) study, it shows the reduction in payback time as the area increases in the Bologna case study.

Financing through rent increase

One option for building owners is the ability to increase the rent, however this has to fall within reasonable legislation. In this scenario, the building owner can incur an increase in the rent in order to help finance the renovation. If feasible, this could even be a short term price hike which will be normalized later, either through rent-free periods or a year without an increase in rent. However, this method of financing is greatly dependent on the legislative nature of the country, and whether it is within the legalities of the system to employ such changes.

Leasing of Renewable Energy equipment and its implications with Islamic Banking

Leasing enables a building owner to renovate without the need for a purchase. This can be a means to overcome the high initial costs associate with sustainable renovations. The installation is owned by a third party, such as a bank, third party company, or another intermediary. Then the owner of the building pays them back over a period of time (STUNNING, 2019). Several types of leasing are possible, which differ in ownership and other economic, legal and fiscal conditions. There are two types of leases that can be used. The first is the operational lease, in which the assets that are leased are treated as rented objects. The second option is the capital lease, in which the assets are treated as a loan. In both cases, the ability to transfer ownership at the end of the lease period is available (STUNNING, 2019). This is an interesting option to explore in Kuwait, especially considering complaints of surveys done around the world that hold issue with the high up-front costs of renovating buildings (ING, 2018). However, an interesting dichotomy which arises when discussing the possibility of leasing is the differences between the Islamic banking and modern banking systems. While in Kuwait both options are available, it is important to note some regional differences, such as the usage of an Islamic banking system, which forbids interest rates, instead opting for a system in which the bank acts as a purchaser of the goods, and then acts as a reseller of the goods, selling the goods back at a profit (Farooq, 2005). The repayment can be done as both a balloon payment and as installments, both which have the same effect on the NPV. In essence, both work in essentially similar ways, however are framed differently. The data for this will be obtained from Kuwait Finance House, which provides an investment calculator for finance for Islamic Banking.

NEBs – Non Energy Benefits

In addition to monetizing the benefits of reducing energy costs, there is also the ability to monetize non energy benefits. Non energy benefits are defined by Plympton et al. (2020) as "benefits that occur in addition to energy savings produced via energy efficiency programs". In their research, however, Plympton et al. (2020) focus largely on the greater scale of macroeconomic benefits such as job creation, and public health. In the research by Plympton et al, however, the study of NEBs was largely beneficial to the

larger macroeconomic area, rather than the microeconomic, especially in the realms of public health. While this is a benefit to the overall argument for sustainable renovation, this does not contribute to the financial feasibility of the individual property owner. In addition to Plympton's research, Skumatz economic research associates (1996, 2004) provided examples of NEBs by beneficiary, as shown below:

Examples of NEBs (by Beneficiary)		
Utility System	Participants	Society and State
• Reduced carrying cost on arrearages • Reduced bad debt • Reduced shutoffs/ reconnections • Fewer notieces, calls, and collection costs • Insurance premium savings • Preduce ancillary services costs • Improve pwer quality and reliability • Reduced subsidy payments • Lower transmission and distribution losses	• Control over bill and energy decisions • Improved indoor air quality • Improved health and fewer lost days at work or school • Improved comfort • Water/wastewater bill savings • Improved property values • Improved aesthetics / appearance • Fewer shutoffs and reconnections • Lower operating and maintenance costs • Improve employee productivity and retenition • Reduced tenant turnover	• Economic development benfits, including job creation, increase in personal income, and state GDP benefits • Improved air quality and reduced healthcare costs • Fish and wildlife impact mitigation • Attracting businesses that demand clean energy / EE (and concomitant economic development benefits) • Energy security • Preservation of affordable housing

In addition to NEBs is also the opportunity of the monetization in reduction of CO_2, as described in the papers by Urge-Vorsatz (2009) and Nehler et al. (2014). In the papers, the methods described are through the investigation of the reduction in the CO_2 emissions earlier in the chain of production for the reduction of expenditure, which generally is not considered when looking in the context of buildings. To exemplify some examples of this in terms of construction, this would mean opting for more local materials or using materials that are less energy intensive to produce. In the context of this research, this has been taken into account by considering the sourcing of what is available in Kuwait locally, which is described in section 3 of this research.

Summary and model selection

To summarize, there are a myriad of ways in which the renovation of housing can be financed. Though many cases are focused on income producing properties, the applicability of them can still be examined nonetheless. This leads to the topic of model selection, and how these are to be related to the specific case study of Kuwait. The models that will be tested will first be seeing if financing through the existing rent is at all feasible, then looking at energy performance contracting, combining energy performance contracting with an increase in rent, and finally examining the add on business model through both the Semprini et al (2017) and cash flow method. What also needs to be contextualized are the suggested business models that are oftentimes paired with the financial modeling, to get a broader view of the barriers associated with application of these models simply outside of financial feasibility. This will be brought up in the interview section of this paper, and the finally summarized in the PESTLE analysis done in the conclusion of the paper.

3.2

RQ 2: What is the feasibility of the application of these financial models to a typical Kuwaiti apartment block?

Part 1: Lterature Review

NZEB - Definitions
To What extent should we renovate?

Since the aim of the project is to have the highest degree of sustainability possible in the most cost effective way, the project aims towards achieve a Near Zero Energy Building (NZEB). However, before claiming to reach the goal, first the research must define what an NZEB renovation is as a means to understand the extent to which a renovation must be made. Firstly, according to the definition defined in the EPBD directive, a "major renovation" consists of:

a) The total cost the total cost of the renovation relating to the building envelope or the technical building systems is higher than 25% of the value of the building, excluding the value of the land upon which the building is situated

b) More than 25% of the surface of the building envelope undergoes renovation. (EPBD, 2018)

Therefore, by EPBD definition, the vast majority of NZEBs renovations would fall under the category of "major renovation" if they are to be executed on existing and outdated building stock. According to COHERENO (Atanasiu et al, 2013), an NZEB renovation can consist of the following:

(a) The energy performance of the building after renovation fulfills the requirements as defined at the level of EU regions, in which each EU region follows a different standard (eCentral, 2018)

(b) The primary energy consumption of the building after renovation is reduced by 75% as comparing to the pre-renovation status

(c) The definition can also be more concrete, with a targeted aim of not more than 50-60 kWh/m2 energy consumption for heating/cooling, provision of heated water, ventilation, and the consumption of the buildings auxiliary systems such as lighting.

(d) The definition can also focus on carbon performance, with a minimum CO_2 requirement of no more than 3kg of CO_2/m2/year. (Atanasiu et al 2013)

When looking at country specific requirements, they adopt one or more of the listed requirements. When speaking within the context of the EU, the different definitions of NZEB renovations differ based on selected metrics of performance, and how said metrics of performance are measured. The table below summarizes which criteria which are used for NZEB renovation of the 11 countries.

Country	Energy Need for Heating Q_H	Primary Energy Demand Q_P	Final Energy Demand Q_F	CO_2-Emissions	Summertime Comfort	Air Tightness	Thermal Transmittance of Fabrics Elements	Systems Efficiency
Austria	•	•	•	•				•
Belgium (Brussels)	•	•			•	•		
Germany	•	•			•	•	•	
Ireland						•	•	
Slovenia	•	•					•	
Portugal							•	•
Slovak Republic	•	•					•	
Italy		•					•	•
France		•						
Luxembourg	•	•		•				
Sweden		•						

Figure 7 - Indicators of NZEB renovation definition used in EU countries. Zangheri et al (2016)

Each country has its own specific approach, which makes settling on a definition for NZEB that has a cross-country application quite difficult. For the purposes of this research, and for the purposes of maximizing the flexibility of the application of the NZEB definition, the most simple and applicable metric will be used, which is an assumption of ~55kWh/m2. The purposes of choosing these are that it offers the most flexible and attainable definition for NZEB i.e. rather than focusing on a specific cooling load that has to be calculated for every country, it just looks at the broad scope of reduction of energy use. Also, due to the reason that this research does not look extensively into the technical side of the energy use, the definition of 75% reduction is not taken into account, especially considering unreliable data, and the unfeasibility of attaining reliable understandings of performance metrics both before and after the renovation.

For the purposes of the research, the definition of NZEB that will be assumed is the assumption of 50-60 kWh. The reason for this is because this is a good global measure that can be used to judge the performance of the building. Definition (A) will not be used as it is heavily reliant on EU policies and the purpose of this research is to approach it for an international context. Definition (C) is not going to be used because the general kWh/m2/annum is found to be 127 (Jaffar et al, 2014), and a 75% reduction would assume 31.75kWh/m2/annum, which is far below the 50kWh/m2/annum required to achieve NZEB status, so the lower option of 50 kWh/m2/annum is chosen for the purpose of feasibility. Finally, although this would eliminate some financing options, definition (D) will not be taken into account because it requires knowledge of the primary energy factor, which is firstly very difficult to achieve, as stated by Fokaides in an interview (Fokaides, 2020), and the available data to calculate it is not readily available in Kuwait. Ideally, both definitions would be compared with each other, however the limitation of data makes in unfeasible to do so without another large scale study requiring finding the primary energy factor and CO_2 generation in Kuwait.

Estimation of renovation measure costs

With the parameters of NZEB defined, there comes the question of selecting the extents and methods for NZEB. Zangheri et al (2016) defined a method of identification for cost optimal and NZEB refurbishment labels for representative climates and building typologies across Europe, which will be adapted for use in the process of deciding renovation levels for other climates. The study by Zangheri et al (2016) begins by summarizing different approaches to NZEB transformations aggregated from a review analysis of the studies of by Evins (2013), Nguyen et al. (2014) and Machairas et al. (2014). Zangheri also conducts further review studies on subjects more specifically focusing on NZEB developments by Attia et al. (2013) and Lu et al. (2015). There is also further literature available regarding the cost optimization of specific building element calculation, such as the optimal insulation thickness for various building elements and climatic conditions summarized by Fokaides and Papadopoulos (2014).

The question arises of how the climatic simulations are then achieved, most literature considered the energy end uses of space heating, cooling, and lighting, which is in line with EPBD standards, and domestic appliances were largely not taken into account. Furthermore, Zangheri et al (2016) take into account the various approaches that can be taken into the simulating the changes for the buildings in question. When discussing methodologically, the literature often focuses on a limited number of building variants, with the quantification of energy needs done by dynamic simulations, while the final energy requirements were calculated using simpler methods, such as “semi stationary methods”, which are hourly measures of energy use compiled to create a total average use per day. Furthermore, the other key element in the decision towards making an NZEB is the methodological approach for the quantity of possible variants. For example, Brandão de Vasconcelos et al. (2016) only considers envelope technologies, and adopts a two-step approach consisting of, as summarized by Zangheri et al: (i) preliminarily discarding of measures with the same or worse thermal transmission coefficient and higher global costs comparatively with other measures and (ii) combination of all resulting measures with each other, creating 35,000 packages of measures. Zangheri et al also mentions researchers such as Ortiz (2016) that use simple “brute force” approaches in which 2000 simulations are done manually over an extended period of time. Zangheri et al (2016) summarize the methodological approaches to energy calculation in a simple table (Figure 8).

Reference	Calculation of energy needs	Calculation of final energy demand	Solving method	Number of building variants
Kumitski et al. 2011	Dynamic simulation with IDA-ICE	Dynamic simulation with IDA-ICE	Combination of the considered measures/packages	< 50
Hamdy et al. 2013	Dynamic simulation with IDA-ICE	Simplified methods and auxiliary design calculations	Automatic multi-stage optimization method based on multi-objective genetic algorithm	3400
Corrado et al. 2014	Semi-stationary method (EN 13790)	Semi-stationary method (EN 13790)	Sequential search-optimization technique	< 50
Ganic and Zerrin Yilmaz 2014	Dynamic simulation with EnergyPlus	Dynamic simulation with EnergyPlus	Combination of the considered measures/packages	< 50
Pikas et al. 2014	Dynamic simulation with IDA-ICE (1 floor)	Dynamic simulation with IDA-ICE (fixed HVAC)	Iterative three-step wise optimization	< 50
Ferrara et al. 2014	Dynamic simulation with TRNSYS	Dynamic simulation with TRNSYS	Simulation-based optimization process (GenOpt)	6000
Brandão de Vasconcelos et al. 2016	Dynamic simulation with EnergyPlus	Dynamic simulation with EnergyPlus (fixed HVAC)	Combination of the considered measures (for envelope only)	35,000
Becchio et al. 2016	Dynamic simulation with EnergyPlus	Dynamic simulation with EnergyPlus	Combination of the considered measures	< 50
Ashrafiana et al. 2016	Dynamic simulation with EnergyPlus	Dynamic simulation with EnergyPlus	Combination of the considered measures (for envelope only)	55
Ortiz et al. 2016a, b	Dynamic simulation with TRNSYS	Simplified methods and auxiliary design calculations	Combination of the considered measures	2000

Figure 8 Table showing methodologies of different researchers, Zangheri et al (2017)

Further than the question of calculating energy performance, there is the question of calculating cost. According to the literature review conducted by Zangheri et al (2017), the majority of the costs were carried by envelope solutions and environmental systems. All the research summarized by Zangheri et al also considered the cost items indicated by the Commission Delegated Act No. 244/2012 (European Parliament 2012a, b) and used a real interest rate between 2 and 4% and a yearly increase of energy prices around 2%. This, clearly, will need to be taken into account when considering the application of these models in non-EU countries.

The eventual culmination of Zangheri’s summarization is the development of a simplified seven step methodology towards the identification of cost optimal benchmarks for building renovations, as follows:

1- Selection of a representative climate

2- Definition of reference building types and determination of base levels of retrofit measures

3- Selection of renovation measures and packages applicable to the building types

4- Execution of energy calculations for each combination of retrofit measures, with the determination of the net primary energy demand

5- Execution of economic calculations for each combination of retrofit measures, determining the investments costs and the global costs over the calculation period

6- Identification of energy levels representing the cost optimal and the NZEB targets and optimum packages of retrofit measures

7- Development of a sensitivity analysis focusing on some key calculation parameters.

This research will follow a similar methodology, but adapt it for the boundaries as follows:

1- Description of the representative climate

2- Creation of a typical market rental building typology based on the aggregation methods and data produced by Jaffar (2018)

3- Estimation of costs based on specifics of Kuwait’s representative climate. The extent of the measures will be done using the following frameworks:

a. Using a cost analysis which has been verified by a local consultant firm in order to estimate the renovation cost

b. Utilizing Fokaides and Papadopolous’ (2014) framework for the creation of a cost-optimal selection for insulation

thickness. While the study is based on mesothermic climates in Europe, the benefit of the framework is the flexibility it provides in application in various other contexts, and does not assume things specific to Europe, except for currency. The equation is as follows:

$$d = \left(+\sqrt{\frac{A_3}{\lambda_{INS} * A_4}} - A_2 \right) * \lambda_{INS} \quad ; d < 0.5\,\mathrm{m}$$

Where d is the insulation thickness, A2 is a constant that is the factor of the rate of change between thermal performance and insulation thickness, and A3 is a constant that is based on the rate of change between the heating degree hours, and insulation efficiency, and A4 is a constant for the long term rate of increase of the insulation material and λINS is the rate of change of the insulation cost. The means in which the constants are derived are explained in more detail in the research by Fokaides and Papadopolous (2014).

4- Using a discounted cash flow method, based on median rent rates in order to see returns over a 10 year period

5- Using a sensitivity analysis to find which factors are most influential in changing the break-even point.

6- Using a Monte-Carlo analysis to create a random set of changing variables given a range, and observing the probability of loss given the simulations.

7- The culmination of these investigations will be used to present the data to 3 different experts working in different part of the fields. This will be used as the data to refer to during the interviews to investigate behavioral problems with. This will be the answer to research question 3.

Part 2: Operationalization

STEP 1:
Description of the representative climate

Kuwait Intro

Kuwait is a small Arab country that is bordering Saudi Arabia to the west and Iraq to the north, sitting at the northwestern tip of the Persian Gulf. It has a population of 4.62 million people, in which 1.40 million are nationals and 3.22 million are expatriates, whom account for 70% of the population (PACI, 2018). Kuwait is a rich, developing country that has one of the highest GDP per capitas in the world (IMF, 2020; World Bank, 2018). As much as 90% of Kuwait's export economy is dependent on oil, and there is little variation in the production of the economy. Building construction plays a significant role in the economy of the Kuwait, being the second highest proportion of Kuwait's investment after the oil sector (AlSanad, 2015). Sustainable building in Kuwait is still in its infancy, with only 10 LEED certifications granted in Kuwait as of 2019 (CIBG, 2020), with Kuwait falling behind other GCC countries and having the lowest engagement with green construction projects (AlSanad, 2015).

Kuwait Climate

Kuwait has an arid climate, with a maximum recorded temperature of around 500C in summer and temperatures as low as 00C in the winter. Average annual rainfall in Kuwait in 2017 was 102mm. Kuwait is characterized by its arid climate yet also experiences humidity from its coastal presence. Kuwait also holds the record for the third highest temperature ever recorded on Earth, which was taken on July 21, 2016 with a temperature of 54.00C.

Prevailing winds in Kuwait are in a south easterly direction, coming in from the northwest, mainly coming in from the upper regions of Iraq, which often brings in sandstorms to the region.

In addition to high temperatures, another key characteristic of Kuwait's environment is a high solar heat gain and solar radiation. Kuwait has very little cloud cover, which results in very intense and extended periods of solar radiation. However, this can alternatively provide opportunities in utilization such as solar panels, however must take into account the reduction in photovoltaic efficiency and its effect on its output given the high heat. (Dubey, Sarvaiya, Seshadri, 2013).

Due to lack of readily available weather data, in a 2009 study was conducted which measured the solar irradiation over the course of a year on an hourly basis, while the results were published in 2015. The study, conducted by Bou-Rabee and Sulaiman (2015) debated the use of average monthly irradiation used in earlier studies and assumed it to be much lower. What was found was that the day-to day variation of irradiance during spring was unusually high, which was assumed to be as a result of the sandstorms that occurred during those months, and that variation was smaller in the fall seasons. The result of this is an average monthly irradiation energy of 170.4 KWH/m2, but with a relatively high standard deviation of 61.3KWH/m2, producing a more accurate number and taking into account the drops in solar energy as a result of sandstorms.

Furthermore, Kuwait also experiences large shifts in the insolation angle of the sun, and an optimal tilt angle was determined to be 280, however it must be noted that the deviation in the insolation angles varies from 500 and down to 70 (Al Otaibi, Al Jandal, 2011).

The implications for NZEB in a hot and humid environment are extensively discussed by Feng et al., 2019, with the results showing that the greatest impact can be done in terms of HVAC and ventilation. Furthermore, following the Fokaides' (2014) research, there is also a significant impact of insulation. More specifically, the renovation measures required for Kuwait were described more in detail by Moncef Krarti (2015), the implications of which are discussed in the following section.

Factors contributing to the high energy consumption in Kuwait

Subsequent to the discovery of oil and the exportation of it in the 1930's, there was an unprecedented growth in Kuwait's economy, which as a result led to massive changes in the infrastructure and lifestyle of Kuwaiti citizens, (Alshalfan, 2013 ; Mahgoub, 2007). In an attempt to ensure high household welfare for all Kuwaiti nationals, the government had promised high subsidies for utility costs. Pair this with a relatively high average annual population growth rate of 2.4% (Euromonitor international, 2013) led to an increased demand for housing. The aforementioned elements, paired with oil-based economy and welfare provisions while in a harsh desert climates has led to a very high domestic energy consumption, of which 70% is dedicated to air conditioning (Jaffar, 2014). These energy subsidies had been in place since 1962, and had not changed for well over 50 years despite inflation and increased production costs (Al-Ajmi, Loveday, 2010). In 2001, peak summer demand was 6750GW, and has been rising at 6-8% per year to reach a peak of 14.42GW in 2019 (Ingram, 2019).

In a research by Moncef Krarti (2015), the renovations measures best suited to Kuwait were discussed via the examination of the electricity usage in the residential sector. The renovations that were ideally discussed were interventions on the HVAC level, insulation, and electricity generation, and switching to more energy efficient lighting. Heating accounts for less that 1% of the usage of electricity in Kuwait and thus was dismissed. Furthermore, the switching to LEDs has been undertaken by Kuwait, with incandescent bulbs being banned as of August 1st 2017 as per ministerial order (No. 60/2017), and energy inefficient halogen bulbs have been banned as of September 1st, 2019 (Al-Nakib, Al-Ragom, and Al-Osaimi, 2019). This will influence the decision of the renovation measures that are selected in the step 3 section of the research.

STEP 2:
Creation of a typical market rental building typology based on the aggregation methods and data produced by Jaffar (2018)

Kuwait Reference Building

Kuwait is a relatively new city, with a key moment in its urban history being implementation of its first master plan in 1952, followed by the master plan of the city in the 70's by Colin Buchanan and partners (AlRagam , 2008). Residential areas were categorized into 2 types. The first of these being the "ideal" residential suburbs, known as manatiq namuthajiya (مناطق نموذجية), which comprises of the majority of the stock in which Kuwaitis dwell, these commercial suburbs are characterized by single plot housing with setbacks on all 4 sides of the building, and is exemplified in areas such as Rawda, Qortuba, or Surra (Jaffar, 2014). The second is the commercial suburbs, or manatiq istithmariya (مناطق استثمارية), which is predominated by the second type of housing in Kuwait. They are 10 to 12 story flats that are found mainly in areas such as Salmiya, Fahaheel, and Farwaniya, which also comprise of a wide swath of the housing stock. The housing described is characterized by having very similar and low quality finishes, oftentimes from the lowest bidder available in local industries. This leads to a lot of standardized and similar looks and finishes appearing throughout the buildings. They are often characterized by the white brick pre-insulated breeze blocks. Also, they generally do not have insulation, and have low performing windows and a lot of potential to improve. These buildings often have open ground floors, for the purposes of parking, as is indicated in the 3d model shown in the following section. Furthermore, it is important not only to focus on the physical and technical aspects, but also the similar political aspects to the building type. It's important to know that the majority of these buildings are inhabited by non-Kuwaitis, with figures up to 98% for Farwaniya (KuwaitGIS, 2020), and that as per Kuwaiti real estate law 74, decreed in 1979, non-Kuwaitis are not allowed to own property. Thus, the conclusion is made that the tenureship of these buildings are rental in majority.

Figure 9 – Examples of the buildings in question – Mangaf (Styles, 2017

Figure 10 - Example of the buildings in question - Farwaniya (China News , 2017)

A framework to evaluate the energy efficiency potential of Kuwaiti Homes

The approach used by Jaffar et al (2014) will be adopted in order to make the creation of a model building. One of the major limitations faced in Kuwait is the lack of transparency and readily available data, a challenge which can be expected to be faced around the world and is particularly faced by this study. The paper presented by Jaffar et al presents a framework for evaluation energy efficiency potential in Kuwaiti residential stock by using a case study and historical data analysis. The approach of a stock model development will prove especially useful in a context such as Kuwait with limited data.
Building stock models often include physic s based models that used to estimate baseline energy consumption.
Jaffar et al's (2014) proposed approach, the archetype technique is used to aggregate stock, and to average out the characteristics of multiple different housing types with minimal amounts of variation between each archetype. (Kavgic et al., 2010; Raslan, Mavrogianni, 2013 , Famuyibo et al, 2012) Jaffar's study seeks to improve the reliability of model predictions for Kuwait by using a case study strategy to create an archetype. Jaffar's archetypes for apartment housing are summarized in the tables below.

House type	Number of units	Approximate plot size	Approximate floor area/dwelling
Villas	105,764		
Government Low income housing 1967–1984 (2 floors)	27,626	250 m²–750 m²	350–400 m²
Government – Middle income housing 1967–1984 (2 floors)	4000	400 m²–750 m²	500 m²
Government housing 1984 – present (2 floors)	24,910	400 m² – 600 m²	400 m²–500 m²
Private villas (2–3 floors plus basement option)	49,228	350 m²–1000 m²	400 m²–1400 m²
Apartments	170,815		
Government apartments 1980s	1088	large complex with many flats/floor	350 m²
Government apartment future plans	Under planning	Low-rise 5 storey building (1 flat/floor)	400 m²
Residential apartments	169,727	In excess of 400 m²	70 m² – 250 m²
Pre-1940s courtyard houses	20,984		
	-	100–150m²	100–150m²
Palaces	47		
	-	In excess of 1000 m²	In excess of 3000 m²

Figure 11 – General information about the housing type, the housing type focused on is highlighted – Jaffar et al (2014)

KUWAIT				
Dwelling type	Number of dwellings	Electricity consumed		
		Share	Average kWh/ dwelling/ annum	Average kWh/m²/ dwelling/ annum
Villas	105,764	88%	145,444	264
Flats	170,815	12%	20,278	127

Figure 12 – Average usage of electricity in Kuwaiti building types – Jaffar et al (2014)

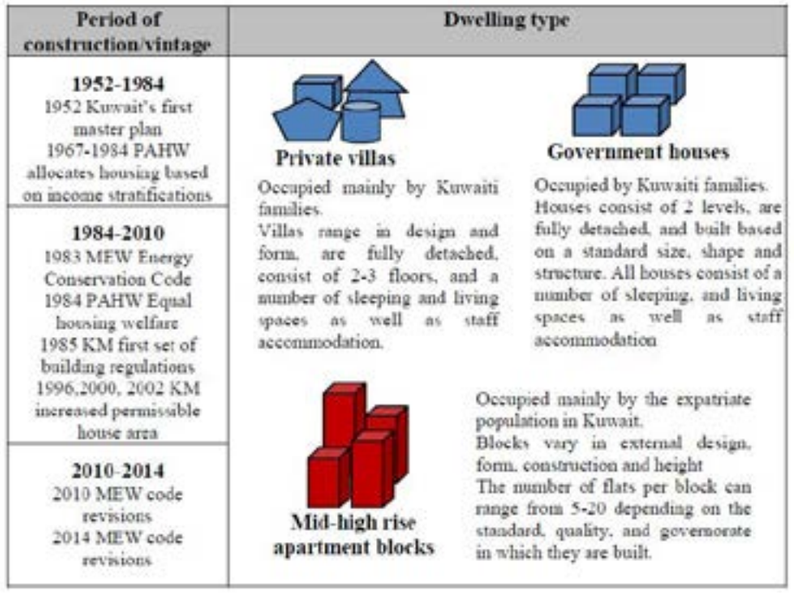


Figure 13 – explanation of the building typpologies as well as a basic timeline – (Jaffar et al, 2014)

Furthermore, the study states that it provides the following: "A framework for estimations of the thermal characteristics of homes made by combining data of the building year and with relative thermal regulations from the MEW [Ministry of Electricity and Water] code guidelines".

The framework calls for "case study strategies that involve multiple case studies to allow for case comparisons and preliminary suggestive generalizations". Furthermore, the study takes up multiple cases from the Ministry of Electricity and Water and monitoring in order to come up with an average kWh per square meter number for each housing archetype.

Creation of a typical model following Jaffar's framework of energy efficiency potential

History of the Building Type

The model building in question is a specific kind of building that started to develop in the late 90's and continued to develop through onto present day (Al-Sager, 2020). It flourished as a result of a successful typology that began to be repeated. This model is found most often in newer commercial housing zones such in the areas called Farwaniya and Mangaf (Al-Sager, 2020). Jaffar's 2014 and subsequent 2018 research show that nearly two thirds of the population live in such areas, as well as data provided from the Kuwait Municipality website

The data used was that of dimensions taken from real estate listings made available online from sectors that fit the methodology, specifically within regions that coincide with the newer buildings built in the post 90's, such as Mangaf or Farwaniya. The median rent per square meter was taken; size of rooms (bedrooms, living rooms, bathrooms, kitchens, etc.) was aggregated, and estimated dimensions of windows. For the window to wall ratio, the codes from the Kuwaiti municipality were used for proposed window-to-wall ratios, as well as setbacks assumed for buildings (Kuwait Municipality, 2020). Furthermore, within Jaffar's research there is aggregated data of window to wall ratios from survey data, which will be compared with the window to wall ratio used in the reference building. These were then compared with the earliest found code of the Kuwait Municipality, which was from 2003.

The energy usage of the building is provided by Jaffar's framework which involved survey data provided by the Kuwait Ministry of Electricity and Water (MEW). This will be used as the basis in which the assumptions will be based.

	Jaffar Framework	Muncipality 2003	Municipality 2007	Municipality 2010	Real Estate Findings	Municipality GIS Data	Average - Model Building
FAR	200	210	210	210	205	207	207
WWR	0.33	0.30	0.40	0.40	0.35	-	0.355
Bathroom	-	-	-	-	3.57	-	3.57
Living Room	-	-	-	-	27.35	-	27.35
Bedrooms	-	-	-	-	10.33	-	10.33
No. Bedrooms	-	-	-	-	1.7	-	1.7
Energy usage	127	-	-	-	-	-	127
Average Rent (KWD/m^2)	-	-	-	-	4.120	-	4.12

Figure 14 Summary table of aggregated items

In the table above, the different characteristics of the building which were checked were observed, these are represented in the far left column. The characteristics being as follows:

- Floor to area ratio
- Window to Wall Ratio
- Bathroom size
- Living room size
- Bedroom size
- Number of bedrooms
- Energy Usage
- Average rent

And in the row at the top, the source of where each number was derived from is written down, going from left to right, they are as follows:

- Data obtained from Jaffar et al (2014) framework
- Municipality code in 2003
- Municipality code in 2007
- Municipality code in 2010
- Findings from real estate online listings
- Information found through the Kuwait Municipality's Geographic Information System

This eventually culminates into the column on the far right, which takes the mean value of all these items to create an "average" that will be used for the model building. The model building is then built using the aggregated guidelines in Revit, and the results are the model below, which also follows key characteristics as described in section "Kuwait Reference Building", and "Kuwait reference building history", which includes a building assuming single tenureship throughout, and a raised plinth for parking as dictated by the Kuwait Municipality guidelines:

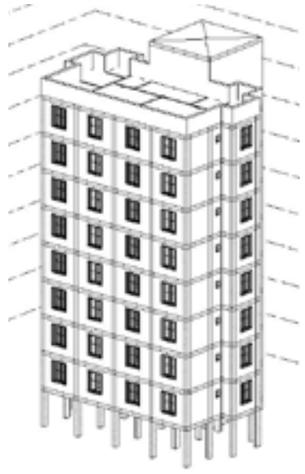


Figure 15 Image of model building

STEP 3:
Estimation of costs based on specifics of Kuwait's representative climate using expert cost estimation (AGi Architects, 2020) and then looking at how much change is caused as a result of Fokaides' and Popadopolous' (2014) equation

For the estimation of the costs, the assumed changes in the building involve a renovation of the following aspects:

- Change in cladding
- Complete change of all windows
- Complete change of ducting
- Complete change of HVAC systems – changing of traditional HVAC units to a VRF system and with VAV units

There will not be an assumption in changes to heating systems, as heating systems are responsible for less than 1% of energy usage in typical Kuwaiti buildings (Krarti, 2015). Furthermore, usage of solar panels is not assumed due to the results of a feasibility study produced by Krarti (2015) which finds that feasibility of photovoltaic panels is possible on the large scale, however on the small scale is not considered beneficial for the individual units (Krarti, 2015) due to the limited roof spaces that are carrying a lot of services (such as water tankers, HVAC units, cable trays etc.), a district level approach is preferred. However, to re-iterate a point made in section 2.4, the research is focusing primarily on the object level to avoid the assumption of group cooperation, and to see if it is feasible for the individual. Finally, the assumption of water consumption will remain the same in both, as reduction in water consumption is has a significant dependance on behavioral changes (Ascenscio, Delmas, 2016), and the study is assuming no changes in behavior of the tenants. To account monetization of CO_2 reduction as discussed in the literature review, the materials that are locally sourced will be the ducting and the insulation material excluding the mounting material. This is because these are items that can be locally sourced at the performance levels that are required of the project. Items which cannot be locally sourced at the required NZEB specifications, such as the windows, VRF, and VAV systems, will not be considered as local, and will use the more oft used imports for these projects.

The cost estimations are done by a third party consulting company with more than 10 years of experience in the local environment. The assumption of the cost is done as such that the extense of the renovation measures will be estimated by the company for 3 levels, a low specification, a middle specification, and the top of the line specification. The costs are estimated for the individual components (cladding, windows, ducting, VRF and VAV systems), and then the costs are estimated by using a bill of quantities and assuming no changes to the overall design, just changes to the individual components of the existing model building. Assuming changes in design would lead to a great number of variables which is not the key focus of the design, and brings the question if at what point this can be considered a new building rather than a renovation. In the cases in which there is an addition made on top of an existing model, everything above the original height of the building is considered as part of the "Addition" budget, all changes made to the building up to the maximum of the original height will be considered as part of the "Renovation" budget.
Once the cost estimations are done, the application of Fokaides and Papadopolous' (2014) equation will be applied as a means of value engineering. Furthermore, it has been already stated that the project is focusing on the object level, and thus it is not assumed of a level of cooperation on the district level. However, with that taken into account, there will be a provision given and that provision will be found by using a Goal Seek in order to find that value that can be spent in order to have an NPV (Net Present Value) of 0 in the case of a net-negative NPV. In this case, the assumption is best clarified through the question that assuming an NZEB is achieved, how much can we still spend to achieve a break-even point? This will allow an observation of the maximum budget that can be spent, given the assumed return rate of 10% and maintaining other variables as constant.

The estimations were based on an assumed range of renovations which has been mentioned above, and using a Bill of Quantity in order to derive the estimations. First, a quantity survey of the changed items will be generated from the Revit model, and then the derived quantities of changed items will be multiplied by costs at 3 expected levels, Minimum, Mid-range, and Maximum. Finally, the costs of savings calculated from the Fokaides equations described in the literature review are applied and that is the fourth cost that is found, the equation used and the final cost estimations are found below:

$$d = \left(+\sqrt{\frac{A_3}{\lambda_{INS} * A_4}} - A_2\right) * \lambda_{INS} \quad ; d < 0.5\,\text{m}$$

Where d is the insulation thickness, A2 is a constant that is the factor of the rate of change between thermal performance and insulation thickness, and A3 is a constant that is based on the rate of change between the heating degree hours, and insulation efficiency, and A4 is a constant for the long term rate of increase of the insulation material and λINS is the rate of change of the insulation cost.

Renovation Level	Cost Estimation
Minimum	KWD 75,952.000
Mid-Range	KWD 89,488.750
Maximum + Fokaides Value Engineering	KWD 100,191.500
Maximum	KWD 103,148.000

From the above table, we are able to surmise that the change in value engineering by the Fokaides (2014) equation were minimal. This is due to the fact that the "minimum" possible performing insulation has to be very high spec given the extreme weather requirements of Kuwait, thus, the "minimum" level is almost as high as the "maximum" level, and thus does not make much of a change in the final cost, with the final difference in cost being less that 1% of the total cost.

For the purposes of the research in every situation, a worst case scenario was assumed. Meaning that, in all situations, the highest expenses were assumed, a 3-year construction period with 0% occupancy was assumed, and in all cases the Net Present Value (NPV) was used as a means of finding out the maximum that could be spent and still be within the realm of feasibility. Also, to further assume the "worst case scenario", the standard of 8% of Gross Potential Income (Koppels, 2019) will be assumed for the maintenance of the renovation. The implications of the savings made by renovation is not taken into account, due to the fact that this requires extensive study with respect to specific decisions made on a per material basis, and this study is focusing on a more generalized approach. Furthermore, in order to account, and continue with the "worst case scenario" the assumption is that the maintenance will be the same both before and after renovation.

Cost Analysis and feasibility

The cost analysis is done through the discounted cash flow method as is standard for financial modeling. The discounted cash flow method is then used to observe whether or not the payback period is achievable within 10 years. The objective of "10 years" will remain constant, due to it being the standard practice for real estate finance (Koppels, 2019). The examination is done firstly through observation of the current Net Present Value of the remodeling cost assuming a 3 year construction period as well as all other factors being constant. A sensitivity analysis is performed in which the variables are changed and then ranked in order of most to least sensitive, the changes are observed by changing each factor by 5% and then observing the overall change to the NPV. Then, provided that the financial estimation has proven to be somewhat feasible, then a scenario analysis will be performed, in which the results for multiple variables will be analyzed and then the combinations which provide a net present value of 0 or above will be observed. The feasibility of the model will be decided according to whether the changes made to the electricity is within the range of its actual cost (the actual cost is found by compounding inflation rates from 19661 until now, and comparing it to the original 0.002 KWD per kWh price inflated to today's price using price index), if the price changes made for rent is within the standard deviation of rental prices found in the online survey of real estate rents, and finally if the payback period is found within 10 years. Finally, a Monte Carlo analysis will be performed, in which the maximum possible and minimum number for each variable will be observed, which gives us the mean and standard deviation, this will be used to run 5000 simulation runs of the project in order to see the probability of success for each possible model. The clarification for the variables is presented in the section pertaining to the Monte Carlo analysis.

STEP 4-6:

Step 4 Adaptation: Using a discounted cash flow method, based on median rent rates of each respective city in order to see returns over a 10 year period

Step 5: Using a sensitivity analysis to find which factors are most influential in changing the break-even point.

Step 6: Using a Monte-Carlo analysis to create a random set of changing variables given a range, and observing the probability of loss given the simulations.

The following section uses a combination of steps 4 to steps 6 in order to make the analysis. They are not performed linearly as in the 7-step method, due to the fact that each financial model is using different kinds of analysis that do not necessarily follow the linear fashion in the 7 steps. It becomes more clear to analyses each financial model individually rather than following the linear system from this point forward.

Cost Analysis: Financing through existing rent and energy savings

The first step is to check the financial feasibility of financing a renovation cost of a building at all. Firstly the financing will be observed to see if it is feasible through the existing rent payments, assuming a 0% occupancy rate throughout the duration of the renovation, which is assumed to be 3 years. In the next section the financing will be observed to see if it is possible through only the difference made between energy saving costs and rent increases. The variables sheet is shown below:

Building Data	
Rent per m²	KWD 4.121
Annual Rent income	KWD 48,268.377
Energy cost per Kwh	KWD 0.050
Annual Energy cost	KWD 12,954.000
Cost of 1l of water	KWD 0.0004
Annula Water Cost	KWD 4,019.568
Annual utilities cost	KWD 16,973.57
Maintenance and repairs	8%
inflation Rate	2.78%
Energy Reduction: NZEB 50kWh	KWD 5,100.000
Minmum	KWD 75,952.000
Mid Range	KWD 89,488.750
Maximum	KWD 100,191.500
Maximum + Fokaides Value Engineering	KWD 103,148.000
Assumed Return	10%
Nominal Annual Rent Increase	2.78%

In the variables above, rent per m2 is calculated via averaging out of real estate listings found online, and annual rent income is derived from the lettable area multiplied by the average rent over the span of 12 months. The energy cost per KWH is derived from the current price used by the Ministry of Electricity and Water (MEW). The following annual energy and utilities cost is derived by multiplying the cost of water and electricity usage by the average water and electricity use found in by Jaffar (2014). The inflation rate is found by using the historical inflation rate of the country from the year 2000 until 2020 and then using the average across the years (World Bank, 2020). For the cost estimations, the cost estimations were provided by a local professional consultant company with more than 10 years of experience, and in order to find the range in which the costs can deviate the cost estimation provided was for Minimum, Mid, and Maximum ranges. The assumed return is 10% as is standard (Koppels, 2019), and the nominal annual rent increase is assumed to be equivalent to the inflation level. Finally, the change in water usage is assumed to be the same before and after the renovation, as this is largely dependent on user behavior, and in this case this is assumed no change in user behavior for water usage. The balance sheet for the above assumptions is found following:

Period	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Occupancy Rate	0%	0%	0%	0%	50%	60%	90%	90%	90%	90%	90%	90%	90%	90%
Hotel income and expenses														
Potential gross income	KWD 48,268.38	KWD 49,612.21	KWD 50,993.46	KWD 52,413.17	KWD 53,872.40	KWD 55,372.25	KWD 56,913.87	KWD 58,498.40	KWD 60,127.05	KWD 61,801.04	KWD 63,521.64	KWD 65,290.14	KWD 67,107.87	KWD 68,976.22
Vacancy allowance	KWD (48,268.38)	KWD (49,612.21)	KWD (50,993.46)	KWD (52,413.17)	KWD (26,936.20)	KWD (22,148.90)	KWD (5,691.39)	KWD (5,849.84)	KWD (6,012.70)	KWD (6,180.10)	KWD (6,352.16)	KWD (6,529.01)	KWD (6,710.79)	KWD (6,897.62)
Gross Rent Income	0	0	0	0	26,936	33,223	51,222	52,649	54,114	55,621	57,169	58,761	60,397	62,079
Hotel income and expenses														
Annual rental income	KWD -	KWD -	KWD -	KWD -	KWD 26,936.20	KWD 33,223.35	KWD 51,222.48	KWD 52,648.56	KWD 54,114.34	KWD 55,620.94	KWD 57,169.47	KWD 58,761.12	KWD 60,397.09	KWD 62,078.60
Annual energy expenditure	KWD -	KWD -	KWD -	KWD -	KWD (2,846.06)	KWD (3,510.35)	KWD (5,412.13)	KWD (5,562.81)	KWD (5,717.68)	KWD (5,876.87)	KWD (6,040.48)	KWD (6,208.66)	KWD (6,381.51)	KWD (6,559.18)
Annual Water expenditure	KWD -	KWD -	KWD -	KWD -	KWD (2,243.12)	KWD (2,766.69)	KWD (4,265.57)	KWD (4,384.33)	KWD (4,506.39)	KWD (4,631.86)	KWD (4,760.81)	KWD (4,893.36)	KWD (5,029.59)	KWD (5,169.62)
Annual Maintenance	KWD -	KWD -	KWD -	KWD -	KWD (4,309.79)	KWD (4,429.78)	KWD (4,553.11)	KWD (4,679.87)	KWD (4,810.16)	KWD (4,944.08)	KWD (5,081.73)	KWD (5,223.21)	KWD (5,368.63)	KWD (5,518.10)
Net annual property income	0	0	0	0	17,537	22,517	36,992	38,022	39,080	40,168	41,286	42,436	43,617	44,832
Investment														
Renovation	103,148													
Investment	-103,148													
Net Cash Flow														
Net Cash Flow	-103,148	0	0	0	17,537	22,517	36,992	38,022	39,080	40,168	41,286	42,436	43,617	44,832
Cumulative Net Income														
Cumulative Net Income	-103,148	-103,148	-103,148	-103,148	-85,611	-63,094	-26,103	11,919	50,999	91,167	132,454	174,890	218,507	263,339
Hotel income and expenses														
Net Present Value	**KWD 51,040.583**													

On a surface level analysis of the cost sheet above, we can observe from the cumulative net income chart that the approximately 103,000KD investment would be paid back in about 4 years after the completion of the renovation (assuming the renovation is done from years 0-3). Furthermore, even with the development delay and the reduced occupancy for the first few years, the payback period was still feasible. Upon usage of the goal seek analysis it is found that the maximum possible expenditure for the renovation to be feasible is 159,292.641 KWD, assuming all other factors remain constant. This value will be used as the "maximum" value for the Monte Carlo simulation.

The aim is to eventually perform a Monte Carlo analysis. The way in which the analysis is performed is first the minimum and maximum ranges of each variable are found. In the case of this analysis, the variables that are being observed are: Rent, Energy Cost, Inflation, and Budget. The numbers are tested with random variables for each within the given range and 5000 simulations are run. The probabilities are then extrapolated from the number of outcomes with a Net Present Value greater than 1 versus ones with a Net Present Value less than 1. Currently, the range of variables for Rent, Inflation, and Budget are found, however we have no logical inference for the range of the Energy cost. In order to do so, data from the next analysis will have to be extrapolated.

The ranges are as follows:

Range	Min	Max
Rent	3.000 KWD / m^2	6.000 KWD / m^2
Inflation	0.89%	6.30%
Budget	1000,000 KWD	160,000 KWD

The range of rent is found from the minimum and maximum found from searches of real estate listings online. The inflation range was assumed by examining the general inflation rate from the year 2000 until the year 2020, and finding the high of 6.30% during the 2008 financial crisis, and a historic low of 0.89% during 2002 (World Bank, Macrotrends, 2020). In this situation, the data is limited by what was able to be found online, as ability to access this data requires in-person presence in Kuwait, which is impossible during the Covid-19 pandemic. The minimum budget in this case is assumed to be the high end renovation cost estimated by the consulting company, and the high end of the renovation budget is considered the maximum possible budget assuming that the NPV = 0.

In order to find out the range of the energy cost, the next analysis is performed, which assumes trying to pay back the price of the renovation solely through energy savings.

Comments on Financing through existing Rent

While this is definitely very feasible, this would imply shutting down income for this property for a period of 3 years according to this study. Though, in the case of ownership of a large portfolio the temporary losses could be acceptable, Kuwait has a unique case in which there are cases in which the ownership is by a single owner and the livelihood of the owner is largely dependent on the performance of this single building. In such cases, asking for a reduction or a complete stop of income for multiple years is directly affecting the livelihood of this individual, and the financing of their everyday lives also needs to be taken into account.

Cost Analysis: Energy performance Contracting + Rent increase

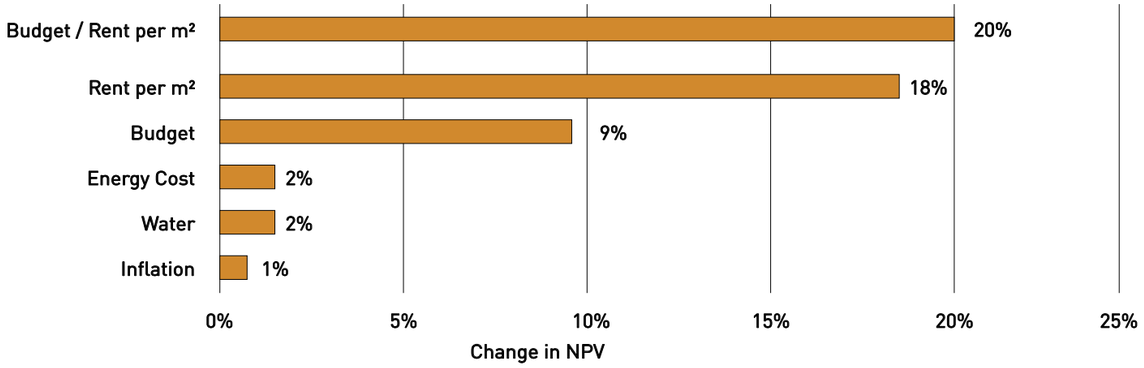
Next is trying to find feasibility of financing the renovation exclusively through rental increase and savings from electricity incomes alone. The variables are the same as the previous iteration, and there are 3 separate net present values, one which looks at the rent as done previously, one which looks at the price of saving through energy exclusively, and one which looks at the energy costs savings and the financing through the difference in price. A sensitivity analysis is also performed in order to see which changes are conducive to the largest changes in the final net present value. The cash flow sheet is shown below:

Period	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Occupancy Rate	0%	0%	0%	0%	50%	60%	90%	90%	90%	90%	90%	90%	90%	90%
Hotel income and expenses														
Potential gross income	KWD 48,253.44	KWD 49,594.89	KWD 50,973.62	KWD 52,390.69	KWD 53,847.15	KWD 55,344.10	KWD 56,882.67	KWD 58,464.01	KWD 60,089.31	KWD 61,759.79	KWD 63,476.71	KWD 65,241.36	KWD 67,055.07	KWD 68,919.20
Vacancy allowance	KWD (48,253.44)	KWD (49,594.89)	KWD (50,973.62)	KWD (52,390.69)	KWD (26,923.58)	KWD (22,137.64)	KWD (5,688.27)	KWD (5,846.40)	KWD (6,008.93)	KWD (6,175.98)	KWD (6,347.67)	KWD (6,524.14)	KWD (6,705.51)	KWD (6,891.92)
Gross Rent Income	0	0	0	0	26,924	33,206	51,194	52,618	54,080	55,584	57,129	58,717	60,350	62,027
Energy Expenditure pre-renovation														
Energy Expenditure pre-renovation	KWD -	KWD -	KWD -	KWD -	KWD (7,227.84)	KWD (8,914.53)	KWD (13,743.52)	KWD (14,125.59)	KWD (14,518.28)	KWD (14,921.89)	KWD (15,336.72)	KWD (15,763.08)	KWD (16,201.30)	KWD (16,651.69)
Hotel income and expenses														
Annual rental income	KWD -	KWD -	KWD -	KWD -	KWD 26,923.58	KWD 33,206.46	KWD 51,194.40	KWD 52,617.61	KWD 54,080.38	KWD 55,583.81	KWD 57,129.04	KWD 58,717.23	KWD 60,349.57	KWD 62,027.28
Annual energy expenditure	KWD -	KWD -	KWD -	KWD -	KWD (2,845.61)	KWD (3,509.66)	KWD (5,410.84)	KWD (5,561.26)	KWD (5,715.86)	KWD (5,874.76)	KWD (6,038.08)	KWD (6,205.94)	KWD (6,378.46)	KWD (6,555.78)
Annual Water expenditure	KWD -	KWD -	KWD -	KWD -	KWD (2,242.77)	KWD (2,766.14)	KWD (4,264.55)	KWD (4,383.11)	KWD (4,504.96)	KWD (4,630.20)	KWD (4,758.92)	KWD (4,891.21)	KWD (5,027.19)	KWD (5,166.95)
Annual Maintenance	KWD -	KWD -	KWD -	KWD -	KWD (4,307.77)	KWD (4,427.53)	KWD (4,550.61)	KWD (4,677.12)	KWD (4,807.14)	KWD (4,940.78)	KWD (5,078.14)	KWD (5,219.31)	KWD (5,364.41)	KWD (5,513.54)
Net annual property income	0	0	0	0	17,527	22,503	36,968	37,996	39,052	40,138	41,254	42,401	43,580	44,791
Net annual Energy Savings	0	0	0	0	4,382	5,405	8,333	8,564	8,802	9,047	9,299	9,557	9,823	10,096
Net Annual Income Increase	0	0	0	0	26,924	6,283	17,988	1,423	1,463	1,503	1,545	1,588	1,632	1,678
Investment														
Renovation	103,148													
Investment	-103,148													
Cumulative Net Income														
Net Cash Flow	-103,148	0	0	0	17,527	22,503	36,968	37,996	39,052	40,138	41,254	42,401	43,580	44,791
Net Cash Flow - Energy Only	-103,148	0	0	0	4,382	5,405	8,333	8,564	8,802	9,047	9,299	9,557	9,823	10,096
Net Cash Flow - Energy + Rent Increase	-103,148	0	0	0	31,306	11,688	26,321	9,988	10,265	10,551	10,844	11,145	11,455	11,774
Cumulative Net Income														
Cumulative Net Income	-103,148	-103,148	-103,148	-103,148	-85,621	-63,117	-26,149	11,847	50,900	91,038	132,291	174,692	218,272	263,063
Cumulative Net Income - Energy Only	0	0	0	0	4,382	9,787	18,120	26,684	35,487	44,534	53,832	63,389	73,212	83,308
Cumulative Net Income - Energy + Rent Increase	0	0	0	0	26,924	33,206	51,194	52,618	54,080	55,584	57,129	58,717	60,350	62,027

Hotel income and expenses						
Net Present Value	KWD 50,935.524					
Net Present Value - Energy Only	KWD (60,698.308)	**Energy price Increase for NPV 0 =**	KWD	0.142	284% increase	
Net Present Value - Rent Increase	KWD (27,377.507)	**Rent Increase for NPV 0 =**	KWD	7.504	82% increase	

Using a goal seek analysis we can observe that in order to finance the renovation entirely through changes in energy price, the energy price would have to be increased to 0.142 KWD, a 284% increase, which is about 0.38 euros as of the time of this writing. This puts it at roughly equivalent to the highest energy prices in the world, comparable to that of Germany and Denmark (Global Petrol Prices, 2020). As of now, Kuwait is in the bottom 20 for cheapest electricity prices in the world. In addition, the cost of electricity found in the goal seek analysis is close to the recommended amount produced in a study Moncef Krarti which recommends increasing the price to approximately 0.136 KWD (Krarti, 2014), which is a 4% difference between the cost found in the goal-seek analysis. In order to achieve a net present value of 0, the rent prices would require an 82% increase with an average rent of 7.504 KWD per m2, which far exceeds the highest rent found in the range of rent values from the real estate data observed of 6.000 KWD.

From the above, a sensitivity analysis is conducted in order to see which variables are conducive to the largest changes in the final net present value. The results are as follows:



From the sensitivity analysis, it can be observed that the initial budget and the rent per m2 are the highest contributors to changes in the NPV. However, the biggest change comes from a relationship between budget and rent. To clarify, this means that the higher the rent is in relation to the budget, the more ideal the NPV is going to be. This leads to the next analysis, which is a scenario analysis of different prices versus changes in rent price, and an observation of which combinations have a positive NPV. The table of results is shown below, with the ranges of the electricity prices ranging from 0.050 KWD which is the current price of energy, up to the maximum of 0.142 which had been derived from the goal seek analysis. The price of rent is from the lowest rate found from the online listings of 3.500 KWD per m2, the maximum price of 7.500 KWD which was found using the goal seek analysis.

	0.050	0.055	0.060	0.065	0.070	0.075	0.080	0.085	0.090
3.500	-32,381	-26,924	-21,468	-16,011	-10,554	-5,098	359	5,816	11,272
3.600	-31,572	-26,115	-20,659	-15,202	-9,745	-4,289	1,168	6,624	12,081
3.700	-30,763	-25,307	-19,850	-14,393	-8,937	-3,480	1,977	7,433	12,890
3.800	-29,955	-24,498	-19,041	-13,585	-8,128	-2,671	2,785	8,242	13,699
3.900	-29,146	-23,689	-18,233	-12,776	-7,319	-1,863	3,594	9,051	14,507
4.000	-28,337	-22,880	-17,424	-11,967	-6,510	-1,054	4,403	9,859	15,316
4.100	-27,528	-22,072	-16,615	-11,158	-5,702	-245	5,212	10,668	16,125
4.200	-26,720	-21,263	-15,806	-10,350	-4,893	564	6,020	11,477	16,934
4.300	-25,911	-20,454	-14,997	-9,541	-4,084	1,372	6,829	12,286	17,742
4.400	-25,102	-19,645	-14,189	-8,732	-3,275	2,181	7,638	13,094	18,551
4.500	-24,293	-18,837	-13,380	-7,923	-2,467	2,990	8,447	13,903	19,360
4.600	-23,484	-18,028	-12,571	-7,115	-1,658	3,799	9,255	14,712	20,169
4.700	-22,676	-17,219	-11,762	-6,306	-849	4,607	10,064	15,521	20,977
4.800	-21,867	-16,410	-10,954	-5,497	-40	5,416	10,873	16,330	21,786
4.900	-21,058	-15,602	-10,145	-4,688	768	6,225	11,682	17,138	22,595
5.000	-20,249	-14,793	-9,336	-3,880	1,577	7,034	12,490	17,947	23,404
5.100	-19,441	-13,984	-8,527	-3,071	2,386	7,843	13,299	18,756	24,212
5.200	-18,632	-13,175	-7,719	-2,262	3,195	8,651	14,108	19,565	25,021
5.300	-17,823	-12,367	-6,910	-1,453	4,003	9,460	14,917	20,373	25,830
5.400	-17,014	-11,558	-6,101	-645	4,812	10,269	15,725	21,182	26,639
5.500	-16,206	-10,749	-5,292	164	5,621	11,078	16,534	21,991	27,447
5.600	-15,397	-9,940	-4,484	973	6,430	11,886	17,343	22,800	28,256
5.700	-14,588	-9,132	-3,675	1,782	7,238	12,695	18,152	23,608	29,065
5.800	-13,779	-8,323	-2,866	2,591	8,047	13,504	18,960	24,417	29,874
5.900	-12,971	-7,514	-2,057	3,399	8,856	14,313	19,769	25,226	30,682
6.000	-12,162	-6,705	-1,249	4,208	9,665	15,121	20,578	26,035	31,491
6.100	-11,353	-5,896	-440	5,017	10,473	15,930	21,387	26,843	32,300
6.200	-10,544	-5,088	369	5,826	11,282	16,739	22,195	27,652	33,109
6.300	-9,736	-4,279	1,178	6,634	12,091	17,548	23,004	28,461	33,918
6.400	-8,927	-3,470	1,986	7,443	12,900	18,356	23,813	29,270	34,726
6.500	-8,118	-2,661	2,795	8,252	13,708	19,165	24,622	30,078	35,535
6.600	-7,309	-1,853	3,604	9,061	14,517	19,974	25,431	30,887	36,344
6.700	-6,501	-1,044	4,413	9,869	15,326	20,783	26,239	31,696	37,153
6.800	-5,692	-235	5,221	10,678	16,135	21,591	27,048	32,505	37,961
6.900	-4,883	574	6,030	11,487	16,943	22,400	27,857	33,313	38,770
7.000	-4,074	1,382	6,839	12,296	17,752	23,209	28,666	34,122	39,579
7.100	-3,266	2,191	7,648	13,104	18,561	24,018	29,474	34,931	40,388
7.200	-2,457	3,000	8,456	13,913	19,370	24,826	30,283	35,740	41,196

Cost Analysis: Monte Carlo Analysis

Now with both the scenario analysis complete, we can begin to conduct a Monte Carlo investigation of the scenarios, one financed with the regular rent, one financed with energy alone, and one financed with energy and rent increases.

In order to conduct a Monte Carlo analysis, the Min-Max ranges need to be defined as well as the standard deviation. The standard deviation is found using the standard method of finding the square root of the variance in the numbers from the data sets, finally the RAND# column is the random number function in excel which creates a random number based on the max, min, mean and standard deviation. The RAND# value is what is inputted into the cash flow diagram and the NPV is recorded 5000 times. The data is presented in the table below.

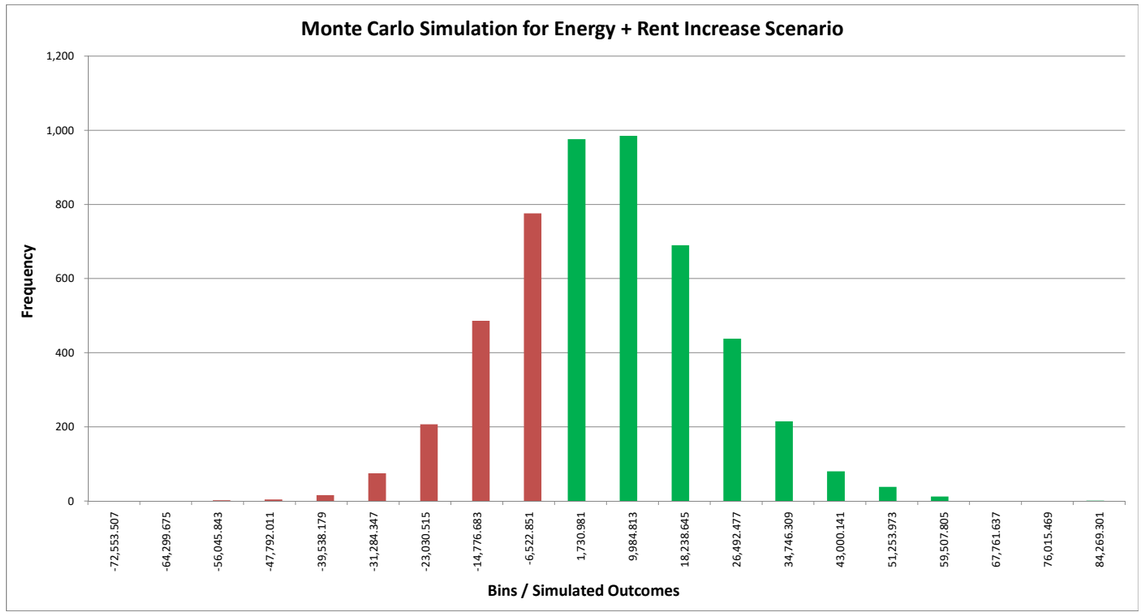
	Max	Min	Mean	St Dev.	RAND#
Rent	6.000	3.000	4.500	0.500	4.789
Energy cost	0.142	0.050	0.096	0.015	0.083
Inflation	6.30%	1.00%	3.65%	0.88%	3.31%
Renovation budget	150,000.000	100,000.000	125,000.000	8,333.333	130,260.909
Rent Increase	6.500	4.120	5.310	0.397	4.640

In the above table the Min-Max of rent is found through the existing data found online. The range of the energy cost is from minimum being the existing energy cost and the maximum being the cost found in order to break even with energy price changes alone through the goal seek analysis. Inflation is from the historical data of highest and lowest inflation rates from the year 2000 until the year 2020. The renovation budget comes from the estimation provided by the consulting company, and the maximum amounts found from the goal seek analysis for the highest possible budget. Rent increase is limited from the median range of the rental rates which was assumed in the first scenario, but the “Max” is the highest rent found from the real estate online listings.

Monte Carlo - Regular			Prob loss	7.50%	
	Rent	**Energy Cost**	**Inflation**	**Budget**	**NPV**
	4.236	0.089	0.034	130,383.577	21,165.440
1	4.355	0.080	0.037	127,403.633	37,795.815
2	3.865	0.079	0.038	134,091.989	8,806.746
3	4.814	0.113	0.019	111,428.850	36,955.488

Monte Carlo - Energy Cost Only				Prob loss	0.9988
	Rent	**Energy Cost**	**Inflation**	**Budget**	**NPV**
	4.236	0.089	0.034	130,383.577	-56,579.177
1	4.418	0.087	0.033	120,522.001	-49,486.442
2	5.504	0.097	0.033	118,582.886	-41,358.532
3	3.863	0.104	0.025	111,535.326	-33,845.171

However, running a Monte Carlo simulation with both changes in rent and energy cost results in the following:



In this scenario we see where that there is a much higher probability of success, with the chance of success being increased to 54.06%. This is unfortunatley still a risky investment, However with the scenario analysis in mind, it could be an option to control the external factors where possible to maintain the rent and energy prices at the acceptable rates.

Cost Analysis: EPC with Islamic leasing

The final cost analysis of EPC is EPC with leasing, which will be very briefly covered. As mentioned in the literature review, an interesting cultural difference between modern banking systems and the system used in Kuwait is the implication of the Islamic banking system. As mentioned in the literature review, Islamic banking does not allow for the concept of "interest rates" in the modern sense (Farooq, 2005), instead opting for the idea of "purchase" followed by a "sell back" period. In addition, another key point must be taken into account, is that for individual owners the limit to the amount of money that can be loaned for a construction project is 70,000 KWD, in accordance to regulations from the Central Bank of Kuwait (Kuwait Finance House, 2020). Secondly, the sell back is done with a profit rate, and the profits rates were found from the financial calculator of a popular Islamic bank in Kuwait, Kuwait Finance House (Kuwait Finance House, 2020), and were found to be between 25% and 27.4%. In order to account for this, an additional line was added to account for "loaned" money as well as the yearly installments that have to be paid, and the Monte Carlo analysis was run twice more. Once with an assumed guaranteed loan of 70,000, and once with an assumption of a range of loans between 0 KWD and 70,000 KWD. Both are shown below. In both simulations the other variable were kept consistent with the previous Monte Carlo analyses of checking variable amounts of increasing in price and increasing in rent.

							21.66%
	Rent	Energy cost	Inflation	Budget	Bank Loan	Profit %	NPV
	5.466	0.084	0.017	128,075.085	69,999.545	0.260	-12,859.204
1	5.230	0.093	0.036	121,125.789	69,999.404	0.257	11,492.990
2	5.537	0.093	0.035	115,030.190	69,999.562	0.263	18,041.350
3	5.939	0.076	0.033	138,935.373	69,999.741	0.263	-22,844.997
4	5.177	0.080	0.055	130,123.772	69,999.444	0.258	4,642.184
5	4.851	0.082	0.045	126,117.872	69,999.556	0.267	10,778.786
6	5.089	0.110	0.041	125,629.275	69,999.767	0.259	19,654.396

Figure 15 - Monte Carlo Analysis with guaranteed loan of 70,000 KWD

							47.60%
	Rent	Energy cost	Inflation	Budget	Bank Loan	Profit %	NPV
	5.283	0.104	0.044	139,157.483	31,279.567	0.260	-6,886.964
1	4.664	0.097	0.028	116,615.218	30,777.115	0.269	6,811.020
2	5.204	0.097	0.033	121,317.708	36,884.327	0.263	3,102.647
3	5.667	0.107	0.027	122,264.511	44,076.971	0.266	3,446.715
4	5.108	0.098	0.041	127,995.182	34,764.675	0.267	-1,137.886
5	5.144	0.091	0.023	123,002.080	28,183.753	0.264	-7,535.191
6	5.812	0.066	0.048	126,035.262	18,947.703	0.267	-18,298.140

Figure 16 - Monte Carlo Analysis with loan range of 0 - 70,000 KWD

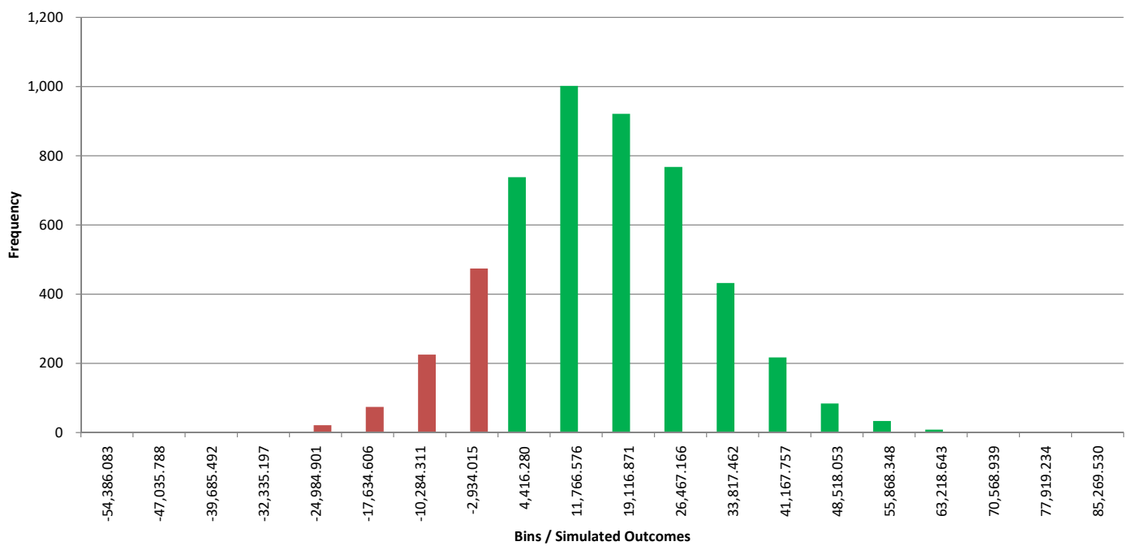


Figure 17 - Monte Carlo with guaranteed 70,000 KWD loan

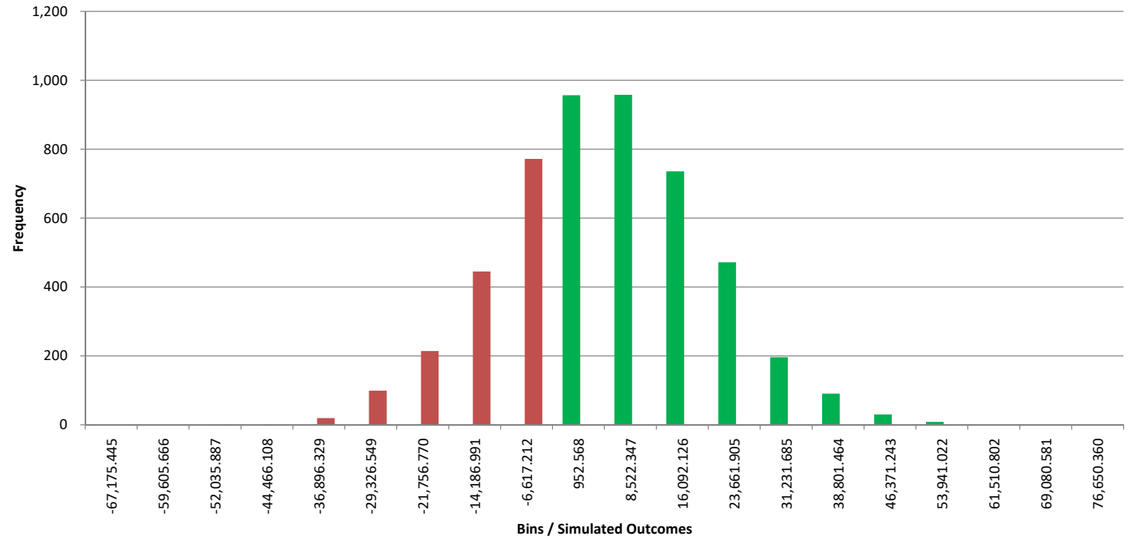


Figure 18 - Monte Carlo with range between 0 - 70,000 KWD loan

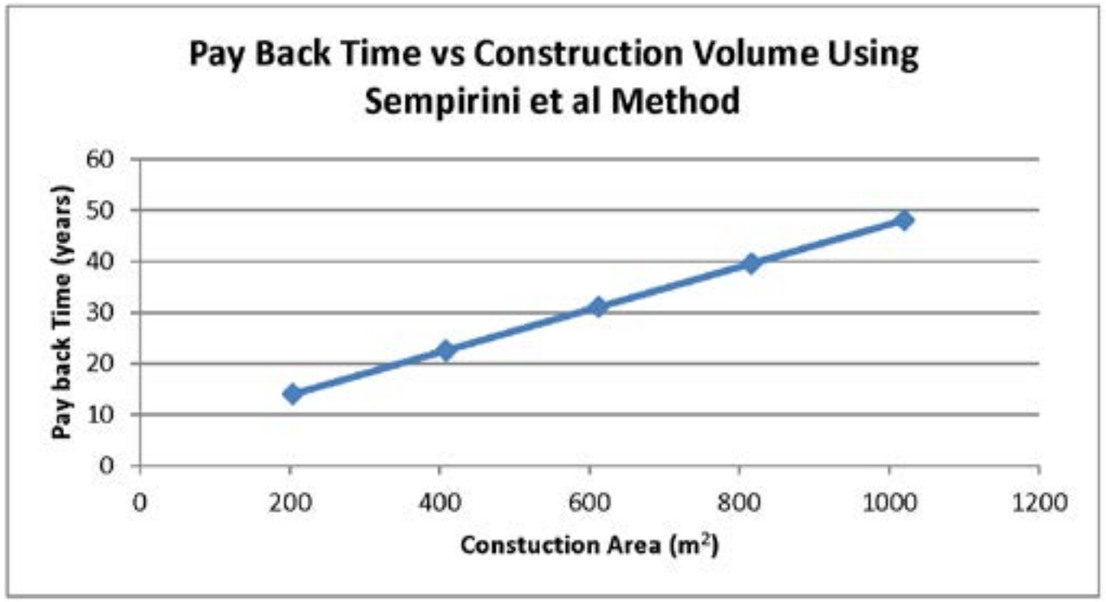
Here a clear benefit in the laon can be observed, with the simulation having a 47.60% chance of loss with a given range between 0 – 70,000 KWD, as opposed to a 21.66% chance of loss with a guaranteed loan of 70,000KWD.

Additional Notes Energy Performance Contracting with and without Islamic Banking

Here we are able to see a unique opportunity, especially with the loan greatly increasing the feasibility of the renovations. It's important to note that the Central Bank of Kuwait has made a limit of 70,000 KWD purchase for construction materials for individuals (Kuwait Finance House, 2020). This presents an opportunity for finance analysts to see how much of a loan is acceptable on a per-project basis based on the savings made after the 10 year mark.

Cost Analysis: Add on Business Model

Next is the study of the Add-On Business Model using both the discounted cash flow sheet with scenario planning and Monte Carlo analysis as well as the usage of the Semprini et al (2017) method described in the introduction.
Firstly, when plotting out the results using the Semprini method, the results were as follows:



Here we see that from the start, the usage of the add-on business model is unfeasible. However, the Semprini model is assuming pay backs exclusively through energy savings, when taking into account additional rental income from the additional lettable area, the cash flow method is used again.

The cash flow was done using 3 scenarios in order to also incorporate increases in rent, here we see the cash flow for the most accommodating scenario, which is to imply maximum rent price, and maximum cost of electricity.

Period	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Occupancy Rate	0%	0%	0%	0%	50%	60%	90%	90%	90%	90%	90%	90%	90%	90%
Building Gross Income														
Potential gross income	KWD 48,253.44	KWD 49,594.89	KWD 50,973.62	KWD 52,390.69	KWD 53,847.15	KWD 55,344.10	KWD 56,882.67	KWD 58,464.01	KWD 60,089.31	KWD 61,759.79	KWD 63,476.71	KWD 65,241.36	KWD 67,055.07	KWD 68,919.20
Vacancy allowance	KWD (48,253.44)	KWD (49,594.89)	KWD (50,973.62)	KWD (52,390.69)	KWD (26,923.58)	KWD (22,137.64)	KWD (5,688.27)	KWD (5,846.40)	KWD (6,008.93)	KWD (6,175.98)	KWD (6,347.67)	KWD (6,524.14)	KWD (6,705.51)	KWD (6,891.92)
Potential gross income - Addition	KWD 6,051.46	KWD 6,219.69	KWD 6,392.59	KWD 6,570.31	KWD 6,752.96	KWD 6,940.69	KWD 7,133.65	KWD 7,331.96	KWD 7,535.79	KWD 7,745.28	KWD 7,960.60	KWD 8,181.91	KWD 8,409.37	KWD 8,643.15
Vacancy allowance - addition	KWD (6,051.46)	KWD (6,219.69)	KWD (6,392.59)	KWD (6,570.31)	KWD (3,376.48)	KWD (2,776.28)	KWD (713.36)	KWD (733.20)	KWD (753.58)	KWD (774.53)	KWD (796.06)	KWD (818.19)	KWD (840.94)	KWD (864.31)
Gross Rent Income	0	0	0	0	26,924	33,206	51,194	52,618	54,080	55,584	57,129	58,717	60,350	62,027
Gross Rent income - addition	0	0	0	0	3,376	4,164	6,420	6,599	6,782	6,971	7,165	7,364	7,568	7,779
Energy Expenditure pre-renovation														
Energy Expenditure pre-renovation	KWD -	KWD -	KWD -	KWD -	KWD (7,227.84)	KWD (8,914.53)	KWD (13,743.52)	KWD (14,125.59)	KWD (14,518.28)	KWD (14,921.89)	KWD (15,336.72)	KWD (15,763.08)	KWD (16,201.30)	KWD (16,651.69)
Energy expenditure for addition	KWD -	KWD -	KWD -	KWD -	KWD (284.56)	KWD (350.97)	KWD (541.08)	KWD (556.13)	KWD (571.59)	KWD (587.48)	KWD (603.81)	KWD (620.59)	KWD (637.85)	KWD (655.58)
Building Net Income														
Annual rental income	KWD -	KWD -	KWD -	KWD -	KWD 26,923.58	KWD 33,206.46	KWD 51,194.40	KWD 52,617.61	KWD 54,080.38	KWD 55,583.81	KWD 57,129.04	KWD 58,717.23	KWD 60,349.57	KWD 62,027.28
Annual energy expenditure	KWD -	KWD -	KWD -	KWD -	KWD (2,845.61)	KWD (3,509.66)	KWD (5,410.84)	KWD (5,561.26)	KWD (5,715.86)	KWD (5,874.76)	KWD (6,038.08)	KWD (6,205.94)	KWD (6,378.46)	KWD (6,555.78)
Annual Water expenditure	KWD -	KWD -	KWD -	KWD -	KWD (2,242.77)	KWD (2,766.14)	KWD (4,264.55)	KWD (4,383.11)	KWD (4,504.96)	KWD (4,630.20)	KWD (4,758.92)	KWD (4,891.21)	KWD (5,027.19)	KWD (5,166.95)
Annual Maintenance	KWD -	KWD -	KWD -	KWD -	KWD (4,307.77)	KWD (4,427.53)	KWD (4,550.61)	KWD (4,677.12)	KWD (4,807.14)	KWD (4,940.78)	KWD (5,078.14)	KWD (5,219.31)	KWD (5,364.41)	KWD (5,513.54)
Annual rental income - add	KWD -	KWD -	KWD -	KWD -	KWD 3,376.48	KWD 4,164.42	KWD 6,420.28	KWD 6,598.77	KWD 6,782.21	KWD 6,970.76	KWD 7,164.54	KWD 7,363.72	KWD 7,568.43	KWD 7,778.83
Annual energy expenditure - add	KWD -	KWD -	KWD -	KWD -	KWD (284.56)	KWD (350.97)	KWD (541.08)	KWD (556.13)	KWD (571.59)	KWD (587.48)	KWD (603.81)	KWD (620.59)	KWD (637.85)	KWD (655.58)
Annual Water expenditure - add	KWD -	KWD -	KWD -	KWD -	KWD (280.35)	KWD (345.77)	KWD (533.07)	KWD (547.89)	KWD (563.12)	KWD (578.77)	KWD (594.86)	KWD (611.40)	KWD (628.40)	KWD (645.87)
Annual Maintenance - add	KWD -	KWD -	KWD -	KWD -	KWD (540.24)	KWD (555.26)	KWD (570.69)	KWD (586.56)	KWD (602.86)	KWD (619.62)	KWD (636.85)	KWD (654.55)	KWD (672.75)	KWD (691.45)
Net annual property income	0	0	0	0	17,527	22,503	36,968	37,996	39,052	40,138	41,254	42,401	43,580	44,791
Net annual Energy Savings	0	0	0	0	4,382	5,405	8,333	8,564	8,802	9,047	9,299	9,557	9,823	10,096
Net Annual Income Increase	0	0	0	0	30,300	7,071	20,244	1,602	1,646	1,692	1,739	1,787	1,837	1,888
ADDITION														
Net annual property income - add	0	0	0	0	2,271	2,912	4,775	4,908	5,045	5,185	5,329	5,477	5,629	5,786
TOTAL														
Net annual property income	0	0	0	0	19,799	25,416	41,744	42,904	44,097	45,323	46,583	47,878	49,209	50,577
TOTAL														
Net annual property income	0	0	0	0	19,799	25,416	41,744	42,904	44,097	45,323	46,583	47,878	49,209	50,577
Net annual Energy Savings	0	0	0	0	4,382	5,405	8,333	8,564	8,802	9,047	9,299	9,557	9,823	10,096
Net Annual Income Increase	0	0	0	0	30,300	7,071	20,244	1,602	1,646	1,692	1,739	1,787	1,837	1,888
Investment														
Renovation + Addition	154,148													
Investment	-154,148													
Net Income														
Net Cash Flow (Total)	-154,148	0	0	0	19,799	25,416	41,744	42,904	44,097	45,323	46,583	47,878	49,209	50,577
Net Cash Flow - Energy Only (Total)	-154,148	0	0	0	4,382	5,405	8,333	8,564	8,802	9,047	9,299	9,557	9,823	10,096
Net Cash Flow - Energy + Rent Increase (Total)	-154,148	0	0	0	34,682	12,476	28,576	10,166	10,449	10,739	11,038	11,345	11,660	11,984
Cumulative Net Income														
Cumulative Net Income	-154,148	-154,148	-154,148	-154,148	-134,349	-108,934	-67,190	-24,286	19,812	65,134	111,717	159,595	208,804	259,381
Cumulative Net Income - Energy Only	-154,148	-154,148	-154,148	-154,148	-149,766	-144,361	-136,028	-127,464	-118,661	-109,614	-100,316	-90,759	-80,936	-70,840
Cumulative Net Income - Energy + Rent Increase	-154,148	-154,148	-154,148	-154,148	-119,466	-106,990	-78,414	-68,248	-57,799	-47,060	-36,022	-24,678	-13,018	-1,034
Hotel income and expenses														
Net Present Value	KWD 23,272.129													
Net Present Value - Energy Only	KWD (107,061.945)		**Energy price Increase for NPV 0 =**		KWD 0.142	284% increase								
Net Present Value - Rent Increase	KWD (69,562.387)		**Rent Increase for NPV 0 =**		KWD 7.504	82% increase								
Net Present Value - additional lettable area	KWD (69,562.387)		**Additional area for NPV = 0**		1345.00	11.02	11 new units (5.5 new floors)							

The assumptions made in the above scenario are assuming an add-on on top of the existing, as the plot sizes of the buildings in question are tight, and the setbacks from the neighbours are already defined by the Kuwait Municipality in its codes. Furthermore, the costs are assumed as costs per m2, which was obtained from the historical data found from projects of the consultants company. The additional income is also calculated as part of the Gross Rent Income. Furthermore, the building period is assumed to take 3 years, and it is assumed that there is a 0% occupancy rating in that time.

In the above scenario, we can see that the NPV is clearly not desirable for any of the scenarios. Using the goal seek analysis we can find that in order for the property to break even with the cost of energy savings and additional rent, the additional area that has to be added is the equivalent of adding 11 floors on top of the existing building, which is not at all feasible. This explains better the results of the Semprini model utilized earlier.

To further test the model, 4 successful scenarios which were derived from the scenario analysis in the previous section. The 4 scenarios are as follows:

Scenario	Rent Price	Energy Price
1	4.120 KWD	0.050 KWD
2	4.200 KWD	0.075 KWD
3	4.900 KWD	0.070 KWD
4	5.500 KWD	0.065 KWD

Using these 4 scenarios, 4 more scenarios analyses were run with the variables of costs/m2 and additional building area. The cost/m2 variable was found using historic data of the consulting company to find the range of prices available for building costs (AGi architects, 2020). To re-iterate what was stated previously, any changes to the building made up to the maximum height of the building is considered to be a renovation, while any changes above the maximum height of the existing building is considered an addition. Areas were built in increments of half floors, with a maximum of 3 floors to retain a possibility of feasibility. The tables are as follows:

Scenario 1		KWD 4.120	KWD 0.050			
	0.50	1.00	1.50	2.00	2.50	3.00
KWD (69,562.39)	**102.00**	**204.00**	**306.00**	**408.00**	**510.00**	**612.00**
KWD 200.00	KWD (43,833.58)	KWD (60,289.66)	KWD (76,745.74)	KWD (93,201.81)	KWD (109,657.89)	KWD (126,113.97)
KWD 250.00	KWD (48,469.95)	KWD (69,562.39)	KWD (90,654.83)	KWD (111,747.27)	KWD (132,839.71)	KWD (153,932.15)
KWD 300.00	KWD (53,106.31)	KWD (78,835.11)	KWD (104,563.92)	KWD (130,292.72)	KWD (156,021.53)	KWD (181,750.33)
KWD 350.00	KWD (57,742.67)	KWD (88,107.84)	KWD (118,473.01)	KWD (148,838.18)	KWD (179,203.34)	KWD (209,568.51)
KWD 400.00	KWD (62,379.04)	KWD (97,380.57)	KWD (132,382.10)	KWD (167,383.63)	KWD (202,385.16)	KWD (237,386.69)
KWD 450.00	KWD (67,015.40)	KWD (106,653.30)	KWD (146,291.19)	KWD (185,929.09)	KWD (225,566.98)	KWD (265,204.87)
KWD 500.00	KWD (71,651.77)	KWD (115,926.02)	KWD (160,200.28)	KWD (204,474.54)	KWD (248,748.80)	KWD (293,023.06)

Scenario 2		KWD 4.200	KWD 0.075			
	0.50	1.00	1.50	2.00	2.50	3.00
KWD (52,297.94)	**102.00**	**204.00**	**306.00**	**408.00**	**510.00**	**612.00**
KWD 200.00	KWD (26,609.71)	KWD (43,025.21)	KWD (59,440.72)	KWD (75,856.22)	KWD (92,271.73)	KWD (108,687.24)
KWD 250.00	KWD (31,246.07)	KWD (52,297.94)	KWD (73,349.81)	KWD (94,401.68)	KWD (115,453.55)	KWD (136,505.42)
KWD 300.00	KWD (35,882.43)	KWD (61,570.67)	KWD (87,258.90)	KWD (112,947.13)	KWD (138,635.37)	KWD (164,323.60)
KWD 350.00	KWD (40,518.80)	KWD (70,843.39)	KWD (101,167.99)	KWD (131,492.59)	KWD (161,817.19)	KWD (192,141.78)
KWD 400.00	KWD (45,155.16)	KWD (80,116.12)	KWD (115,077.08)	KWD (150,038.04)	KWD (184,999.00)	KWD (219,959.96)
KWD 450.00	KWD (49,791.52)	KWD (89,388.85)	KWD (128,986.17)	KWD (168,583.50)	KWD (208,180.82)	KWD (247,778.15)
KWD 500.00	KWD (54,427.89)	KWD (98,661.58)	KWD (142,895.26)	KWD (187,128.95)	KWD (231,362.64)	KWD (275,596.33)

Scenario 3		KWD 4.900	KWD 0.070			
	0.50	1.00	1.50	2.00	2.50	3.00
KWD (49,233.92)	**102.00**	**204.00**	**306.00**	**408.00**	**510.00**	**612.00**
KWD 200.00	KWD (23,900.67)	KWD (39,961.19)	KWD (56,021.70)	KWD (72,082.22)	KWD (88,142.73)	KWD (104,203.25)
KWD 250.00	KWD (28,537.04)	KWD (49,233.92)	KWD (69,930.79)	KWD (90,627.67)	KWD (111,324.55)	KWD (132,021.43)
KWD 300.00	KWD (33,173.40)	KWD (58,506.64)	KWD (83,839.89)	KWD (109,173.13)	KWD (134,506.37)	KWD (159,839.61)
KWD 350.00	KWD (37,809.77)	KWD (67,779.37)	KWD (97,748.98)	KWD (127,718.58)	KWD (157,688.19)	KWD (187,657.79)
KWD 400.00	KWD (42,446.13)	KWD (77,052.10)	KWD (111,658.07)	KWD (146,264.04)	KWD (180,870.01)	KWD (215,475.97)
KWD 450.00	KWD (47,082.49)	KWD (86,324.83)	KWD (125,567.16)	KWD (164,809.49)	KWD (204,051.82)	KWD (243,294.16)
KWD 500.00	KWD (51,718.86)	KWD (95,597.55)	KWD (139,476.25)	KWD (183,354.95)	KWD (227,233.64)	KWD (271,112.34)

Scenario 4		KWD 4.900	KWD 0.070			
	0.50	1.00	1.50	2.00	2.50	3.00
KWD (47,080.08)	**102.00**	**204.00**	**306.00**	**408.00**	**510.00**	**612.00**
KWD 200.00	KWD (22,051.11)	KWD (37,807.35)	KWD (53,563.58)	KWD (69,319.82)	KWD (85,076.06)	KWD (100,832.29)
KWD 250.00	KWD (26,687.48)	KWD (47,080.08)	KWD (67,472.68)	KWD (87,865.28)	KWD (108,257.87)	KWD (128,650.47)
KWD 300.00	KWD (31,323.84)	KWD (56,352.80)	KWD (81,381.77)	KWD (106,410.73)	KWD (131,439.69)	KWD (156,468.66)
KWD 350.00	KWD (35,960.20)	KWD (65,625.53)	KWD (95,290.86)	KWD (124,956.18)	KWD (154,621.51)	KWD (184,286.84)
KWD 400.00	KWD (40,596.57)	KWD (74,898.26)	KWD (109,199.95)	KWD (143,501.64)	KWD (177,803.33)	KWD (212,105.02)
KWD 450.00	KWD (45,232.93)	KWD (84,170.98)	KWD (123,109.04)	KWD (162,047.09)	KWD (200,985.15)	KWD (239,923.20)
KWD 500.00	KWD (49,869.29)	KWD (93,443.71)	KWD (137,018.13)	KWD (180,592.55)	KWD (224,166.97)	KWD (267,741.38)

We can see that under all circumstances, all combinations of building cost and additional rental area result in failure. Furthermore, when running a Monte Carlo analysis including the variables of Rent – Energy Cost – Inflation – Budget – Additional Area – Cost of Addition, the results indicated that there was a 99.96% chance of failure. The results are conclusive that the Add on Building model is not at all suitable for the model building that had been defined.

Further comments on the Add on Model

In addition to the failure of the Add-On model financially, there is also the question of feasibility. First of all, it is important to note that in the case study conducted by Semprini, the typology of the building was much larger than the typology of the building here, which could indicate how the results were incompatible. Furthermore, in discussing this in an expert interview, the structural ability of the Add-On model is very much not feasible given Kuwait's building culture (Al-Sager, 2020), with many of these buildings being designed for "bare minimum" and for shorter life spans, which while is a limitation to all of the models, it holds particular note when discussing a large structural addition to the building. In addition to being built "bare minimum", oftentimes buildings are also not drawn as per the original drawings, which make getting reliable information to expand upon an existing building very difficult to obtain (Al-Sager, 2020). To refer back to what was previously mentioned in the assumptions of the cash flow diagram, the buildings are often packed together in a way that does not encourage longitudinal extensions, given that the plot area is already used, hence why the assumption of vertical additions was made. A way to counter these balances might be to look at the portfolio level in order to attract stakeholder which have a wide portfolio, but also in the case of Kuwait, and also the reason why the research is focusing on the object level, many of these buildings are owned by single owners, of which their livelihood depends on the financial performance of the building and thus do not have the ability to have a real estate portfolio (Al-Sager, 2020).

Implications of the changes proposed in the previous sections

Kuwait Electricity subsidy

A key element and difference in the Kuwait context is that of the electricity subsidy. The subsidy in Kuwait is a major driving factor in the general attitudes towards sustainability in the region, and will play a key role in investigating the barriers and the changes that need to be made in order to make renovations financially feasible. As of 2016, Kuwait's electricity tariff stood at 0.7 cents per KWH, which was one of the lowest in the world. To briefly compare to other countries, Saudi Arabia is at 1.3, Iran is at 2.7, Russia at 11, USA at 11.8, and Norway is at 14.9 (Krane, 2014, p.1). As of 2017 however, Kuwait's tariff has increased from two 0.002 KWD to 0.050 KWD (around $0.082, by 2017 currency index) per KWH (KUNA, 2017). Furthermore, Kuwait is does not perform well in terms of economic efficiency, in terms of GDP generated per KWH consumed, Kuwait stands amongst the lowest in the world. Finally, according to the World Bank, "Kuwait's CO_2 emission per capita was 27.3 metric tons in 2013 (World Bank, 2017); about three times OECD and five times MENA (Middle East and North Africa region) averages. Kuwait's CO_2 per capita is the second highest in the Gulf region, after Qatar whose CO_2 emission per capita was 40 metric tons. When discussing Kuwait's electricity consumption of electricity per capita, it reached a peak in 2005 at 17,000 KWH per capita, and then decreased to 15,600 KWH per capita in 2014 (World bank, 2017)".

In a 2017 study, conducted by Ayele Gelan for the Kuwait Institute of Scientific Research, the economic effects of such a change was studied through a simulation and general equilibrium analysis. Within the region, there has been a growing awareness among researchers that existing policies are not sustainable, as highlighted by (Gelan, 2014a, 2014b; Alotaibi, 2011; BuShehri and Wohlgenant, 2012; Darwish et al., 2008; Darwish and Darwish, 2008). While there is some variation in the GCC (Gulf Cooperation Countries) in regards to each country's policy reforms, Gelan (2017) states that Kuwait's policy is observed as "the least reform-oriented or otherwise conservative end of the spectrum" (Fattouh and El-Katiri, 2013; Wang et al., 2016; Dyllick-Brenzinger and Finger, 2013). Prior to the study by Ayele Gelan, the research on Kuwait's electricity reform is mostly ex-ante analysis of what is expected to happen with the reduction of the current subsidy. In the context of this research, only the sections relevant to real estate will be discussed.

The question arises, however, as to how the approach to the change of the electricity subsidy should be performed, with 2 scenarios in discussion. Scenario 1 involves a simple subsidy reduction, while scenario 2 a subsidy reduction is done with cash transfers to compensate user losses. In Gelan's (2017) study, a computable general equilibrium (CGE) model was used in order to calculate the potential economic effects to the policy changes. A CGE is a software that use economic data to estimate how an economy my react to changes in external factors, by utilizing a series of modules to account for different equations that predict different outcomes. For the purposes of the study, the CGE used by Gelan was the International Food Policy Research Institute (IFPRI) standard computable general equilibrium, but was altered in order to account for specificities regarding Kuwait's context, namely, the differences in economic conditions and benefits enjoyed by nationals vs expatriates, an additional module was created to estimate environmental impact, and a larger reliance on the oil sector (Gelan, 2017).

Gelans study finds multiple implications in the policy, and within the study, they are subdivided into the categories below, and their relevant ones are summarized below:

Aggregate economic and environmental effects:

In scenario 1, we see a reduction of GDP by 0.46%, as well as a budget surplice and balance payment decline by 0.76% and 0.88%. We see similar declines in external sectors, with exports, imports, and Balance of payments surplus declining as the imports start becoming increasing in relation to exports. However, we can see the push-pull between the economy and CO_2 emissions as the overall emissions decline by 1.6%, this is especially the case in Kuwait as the economy, as well as the majority of the electricity produced for the company depends almost entirely on fossil fuels.
In scenario 2, it was observed that the adverse effects on the economy were countered, with an increase in GDP of 0.36%, and an increase in the balance of payments surplus of 0.42%, as we are seeing that the most effected family retain their financial empowerment, thus increasing household welfare by 0.11%. Government savings decline but in a negligible proportion but government spending is higher than that of scenario 1. Gelan describes the results as follows:
"The fact that scenario 2 has a consistently positive effects on most key macroeconomic variables indicates that shifting subsidy from power plants to the rest of the economy would have positive economy-wide effects. These results come through efficiency gains and positive stimulus in the economy. Reduction electricity subsidy improves resource allocation across sectors, resources moving out of less productive to more productive sectors. The relocation of subsidies causes user effective demand to rise, which in turn stimulates more production activities."
In the scenario 2, there is a lower reduction in CO_2 emissions, 0.67% as opposed to 1.6%. The differences between the 2 scenarios come from the contrasting levels of economic stimulus in relation to CO_2 reduction. The results of this study also corroborate with the results of another study by BuShehri and Wohlgenant in 2012 which employs a similar partial equilibrium approach and found that the adverse effects on household welfare can construe the need for temporary cash payments in lieu of temporary welfare loss, but also as a means of avoiding political backlash.

Sectorial value-added effects

This is an area in which the most adverse effects were projected, namely because of Kuwait's reliance on fossil fuels, and its subsidies working towards the power plants. According to Gelan's computer general equilibrium model, scenario 1 showed contractionary effects in the industries, whereas in scenario 2 most sectors saw a more positive stimulus, mainly because of the transfer of subsidies from the inefficiently operating fossil fuel industry of Kuwait to other, slightly better operating industries in Kuwait. Gelan's takeaway here is that subsidies should focus on industries which are most dependent on the oil industry, and thus should be targeted by authorities for promotion.

CO_2 emissions

In both scenarios we see a reduction in CO_2 emissions, however we see a much greater reduction in CO_2 emissions in scenario 1 as opposed to scenario 2, at 1.55% and 0.67% respectively. However, scenario 2 shows a smaller decline in relation to the economic decline that is projected to happen, meaning that for every percentage lost in GDP in scenario 1, a greater percentage of CO_2 emissions are lost in scenario 1 as opposed to scenario 2.

Economic implications of large scale renovation

As of April 2016, Kuwait had approved the bill to reform the electricity tariff from a rate of 0.7 cents to at least 1.7 cents (in April 2016 money). However, the policy applies only to expatriates, whom constitute 2 thirds of the population, yet consume about 20% of the total electricity (Izzak, 2016). Within the declaration of the law, it was not stated as a "removal of subsidy", but as an "increase in tariff". Within the reform, there was huge emphasis placed on the well-being and maintenance of household welfare, especially considering that owners of family households represent a strong political voice in the Kuwaiti environment. In a reactionary measure against political backlash, and as a means of protecting the economy from adverse effects, there came the suggestion for the Kuwaiti-exclusive compensation scheme. However, according to Gelan (2017), excluding expatriates from compensation would have negative implications on overall aggregate house welfare as well as dampening the economic benefits of the economy.

In general, Gelan's 2017 simulation experiments did not indicate that a 30% increase in the electricity tariff would cause significant contractions in the economy, and is best summarized with one of his concluding statements:

"In general, the simulation experiments indicate that electricity subsidy reduction does not necessarily cause contractions in economic activities or declines in household welfare. The differences between the two policy scenarios indicated that the adverse demand side effect of the subsidy reform dominates unless the reform is accompanied with other measures. Specifically, when users are compensated for their losses, then the policy reform would have positive effects and hence changes aggregate GDP and household welfare effects become positive. The simulation experiments reveal trade-offs between economic and environmental policy objects. For instance, scenario 2 yields better economic effects but less environmental benefits compared to scenario 1 and vice versa."

3.3

RQ 3: What are the non-financial opportunities and barriers to the adoption of such financial models for the renovation of income producing properties?

- Literature Review

Introduction

As a brief introduction to this section, it is evident that there is a lack of sources readily available for sustainability in Kuwait. The literature review was conducted by searching the following sources: Scopus, JSTOR, Google Scholar, Taylor & Francis Online, and searching for the keywords “Kuwait”, “Sustainability”, and “Barriers”, “Feasibility” in various orders.

Awareness, Drivers, Actions, and Barriers of Sustainable Construction in Kuwait

In a qualitative questionnaire conducted in 2011 (n=122; AlSanad, 2011), as well as a follow up questionnaire in 2015 (n=504, AlSanad 2015) was created to observe the barriers and opportunities to sustainable construction. The study questioned stakeholders about their opinions on sustainability in Kuwait. In the first survey, conducted in 2011, The questions were asked were about:

1) Knowledge of sustainability in concept, asking if the participants considered themselves “to have moderate development of knowledge of sustainable themes” (AlSanad, 2011)

2) The development of knowledge in sustainable concepts

3) Represented the awareness of stakeholders through the implementation of sustainability in their own projects

4) Whether participants would be willing to implement sustainability measures themselves or would require government intervention

5) If the participant had interest in sustainability as a whole

The 2011 study comes to the conclusion that with willingness to adopt sustainable technologies, the future potential for sustainable practice in Kuwait has more potential, furthermore, the paper does state that without governmental intervention threatening the economics of the construction industry, there will be very little incentive to change the practices that are being performed, which is the topic of the 2015 follow up study, also conducted by AlSanad. It comes to the conclusion that there exists an awareness and willingness for sustainability, it is in need of more tangible enforcement on behalf of governmental authorities.

In a follow up study performed in 2015 (n=504), the questionnaire was sent out to a wider breadth of stakeholders, and the topics discussed are the following:

1) Level of knowledge and understanding of Green buildings

2) Developing Knowledge of the concept of green or sustainable construction

3) Willingness to take action by incorporating necessary changes to implement green building practices

4) Perception of the role of government in the promotion of green construction practices

5) Ranking what they believed were the driving factors behind green construction

6) Percieved barriers (Rated from a 1-5 in terms of significance) to sustainable construction projects

The results of this study found more reliable, but conflicting evidence to the first study conducted in 2011. In this questionnaire, a larger number of respondents stated that they have a Low-Moderate understanding of the subject of sustainable buildings, with 31.90% stating a “low” understanding and 30.80% stating a “moderate” understanding. A total of 62.70% considered themselves to have low to moderate knowledge of sustainable construction practices. When asked to rate their own efforts to developing knowledge of sustainable building practices, 62.30% of respondents stated a “moderate to good” understanding, and further stating that the majority of them (71.9%) had a good to excellent willingness to incorporate necessary changes in their future projects. Finally, 88.1% of respondents agreed or strongly agreed that government intervention was necessary for the enforcement of sustainable practices in Kuwait.

When discussing driving factors and barriers, the respondents were first asked to rank what they perceived was the most significant driving factors, and then put on a scale from 1-5 the significance of the barriers that they perceive to exist for sustainable practices in Kuwait. The driving factors were ranked, from first to last, as educational programs – rules and legislations – green design guidelines and construction standards – economic incentives. When reviewing barriers, the following barriers were mentioned as part of the questionnaire in order of rank and mean value in participants’ answers:

1) Economic conditions (MV=3.34)

2) Risk associate with implementation of new practices (MV=3.61)

3) Green buildings are expensive (MV=3.62)

4) Lack of clear benefits of sustainable construction (MV=3.90)

5) Fewer developers undertaking green building projects (MV=3.93)

6) Unwillingness to change (MV=3.98)

7) Lack of qualified staff(MV=4.05)

8) No existing rule in Kuwait to adopt green building (MV=4.13)

9) Lack of government support/no incentives (MV=4.16)

10) Lack of awareness (MV=4.24)

All of the mean values of the items scored significantly higher than the median value of 2.5, but we can now observe a clearer picture of the perceived barrier to sustainable construction. The results indicated that the general awareness level is lower than previously assumed in the 2011 study, especially now with the improved methodology of the study. Furthermore, the study re-iterates the need for governmental intervention, due to the lack of incentives provided for stakeholders in order to achieve building stability, and the study points to the highly subsidized utilities in Kuwait, and is one of the starting points in the recommendations of the paper (AlSanad, 2015)

Although the studies are exploring an important part of the sustainability question , they are lacking in some respects occasionally pointed out previously, however, a major drawback of both studies is that the methodologies did not clarify how it is taking into account potentials for participants to overestimate their own knowledge or willingness into sustainability. Furthermore, the studies found did not express into the use of different financial modeling into the adoption of sustainable practices and renovations, and also did not indicate at which cost is acceptable as part of the risk of innovation.

Summary

What the literature review above provides is a surface level look to the awareness and willingness of companies to deal with sustainability, and provides the research with insight towards the barriers that could be presented from a financial advisor’s perspective. Here, it becomes important to understand that a major component is the governmental action. This plays an important role when studying the PESTLE analysis in the final section.

Step 7: ***The culmination of these investigations will be used to present the data to 3 different experts working in different part of the fields. This will be used as the data to refer to during the interviews to investigate behavioral problems with. This will be the answer to research question 3.***

RQ 3: What are the non-financial opportunities and barriers to the adoption of such financial models for the renovation of income producing properties?

Opportunities and Barriers - Introduction

During the interview process, there were certain items that were discussed in order to find the barriers to using financial models. The interviews were conducted with select experts in the field. The issues are categorized in the PESTLE format, and then are translated and summarized into the final PESTLE diagram in the conclusion. To clarify, a PESTLE analysis is the analysis of the pros and cons of a certain element under the lenses of Political – Economical – Technological – Legal – Environmental. The PESTLE analysis is used because it is a tool used to investigate the prospects of entering a new market from a wide range of positions (Perera, 2017), and the research is aimed at focusing on financial consultants wanting to expand into other territories. The experts interviewed are shown in the table below:

Person	Affiliation	Reason for Interview
Aisha Al-Sager	Managing Director – *AGi architects*	Understanding history and background information about building type - Understanding from an architects' perspective
Abbasi Kothari	Financial Consultant – *Tamdeen Real Estate*	Understanding the perspective of a financial consultant and why there is a lack of adoption
Heba Al-Dousari	Senior Asset Manager – *FAWSEC Real Estate*	Understanding the perspective of an asset manager and how sustainable renovations can improve situations in Kuwait

Political

During the interviews, there was discussion regarding the political problems in dealing with application of large scale renovation. One such issue is that in general, the national interest is not currently focused on environmental issues, in fact it is something that is rarely mentioned (Al-Sager, 2020 ; Macdonald, 2019). In addition to the issues of environment not being an aspect of concern, there is the further issue of Kuwait government's generally slow place in performance, highlighted also by a lack of clear mechanisms in place in order to get things moving (Arab Times, 2019). In general, this does indicate a lack of support and barriers which would go into getting a renovation project moving, let alone financing it at all. Furthermore, in terms of movements and getting action done within the context of Kuwait, it's usually the government that is the largest driver of change (Al-Sager, 2020).

Furthermore, from both interviews and published news sources, it is a well-documented issue that Kuwait's political system is marred by corruption and inefficiency. This issue is documented in both research, mainly stated by Biygautane, Gerber, and Hodge (2017) in their research The Evolution of Administrative Systems in Kuwait, Saudi Arabia, and Qatar: The Challenge of Implementing Market Based Reforms. Furthremore, this issue can further be supported by recent headlines seen in the news. Cases such as the following:

البنك الدولي: نظام الخدمة المدنية.. فاشل
(Translation: World bank: [Kuwait's] Civil Service, a failure]
Al Qabas, 2016

Anti-Government protest held in Kuwait City on November 6th (The article specifically mentions corruption as cause for the protest)
Garda, 2019

Arab Newspapers comment on the Struggling Kuwaiti Economy
(UAE National News, 2011)

These headlines, as well as frustrations that are expressed through interviews are indicative of a larger problem of governmental inefficiency and corruption at play. This presents an extremely significant barrier, and could warrant several years' worth of anti-corruption research all on its own. As described by Aisha Al-Sager, "the parliament is adopting a populist agenda".

Economic

Kuwait has been heavily subsidizing electricity since 1966 (Gelan, 2017), and a recent increase in the population as well as average usage of electricity per person is straining the system. Both studies by (Gelan, 2017) and (Krarti, 2014) are in favour of a reduction in the subsidy of electricity, and Gelan's 2017 study indicates that there can be an offset of the major economic factors provided governmental support for those affected the most by the changes. This concept, paired with the discovery made in the "lease" section of the quantitative research, indicates that there is an opportunity for a short term usage of the funds that is saved from subsidizing the electricity to provide loans for those willing to renovate their buildings, decreasing the chances of loss. Furthermore, when discussing the changes in renovation, many of the owners of such properties are single owners whose livelihood depends on the performance of the building (Al-Sager, 2020). This means that incurring a loss on a building is directly affecting someone's livelihood, and losses are seen as more risky as they these individuals are not in able to absorb short term losses for long term benefits. Furthermore, another issue encountered economically is the changing of the country's codes. As stated by interviewee Abbasi Kothari:

"Demolition happens because the FAR keeps changing, when the FAR changes it becomes much more profitable to demolish the building and build a new one" – Kothari, 2020

The issue of the changing laws is one that is also repeated by Krarti (2015), whom also states that in addition to having a retrofit program, or a retrofit mindset, there needs to be constant updates to the energy codes every 5 years, with the last major change being in 2010 after the first edition that was made in 1983 (Krarti, 2015). He also goes on to compare it to the ASHRAE energy efficiency code, which changes every 3 years. This area begins to majorly overlap with the political section at this point, yet the major economic advantage of destruction and renovation should not be dismissed, and it becomes important for financial advisors to express and incentivize the benefits of building for the long term.

Finally, another key issue brought up during interviews was the idea of renovating housing as part of a larger portfolio level investment. One quote which indicates this is the following:

"For the Fahaheel project, we renovated the residential towers because we wanted to increase the attractiveness and increase the value of the commercial building next to us" – Kothari, 2020

This provides a window of opportunities for approaching renovation on a portfolio level scale where possible, where potentially items such as the Add-On-Business model, which was found to be unfeasible in this case, could become more feasible with a look at the portfolio level.

Social

One of the largest factors into adoption of new approaches in Kuwait is the social aspect. The intricate social structures of Kuwait are always a factor of play, which begins to have some overlaps with the political section mentioned earlier. The populist direction Kuwait's politics has been moving into is partly due to the general mindset

of society.

“Kuwaiti’s very much live in the moment, Renovation is simply not part of the culture” (paraphrased) – Al-Sager, 2020

Kuwait exhibits a lot of societal barriers to the development of change, namely that the idea of renovation is not an attractive one, and that the idea of maintenance is not part of the building culture. This is driven by what was referred to as “a change in consumer habits” in recent times (Al-Sager, 2020), resulting in a very “in the moment” kind of consumer psychology. This could present difficulties for the implementation of new ideas for financing buildings. The “One Stop Shop” is used as an example of making it more palatable on the consumer end to consider renovation (Mlecnik, 2016), however, Kuwait also presents an opportunity in this, expressed in the following quote:

“A lot of these buildings are done by these engineering offices that produce these cookie cutter designs, and everyone goes to them…” (paraphrased) – Al-Sager, 2020

The “cookie cutter” engineering offices described provide an interesting opportunity to enter the market, in which financial advice could be given as part of the consultation, or a financial office can pair in with one of the do-it-all type engineering offices.

Additionally, Kuwait’s building culture has its own systematic issues. Experience from the creation of this research has proven a severe lack of reliable data and professional handling of documentation when dealing with the building sector. Also corroborated by the statements made in the interview, especially made clear when the interviewee had recounted an event of a renovation in which the drawings were completely mismatched with the on-site condition.

Finally, when discussing rent increases, though the increases suggested in the quantitative section are minor, there is definitely the risk of increasing rent for people who cannot handle any minor increases in expenses. Relating back to a point made in the Economic section of this chapter, this is a direct impact on an individual’s livelihood that is being discussed, and is an area of study outside of the scope of this research.

Technological

The main technological hurdle in Kuwait also overlaps a little with the political and the economical. A lot of these buildings whether as a result of the building culture or as a form of speculative building as a result of expected changes in the FAR as described in the economical section of the chapter, are built to the “bare minimum” specification. “These buildings can barely carry themselves”, let alone additional weight of additional floors. That said, the building type in particular is built in very packed areas, as well as with limited setbacks from the neighbors, which puts models such as that Add-on building model at a huge disadvantage, especially considering the inability to develop longitudinally.

Legal

In the literature review section there was a suggestion of the usage of the public private partnership as a means of achieving renovation goals, which could be considered due to the recent popularity of Build-Operate-Transfer projects such as Chalet Service Centers in the Doha areas (KAPP, 2014). However, a major legal barrier that was brought up during the interview was that within Kuwait law, Private Public Partnership programs are only run with the capitulation that the Public Sector will be the final owner of the project in question (Al-Sager, 2020). This essentially places a substantial legal barrier on the changing of the law in order to be able to achieve renovation without the handing over of private property to government ownership. This makes it difficult for recommending a renovation through private public partnership as discussed in the literature review, however, it becomes more important to understand that through the reduction of the subsidy and the saving of funds, leases can be extremely helpful for both parties as exemplified by the lease section of the quantitative section of the research.

Environmental

Finally, the environmental aspects that come into play when discussing renovation is the obvious poor performance of these buildings in Kuwait. Unfortunately, Kuwait has the second highest carbon footprint per capita in the world, only second to Qatar (Krarti, 2014). The unfortunate side effect of renovation is the increase in demolition waste, and issue which was brought up as an issue by Kartam et al (2004), which states that construction waste accounts for 15-30% of all solid waste weight (Kartam et al, 2004). A key environmental threat is the ongoing legislation that could provide more attractive FAR possibilities for real estate owners, which could threaten the attractiveness of a renovation.

Summary

To summarize, though the financial feasibility can be achieved, and there are options for financing it, there comes a lot of unexpected barriers which begin to suit different financial models’ strengths and weaknesses. The PESTLE format of the interview results here will be summarized and translated into the final PESTLE diagram summary in the conclusion section, along with recommendations.

CHAPTER 4:
CONCLUSIONS AND RECOMMENDATIONS

Conclusions and Recommendations

The goal of this research was to find the applicability of existing financial models to a context in which those financial models were not designed for, and it has found that there are indeed applications for these models in a Kuwaiti context. In fact, these models are even more applicable to Kuwait due to the burden of the energy and water costs being on the owner of the building, rather vthan the tenants. Furthermore, through the interviews some larger issues had come to light, ones that have little to do with financing. Through the end of this research, it actually begins to appear as though financial feasibility is the least of the problems related to addressing this. What this research culminates into is a series of recommendations and pros and cons for each model, as well as the adoption and the application of a 7 step model on a real life scenario, creating a framework for not only model selection, but an approach for how to test these models. The intended goal of this research is the ambition that this will aid in connecting knowledge pathways between east and west, and on the broader scope, provide a framework for the application of western knowledge to a nonwestern context. Below are short answers to each of the research questions, and following that is a full summarized PESTLE analysis at the end of the chapter.

RQ 1: What are the current available financial models that can be used for renovating the income producing properties?

There are a wide variety of financial models developed in Europe that have relevance to their usage in the Middle East. Contrary to expectation, energy performance contracting actually makes a lot of sense despite the subsidized energy costs due to the landlords paying for the change. This was also expressed by Haifa Al-Dousari, a member of the asset management team of FAWSEC real estate, during the interview, stating the following:

"They are careless because they are not paying for it."

Which brings up an interesting behavioral barrier, though it makes it more likely for an investor to consider changes, it makes it less likely that the tenants are going to change their behavior in tandem with the changes made.

Other models which monetize things such as CO2 reduction and Non-Energy benefits prove to be more difficult to apply, though still valuable, because of a large need for data from all the stages of a building's development to be able to calculate the total cost.

RQ 2: What is the feasibility of the application of these financial models to a typical Kuwaiti apartment block?

As it turns out, the application of the models are quite feasible when speaking directly from a financial sense. Especially with Islamic banking which reduces the probability of loss for energy performance contracting from 46% to 25%. The outlier, however, was found to be the add on model, which given the constraints of the building type in question, would require far too much addition for it to be feasible, and also has to deal with the issue of the weak existing structure.

RQ 3: What are the non-financial opportunities and barriers to the adoption of such financial models for the renovation of income producing properties?

It was found in the research that the financial barriers of the project are actually relatively easy to come across, and that the specific situation in Kuwait lends itself to making sense for the renovation of the buildings. However, there are various legal, societal, and institutional barriers that make it relatively unfeasible to do so. Education, corruption, and cultural problems cause extreme difficulty in getting the idea of the financial feasibility across to begin with. This, combines with a general lack of data for this context, leads to the need for a larger sociological research that needs to be done to find the underlying causes for the broad scope issues that are to be made. The summary of the non-financial barriers, and their relation to the financial barriers, are summarized in the Summary web after the PESTLE analysis.

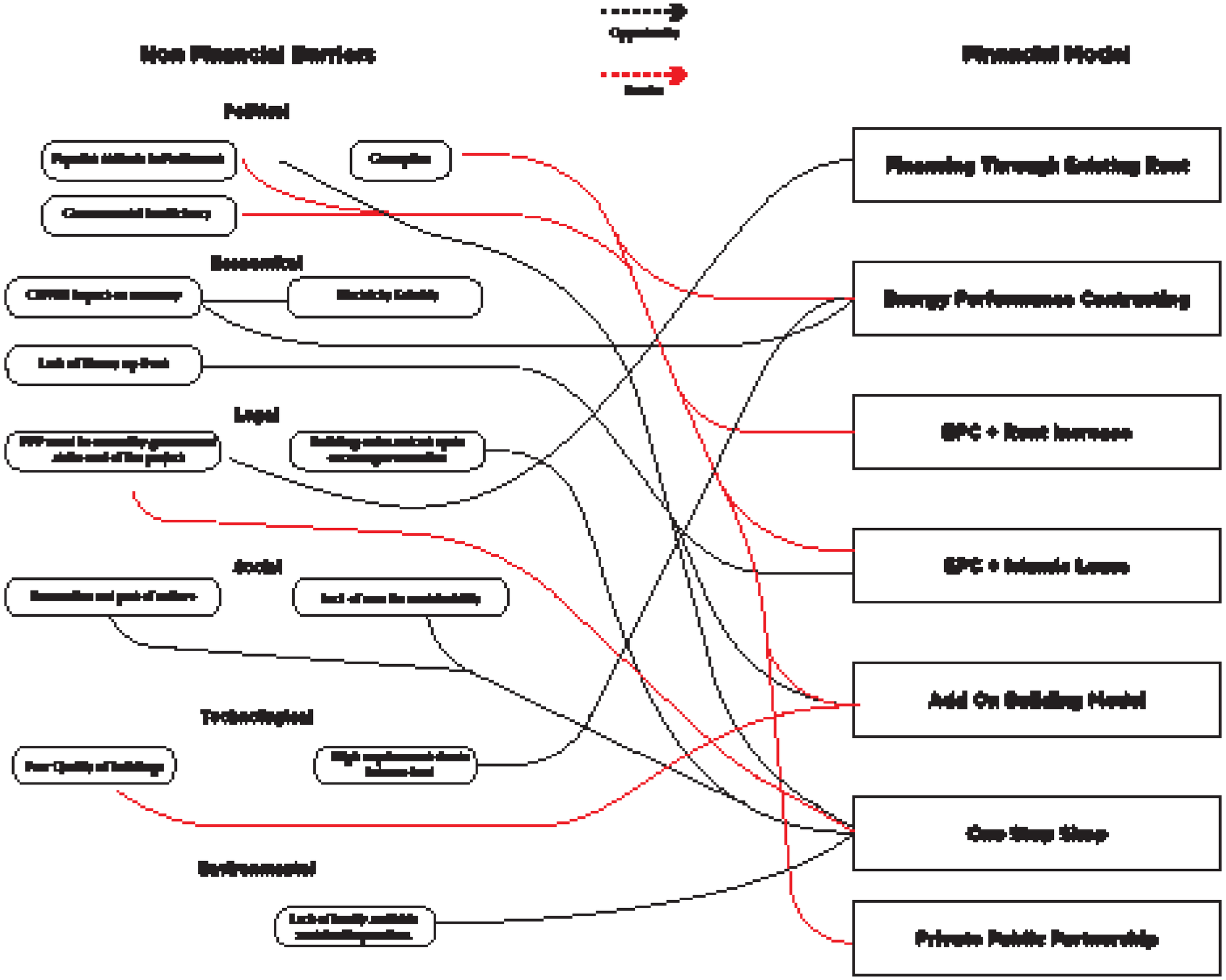
The take away from this is that although through this research it is shown that some models are financially feasible with the status quo as is, and the others are financially feasible given some changes that are within the boundaries of feasibility, the social and other non-financial barriers pose a much greater challenge into the application of these models. As is consistent with other research (Krarti, 2015; Herrero & Thornton, 2020) the barriers are not a financial ones, but rather behavioral ones. There is a large lack of sociological research into why the behaviors and social zeitgeist in Kuwait is the way it is, which would help begin to address some systematic issues. The vast majority of the changes in this research indicate that in order to enact change some level of governmental intervention is necessary, however from the interviews it can be concluded that the government is slow to enact change. Considering that governmental intervention could be a strong driver, and the removal of subsidy and using the earnings saved from the subsidy to assist in renovation on the short term before implementing a long term policy could be a great opportunity for the public sector. In addition, to make it even more attractive for investors, the ability to provide sustainable renovation in exchange for additions to the FAR could prove to be another interesting opportunity. This research concludes that there are a myriad of ways in which large scale renovation could be feasible, but there are larger systematic and social issues at play, and that the challenge of renovation is not necessarily a financial one, but a behavioral one. Within the real estate market, there are some ideas of re-examining real estate valuation in order to include societal and environmental benefits within the value, using items such as Life Cycle Costing to re-examine the value of a property (Kucharska-Stasiak & Olbinska, 2018; STUNNING 2019). This looks to be an important stepping stone in improving the financial feasibility of renovation without the intervention from the government.

Finally, the research is aimed to be from the perspective of financial advisors. In the research, we see an application of an adopted framework in order to test the financial feasibility of various modes of financing. Although the summary is given in the PESTLE analysis below, an overview will be given here. A key component found in the research is the unique kind of client that is present in Kuwait, that of the single owner of the building who relies on the performance of the building for their livelihood. In such cases, the financial advisor is to take care of incurring loss on the short term. Oftentimes we hear of the idea of incurring a short term loss for a long term gain, but in some cases when incurring a short term loss implies a reduction in an individual's livelihood for 2 years, it becomes understandable that the short term loss is not something an individual can take. This is when it becomes more attractive to take advantage of changing laws, particularly ones that involve the FAR, to utilize that opportunity to be able to make a long term success with a more permanent building. On the larger scale, especially when discussing on the portfolio level, the recommendations of renovation become much more attractive, especially when taking into context the shared impact of a group of buildings. Like mentioned previously, an adoption of a real estate valuation that takes life cycle costing into account would be greatly beneficial in order to increase the attractiveness of the concept of renovation, without the need for governmental intervention.

	P Political	E Economical	S Social	T Technological	L Legal	E Environmental	SUMMARY / RECOMMENDATIONS
Existing rent ***Utilizing the existing rent of the building to finance the renovation***	**Pros / Opportunities:** - Does not need political approval - No additional changes needed for electricity costs	**Pros / Opportunities:** - By far the most feasible - Fastest Return rate - Highest NPV in the longer run	**Pros / Opportunities:** - Not incurring additional rent on the tenants - A financial advisor could be useful to prove the feasibility of the option	**Pros / Opportunities:** - The high NPV gives a good chance to maximize the amount of technology that can be used - Opportunity to make the building more stable - Flexible to deal with technological changes	**Pros / Opportunities:** - It needs no changes to the legal framework in order to be able to be put to use	**Pros / Opportunities:** - Most feasible for environmental, highest NPV in the long run - Most likely to produce best results given that more budget is available	Financing through existing rent has proved to be the most feasible without the need for intervention in changing the price of power. This method also has the highest NPV on the long range, and highest change of NPV before and after change, however this means of financing implies an effect on the already existing income stream of an owner for the short term, which could prove as a barrier in order to move forward with this method.
	Cons / Barriers: - Using a building's existing income is not going to be a popular idea	**Cons / Barriers:** - Why renovate when there is a chance in increase in Floor to Area Ration? - Using existing income when it is a single owner means directly impacting their livelihood	**Cons / Barriers:** - Using owner's existing income stream, particularly for those who don't have a portfolio to lean on, does not sound enticing	**Cons / Barriers:** - Existing infrastructure is not good	**Cons / Barriers:** - No legal precedent to doing this. Existing tenants would need to move out for the duration of the renovation	**Cons / Barriers:** - Least likely to be adopted because of incurring short term loss for long term gain	
Financing Through Energy Savings ***Not touching the existing rent, but using the savings exclusively from energy reduction to finance the renovation***	**Pros / Opportunities:** - Does not need political approval if not relying on changing of electricity price - No additional changes needed for electricity costs - Reduction of subsidy is an opportunity to take advantage of	**Pros / Opportunities:** - This can be done with the removal of the subsidy	**Pros / Opportunities:** - Not incurring additional costs on tenants - The fact that the burden of utility expenses is on the owner of the building makes this more attractive	**Pros / Opportunities:** - If cooperation between private and public entities is possible, then an attractive option -	**Pros / Opportunities:** - Good legal justification for this, not changing anything existing	**Pros / Opportunities:** - Most direct impact on energy savings	This is the most logical and simple approach. If possible, getting the desired NPV with energy savings is by far the most attractive way of selling the idea of financing. This method does not rely on any external factors to change in order, and is also attractive because in Kuwait the burden of utilities expenses is on the owner of the building. However, given the current subsidy this financing method is not feasible within 10 years, and is looking at something closer to 30 years for it to become feasible, which is often too long term for it to attract any owner.
	Cons / Barriers: - Relying on the government to change energy savings lead to a lot of inertia - Currently the subsidy does not make it feasible what	**Cons / Barriers:** - Currently subsidy does not make it feasible - At some point reliant on tenant behavior for maximizing funds	**Cons / Barriers:** - Having to rely on major changes within the energy prices to make this feasible is not likely - At some point reliant on tenant behavior for maximizing funds	**Cons / Barriers:** - Limited in budget if we are going to have a 0 NPV.	**Cons / Barriers:** - Reliance on the change of electricity means having to deal with the institutional barrier of getting the government to reduce the subsidy	**Cons / Barriers:** - Unlikely to be adopted due to the	

	P Political	E Economical	S Social	T Technological	L Legal	E Environmental	SUMMARY / RECOMMENDATIONS
Financing Through Energy Savings and Rent Increase ***Using the energy savings in tandem with a small rent increase to finance the renovation***	**Pros / Opportunities:** - Does not need political approval If not relying on changin energy price	**Pros / Opportunities:** - By far the most feasible without incurring a loss on the income of the owners existing income stream - A small increase in rent leads to a large positive change in NPV	**Pros / Opportunities:** - Due to the sensitive nature of the rent, a small change would be needed to make a big difference	**Pros / Opportunities:** - There is more potential for availability in budget to achieve a high end renovation	**Pros / Opportunities:** - a combination of energy savings and rent increase means that there is a flexibility to find the best legal option	**Pros / Opportunities:** - Increased budgetary expenditure possible given that rent can be flexible	Due to the sensitivity of rent on the NPV, a small change in rent can make a big change in the feasibility. This paired with the savings in electricity can make it a more attractive offer. A small increase in rent can make it more possible to rely on smaller changes in elctricity price. However, both this and the previous model depend on changes in electricity price, and there is a huge political barrier to achieving that.
	Cons / Barriers: - Increases in rent can lead to some issues with tenants	**Cons / Barriers:** - Increases in rent unlikely.	**Cons / Barriers:** - Increases in rent could lead to some issues with tenants	**Cons / Barriers:** - Limited to the budget of what a rent increase can allow - No real legal basis for renovation while maintaining original tenants	**Cons / Barriers:** - Increase in rent could provide a threat from tenants	**Cons / Barriers:** - Limited by the amount that rent can be increased logically	
Financing Through Energy Savings and Rent Increase with Islamic / Regular Loan ***Same as the one above, only using an Islamic loan to assist***	**Pros / Opportunities:** - Posturing it as an Islamic loan would make it more popular	**Pros / Opportunities:** - By far the most feasible - Fastest Return rate - Highest NPV in the longer run	**Pros / Opportunities:** - The usage of a loan makes it easier to be able to reduce the increase in rent	**Pros / Opportunities:** - Increased NPV means more budget for technological barriers	**Pros / Opportunities:** - The loan allows for more flexibility and reduced need for increasing rent	**Pros / Opportunities:** - Increased budgetary expenditure even more possible because loan improves the NPV	While the issues are similar to the previous ones, the loan with a payback period of 10 years has been found to greatly improve the feasibility of the renovation, reducing the probablilty of loss from 47% to 29%. The barrier here is firtly that loans for renovation projects are limited to 70,000KWD maximum for private owners, and that there is no guarantee that the full 70,000 KWD would be granted
	Cons / Barriers: - Increases in rent can lead to some issues with tenants	**Cons / Barriers:** - Reliant on receiving the loan	**Cons / Barriers:** - Reliant on actually receiving the loan - Loan is limited to 70,000 KWD for renovation project from the Central Bank of Kuwait - The uncertainty of whether receiving a loan of 70,000 means lower chances of success	**Cons / Barriers:** - Limited budget as far as what rent increased and changes in electricity price will allow	**Cons / Barriers:** - The risks of attaining a loan - Legal risk of loan, and risk of not attaining full loan	**Cons / Barriers:** - Reliant on receiving a loan - Again limited by the logical increases possible in rent and electricity changes	
Add on Business Model ***Creating an additional building to cover the expenses of the renovation***	**Pros / Opportunities:** - This would be the most attractive for owners as an increase in the revenues	**Pros / Opportunities:** - Most potential for revenue increase when feasible - More likely to be attractive when a portfolio level intervention is possible	**Pros / Opportunities:** - Gives an opprotunity to create new building type, and a higher land value	**Pros / Opportunities:** - New additions provide opportunities for better technology not related to existing	**Pros / Opportunities:** - There is legal precedent for renovating and increasing FAR	**Pros / Opportunities:** - New additions can provide potentials for improving the urban environment	This is by far the most attractive in increasing the NPV provided that there is a large portfolio to deal with. There is precedent for entire buildings being demolished for an increase in FAR, and it would not seem unfeasible to suggest an add on.However, from a financial perspective, this is completely unfeasible for a small building because of the very high up front costs in actually building a building, with the case in the project requiring nearly 11 floors of additional space to make up for the costs. In addition to that, there is a huge strucutaral barrier in that the existing infrastructure in Kuwait lacks both reliable data and reliable build quality.
	Cons / Barriers: - Have to rely on municipality giving additional benefits	**Cons / Barriers:** - Up front costs of renovation very high, unfeasible for small projects	**Cons / Barriers:** - Increased build time means building will not have tenants for longer	**Cons / Barriers:** - Severe lack of data and good infrastructure in existing buildings makes this more or less unfeasible on a non portfolio level intervention	**Cons / Barriers:** - There is no legal precedent for renovating and increasing FAR of another project - This could lead to a dangerous precedent	**Cons / Barriers:** - Increased construction waste from additional building	

	P Political	E Economical	S Social	T Technological	L Legal	E Environmental	SUMMARY / RECOMMENDATIONS
Using a One Stop Shop ***One "shop" which covers all the needs for a sustainable renovation***	**Pros / Opportunities:** - Does not need cooperation with the public sector - Potential to hook onto existing companies - A precedent for this is set in the "cookie cutter engineering office"	**Pros / Opportunities:** - Expert consultations could lead to best possible NPV	**Pros / Opportunities:** - Provides a soft introduction to renovation, provides everything a consumer needs in one go	**Pros / Opportunities:** - Providing synergy between parties could lead to most cost effective technologies	**Pros / Opportunities:** - No legal barriers to setting up a one stop shop	**Pros / Opportunities:** - Provides a good front for environmental education	A one stop shop is an interesting proposition, and is a good way to softly introduce the idea of renovation into the general public. However, this would not be feasible as there is very interest in it. There is an opportunity in such that there exists the idea of the one stop shop in Kuwait already, which is the engineering office, which supplies all sorts of services in one place without much effort on behalf of the client.
	Cons / Barriers: - The difficulty of it "catching on"	**Cons / Barriers:** - Why renovate when there is a chance in increase in FAR? - Using existing income when it is a single owner means directly impacting their livelihood	**Cons / Barriers:** - Social barrier of people not being cognizant enough of sustainability means	**Cons / Barriers:** - Finding the qualified people is going to be a challenge	**Cons / Barriers:** - No Legal precedent for a one stop shop	**Cons / Barriers:** - It will be a small movement that will require a lot of work to gain traction	
Using Private Public Partnership ***Private entities working with the public entities for a joint cause of mass renovation***	**Pros / Opportunities:** - Public sector actually has a great need to do this for the easing off of the subsidy	**Pros / Opportunities:** - Power of the public sector can provide long term loans for a short period and has a positive impact on NPV - Corona crisis might pave way for Kuwait to be more cognizant of spending of public reserve funds	**Pros / Opportunities:** - Provides a good precedent for different kinds of public private opportunities	**Pros / Opportunities:** - Public funds can be used to host private enterprises for improved funds for innovation	**Pros / Opportunities:** - Can set precedent for a new legal change	**Pros / Opportunities:** - A chance to make the public sector more cognizant of these issues	A Public Private Partnership appears to be the most logical means of achieving renovation. Particularly because the public sector does in fact have a large stake in this considering how much public funds are being spent on the electricity subsidy. Pairing this with the fact that 10 year loans of 70,000 KWD has proven to be very valuable for improviing the likelihood of success in the renovation case, it makes for a compelling case to do so. Unfortunately, this has the largest barrier in which the government both has a lot of inertia in taking action and also that there is no legal precedent for this, especially considering that within Kuwait Law the public sector is always the final owner of a PPP project.
	Cons / Barriers: - Public sector unwilling to admit issue with subsidy	**Cons / Barriers:** - Corona crisis has greatly affected Kuwait's economy and reserve funds	**Cons / Barriers:** - Rampant corruption in general hinders the ability for parties to cooperate	**Cons / Barriers:** - Government generally has a lot of inertia in its action	**Cons / Barriers:** - Unlikely to have a legal change as the Kuwait Law dictates that in all private public partnerships the public sector needs to be the final owner, which does not aid in renovation	**Cons / Barriers:** - Public sector has generally not shown interest in the environment	


Non Financial Barriers
Financial Model
Political
Economical
Legal
Social
Technological
Environmental
Financing Through Existing Rent
Energy Performance Contracting
EPC + Rent Increase
EPC + Interest Loans
Add On Building Model
One Stop Shop
Private Public Partnership

CHAPTER 5:
LIMITATION AND REFLECTION

Conclusions and Recommendations

A key issue of this research is the general lack of data availability and reliability for the given context, which was partially addressed by using Jaffar et al (2014) framework of aggregation. Furthermore, also mentioned in Jaffar et al's 2014 framework, is the importance of interpersonal relationships in order to be able to get information in the Kuwaiti context, a limitation that was hindered by the effects of covid-19, due to this limitation, the research was also not able to take into account the different values of the different governates (e.g. Mangaf vs Farwaniya). In addition, the research is not able to predict the economic effects of the pandemic, and that remains an unsure future in the scope of the research. Continuing on the topic of interpersonal relationships, a major component of to the research is the social barriers which act upon the push to renovate. Issues discussed such as building culture, consumer habits, or behavior in a Kuwaiti context requires a larger sociological study outside of the scope of this research. A question such as "Why doesn't Kuwait care about sustainability" requires much more in depth sociological investigation than what is possible within the scope of the research. Furthermore, when discussing water usage, there have not been any changes done to the assumption of changes to the water usage, and water usage has been assumed to be the same before and after renovation. This is due to the fact that reduction of water is mostly dependent on tenant behavior, and this was assumed to be unchanged.

To refer back to the lack of data availability, the best case scenario for creating an aggregate building given inability to have information readily available is to do an onsite survey of multiple buildings in a given block and aggregate the characteristics between them, which again, was impossible to do because of recent difficulties.

In order to further the research, one area in which it can expand upon is the clarity and user-friendliness of the financial models. While excel is limited to changing and examining 1 or 2 variables at a time, in the further development of the research the models could be moved into more advanced software such as grasshopper that would make the visualization of the effectiveness of the models more attractive and clear.

Reflection

Research Approach

From even before the beginning of the thesis there was an acknowledgement of a lack of data for this context. A purpose of this thesis was to learn how to work with slim data, as oftentimes during personal experience it was found that there are basic assumptions given in professional settings in the Netherlands that simply cannot be made in Kuwait. The framework of aggregation was an approach that was assumed to need to be taken before, and thankfully the framework provided by Jaffar et al (2014) proved instrumental to both execution and legitimization of the research.

A key limitation is the inability to gain on site access to the buildings in question, and make a more fully realized survey of these buildings in a given context. Ideally, the research would have been done on a specific block with a more specific renovation on multiple buildings. This would have been the ideal method of approaching given a lack of data.

A good resource for single housing typologies the report "Spaces of Living: Urban reflections of Kuwaiti society (Al-Shalfan, 2013) which reflects housing typologies and the method in which they are lived in. Such a resource would have been invaluable for this research, and there needs to be a more in depth look available to housing typologies which are not deemed as attractive.

Broader Context and Scientific Value

The research hopes to provide bridges of knowledge between east and west, with a clear application that in some cases these models were actually more feasible for the given context. The quantitative section emphasizes on this, whereas the qualitative section broadens the barriers to what looks like a feasible solutions.

In terms of looking at it through the lens of Management and the Built Environment at the TU Delft, this research aimed to touch upon subjects not often discussed in the field. Especially considering TU Delft prides itself on its international facing position, in the broader sense of the word during my personal education the concept of how to look and apply the knowledge outside of the Netherlands was barely touched upon. This research aims to look at how assumptions we have and privileges we are granted since we are studying and living in a first world country cannot be assumed when working abroad. This hopefully aims to make me a more flexible, more agile and international asset, and with the hope that this research can carry on doing the same for others, and moving the Education at the MBE department more valuable for international students and Dutch students who will be working on international projects.

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APPENDIX

Interview With Aisha Al Sager - Managing Director - AGi Architects
[note: Original Interview was lost. This is a replacement summary of what was covered in the original]

[00:00:02] This is interview number two with just the first interview was lost for the purpose of this interview is to recover the issues that had been covered in the first interview. And without further ado, let's proceed with our interview. Can you please introduce yourself?

[00:00:31] I'm Aisha Al Sager Managing Director of AGi Architects

[00:00:37] And I'm going to go on the assumption that you know what my research is about. So I will not have to recap. And in the interest of time, we will be summarizing some details of the interview and referencing the previous.

[00:00:52] And so the first issue of the interview is you do know that the research is a lot about these buildings in this area. So like Mangaf and Farwaniya and to a smaller extent, Hawalli, can you briefly talk about where these buildings came from and why this typology became?

[00:01:15] Hawalli, I think a little bit of an outlier, just because it was zoned differently and there's different rules that apply to it than you do, but it's not as impactful or just because they're relatively newer and these projects kind of just over and representing, they're just cookie cutter projects where there's just few years that you go when you buy a whole package and the package is like a hundred one thousand square meters, whatever it may be, and use electronic pre engineered with everything. So even in different parts, there's not a change, pretty much saying whatever is there. So this is what is kind of making it a little bit standard is that the options available to the people are actually quite simple to really do a design. The second thing that is interpretation of the building code that people are just beginning to and not changing.

[00:02:30] So that's why the Building proliferated is also with a very specific budget attached to. it

[00:02:40] And when did these buildings start to become popular? And why

[00:02:44] I would say after 1990 after the invasion. Because if you look at the projects we had before you see that the sizes were much more generous in terms of the size of the room and then in the 1990's you see that they become smaller and then in the 2000's it becomes much smaller, and then with the change in the code they became taller and much thinner so they accommodate 2 apartments or 4 smaller apartments.

[00:03:30] From the research that I had shared with you last time, it was found that the renovation of these projects has been is financially feasible and actually financially makes sense.

[00:03:43] So why don't you think people do sustainable renovations for these?

[00:03:50] First thing is, I ddon't think the building code or the municipality or the general culture encourages renovation. I'm not even talking about conservations I'm just talking about renovation.

[00:04:06] And even when people come to their own houses demolishing them rather than renovating them

[00:04:21] The second is the process of actually renovating in the municipality I don't think people know it's an option and they don't actually know how to do it. And a lot of these buildings are not owned by real estate companies they are owned by individuals and i

[00:04:46] It becomes sort of a hassle for them if there isn't someone to help them get them to do this right.

[00:04:52] And if you go to anyone that's going to help me, they were like, well, you know, when you just demolish it, you make more money. These are the kind of arguments that I think come into play.

[00:05:03] So I think a lot of it is systemic culture. I'll just give you an example when people move into their house. If they and something gets broken within five years, they usually call the contractor to fix it. Know you're supposed to call a handyman right?

[00:05:22] So I think it's much more systemic cultural issues, even though there are barriers too…. The other thing is that some of the projects when they do get built they are not built the way they were intended. Unless they were projects that were well built you find that materials have been changed and structure has been changed and then you find that it has changed from the original design.

[00:06:13] OK.

[00:06:16] One of the points that I talked about in my research is that the price of electricity has not changed from 1966 and then there was suddenly a 500 percent increase in 2017. Why do you think that is?

[00:06:33] Well, basically, you don't really have taxes in this country and the price of electricity is subsidized.

[00:06:42] And even though it is only a certain segment of the market, actually, and the reason is because the government wasn't able to. Change the regulation, because sort of a lot of pushback from parliament is taking on a more populist agenda. It is coming at some point sooner rather than later like 3 years ago they reduced the subsidy for gasoline and petrol. And there was a huge complaint but then it went down and people got used to it. So I think it's coming at the end of the day but there's also this populist agenda.

[00:07:25] So you've already mentioned that you think the price of electricity could increase, but you know of any institutional barriers within the government that could slow this process down?

[00:07:37] Yes, definitely. I think the problem is that maybe one of the biggest issues for parliament, again, there is a lot of members of the populist agenda and they're sort of campaigning on this [unintelligible].

[00:07:56] And one of them is changing on subsidies or taxation or any kind of contribution like that. And with the welfare state, we know this is and it's not going to happen because I mentioned before the election, so people and I think a of people campaigning, we're going to make sure that…

[00:08:24] You don't see people campaigning saying they're going to remove the subsidy. Even if they believe it it's not something that they're going to campaign for.

[00:08:32] OK, and you generally think, why do you think the whole idea of being sustainable is not catching on in way?

[00:08:44] What do you mean by sustainable?

[00:08:59] Well, I think a better way to ask the question is if you have any comments on this culture of sustainability in Kuwait, if it's picking up or not.

[00:09:10] I don't think so, it is picking up a lot more, I think, for the corporate clients. You do find it with individuals, but it has to be something that's interesting to them. I think once you talk about it, that they're able to you more bang for their buck then they are more interested. Just, for example, if they measure, it's more they are to get more interested, then then not because then they can make a financial argument, because right now there isn't sort of any regulation that pushes you to kind of achieve that. So if it's just a question ethics or the bottom line, unfortunately the bottom line is winning. I do think that's changing, but I think that change will instigate more change.

[00:10:01] OK, and one of the models that I was testing was the idea of the adult model, which is once you renovate, you were allowed to build on top of the existing building in order to be able to have maybe higher rent apartments or fancier apartments to be able to pay for the renovation. What do you think are the barriers to this kind of model?

[00:10:32] I think the biggest barrier that the building that you're looking at there is the bare minimum. So I don't know, without more structural reinforcement, for example, you could actually have these add ons in place and obviously they're accumulated.

[00:10:51] So I think that's one of the areas is just the way these things have been built like the actual designs we design. The second is just the statutory guidelines having to change that to the.

[00:11:15] OK, the final question is one of the potential opportunities that has been described in the paper is the idea of the one stop shop, which I described to you previously, and the idea of a private public partnership. Can you briefly discuss what you think about using both of these to achieve the renovation?

[00:11:40] I think the first one is better is it's probably easier to implement, you know, the same way we have a couple of us that go through for these projects.

[00:11:53] You have the same option and they will be able to find the full service, whether it's design and execution or just design and ultimately contractors doing this type of model. And soon as one or two start becoming successful, this will trickle down to the market.

[00:12:14] And the feedback is a bit harder because we can only talk to BP, the government itself.

[00:12:23] So you to develop a building where you develop a project and upgrade it for X number of years and then after that goes back to the government.

[00:12:33] So the government essentially gives you the land or maybe and the infrastructure and everything else, and it will make it for X amount of, if you would like, a reduced rent or zero rent, even in some cases, depending on how big the project is and how much income is coming in.

[00:12:57] So people get water because up until now, something that you can apply to a private project, but it's something that the regulation changes, then it's a possibility. I mean, I guess one possibility is that the government will say, we'll give you more. Like you said earlier, maybe more if they are going to do this or you get some kind of tax break or something like that, so it's not a bad

be, but you get some kind of payback that will encourage this kind of behavior.

[00:13:38] But do you think the idea of kickbacks makes a lot of sense, considering that a lot that these owners are mostly individuals

[00:13:49] Yeah, I do, because the means that they're getting more revenue.

[00:13:53] OK, that concludes our question.

[00:13:57] And again, I would like to reiterate that this is a summary of the previous interview done for the purposes of recording. The previous interview, unfortunately, has been lost due to corruption. So to round that out, I would like to say thank you very much.

[00:14:14] Thank you very much. Thank you for your time. I hope we kept it brief and I'm going to stop the recording.

Interview With Abbasi Kothari - Commercial Manager - Tamdeen Real Estate

[00:00:01] ***So now that the reporting is beginning. Hello. Hello. I hope we will reintroduce ourselves again. This is Mr. Abbas Kothari, and please tell us about yourself and please let us know that you are consenting to being recorded.***

[00:00:24] That's not problem for me. My name is Abbasi Kothari, I'm working in Tamdeen Real Estate as a commercial manager.

[00:00:31] Mostly I'm handling all the projects, serving in contracts and cost related, all the issues and the contractual correspondences. So I'm responsible for all those things.

[00:00:47] Excellent. Now we have a general overview, you've already seen the research and yes, now the question is not just about the financial feasibility. So we have looked at the financial feasibility and kind of seeing how it works. We are seeing which European models work and which ones don't. However, the other questions that we are starting to look that the research is starting to look at now is looking at barriers that are not financial. So we are looking at things like behavioral barriers, political barriers, institutional barriers to actually executing this kind of thing.

[00:01:31] So now that you've seen the study and I'm sure you have a lot of experience in this, if it's financially feasible, why do you think people don't actually engage in sustainable renovation of their property?

[***00:01:53] Because from the research that we are looking at now, we've seen that it is financially it's possible to be financially feasible to actually renovate the properties. But why do you think the owners are not willing to do so?***

[00:02:09] Generally, you know, all buildings, they held the limitations of the built up areas, so the owner prefers to demolish the building and rebuild so they can the more rentable areas because the roofs are keep on tending. Yeah, so this is one of the reasons most of the owners don't prefer to have the in the system but building.

[00:02:36] So what happens is they prefer to demolish and then they build the new ones. The FAA has been increased. Yes.

[00:02:57] Also, I had mentioned that the price had not changed since nineteen sixty six and then only had a sudden increase in twenty seventeen. Why do you think the price hasn't been changed from all of this by.

[00:03:12] The price of electricity, I mean.

[00:03:16] Because the government is providing the subsidy, so that's the reason the electricity prices are not yet.

[00:03:25] But do you have any reasons to think of why the government has decided not to reduce the subsidy until 2017 because they have a lot of energy instead of wasting?

[00:03:42] It's better for them to invest in the infrastructure roads.

[00:03:55] Do you think the price of electricity could actually increase and what kind of barriers do you think are there to being able to increase the price of electricity again?

[00:04:08] In the near future, I again don't think that the electricity price will be increased because now the technology they are going for all it is, you know, so the demand is is stable. Again, what I said, because most of the people they're going for already/

[00:04:34] But other but the question is, the issue is not just led, but there's also the question of AC, and that is where 90 percent of our energy usage comes from. So in relation to HPC, what do you think? You think that. Because actually, this is not necessarily the most energy efficient thing.

[00:04:57] Yes…

[00:05:40] It's OK if you don't know, we can move on to the next question.

[00:05:43] Yeah, let's move on, because I think this is more of a question of someone more familiar with with the way government, which is quite another question that I have is let's assume that Tim Dean, for example, wants to renovate one of the older buildings, that it becomes more sustainable. What difficulties would Tim Dean as a company face if they wanted to do something like this?

[00:06:16] As a tamdeen in past we also did and currently we are doing it. It's not that Tamdeen is not interested in renovating. If you remember Manshar we renovated manshar and manshar mall. By doing this not only did we gain FAR but also we also gained increased rent from the tenants. Not only manshar mall but also souq al kout on the north side we did a renovation

[00:07:01] Yes. So yes.

[00:07:04] So my question is that Tamdeen does engage in renovation project. Yes. But why do you think other companies don't?

[00:07:16] Commercial complexes some of them go for renovation like for exampole manshar renovation maybe it was completed in 2006 and in 2011 we decided to demolish and build a new mall because of the new FAR, so with the al kout mall it is also completed. If the FAR is increased then they are going for the demolition and if maximum FAR is achieved then they are going for the renovation.

[00:07:53] ***OK, if they are gaining the FAR, they are going for the demolition. If that is, if the FAR is already to the maximum, then they are going to insist that, as is OK to further us to further ask about your question is why did Tamdeen decide on renovation?***

[00:08:36] No, let me just tell you, this local court is is a beauty project, so our lease period will be expired in a few years and recently we'll build a good model to help, you know, nice level of the quality of the tenants and everything. We had to renovate because both are connected with the original.

[00:08:58] OK, so if it were our own property, if it was our own property, maybe we could have done the same thing. What we don't want to demolish, again, more efficient and we're going to build a new one.

[00:09:13] Yeah. So so for you for tamdeen it was more of a kind of upgrade.

[00:09:41] You wanted to make it more attractive and have less money and have better Tennant's.

[00:10:01] Can you talk about if Tamdeen is renovating any of the residential properties?

[00:10:09] In past, we have done the renovation of four residential towers and we did not renovate fully, but we did we did the renovation partially there and at the same time, we were doing the renovation.

[00:10:27] OK, so and what was there and what was the reason why you decided to renovate the residential towers and not demolish them?

[00:10:37] Because the time we did so, to have the similar kind of, you know, renderings and all and plus upgrade to upgrade the residential areas, then we decided to renovate.

[00:10:54] OK, but financially, did it make sense to renovate as well?

[00:11:00] And financially, it was not for the financial of the residents of Tower, but it's it's what for overprotect. Yes. And again, financially to live on the project.

[00:11:12] OK, so once we are talking more about, like, portfolio level.

[00:11:21] So when we are talking about multiple projects at the same time, it starts to make more sense to renovate.

[00:11:27] Yes, yes. OK, this makes a lot of sense. I have one last question to ask you. Which is as an owner of an income producing property and residential properties, do you experience any issues with tenants that affect their financial flows and stuff like that? And what kind of issues you encounter?

[00:12:12] The recent issue is the covid.

[00:12:15] Oh, yeah, of course, it has affected almost all the tenants. Yeah, but obviously before covid, what were the kinds of issues that would come up?

[00:12:34] OK, I'll give you the example only for the 360 model when we built a 360 model. We had a food court, you know. Yeah, but the design was not that attractive to, you know, so and it's not user friendly.

[00:12:52] So we decided to renovate only the food court area to make it more open so people can see all the restaurants units and it gets the more traction towards the people because some of the business in those areas was very mixed. There was no business for some of the tenants that.

[00:13:13] OK, but once you renovated, did he see an increase in the business for the tenants?

[00:13:21] Yes, definitely. We have seen the increase in the business because some of the tenants there were not having any business and they are happy now.

[00:13:30] So that's very nice to hear.

[00:13:34] So and some of the tenants, they were not performing good. They have decided not to renew their tenancy, you know. And we are very nervous.

[00:13:47] What do you mean, not performing well?

[00:13:51] Because some of the tenants, you know, they were not up to the mark of 360 standard, OK. OK, and the business was very dull and they were losing.

[00:14:05] So it affects a different you know, it affects overall business of 360. Also, if anyone is not performing well, so it didn't really help them either. Either they bring they give them a chance to bring the new new franchisee or they bring the new tenants.

[00:14:25] OK.

[00:14:28] This is interesting. Can I also ask you the same question, but for residential properties, so what kind of issues do you guys faced with the residential properties?

[00:14:47] We can't build our projects and projects, we don't have any such problems.

[00:14:55] Well, I obviously I'm not talking about like I'm not talking about big problems on the scale of covid.

[00:15:02] I mean, something more like like daily minor things that you deal with or issues with facility management or things like that.

[00:15:14] Actually, I'm not into the facilities management

[00:15:18] That's fine

[00:15:27] How involved are you with, say, the day to day of the performance of these buildings and see again our role stops the moment we hand over the buildings to the operator, OK?

[00:15:43] Because we a different. So the moment the construction, the construction activity is over, design and construction activity is over, we hand over to the tenants, so we hand over the operators. And after the operator handles day to day activities, we are generally not getting involved unless unless they come back to us and ask for some requirement that we have to do something to make the place more and more attractive. OK, so we do the kinds of things, but generally we don't get people in day to day activities.

[00:16:18] OK, that makes sense. That is more or less the questions that I have. Thank you very much, Mr. Kothari. Thank you very much. You've been very helpful. And I will now stop the recording.

Interview with Haifa Al Dousari - Asset Manager - FAWSEC Real Estate

Ehsan Rahimi** [00:00:03] **This is interview with Engineer Haifa for the purposes of the master's thesis.

[00:00:13] The recording has been confirmed and I would like the interviewee to confirm that she has consented to being recorded.

[00:00:22] Yes.

[00:00:24] OK, first of all, thank you very much for agreeing to this interview. Oh, second, uh, can you please give us a brief introduction of yourself?

[00:00:40] OK, I'm engineer Haifa Al Dousari, mechanical engineer, I am holding a bachelor's degree in business administration.

[00:00:48] I've been working for more than twenty two years and building maintenance, mainly building maintenance and like a helpdesk for the tenants and the people and for the tenants mainly. And few about the renovation projects, but not major renovation and maintenance, mainly in the maintenance, building maintenance.

[00:01:18] [Translated] [Also I wanted to tell you if you have any problems expressing yourself in English there is no problem continuing in Arabic]

[00:01:47] So you are familiar with the kind of building that we see in the presentation and we see. Yes. Info on it I guess. Why do you think this kind of building became popular.

[00:02:05] And became popular because these buildings are being used for investment and this area is mostly filled with expatriates. The style itself. It will suit their life style life as somebody is coming to make money and build himself and go back to his country. So it should be like economical buildings. Suits these people or the companies, sometimes it is being rented for the companies and the company will accommodate their staff. So as Kuwait is growing up, this these buildings will grow as well.

[00:02:49] With the projects.

[00:02:50] And somebody will come and manage this project, will do this project, will execute this project. So people are coming, still coming and expecting we will have more and more of these projects in the future.

[00:03:07] The data that I've shown you in the interview shows that it is financially feasible to renovate this building. Why do you think people don't?

[00:03:21] First of all, especially in Farwaniya, it's very, very, very old, very old area. The buildings, I mean, and it's being used… and it's very old. It looks like old buildings doesn't match the the modern style.

[00:03:42] What is in Kuwait City. What is happening in Kuwait City. And everybody wants to grow up. Everybody likes to make a change in the building. We would like to see the new buildings. The old style is finished. We don't want to complete with it.

[00:04:00] OK, next question, the price of electricity has not changed since nineteen sixty six and only changed by 500 percent in 2017

[00:04:15] Part of the solutions that make the buildings that make the building feasible [Translated: Is to increase the price of electricity. In your opinion, what are the barriers that we have to increase the price of electricity?]

[00:04:38] It will make a lot on the investor himself, any this is any I know that's there. Is that for for Kuwaitis or for private is a private house. It's the charge is different. Right.

[00:04:58] But for the investment sector, if you are doubling because they are consuming the electricity 24 hours, you and the people who are living there are mostly careless. So it will be a waste of power. And on the other hand, you are asking to increase that the charge. So it will be a big load on the investor.

[00:05:25] But if you are if you are not going to do any solution for the center, for the building itself and there are many like smart buildings that save the power and this way you can make it and you can increase the charge. But if you are still on the current situation and you want to increase, it will be a big load.

[00:05:51] [Translation: Now you have spoken from the perspective of the investor, but in your opinion from the perspective of the government]

[00:06:01] What do you think the issues are? Do you think it's likely that the government will change the price of electricity or or do you think it's unlikely?

[00:06:20] It's a good option for the government, for sure, but as you know, after Corona, now most of the people have left Kuwait. OK, so the investors already are trying to increase the rent itself. And still, they knew that there would be a need and there will be a project, so somebody is coming if you are to raising that and the people will not come even if they are coming for the governmental projects. So you should make a balance between the investor and the government and the people who are coming with based on projects, sometimes as a government that will give them the accommodation free and it will be a package of their contract.

[00:07:07] But most of the time, this people will not like this one, the accommodation and they will go they will take like allowance and go and rent something else. And I think before 15 years, I've met one Sudanian, he was telling me that he left Abu Dhabi because of this, because of this problem, he said Kuwait is better in the rent and electricity.

[00:07:33] He said, what I'm earning in the as a salary, I would pay like thirty five of it for the electricity.

[00:07:43] And rent for sure.

[00:07:46] So it will not attract the foreign people to come and live in Kuwait because we need them

[00:07:55] One of the things we had mentioned in your previous answer is that the people living there are careless. Since you are dealing with tenants, can you further explain some of the issues that you have?

[00:08:13] Yes, most of them are laborers there. It is not a it's not a matter of education. It's like it's like ethics and beliefs and like so as your contribution and it whatever you are living, you should save the power for yourself first and to save your money.

[00:08:33] And yeah. And usually the mentality we are not paying for the electricity or water, so no problem, we will not close the water totally. We will not switch off the AC. If it is the split units, we will not turn off the TV. They are very, very, very careless then it is working there for 24 hours regardless to our like we are putting notifications, we are putting announcements, we are putting and even the government. There was a campaign on the TV during Corona. To save power, electricity and water. But I can't see that nobody is listening to this awareness campaign. They are very careless because they are not paying for that.

[00:09:26] OK, so this is from experience that you are having with in FAWSEC

Yes

[00:09:36] Or others on this issue, as someone who is working in asset management, what are the regular issues that you are seeing that come up? [Translation: For example, when we have problems or tenant complaints, what are the problems that usually come up?]

[00:10:39] So currently for our situation they are renting out the whole building. And the tenants are our instructors.. Our buildings is in Hawalli, which is better than farwaniya, and mangaf is the best of all of them. And these buildings are old.

[00:10:44] So the drainage system, sometimes we have a failure because the area is old now. Yeah, we need to change the network itself. You know, we are putting good solutions and Hamdullah, we are shifting to our new building and we have a very big compound owned by the company itself. This is a new one and it's a smart building. But kind of what we are renting is very old building. OK, deconditioned, the building condition is good, but we still we have.

[00:11:17] problems in the drainage system and the electricity itself.

[00:11:23] Sometimes you have those connections that are very old now, not when you see that everything is developed. Even though while connections now just being different, so we need to change everything, but as it is not ours, we cannot change it. And you are talking about a building and this is the infrastructure, you can't you cannot change everything.

[00:11:55] Just two more questions of the session,

[00:13:02] OK, another question is, is the in the buildings that you own as an asset manager, managing manager and as a company, is the environmental performance of the building something that you take into account?

[00:13:20] Why and why not?

[00:13:24] In the new building?

[00:13:58] ***[Translation: No I mean in the buildings that you have already, I know it's there in the new building. But I mean the buildings that FAWSEC is inhabiting now]***

[translation: I'll explain to you now, it's correct that FAWSEC has buildings that we rent it out but I can mostly talk to you about that building].

[00:14:20] We have 2 campuses, one in jabriya and one in Hawalli, we had like investigation inspection visits from *[the environmental authority]* and they used to check the pipes for water, water,

water network, and they would check the water tanks. To they are doing that two years. OK, so this is for the water and they are checking the filter water filters, they are checking for the cooler water cooler. They are checking the toilet, the toilets and the kitchen also in all of the buildings. And they confirm that the love that we are maintaining them very well and we had the look of maintenance in summer. We cleaned using the special chemicals. We are cleaning up the whole network. This is this is during summer. So we are maintaining good and the water supply and for the electricity now we are doing like…. It is small the procedures we are doing to save the power and instead we will after nobody, after 5:00, all the switches should be off and only the main entrance, the lights as per the Kuwait government rules because we cannot switch off everything and keep the building dark. So we are trying to minimize this one. So this will directly affect the environment. Also, we have we have like a recycle projects for everything. But unfortunately, since the students are not here, so nothing we are going to recycle because they are the one who are you who are using the water. But the papers, so many things we are recycling, we are dealing with companies, we will gather them in one place and then they would come on weekly basis to collect these recycled items. As for the building itself, we are doing three major maintenance projects during the year. Summer is the biggest major, the biggest maintenance, the project every year and during winter break. When you are doing the maintenance, you want to talk about the civil work of the buildings sometimes because now the school more than 30 years, I think? The building is it's not that much a new new, 20 years maybe. So we have a few cracks you have to witness. We are going to I mean, we have a few projects where we stop because of Corona, like changing the entire drainage system. To a smart one, and we were doing also the cables. This was one of the projects, the landscape itself, and we were supposed to add one floor on one of the buildings. Which we study, if it is OK

[00:17:43] … or if it would hold.

[00:17:47] We had one more one more floor and we we went through all the procedures now on the execution Corona came, and everything was stopped.

[00:18:02] So we are so we are doing many projects in the four for four minutes and for maintaining any which will give more lives for the building itself. If you come and you know, the old buildings are stronger than the new one. During the heavy rain, the country, we are facing a problem and one of the campus, but we've already solved this one in the isolation and these things. But overall, the buildings are very strong.

[***00:18:55] [Translation: You are constantly monitoring your buildings? What kind of preventative care do you use?]***

[00:19:12] Usually we have maintenance for the morning shift and we have another one for the evening shift. So any medical, any default, anything we can do, we cannot do during the student presents in the school and we will do it afternoon, evening, so on. So it's continuous maintenance work and you will not keep anything till that. You know, there are more than one thousand students. You cannot continue with their lives for anything b

[00:19:46] these are all measures that you are doing for for your educational building.

[00:19:54] But do you see any of these measures done or the residential ones?

[00:20:25] Maintenance we usually do during summer because all of the stuff, you know, that foreign it will be good. So we have two months to complete months. We will do all maintenance, OK? Everything, even the pensione, even the paint, we will maintain the machine, the paint, the windows, electricity, and most of the time. The building owner has his own contract with the AC, for example. So we will supervise. Yes. So we will supervise this this work.

[00:21:02] ***You can see value in.***

[00:21:05] ***Maybe spending a little bit more to have a nice to five or more to have a stronger, let's say component/***

do you see any changes happening in Kuwait in the future or the so that buildings are more sustainable or do you see that there is or do you think it's less likely?

[00:21:38] No. it will then there is a big chance for new buildings and mashallah if you go to Kuwait City now, many if you see in the 80s compared to the 80s of seats now totally different. One hundred percent, it's different. And this will this will be contagious, you know. Yeah. And even the mentalities of the owner of the investors know now that we are traveling a lot. The world is open to social media, so even our mindset is different now. So inshalla we believe it will be changing to the to the better. And that is the big chance to change everything inshalla

[00:22:24] ***OK***

[00:22:26] Because if you look you see if you see our personal life on the house and mean when you go to Dubai or go to anywhere, you would like them to come and reflect your what you've seen there on your house.

[00:22:43] But that's why I'm telling you, it will be changed. Inshallah.

[00:22:49] ***Inshalla, OK,***

it will come with time, yeah.

[00:22:55] ***And so, uh, thank you very much, Engineer Hifa.***

[00:23:02] ***This concludes our interview, and I am going to stop the recording.***