



Towards a design prototype of an agriculturally productive residential building

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ABSTRACT

The global population increase is one of the most significant challenges facing people in all areas, especially in food security and food provision. As human numbers increase, pressures on environmental and food resources increase to provide food for the population. Various other factors affecting food security, such as urban growth, climate change, and increasing city sizes, exacerbate the issue. The problem intensifies in Egypt, where population growth rates exceed the global average, coupled with limited development resources and agricultural constraints. Encroachment on agricultural lands by urban growth further exacerbates the food security issue in Egypt. Therefore, different approaches must be considered to ensure food security in Egypt, including sustainable agriculture practices that do not harm our ecosystems. This has led to the emergence of urban agriculture concepts within cities and buildings to compensate for the shortage of agricultural land. Since housing is a fundamental structure in urban cityscapes, forming the largest urban area and a key component of urban societies, the discussion revolves around attempting to compensate for agricultural production through residential buildings by transforming the living environment into a productive agricultural setting within a sustainable framework. This aims to provide an integrated agricultural environment within residential buildings that does not increase operational loads, energy consumption, or resource usage for the building. The study establishes environmental, social, and economic principles for designing and integrating agriculture into residential buildings, evaluating and testing these principles through application using Design Builder software to determine agricultural design priorities in residential buildings and the principles and requirements for their implementation in Egypt.