Implementing Modular Houses in Honduras: A Sociotechnical Analysis

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Socioeconomic Status of Honduras

Honduras is the second poorest country in the Caribbean and Latin American Region, which makes the development of infrastructure essential to the wellbeing and sustainability of its population (The World Bank, 2021). Infrastructure affects almost every aspect of the day-to-day lives of its citizens. The country has a population of around 10 million people, and around 20 percent live in extreme poverty conditions, such as homelessness (Chapman, 2018). As with most third-world countries, poverty and homelessness are amongst the most common issues that Honduras faces, which exacerbates the already poor socioeconomic conditions of the country. A potential solution to mitigate these precarious living conditions is the implementation of modular homes. Modular homes are prefabricated, inexpensive units that can be easily installed in any desired location (Karmod, 2013). The following research will analyze how through the building of modular homes, the country's economic and social situation will improve. Additionally, the implementation of modular houses in poor areas will have a ripple effect, as it contributes to the reduction of unemployment, poverty, and crime rates, and consequently leads to an increase in alphabetization rates, GDP, and an improvement of the overall well-being of its people (Dolan, 2021; Taylor, 2015). Technological determinism and technological fixes are applied to this analysis to demonstrate how the implementation of modular homes can shape society and serve as a solution to improve the social and economic situation of Honduras. Ultimately this paper answers the following question: How does the implementation of modular houses benefit the social and economic standards of Honduras?

Methods of Analysis

The question being answered in this paper is: "How does the implementation of modular houses benefit the social and economic standards of Honduras?" This question is answered

through documentary research and supported by two case studies, an interview, and auto-ethnography. Documentary research provides evidence to support that improving the living standards of people who live in precarious conditions will have a positive impact on the overall social and economic status of the whole country. The keywords used to find the research are those that discuss third-world country socioeconomic issues, the impacts of living standards on the economy, and the benefits of modular housing. Furthermore, two case studies: one that discusses the implementation of modular houses in a refugee camp in Turkey and another that describes the implementation and benefits of affordable housing specifically focusing on Honduras provide a greater understanding of modular houses as a solution that can have a significant impact on society. Both cases are used to support the research and analysis. Finally, the use of auto-ethnography accounts for the incorporation of personal background, experience, and insight into first-hand information that cannot be accessed through research.

Honduras and Modular Housing

Poverty is an increasingly alarming issue in Honduras. Almost half of its population, approximately 4.8 million people, lives on less than US$5.50 per day and even worse, one-fifth of Hondurans live in extremely precarious conditions, with approximately less than US$1.90 per day (The World Bank, 2021; Chapman, 2018). Poverty is correlated with homelessness and other social and economic issues, such as low alphabetization rates, high crime, and unemployment rates, among others (American Psychological Association, 2009). As a Honduran Citizen for nearly 22 years, I have witnessed the detrimental consequences of poverty. It is very common to see people on the streets begging for money just so they can afford something to eat. These people are, most of the time, whole families that range from elders to newborn babies. Even

though poverty has multiple detrimental consequences, such as hunger, one that contributes to and exacerbates the others is the lack of access to shelter.

The rates of homelessness in urban areas of Honduras are very high, with low to none numbers of homeless shelters (Covenant House, 2022). It is not surprising to see people living under bridges, riverbanks, and even streets, as they have no other shelter (Children International, 2021). Furthermore, entire communities live in houses made out of metal sheets, wooden planks, carton boards, and other scrap materials (Kennedy, 2020). Therefore, these houses are not only unstable and vulnerable to mild and harsh weather conditions, but also extremely overcrowded. As a result, many citizens live in extreme precarious and unsanitary conditions, which further contributes to unhealthy and poor living situations (BBC, 2020).

One proposed solution is the implementation of modular housing in urban areas of Honduras. Modular houses are more affordable prefabricated units that are installed in any desired location in a simpler and faster manner than a house built from the ground up (Karmod, 2013). In regards to its occupancy, a modular house can fit up to 8-12 people. In addition, these houses can be made out of biodegradable and reusable materials, which drastically decreases their cost (Porta-King Building Systems, 2021). Another advantage of this type of housing is that it can be assembled on almost any surface regardless of the type of soil composition (Karmod, 2013). All these features make modular houses a viable and affordable solution to combating homelessness.

Significance of Technological Determinism and Technological Fix

The implementation of modular houses in a society such as the urban areas of Honduras, fits within the field of STS because the technology applied has as a purpose the ability to

improve and shape society. The STS frameworks being used in this research paper are technological determinism and technological fix. In his essay “Technological Determinism in American Culture,” American historian Merritt Roe Smith defines technological determinism as the way in which society is shaped by technology (Smith, 1994). He emphasizes how the 19th century was a turning point in American society as the American Civil War was characterized by immense technological progress, some examples being the development of electricity, railroads, telegraphy, etc. (Smith, 1994). For this research paper, a category of technological determinism is being used to analyze how the implementation of modular houses can shape society in Honduras. This category is called soft determinism. As explained above, technological determinism is technology that serves as a “guiding force in society’s evolution.” However, soft determinism delineates that people “still have a chance to make decisions based on the outcome" (Techopedia, 2012). Another critic of technological determinism and its sub-category of soft determinism is Allen Dafoe. In his article “On Technological Determinism: A Typology, Scope Conditions, and a Mechanism,” Dafoe mentions that there are “few scholars [that] would deny the influence of technology upon social relations” (Dafoe, 2015). He then continues to give examples of how technological change can quickly generate small to large-scale effects or “unintended consequences" on society (Dafoe, 2015). Therefore, this research analyzes how modular homes, the technology, can have an effect on the people of the community it is intended to shape.

The second STS framework being used in this research paper is technological fix. Alvin M. Weinberg was the first author to introduce this concept. According to Newberry, Weinberg’s “technological fix” refers to “the use of technology to respond to certain types of human social problems that are more traditionally addressed via political, legal, organizational, or other social

processes" (Newberry, 2005). As alluded by both authors, it is likely for detrimental and unforeseen side effects to emerge as a result of technological and social fixes (Newberry, 2005; Weinberg, 1978). There is controversy around whether technological fixes can be considered an absolute solution to a problem (Newberry, 2005; Weinberg, 1978). However, even if these fixes are not seen as absolute solutions, they can help improve the situation for at least a certain period of time or until a permanent solution can be provided. For this reason, this framework is relevant to the research paper, which aims to analyze and prove that by implementing modular housing the overall socioeconomic situation of a third-world country can be improved.

Discussion of Results

Third-world countries are largely and continuously affected by socioeconomic problems such as poverty, unemployment, inequality, lack of basic needs, and inadequate access to resources (Akubue, 2000). These problems inevitably aggravate the social and economic conditions of the country's welfare, making the implementation of technology, such as modular housing, not only a necessity but an urgency. As possible solutions to these underlying and ongoing problems, researchers have proposed alternatives such as political regulations, better management of resources, increased access to healthcare and education, among others. While these solutions are viable, attempting to tackle said problem using infrastructure, modular houses specifically, remains largely unexplored. As specified by Anthony Akubue, "the appropriateness of technology is not limited only to job creation, using local resources, and utilizing renewable energy resources but it is also about being affordable, easy to maintain, compatible with existing infrastructure, efficient in the use of scarce natural resources, environmentally benign, and partial to small-scale" (Akubue, 2000). Modular homes fit this description, as they are cost-effective,

easy to build and maintain because they use recyclable material, and their installation and usage are meant to have minimal environmental impacts.

To best understand the answer to this research question, it is necessary to engage in an in-depth discussion on each particular case study and how it is contextualized to Honduras itself, as well as supporting evidence and personal knowledge as a Honduras citizen. The first case focuses on a refugee camp in Subaşı, Turkey which serves as evidence on how to implement modular housing in a community, the benefits of modular housing, and the factors that make using these types of homes a sustainable, eco-efficient, and affordable option. The second case is an unpublished case study from a textile manufacturing company based in San Pedro Sula, Honduras. This second case is supported by a thorough interview and discussion with the project manager of the operation. This interview provided valuable, humane insights that are not shown or highlighted in the data portion of the case. The case analyzes how building affordable homes for the company's underprivileged laborers and employees benefited and improved their livelihoods, their own personal wellbeing, and indirectly, their families by supporting their personal economy. Also, the case points out several important factors that must be taken into consideration when implementing any type of affordable housing.

Analysis of Case 1: Circular Economy and Regenerative Sustainability in Emergency Housing: Eco-Efficient Prototype Design for Subaşı Refugee Camp in Turkey

The first case focuses on circular economy and emergency housing in a refugee camp in Turkey. According to a case of an eco-efficient prototype design of modular housing done for a refugee camp in Turkey, in 2020, "82.4 million people were forcibly displaced" as a direct consequence of several internal and external factors including natural disasters, social conflicts, epidemics. This prompted an urgent necessity to "provide protection and decent living

conditions" to all those individuals who found themselves without a home (Mercader-Moyano et al., 2021). The case emphasizes how essential housing is for the basic survival of individuals because it has the capacity for "maintaining human dignity and sustaining family and community life" (Mercader-Moyano et al., 2021). The type of housing this case is referring to, emergency housing, is one of minimal habitat meaning that it can sustain a single family in terms of "dimensions, materials, costs, construction times, and permanence" (Mercader-Moyano et al., 2021). The prototype design implemented in Subaşı, Turkey, describes and includes many iterations of modular housing, each with a different design, architecture, materials, and usage. Some features of modular houses include being relocatable, reusable, recyclable, and resalable. These characteristics of the modular housing prototype contribute to the circular economy. Circular economy, in terms of housing, is one that can be recycled for multiple purposes and made with reused materials (Mercader-Moyano et al., 2021). After designing these prototypes of modular houses, they were implemented in the Subaşı refugee camp, and many conclusions were reached on the maintenance of these houses and why they were successful in sheltering these families and reincorporating them into society. Therefore proving to have a beneficial effect on the Subaşı community of refugees.

The prototypes of modular houses were implemented based on an "eco-efficient design protocol," characterized by their rapid and easy construction, and adaptability to any environment (Mercader-Moyano et al., 2021). Overall, the case highlights the many positive consequences brought about by the modular homes to the Subaşı community including "equality among people," protection of the environment, and prosperity (Mercader-Moyano et al., 2021). More specifically, the case describes the advantageous qualities of these designs, which proved to be easily transportable as they could be installed on rough terrains, and could house families

of different types and sizes (Mercader-Moyano et al., 2021). In addition to the previously mentioned characteristics of the houses, the installment and maintenance required little to no training, which means the household user can take care of their premises by themselves. After the implementation of these modular homes, the Subaşı community saw a significant improvement in socioeconomic conditions, namely, an increase in security, inclusivity, "sustainable development," and a decrease in inequality, "land degradation," and "biodiversity loss" (Mercader-Moyano et al., 2021). Therefore, the environmental, social, and economic impacts are clearly demonstrated in the case as a direct result of these modular homes.

Another important benefit pointed out in the case of Turkey is that modular homes do not serve solely for housing but can be used as field hospitals, vaccination centers, and morgues, and can be adapted for all types of activities (Mercader-Moyano et al., 2021). To ensure the longevity and long-term sustainability of these prototypes, the case mentions that this requires a one-time training to the users about their home, its construction, maintenance, and the general value of the house in order to "provide them with autonomy for the future" (Mercader-Moyano et al., 2021). The multiple uses and the easy maintenance are other two advantages that using modular homes has as it can have important effects not only in increasing housing but also in other fields of the society, such as medicine.

This case clearly delineates the benefits provided by modular homes and how these were responsible for improving the conditions of the victims and the overall refugee community of Subaşı, Turkey. As this project proved to be successful in Turkey, it provides evidence that the implementation of modular housing could also have similar beneficial consequences in communities of low resources like Honduras. Case 1 emphasizes the crucial role that a stable home plays in enabling an individual's incorporation and participation in society. As Gilbert

states “to the poor a house is not just a physical dwelling place but a place where people “live, work, and struggle for survival” (Gilbert, 2000). Consequently, the role that the implementation of modular housing in Honduras aims to generate is to provide people that are currently living in precarious conditions with a safe home and create a sense of stability and security that will allow them to reincorporate and add to society. The security of a physical space allows struggling people to begin building wealth, saving money, and investing in areas such as education for their children. Stable and secure housing thus has generational effects (Andonie & Head of Operation, 2022). Furthermore, it will also have a ripple effect in tackling homelessness, resulting in the reduction of several social and economic problems (Gilbert, 2000).

Moreover, as discussed in Case 1, the ability to relocate and the reusability of modular houses make them particularly suitable for implementation in the different locations across Honduras. Additionally, these houses can be easily maintained by unqualified personnel, which means that the Honduran citizens can be easily taught to be responsible for their home and its care. Furthermore, modular housing has many environmental advantages. They are made of environmental-friendly materials which pose no harm to the ecosystem (Mercader-Moyano et al., 2021). This is an important aspect to consider as these houses will most likely be installed near riverbanks and mountain sites as these are the areas where communities of low resources mostly reside in Honduras.

Analysis of Case 2: Effects of affordable housing and other development pillars in improving quality of life for manufacturing workers in Honduras

This case was a study by a textile manufacturing company located 20 minutes outside of San Pedro Sula, Honduras. The data collected, results and conclusions reached remain unpublished and largely unavailable to the public. For this reason, the head of operations of this

project and manufacturing company has asked to remain anonymous, and so their names are omitted for the purpose of the research. Accompanied by the case study, an interview was conducted with the head of operations, where the impact of affordable housing was thoroughly discussed and analyzed.

The case first begins with a sociodemographic study of the group of employees, or partners. 625 partners were used as participants, focused on five "axes of study." These axes are the following: identification, economics, education, health, and housing (Textile Factory, 2020). Identification focused on collecting the personal data of each partner, such as the number of children, brothers, parents, and others living in the same household. Economics focused on the investigation of the partners' income levels, and expenses, and asked whether they had any "knowledge of saving and vision of main needs and economic lacks" (Textile Factory, 2020). Education essentially assessed the levels of education of the partners and their associates (i.e., spouse, children, brothers, parents, others). Health collects the medical records of each partner and associate, as well as more general information including how often they visit the doctor's office, proximity to a medical facility, and access to medical supplies. Finally, housing meant individually visiting each partner to analyze the characteristics of their homes (i.e., area, material, own or rent, rooms, electricity, water, kitchen, others) (Textile Factory, 2020). The characteristics of the home are used to determine other additional "factors and conditions that affect their lives and performance" (Textile Factory, 2020). The ultimate objective of the recollection of all of the aforementioned data is to provide "reliable and objective information, with regards to the socioeconomic conditions" of the partners and their families. Therefore, the textile manufacturing company can efficiently proceed to generate affordable housing projects and other initiatives to improve the standards of living of their employees.

The results of the study found several interesting data that were later interpreted and discussed in the interview with the head of operations. Several conclusions were reached. First, the results found that the poverty line is $2.8 per person per day in urban areas and $1.4 per person per day in rural areas. The poverty line can be interpreted to point out various indicators, specifically, revealing which partners of the study are under the poverty line, in order for the textile company to focus on them. By doing so, it was uncovered, then, that "6.72% (42) of the partners are below the poverty line" (Textile Factory, 2020). In addition to this, 16.80% (105) of the partners live in inadequate housing conditions and an average of 6.19 people inhabit the house of each partner. Within a household, an average of 3.3 are children and 0.6 are older people (Textile Factory, 2020). In terms of health,16.80% (105) of the participants of the study were recorded to have at least one member of their family diagnosed with a chronic disease (Textile Factory, 2020). In terms of education, it was shown that many completed their education all the way through elementary school but very few have a high school or college degree (Textile Factory, 2020). Additionally, many partners revealed that they are in debt to either bank, creditors, or lender agencies, due to necessity or bad money management.

After the collection of this data, the factory launched the construction of affordable houses and the remodeling of existing homes. Around 35 affordable houses were built for partners who lived in inadequate conditions, and more than 250 houses were remodeled, improved, or supplied with necessary resources (i.e., bathrooms, mattresses, ovens, furniture, etc.) to improve living conditions (Textile Factory, 2020). Other than housing, the factory also launched several incentives to promote health, economy, and education. These programs included workshops that touched base on topics such as money management and debts, as well as programs that provided partners and their families with the opportunity to learn new traits in

the textile field or join the local public school. Moreover, vaccination brigades were hired to give house-to-house visits with the goal of safely vaccinating the partners and their families. All of these efforts showed a great improvement in four different socioeconomic standards: housing, health, education, and economy. More than 12,000 members, including partners, their extended families, and other employees, were positively impacted by the affordable housing project and the implemented factory initiatives (Textile Factory, 2020).

After reading all the data collected from the study provided by the textile manufacturing company and engaging in a thorough discussion with the head of operations of the affordable housing project and initiative program, there is evidence supporting the positive impact of modular housing in multiple aspects of the standards of living of families of scarce resources. The reason this specific case was chosen was that it is based in Honduras, providing a first-hand perspective. The focus group is made up of people from medium to scarce resources, which is similar to the population the research question addressed. Furthermore, the role that the affordable housing project played in this community is directly in line with the role that the implementation of modular housing aims to fulfill. Furthermore, based on the outcomes of the project, the health, economic, educational, and overall living conditions of the participants and their families were improved. These results were corroborated and clarified during the interview conducted with the head of operations of the project. However, it must be understood that the implementation of affordable housing alone does not provide a solution to the barriers that these families face (Andonie & Head of Operation, 2022). As discussed during the interview, the access to better conditions of living works as a catalyst to jumpstart the process of improving the socioeconomic standards of a family, but because this is a multifaceted problem, there is

significantly more action that needs to be taken in order to find an integral and long-lasting solution (Andonie & Head of Operation).

During the interview, there were many socioeconomic obstacles, other than precarious living conditions, that perpetuated poverty, low education levels, and stable economical attainment among the participants. These include poor economic management and full dependence on the earning wage of just one family member. The project manager pointed out that even though the participants received medium to low wages, the problem was not the wage itself but that the whole family relied on a single member's income. Additionally, money management was also a big issue, as participants did not have the education or knowledge to sustainably, evenly, and efficiently distribute their income. Because of this, the focus of this project, aside from providing affordable houses and better living conditions, was to instill and encourage a sustainable way of living among the participants and their families. The aim was to tackle the socioeconomic issues encountered. This is possible by, beginning with small but clear steps, "teaching them how to fish," instead of just implementing superficial solutions without any long-term changes.

Limitations of Research

The research study posed several limitations. The main limitation presented was the lack of available data. Honduras is a small, underdeveloped country in Central America, so conducting a full, well-rounded study of it becomes difficult given that data, particularly data pertaining to infrastructure, is not properly recorded or widely available. The main reason for this, is that while the country continues to face several challenges, it stands among many other countries who are plagued by these same issues, and it is therefore not considered a site of great interest among researchers to conduct in-depth studies. Moreover, the use of modular

construction is relatively new to the industry. Because of this, research that directly links modular housing as an alternative to combat socioeconomic issues in third-world countries is scarce. Another limitation faced over the course of the research was in providing a defined, conclusive answer to the research question since solving socioeconomic issues is very complex and requires a multi-dimensional analysis of a number of factors and conditions both of the country itself, the technology involved, the proposed solution, and all the possible impacts that the solution would have if and when implemented. Given that there is no one simple solution and due to the possibility of many alternative results in both the short and long term, engaging in this research required the consideration of several perspectives, an assessment of the region itself, an understanding of the affected population and of the efficacy of the proposed technology in its ability to tackle the problem at hand. This research will receive continuation in the event of moving back to Honduras and being more closely and directly in contact with the area where the project would be implemented. More in-depth research needs to be conducted on the possible organizations willing and available to conduct and pioneer this project, either non-governmental entities or local governments.

Conclusion and Next Steps

This research aims to tackle the question of modular housing and its ability to benefit the socioeconomic standards of Honduras and its population. While the research and data serve to show that modular housing can begin to better certain existing problems, alleviating homelessness, poverty and increasing the overall wellbeing and stability, it cannot be said concretely that modular housing is a direct and permanent fix to all the issues that Honduras and other third world countries continue to suffer from. Nevertheless, the studies, data gathered and cases in question do serve to show that the implementation of modular housing is a feasible and

promising first step. Soft determinism and technological fix can be seen in both cases, through the examples of how modular homes improved the lives of the refugee camp in Turkey and provided homes and other incentives to the employees of the textile factory in Honduras, serving as stepping stones for them toward the improvement of different aspect of their lives (i.e education, health, housing, and financials). By providing a solid foundation and a quick, easy, affordable alternative, the proposal of this project contributes to igniting action, in the hopes that in the future, better, more sustainable long-term alternatives and large-scale solutions will be put in place to best address these issues. The ultimate purpose and overall goal of this project are that the findings will motivate organizations, leaders, and other third-world citizens to find ways to help communities living in precarious conditions. Another significant aim of this research is that these conclusions, results, and methodologies can potentially be replicated and applied in other third world countries facing similar challenges and that ultimately, others can begin to see that solutions like modular houses do have the capacity to improve the living standards, economic welfare and social standing of the country in which they are implemented.

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