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# SMART HOMES IN EMERGING MARKETS: A CASE ANALYSIS FROM DUBAI-BASED PROJECT

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## Abstract

The research taps into the topic of smart homes to understand what features in a smart home would make it a success for the potential customers. The research was a primary type of research with the data collection method of Surveys and Interviews both. 300 respondents answered the survey which was based on the Kano model and calculated the dependence of the 'Must', 'Want' and 'Exciters' factors of smart homes on the customer satisfaction levels of potential smart home buyers through Multiple Linear Regression Model. The results showed an average 50% likelihood of customers being satisfied if these features were given in a smart home. For the interviews, 5 interviews were done from corporates from the smart home industry in Dubai. Their insights on the logistics and planning of smart homes are given in the discussion section.

Keywords: Smart Homes, Kano Model, remote access, security

## **1. Introduction**

## 1.1 Introduction to the Problem

The smart home technology allows users effective management of homes using the integrated network and programmed devices operating on that network (Li, et al., 2018). According to the research by (Pragnell M., et al., 2000) smart homes have a great potential because of the benefits the users can reap. The main benefits which adds to the success of smart homes, according to (BlueSpeed Solutions, 2016), include added remote security functions, especially when the household has young children and working parents, energy- efficient management and use of devices at home as well as insights to the usage patterns of devices.

According to (Madakam, 2014), smart homes offer varying degree of sophistications based on the devices being used which could enable users a lot of automation. From temperature control to ordering groceries, a smart home could very well automatically perform the domestic chores otherwise requring constant attention from the home makers. (Wilson, et al., 2016) highlights the importance of smart homes for people with disability and improving to make their lives easier.

According to (Luor, et al., 2015) the success of any smart home would depend on understanding which features work best for a smart home owner. In essence, every smart home should be tailored to fit the need of the user. These would be identified as 'success factors' from now onwards in the study. In order to understand the success factor for a smart home, it is imperative to tap on those compulsory attributes that should be present in a smart home to make it a success.

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Smart homes might as well be the only homes of the future (Solaimani, et al., 2013) and it is imperative to study the success factors sought by smart home owners. This study is undertaken for the same purpose in the region of UAE to add to the body of knowledge, as UAE is a fast growing and high-investment-based economy which could be receptive to this arena of technology (Guellil & Al-Jundi, 2018).

The literature gap is observed in the sense that not a significant amount of literature is available regarding smart homes in the UAE and what factors would make those smart home a success. The topic is significant as postulated above and hence studies on this topic could enlighten the releavant industry as well as form a basis for future researches.

## 1.2 Research Problem:

Keeping the above postulates in mind the area of this particular study is to understand:

- a. To find the high success factors for smarthomes in the market of UAE
- b. To analyze the smart homes in the market of UAE by interviewing a smart home constructor present locally

## 1.3 Theoretical and Empirical Review

For this research, Kano Model would be used to suggest the theoritical model of the study.

(Luor, et al., 2015) state in their research that the use of Kano Model is highly beneficial to understand the smart homes perceptions of the user. Kano model is one of the graph based tools which could be used to compile and then prioritize a list of factors by the researcher which are, in theory, most likely to satisfy the customers (Rotar & Kozar, 2017). The following is a graph of Kano Model:



Figure 1 (Coleman, 2014)

Based on this model, Musts are factors which could not be compromised upon. For smart homes these could be advance security systems, automated control of the appliances, remote access using cameras (Zsolt & Orosz, 2018). Wants could be a factor which is not needed but beneficial to have. For Smart homes these Wants could be Upgradability to newer machines with time and

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Expandability to accommodate every new gadget coming in over time (Electronic Housing, 2014). Exciters are bonuses and could have a huge advantage on the customer satisfaction levels. These for smart homes could be data insights and sustainability solutions (Mukendi & Adonis, 2018).

## 1.4 Suggested Theoretical Model:

Based on the above discussion and from the studies of (Zsolt & Orosz, 2018), (Electronic Housing, 2014) and (Mukendi & Adonis, 2018) the Kano model is used to come up with a hoeritical model which would lead to the verification of the objectives of this study. The Model is as follows:



Table 1 Researcher's Own thought model

According to this table, all 3 of the Kano's model factors account to high success rate in the home owners of Smart homes. These factors have been conceptualized, as discussed above, using the studies of (Zsolt & Orosz, 2018), (Electronic Housing, 2014) and (Mukendi & Adonis, 2018) to form a detailed research survey.

## 2. Method

## 2.1 Research Approach:

For this research, both quantitative and qualitate methodologie were used to attain the required data from the respondents.

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The quantitative data was gathered in the form of surveys that were distributed to the respondents. This data was used to validate the hypothesis derived from the first research objective which was to understand the success and failure factors for smart homes in the perception of the users. As for the qualitative data, semi-structured interviews were conducted to gather data on the second research objective of the study which was to analyse the feasibility of smart homes in the UAE market.

The interviews were conducted with the upper management corporates of a smart home project in Dubai, which is known as the Dubai Lifestyle City. From hereon, it will be referred to as DLC.

## 2.2 Data Collection Method:

For the quantitative data, the survey was formulated using the Emperical Model suggested above. The survey was a questionnaire that identified if the user would be satisfied by using the feature of the smart home. The survey was first used for a pilot study on 50 respondents to attain a value of Chronbach's Alpha.

For the qualitative data, a total of 5 interviews were conducted with corporates who belong to the Smart Home Industry in the UAE. A semi-structured questionnaire was designed to understand the factors highlighted in the Empirical Review ahead. The answers were recorded.

## 2.2 Respondent Profile and Sample Size

For the quantities data, a sample size of 300 was selected and 300 respondents were approached through social media platforms to fulfil the survey. These were the residents of UAE with ages of 25 and above. For the qualitative data, 5 interviews were conducted with corportaes from the industry using networking. Convenient sampling method was used to approach the respondents for the survey and the interview.

## 2.2 Calculations:

The first test that was run on the data was Multiple Linear Regression Model. This statistical test estimates the quantitative relationship between a dependent and more than one independent variables (Uyanık & Güler, 2013). The dependent variable here being Success Factors for smart homes whereas the independent factors are the conceptualized factors on the Kano Model described above.

For the interviews, the panel were asked 7 semi-structured questionnaire. The answers were recoded and have been discussed in the next heading.

## 3. Results

## 3.1 Surveys:

The result for the survey is stated below.

For the 'Must' factor, there were a total of 3 independent variables and one dependent variable namely:

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Independent Variable	Dependent Variable			
Advanced Security System	Customer Satisfaction			
Automation of Appliances				
Access allowed remotely to all devices				

Table 2 the dependent and independent variables for the facor of 'Must

The first test that was performed measured the R and R squared value. These values determine how much of the dependent variable could be explained using the independent variable:



Table 3 the values of R and R squared for Dependent and Independent Variables of 'Must'

The R squared value, which is usually described in percentage came out to be 58%. The higher the percentage, the more reliable is the independent variable on the dependent one.

The multiple linear regression test was also done which came out to be:



Figure 2 The Multiple Linear Regression Analysis of 'Musts' on Customer Satisfactiom

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For the multiple linear regression model, the more the plotted points are on the line, the more it shows the dependence of independent variables on the dependent one. As evident from this figure, the plottings are relatively on the line and show a 58% correlation.

For the 'Want' factor, there were 2 independent variables and one dependent variable which is below:

Independent Variables	Dependent Variables			
Expandability	Customer Satisfaction			
Upgradability				

Table 4 the dependent and independent variables for the facor of 'Want'

The R and R squared was calculated as follows:

#### Model Summary<sup>b</sup>

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	dfl	df2	Sig. F Change
1	.225 <sup>a</sup>	.051	.044	.410	.051	7.913	2	296	<.001
a. Predictors: (Constant), WANT2, WANT1									
h Danandant Variable: CucsatWant									

b. Dependent Variable: CusSatWant

Table 5 R and R squared values for the dependent and independent variables of 'Want'

The correlation is 44% which means 44% of the wants would likely end in customer satisfaction for buyers of smart home.

The Multiple Linear regression analysis is as follows:



Figure 3 The Multiple Linear Regression Analysis of 'Musts' on Customer Satisfactiom

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The table shows a less than 50% plotting on the table which shows indecisiveness of the customer on these factors.

For the 'Exciters' factor, there were 2 independent variables and one dependent variable which is below:

Independent Variables	Dependent Variables			
Data Insights	Customer Satisfaction			
Sustainability Solutions				

Table 6 the dependent and independent variables for the facor of 'Want'

Following are the R and R squared values for exciters:

#### Model Summary<sup>b</sup>

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.225 <sup>a</sup>	.051	.044	.410	.051	7.913	2	296	<.001

a. Predictors: (Constant), Exciters2, Exciters1

b. Dependent Variable: CusSatExc

## Table 7 R and R squared values for the dependent and independent variables of 'Exciters'

This is the highest value among the 3 factors, which is 51% showing more than half percentage of dependability of these perks likely to ending in customer satisfaction for smart home buyers.

The Multiple Linear Regression is as follows:



Figure 4 The Multiple Linear Regression Analysis of 'Exciters on Customer Satisfaction

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As is evident from the table above, most of the plottings are on the line passing thought the curve showing a 51% dependability.

## 3.2 Interviews:

The following encompasses the answers to the interview questions which were coded and then shown below:

The first question asked the interviewees about the main technologies which were used in smart homes. It was found that DLC used all the modern technologies in the area of audio/ video, security and surveillance, automation systems all controlled by iPhone and iPad. Other technologies included soundproof walls, touch panels for each room and special wirings to connect the equipment. It was found that DLC used key technologies in an attempt to build a highly efficient model of smart home as also found from the secondary research conducted.

Progressively, the second question asked the interviewees about the planning stage of developing and implementing information systems and about the steps which DLC took to know customer needs and requirements before deciding what technologies and features were to be installed. It was found that no survey was done for this purpose. However, ideas were taken from already successful smart home projects around the world. Since the target customers of DLC were high profile people and their needs were expected to be more focused on lifestyle, the features were decided accordingly. Planning is an important stage as found from the secondary research and DLC undertook planning activities which shows its attempt towards building a successful smart home project.

The interviewees were then asked the main challenges faced by the DLC development team and the contractors. Key challenges included lack of power since there is not permanent electricity supply on the site; lack of availability of local support in UAE since most of the hardware was to be imported from abroad; identifying the right consultant who could bring all the expertise on one platform; meeting the deadline with other contractors and meeting the standards set by the consultant.

Moving on to the fourth question, the interviewees were asked what considerations were undertaken by DLC to make sure the technology implemented at DLC was reliable, free of glitches and user- friendly. It was found that DLC selected the contractors and suppliers on the basis of their portfolio and previous experience. Hardware, software and products with high customer satisfaction rates and best specification were chosen for the DLC smart homes. Proper survey of the site was undertaken by the engineers and decisions were made to ensure that the systems were free of glitches and user friendly.

When asked about the dependability factor of the model villa and what steps are taken if a system or system component breaks down, it was found that the systems used at DLC were not vendor specific. The organization offers to replace the system with the latest technology in case of any break down. Regular maintenance is planned to be provided to the villa owners to ensure smoothing functioning of the systems. Thus after sales service is included in the deal (at a minimal annual cost).

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Then the interviewees were asked about the security of the system against hackers and external cyber threats and steps taken to ensure the security. It was found that no crucial information of customer is being stored on servers but to avoid unauthorized access, a firewall has been set up to avoid all unnecessary traffic from outside besides using encrypted passwords for authentication.

Interviewers were also asked about the limitations (excluding the cost and budget) in deploying the technology and providing any features. It was found that limitations included lack of electrical power, lack of cooling system in the server room and that many planned features were not proceeded with because of time and unavailability of technology.

Lastly, when asked what steps, if any, were taken to make sure the maintenance cost of these systems was at a minimal, interviewees replied that experienced contractors ensured that the systems required less maintenance. Besides, a maintenance/ tech-support team was in place to handle the troubleshooting efficiently and the team was available on call to the residents. Charges were applicable but kept to the minimum.

## 4. Discussion

Following points summarize the conclusion gained from the surveys:

- These respondents of the survey and potential customers of smart homes are in a market which is still relatively new to smart homes. With many gadgets already offering a lot of the features at much cheaper prices, the customers want something more which justifies their spending on such expensive home solutions.
- The high percentage of the 'Exciters' factors show that these home owners are looking for smart solutions to save the environment. The sustainability factor was included in one of the exciters and this received the highest percentage of getting the customer satisfaction.
- The customer of tomorrow is much more aware of and educated about savings and and their patterns. Having smart homes which give insights and logarithms that could build upon these insights to give solutions could be highly appreciated.
- This means that the integration of Artificial Intelligence at a higher level in smart homes could prove beneficial to spur buying. These could be done by solutions which are specific to smart homes and not available separately as devices.

The following points summarize the conclusion of the interview:

- The result of the interviews showed a compelling use of technology to create a multi hub of connected applications to creature a smart home projects. The most updated technology was applied in smart homes as one of its USP (Unique Selling Point).
- Quite a number of challenges were faced by the smart home constructors owing to the fact that it is a new industry and the materials for construction have to be improved from other countries.

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- The research for smart homes in the geographical region was not conducted as it should have been. Research is imperative to any new project and the qualitative research conducted in this paper could potentially help the smart home constructors in their projects.
- Smart homes are a lot about luxury and the constructors ensured that owners achieve the luxury through the architecture and design and not only the technology.
- Safety was one of the main concerns in smart homes and most focus of the builders was assured to this arena of housing.

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