APPLICATION OF INDUSTRIALIZED HOUSING SYSTEM IN ADDIS ABABA, ETHIOPIA

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Abstract - For the last decade, the housing industry in Addis Ababa has shown tremendous growth mainly due to the mass housing development project that has been undertaken by the government. However, the housing development in Addis Ababa is not without problems. The main difficulty has been the mismatch between supply and demand to overwhelming housing demand and poor affordability. To ease the pressure on the large-scale production, population, resources, and environment, this study investigates housing industrialization as one of the feasible options for Addis Ababa. A critical literature review, field research, and contextual analysis were conducted to collect data that is currently in progress. The study analyzes the existing difficulties and threatening encounters as well as opportunities for future development of Addis Ababa's housing industry, and it reviews the way in which to stimulate housing industrialization. The study revealed that developing nations like Ethiopia need to give particular consideration for the formation of a framework for the development of housing industrialization that advances the progress of housing technology, thereby developing housing contribution to science and technology.

Keywords - Industrialized housing, building components, material, technology, Addis Ababa,

I. INTRODUCTION

There are many challenges in the housing industry of Ethiopia. Some of the main problems are high material consumption and wastage, low efficiency in production, and low contribution to technology advancement. The development of housing technology in Ethiopia is mainly characterized by the application of traditional construction methods rather than the development of innovative construction technology. Comprehensive and interrelated building systems have not yet been developed. The concepts associated with the industrialized building system that applies modular coordination; interrelated design and standardization of components have not been established for housing development, although there are some sample trial projects which applied these techniques using imported technology.

For the last decade, the government is predominantly providing housing by the construction of low-middle rise condominiums using the on-site production of reinforced concrete frames and walls, together with masonry non-load bearing walls [1, 2]. Off-site components and materials are produced locally by Micro and Small Scale Enterprises (MSE) in a situation where it is possible for delivery and installation on site. Traditional construction techniques are still being used in housing construction. The skills of construction employees in Addis Ababa are relatively low because a large number of construction workers in Addis Ababa are from rural areas. Many construction workers have received no formal training and are initially employed cheaply from the rural area [3]. The manufacturing capacity of traditional building materials in Addis Ababa is limited and contractors find it necessary to import more than half of the material from other countries. The introduction of new construction materials was low and a large proportion of existing materials did not have a specification. There was little evidence of innovation and research in the development of new materials and construction process.

The lack of modular incorporation for housing components and the low capacity of production hinder the form of housing industrialization and general housing component system in Ethiopia. The working methods for promoting housing industrialization is not yet developed, including a general decision-making process, effective working procedures, as well as detailed specific objectives, step, and actions. Recent practices on housing industrialization have been on demonstration housing and sample projects. However, the technical supporting system, and well-trained skilled personnel, the capacity of component production and the supply-chains for driving forward the housing development have not been formed. In addition, the market stimulating mechanism for self-development, self-renovation, and self-perfection is not well established.

II. REVIEW OF PREVIOUS STUDIES

Previous studies indicate a lack of research in housing investment, regulations, housing industrialization, and advanced housing mechanisms intended to promote building industrialization and to meet the future demands for housing development [3, 4]. A multi-faceted incremental approach is required to promote industrialized housing by encouraging innovative design based on an appraisal of existing industrialized housing systems worldwide [2, 4-6]. The design would incorporate locally produced materials, especially those that could be created from waste products and agricultural by products such as bamboo. Innovation was also encouraged using

modularization and the use of composite panels, and service looms that would provide sustainable and high-performance lifecycle solutions.

As shown in figure 1, Li has proposed the key to promoting housing industrialization is to generate adequate demand for industrialized housing through promoting the good quality and value it offers. In order to achieve this goal, it will be necessary to develop a house building system that incorporates sufficient and adequate new construction science and technology. This is not such an easy task to achieve as the traditional nature of Addis Ababa's construction industry and its supply chain as well as a general lack of skill and expertise in housing industrialization methods. A sample prototype and adequate performance testing of new materials and components are necessary to fasten the development of industrialized buildings. Prototypes will be significant in testing the design and to understand the performance from which specifications and standards can be developed.

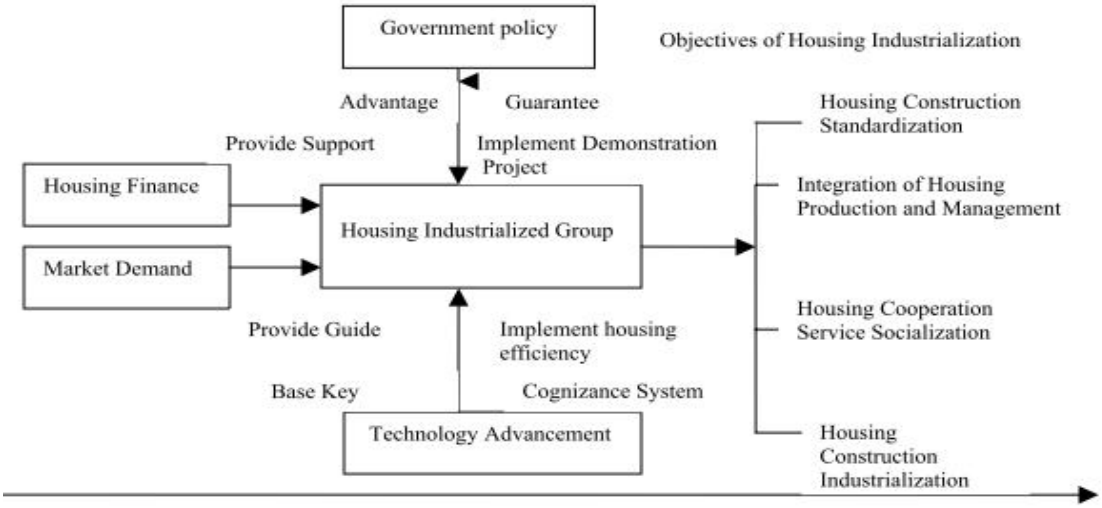

Figure 1: Development of Housing Industrialization
Source: Li et..el. (2002), Modern Housing Management, P35 (2002)

III. CONTEXTUAL STUDY

Addis Ababa is home to 25% of the urban population in Ethiopia and is one of the fastest growing cities in Africa [7]. It is the growth engine for Ethiopia and a major pillar in the country's vision to become a middle-income, carbon-neutral, and resilient economy by 2025. Addis Ababa's economy is growing annually by 14%. The GDP of Addis Ababa has grown, on average, by more than 15% over the last five years; much faster than the national GDP over the same period [8]. The city alone currently contributes approximately 50% towards the national GDP, highlighting its strategic role in the overall economic development of the country [7]. The state of Ethiopian cities (2015) report estimates that Ethiopian cities generated about ETB 227.3 billion. In the same year, Addis Ababa's GDP was about ETB 66.3 billion, well above 29% of the overall GDP of Ethiopian cities [9]. In addition, other data from the city's Bureau of Finance and Economic Development (2016) shows that Addis Ababa's per capita income has grown from USD 788.48 in 2010 to USD 1,359 in 2015 at current prices- higher than the national average.

The process of urbanization is accelerating. With the current pace of urbanization, the city's population is expected to double in the coming 10 to 15 years, which means a vast growth in Addis Ababa's housing market. In addition, more than 80 percent of the existing housing needs complete replacement (3). People in Addis Ababa need all kinds of buildings, including an office building, commercial, residential, and other buildings. This growth will create a huge demand for building construction especially that required for housing. For the last decade, the city administration has constructed more than 260,000 housing units. But at current levels of production, the existing demand far exceeds the supply. Close to one million housing seekers have been registered under the mass housing development program, among them around 170, 000 peoples got the houses. This shows that Addis Ababa needs to build several million square meters in the next decade. Rapid urban growth compounds the existing challenge in improving housing conditions. With the urban population expected to triple by 2028, the number of urban households will also triple from about 3 million in 2007 to about 9 million in 2037, making the need for housing even more pronounced [10].

IV. EXPECTATION OF HOUSING INDUSTRIALIZATION

Urbanization and rapid growth of national economy has resulted in tremendous housing demand. According to Shen (2002) housing industrialization will enter a fast development period when GNP

reaches 600 to 800 US Dollars. In 2016, Ethiopia's GNP was at 605 US Dollars per capital [11]. This shows that Ethiopia is also on the verge of fast housing industrialization. If an integrated housing system is to be established in Addis Ababa that includes both the housing industry and other industries, then it will be necessary to enhance the execution performance of the construction industry and to increase the contribution of the industry to new innovation of materials and methods. This will require a change from traditional large-scale production on site to fabrication and offsite assembly so as to improve productivity and quality. In turn, this will require new expertise and skills, which should be expressed in an integrated supply chain system by utilizing new technologies and standardized components.

1. Housing development projects that applied industrialized housing system in Addis Ababa

There are 4 housing development projects that applied industrialized housing system in the different scale [2, 5, and 12] These projects demonstrate different types of housing design, construction level, and dwelling quantity. These projects are essentially rationalized and improved versions of traditional construction projects, which provide incremental improvement rather than a breakthrough in construction science and technology. This represents a safe approach, in that the improvements are based on designs that are known to work and are within the capability of designers and constructors. Therefore they do not comply with the radical approach necessary to significantly increase production, improve affordability, quality and value for money.

2. Key for industrialized housing in Addis Ababa

The promotion of industrialized housing in Addis Ababa will require the following issues to be addressed:

1. The formation of a housing system standards and specifications that is appropriate for industrialization according to local conditions in Addis Ababa.
2. The development of new innovative method of building component production and construction
3. Technology transfer from other related industries that could be applied for the establishment of new production
4. Establishment of integrated material supply chain
5. The establishment of industrialized housing sector

CONCLUSION

As Addis Ababa is the economic, cultural and political centre of Ethiopia and it is in a favourable economic situation to lay a good foundation for the development of its housing industrialization. Currently, the housing market is active, but problems exist with the development of Addis Ababa's housing industry, which includes poor design concept, primitive technology, low management level, few new materials and production methods and poor standardization. The task of designing and manufacturing a housing system from scratch is a major task since all building elements and components will need to perform in an integrated manner to cope with the environment and wear from users. It is, therefore, necessary to invest heavily in research and development programs that incorporate extensive testing of prototypes intended to further develop designs where the risk of failure is reduced.

In addition, a pre-requisite for successful adoption of new technology in Addis Ababa is the provision of proper education and on-the-job training to the existing local workforce. Also, incentives should be given to local housing developers, in order to encourage the use of industrialized methods for housing production. Finally, it is urgent to boost the development of housing industrialization and to expeditiously meet the demand of the housing market and also to modernize the housing construction industry.

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