Probing Recycling Shipping Containers into Sustainable Housing Options for the Development of Urban Slum Areas in the Philippines

I. Introduction

With development and modernization, urbanization is a progression where industrialization and economic development result in city-building and encourages urban specific changes in specialization, labor division, and human behaviors [30]. Thriving urbanized cities are distinguished proofs of prosperity and growth of developing countries yet are juxtaposed to the people settling in the slums' poor living conditions. The Philippines remains a prime example of such. The United Nations declared that 54% of the world's population lives in urban areas and is estimated to reach 66% by 2050, with nearly 90% of the latter in Asia and Africa [29]. At present, it is estimated that one in eight people in the world live in slums or experience slum-like conditions, and it is estimated that within 15 years, more than three billion people will need adequate housing [3]. Therefore, these challenges are reasons for poverty's obstinacy, depriving millions of their rights to proper housing and dismissing them from urbanization's benefits and promises.

These realities, in context with the country's economic situation, is an urgent matter for those greatly affected by the rapid urbanization and its effects such as displacement of the residents, environmental consequences, access to essential services and services, insufficient housing, sanitation facilities, loss of livelihood, and land tenure procurement [20, 25, 31].

Slums are generally the result of a combination of rapid urbanization and demographic growth, bad policies, and inappropriate incentive systems, including poor governance, problematic regulatory frameworks, dysfunctional housing markets, and a lack of political will [3]. Slums are characterized by poor sanitation, overcrowded and crude habitation, inadequate water supply, hazardous location, and insecurity of tenure [3]. These conditions are portraying the existence of scant incomes from lack of proper jobs and poor living circumstances.

During Aquino, the government adapted the United Nations Global Shelter Strategy (GSS 2000) with the fixed point that shelter needs to be affordable even for the lowest income group and that there are several low-budget housing projects for the urban poor people living in informal settlements, to provide them shelter and improve their quality of life [21]. Still, with recent information, it was said that the Department of Human Settlements and Urban Development was only given P3.68 billion as their total 2021 budget proposed for five agencies. This 2020, it's less than half of their total budget, P7.83 billion, and only 5% of the P77.1 billion total budget the agencies requested that the DBM set. From the NHA's target of 99,510 housing units, the target has been adjusted to only 68,095, a decrease of nearly 32%. [27]. The housing sector is recommending a total of P47.52 billion to address the housing requirement of 101,000. If the recommended budget is only P6.32 billion, this could only translate to handle 12% [23]. These numbers imply that there is a lack of apt government action in order to address the housing situation fully.

On the study of [24], it stated that the government of Manila has been tolerant to the illegal occupation of the underprivileged areas as they do not offer a capital return and is worsened by a lack of a structured and long-term strategy for addressing urban growth; a total

lack of a genuine political deed to address the problem in a comprehensive and sustainable approach. Hence the problem will persist as there is still a rapid increase in the population that lives in these undeveloped sum areas whilst the housing projects' resources and funding remain unsettled and meager, regardless of how many governments would pass.

In tackling the issue of urban poverty, slum upgrading (improvement of roads, drainage, improvement of housing) is one practical approach and is practiced through relocation and resettlement, but the general approach in the country's case is heavily involved in a partnership with the government, along with the varying policies that vary, as do its degree of success [19]. In the study of [3], two of the ideal extents of improving slum areas are the durability of the house, where the latter is built on a nonhazardous location and has a structure that is permanent and adequate to protect its inhabitants from the extremes of climatic conditions such as rain, heat, cold, and humidity and has sufficient. These are general rubrics in order to meet the demands of sustainable and livable housing conditions adequately.

Globally, there are 17 million structurally sound shipping containers that can be reused after ending their freight purposes [18]. In the Philippines, recent articles show an abundance of unused shipping containers in the Manila International Container Port, where the yard is operating at 98% capacity [13]. According to [35], Manila is the 28th busiest container port globally, handling about 5 million twenty-foot equivalent units in 2018.

In constructing these containers into probable housing, it was claimed that modular construction was 40-60% quicker and produced 70% less onsite waste than traditional building methods. It does not require complicated construction processes, which reduces cost substantially [18]. It can also be stacked more than eight levels high and resist corrosion if well coated [4, 28, 29].

With the available literature, this paper intends to evaluate the shipping containers' feasibility to be a sustainable housing option for developing the urban slum areas in the context of sustainability and resource practicality.

II. Viability of Container Housing

Shipping Containers as Practical Building Materials

Reusing materials reduces the need to acquire new materials; the same can be said in using shipping containers for home building purposes as a conventional construction material. It has an innated structural design with standard dimensions and built-in properties. Given these, this makes them an excellent modular structural component, and prefabricated shipping containers can be made as a substitute for timber-framed constructions [32]. The previous study also stated that this has resulted in a drastic drop in embodied energy compared to a conventional building. Reusing shipping containers is the ultimate in sustainability, using far fewer materials and embodied energy than any building construction [28]. The same study claimed that this modular construction was 40-60% quicker and produced 70% less onsite waste than traditional building methods. Also, it does not require complicated construction processes, which helps to reduce costs substantially. It can be stacked more than eight levels high and could resist corrosion if well coated [4, 28, 29].

The analysis of [2] indicated that this type of material's most robust feature lies in its capacity, both in prefabrication and construction, to be easily dismantled and transferred to a

different site. The same study compared the conventional medium-rise housing unit prices and the study's conceptual container and evaluated that both were almost priced the same.

Sustainability

According to the study of [10], a container home can be constructed of about 75% recycled materials by weight. Erection of these houses takes a trend in sustainable construction features such as wallboard or paneling with insulation, well-insulated flooring/ceiling options, ceramic coating, and polyurethane foam insulation, low VOC paints, primers, adhesives, and sealants, making it generally more energy-efficient and sustainable [17]. Besides this, shipping containers are well made, making them fire, rust, and mold-resistant [33].

The sustainability and acceptance of these shipping containers would depend on various factors such as market reciprocation, social, environmental, economic benefits, and law regulations of the latter. Studies have also considered the containers' use due to their constructability, life cycle, ecological impacts, and social context and effects. In the design of the study of [11], the life of a building is increased from 60 to 100 years, the overall whole life cycle impact indicators have increased significantly in the range of 55.4-74%. In the same study, they evaluated the impact between standard and low maintenance scenarios and were varied by a marginal decrease in the range of 1.6-6.8%, while the transportation scenario showed a negligible difference.

III. Discussion

To evaluate shipping containers as probable housing options, it should be noted that they are almost the same size as the traditional houses in the housing projects based on the studies of [2, 21], where the ordinary houses made in the housing projects are between 20m² and 24 m² and are too small to accommodate the often large families. In the same study of [21], most of the residents split the house into smaller rooms, leaving the house with low ventilation possibilities. Given this, the container's size has the same disadvantages as traditional houses in the projects. However, this concern can be alleviated because the container houses can be placed on top of each other, reducing the land size requirement while furnishing more living space and provide natural ventilation for higher placed containers [1].

There have been many studies regarding the challenges of cargo container housing; some of those are availability, increased expense, and acquisition of usable land, low profitability, problems with transportation, lack of space, possible weathering, poor indoor climate, stockpiling resources, and suitable design, geographical consideration, and government involvement. [1, 2, 4, 7, 8, 22]

In contrast with this, [9] showed that a multi-story arrangement of the containers is plausible as it reduces the expense, compared to a per-square meter cost, is quicker to build, and considers higher thickness development of settlements and is environmentally acceptable.

The potentials of these shipping container buildings were examined by [36] and its implications to the Nigerian housing challenges. The results implied that while the containers had their negatives, the advantages outweighed any disadvantages and was positively recommended in tackling the housing needs.

The affordability of cargo container housing would be assumed to be dependent on the income of the household head, which was proven by the study of [1]. The study showed that the respondents strongly agree that the affordability of capital influences cargo container

housing affordability. This, coupled with the government's weak response to steadily address the issue, would add to the reality of using the containers as improbable.

While many studies show positive and negative points of recycling shipping containers as a housing option, the methods used in correlating the data differ in geographic positioning, availability of funding, conceptual design, social acceptance, and focus. The Philippines lacks local studies that determine the use of shipping containers as feasible building materials for urban slum area improvements and a lack in establishing a concrete sustainable long-term plan that tackles the issue along with the inevitable assistance and management of the governing body.

IV. Conclusion

The main objective of this study was to evaluate recycling shipping containers into possible sustainable housing options that can be and make it into a viable choice to be used by both the public and the government to develop the urban slum areas; a persisting problem in the Philippines even after multiple successions of different governments. Given the presented literature, the feasibility of using shipping containers would greatly depend on the resources available, from government funds and capitals to private aids and the country's economy's general capability to sustain this design long-term.

There is also a lack of available text for the laws that regulate the building process if the containers are to be used. It is a great consideration to be discussed to correspond with the current building laws.

Additional surveying on the current situation of the slum areas with a focus on land size and availability, population density, geographic placement, and the public's sentiments should be accomplished to further this paper.

Also, to better gauge the effectiveness of this type of material for medium-term occupancy, structural testing of the unit may be required to arrive at more precise data on the number of years that a shipping container may still be considered as structurally sound as a livable unit after it has been classified as being no longer seaworthy [2].

A widely accepted study that thoroughly checks whether using shipping containers as a sustainable and practical housing option to improve developing slum areas, which also deals with considerations equivalent to the public's need, is still not present. Hence, given the limited access to literature and studies focusing on local context and implications, it is hard to fully gauge its (shipping containers) capabilities as a means to the issue. Still, its advantages and possibilities lie attractive and sought after.

V. References

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