

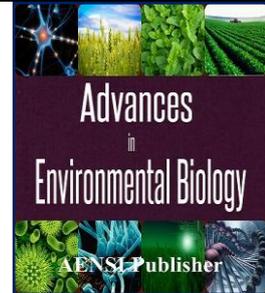


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Evaluating The Urban Agriculture Of Roof Garden At High-Rise Building In Malaysia

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ABSTRACT

Berkembang penduduk bandar menyumbang yang membawa banyak masalah yang berkaitan. Jelas sekali fungsi yang penting dalam bumbung adalah untuk menjaga cuaca daripada bangunan tinggi tetapi, tidak ada bumbung perlu dikekang untuk tujuan ini tunggal, terutama dalam hal ini pembangunan bandar global yang buat adalah amat sukar untuk mencari tanah untuk taman-taman dan taman-taman dan juga kerana, penggunaan pertanian bandar. Kajian ini kami berhasrat untuk memahami subjek yang taman bumbung untuk penggunaan pertanian bandar di taman bumbung di bangunan tinggi. Kertas ini adalah kertas kajian yang cuba untuk beberapa ciri-ciri taman bumbung untuk kegunaan pertanian bandar di taman bumbung di bangunan tinggi. Akhir sekali, penggunaan pertanian bandar di taman atas bumbung adalah sangat berguna untuk penduduk yang tinggal di dalam bangunan yang mempunyai teknologi ini, sebagai contoh ia boleh membantu untuk mencapai kemampunan ekonomi dan alam sekitar. Di samping itu, dengan menggunakan pertanian bandar di taman atas bumbung yang boleh membantu negara-negara yang berbeza untuk keselamatan makanan. Jadi, manfaat taman bumbung dan pertanian bandar digalakkan untuk orang-orang yang tinggal di bangunan tinggi untuk kegunaan taman bumbung di Malaysia.

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INTRODUCTION

Malaysia is a tropical country that their land changed for developmental policies.[1] Rooftop garden involve grow of many plant for example trees, shrubs, beautiful flowers grass on the roof that help to landscape of city.[2] Wong et al. to study the effects of rooftop garden on the cooling load and annual energy consumption of a five-story hypothetical building in Singapore".[3] newly, a lot of projects have applied extensive green roofs in Hong Kong such as public buildings such as schools and government buildings.[4] The first rooftop garden established for improve aesthetics in Germany.[5]

Nowadays, most of people effort to having pleasant living environment and sustainable development of urban areas.[3] Mainly landscape is so important and it has the aesthetic effects .Also, rooftop garden is balance of the ecology cycle and rooftop garden has great landscape in urban area.[6]

In addition, urban agriculture is vital in order to maintain an adequate and sustainable food supply,[7] In addition, access to an open place, including different forms of extensive agriculture is recognized as a valuable feature of urban areas with great quality.[7] Because of some reasons and commercial goals urban agriculture is trying to supplement family consumption when income is low.8 At present, Malaysian urban agriculture is a way to sustainable development with the potential of supplying food or relevant services in urban areas. Urbanization and the globalization of the food system are causing a number of social, environmental, economic and political problems globally, which run contrary to the desperate need for sustainability. Urbanization is related to increasing greenhouse gas emissions from raised energy expenditures in rapidly expanding cities.[9] The concern about the positive impact of urban agriculture has led to the development of policies that seek to encourage Malaysians to get involved in this activity.[10]

Finding of this research help to people who living in a high-rise and they like use of urban agriculture at the roof of their condominium.

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2.0 Definition Of Roof Garden:

The roof garden is a garden on the roof. This means that each roof cover with plant, such as, trees, shrubs, bushes and grass as well as another definition of roof garden is environment or nature in the sky.[11] Green roofs are roofs of buildings covered with a growth substrate and plants, which are also known as roof gardens, living roofs, and eco-roofs".[12] Roof garden is a good way to enhance buildings in urban areas through landscape design, which can transform the obsolete areas into valuable area that provides ecological and economic services. In Europe, the rooftop gardens are widely used. For example in Germany in the year 1996, one in ten apartment roofs were made greened, whereas in Switzerland about 70% of apartments roof were greened.[13] According to (International Green Roof Association, 2013) there are three types of green roofs.

2.1 Extensive Green Roof:

These types are well suited to roofs with modicum load bearing capacity and sites which are not meant to be used as roof gardens. The costs of extensive roof garden are lower than Semi- Intensive or Intensive Green Roofs. These types of green roofs are containing little nutrients, is not very deep but suitable for less demanding and low growing plant communities.

2.2 Semi-Intensive Green Roof:

"Semi-Intensive Green Roofs in terms of requirements fall in between Extensive and Intensive Green Roof systems. More maintenance, higher costs and more weight are the characteristics for the intermediate Green Roof type compared to that of the Extensive Green Roof. A deeper substrate level allows more possibilities for the design; various grasses, herbaceous perennials and shrubs such as lavender can be planted while tall growing bushes and trees are still missing".

2.3 Intensive Green Roof/ Roof Garden:

On Intensive Green Roofs all the things that used in the ground garden such as; Lawn, perennials, bushes and trees are possible to be planted, Walkways, benches, playgrounds or even ponds can be established as additional features on the roof. There are no limitations in design and individuality, but a few things have to be considered. But the intensive green roofs are very high costs than extensive green roofs. Types of rooftop gardens can be seen in Figure 1

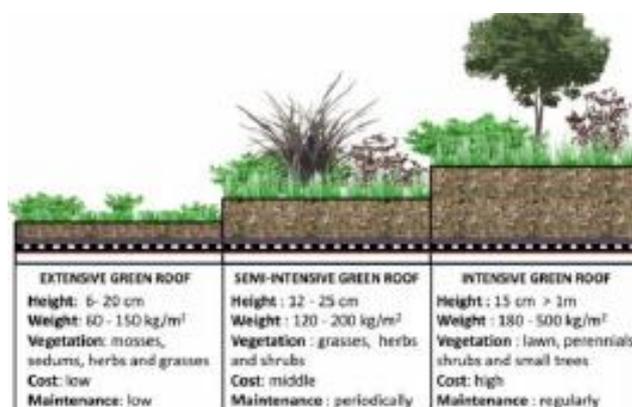


Fig. 1: three types of roof garden

3.0 Benefits of Roof Garden:

The multiple benefits that green roofs offer to urban areas are well-known and studied. The most prominent are the: mitigation of the "heat island" effect in cities.[14] In addition, besides the decorative benefit, rooftop garden has many facilities about environment, economic, architectural enhancement, habitats for wildlife, amusement opportunities, food security "as well as a more aesthetically pleasing environment in which to work and live".[15] Several authors as well as various internet site highlights the positive effects of rooftop gardens. The benefits of rooftop gardens can be summarized as follows:

A green roof offers environmental benefits for a building and its surrounding. Rooftop garden storm can help water management[16], can improve water run-off quality[17], able to improve urban air quality[7], and also able to make an extension of roof life.[7] Rooftop garden can be a good way for reducing the urban heat island effect.[18] provide insulation of a building for sound[7] can be a replacement of displaced landscape, Other benefits also include enhanced architectural interest and biodiversity.[19] Green roofs have been used as an environmentally friendly product to encourage sustainable construction [30]. At the same time, using DOE-2 energy simulation program in the installation of rooftop garden on the five-story commercial buildings can results in saving of 0.6-14.5% in the annual energy consumption, and shrubs was found to be most effective in

reducing building energy consumption. Rooftop gardens can absorb water from rainfall and prevent runoff from flowing across the city.[20] Flood has high economic losses and it has a bad effect on the national economy, roof garden can reduce the risk of flooding in a city.[20] Reduce of storm water runoff is the greatest environmental service from rooftop garden. "Research has shown reductions of 60–100% in runoff".[20] Roof garden instead of impervious roof surfaces with plants can reduce runoff volume and it can help to delay the runoff by a combination of evapotranspiration and retention. In addition, diversity in vegetation for instance structural complexity and height can influence retention and runoff patterns. [21] Roof garden help to balance of urban ecosystem and this technology provide habitat in inside of crowded city for the coexistence of plants animal species some of which may be rare or endangered. Moreover roof garden is good habitat for birds.[22]

Below figures show samples of roof garden in Malaysia:



Fig. 2: Serdang Hospital from Malaysia



Fig. 3: The Heritage Condominium from Malaysia



Fig. 4: One Utama Shopping Building from Malaysia



Fig. 5: One Utama Shopping Building from Malaysia



Fig. 6: Lot 10 Building from Malaysia



Fig. 7: Lot 10 Building from Malaysia

4.0 Suitable Roof For Use Of Urban Agriculture At Roof Garden:

One of the most important sections about this topic is the structure of the roof for rooftop garden because this section provides the load-bearing roof. For instance, the most suitable structures of rooftop gardens are flat roof, Monopitch roof and flat roof with the rooftop structure garret story.[23] Flat roof was more important and significant during the 18th century and they were used for terrace and garden pavilions in this century. But the application of this type of roof changed in the 19th century. Today, flat roofs are very common, especially for rooftop gardens. Also, this type of roof is termination of horizontal building.[23]

Another type of roof is Monopitch roof, a basic form that has a slope on one side of the ridge only. Besides, this kind of roof structure is suitable for green roof.²³ Value of roof space as a way of increasing densities by integrating uses which normally occupy extensive sites at ground level has long been recognized. For instance, in many cities with a lot of population, roofs are commonly used for a car park in this situation. Similarly, there are numerous examples of roofs as entertainment venues, with basketball or swimming pool and other facilities.[23]

5.0 The Significance of Urban Agriculture At Roof Garden:

Several studies show that special roof garden is a help in growing the agriculture also this technology can save the owner's costs.[24] Agriculture at rooftop garden is worthwhile to economic, social and environmental sustainability as well as this technology can reduce problems of the environment[22] addition to improving its durability. Thus, it is very convenient for the residents to adopt this technology.

To determine the suitability of these green roofs for urban agriculture, it is necessary to study the micro urban environment and growing conditions, and compare different crops and growing methods³². In fact, one of the perfect facilities of roof garden is a place to produce food and local vegetables on a roof. When a building's roof is used for suitable agriculture or edible rooftop garden, in this case rooftop garden and green roof have useful means for this technology. This section shows the best agriculture and an interesting example at roof to many countries in the world.[22]

Although urban agriculture at rooftop garden is very useful for residents of condominium but this technology has some barriers for example: inadequate access to our information about promotes, insufficient labor, high quality seed credit perhaps subsidy intended for startup company prices or perhaps advices.[25] The last mentioned items are generally of more concern throughout developing nations. A different barrier introduced by the rooftop garden structure engineering is actually the price of rooftop garden structure setting up and upkeep.

95% of all vegetables consumed by the country are imported from other countries. Also, Singapore has a supporting environment for agriculture on the rooftop. One of the great examples of this technology has used hydroponics green roof set up at Changi General Hospital in 1988 in Singapore. Bangkok is another city which is very appropriate for agriculture due to its perfect climate. However, owing to the growth of urban development and loss of urban agriculture, this city cannot provide enough food for its residents and they have many problems with food security. Laksi in Bangkok is another great rooftop garden with agriculture where the main purpose of the structure of the roof garden is to increase the production in the region, increase the green belt and grow healthy vegetables for household consumption in this city. This project helps the people to be more aware and demonstrates the practical and efficient ways of urban agriculture in this area. In recent years, many people in Taiwan are trying to find suitable buildings to perform the agriculture on their roofs. For example, rooftop garden in this area is a rooftop container garden.[22]

Eco House in St. Petersburg, Russia is a good example of a rooftop garden project which offers jobs in order to increase cash flow among individuals who are living within the apartment complex.[26]

Furthermore, installing roof garden with urban agriculture can be useful to environmental, social and economic sustainability of many buildings in cities. Rooftop agriculture allows for the retention of traditional or cultural gardening practices while local choice of plants can preserve heritage species and maintain diversity in the diet. Also, it can help to reduce many problems of the environment together with enhancement of community function and development of urban food systems.[22] The landscape architect worked closely with the architect and donor to develop a vision for a green roof to include a flower and practical vegetable garden. A garden used in extremely creative ways for horticultural learning, environmental awareness, and food production. The Gary Comer Youth Center Roof Garden is an after-school learning space for youth and seniors in a neighborhood with little access to safe outdoor environments. Figure (8)



Fig. 8: Urban agriculture at roof, The Gary Comer Youth Center Roof Garden, Chicago

Besides, it provides social sustainability to people, for example active community participation, community green space and gardens, social inclusion, provides fresh food for the poor, education, local employment, and amenity space for exercise, recreation and aesthetic value.[22] Moreover, roof garden agriculture gives economic sustainability, which includes "increased local food production and saving and security, selling organic vegetables and food, increasing property value by access to open space/views, improved roof durability,

reduced building cooling load and energy costs, increased life span of the roof and increased availability of biofuels.[22] Also, the rooftop garden agriculture allows employees to have the new food industry via food sources resulting in potential cost savings and increasing value of the property.[27] Figure(13)



Fig. 9: Use of Urban Agriculture at Roof garden

Finally, the use of urban agriculture at rooftop garden is very useful for residents who live in the building that has this technology, for example it can help to achieve economic and environmental sustainability. In addition, using urban agriculture at rooftop garden can help different countries to food security[31].

6.0 Discussion And Conclusion:

Agriculture means production of goods by growing plants, animals and other life forms. In fact, one of the human activities is agriculture and it should continue in the urban environment and region [29]. Overall, agriculture is the creation of natural produce and growing plant, and owing to urban agriculture a substantial number of plants are growing in the cities. There are two types of agriculture namely conventional agriculture and sustainable agriculture (organic agriculture). One of the most significant advantages of urban agriculture is food security. In addition, urban agriculture advances the sustainability of energy by using manufacturing, transportation and other economic sectors that also have significant environmental impacts. Roof garden means growing many plants in medium soil on top of the roofing system with flat or sloped rooftop design with vegetation. Also, it includes five or six layers on top of the building where each layer contains a waterproof membrane, a protective layer, the growing medium vegetation materials and irrigation system. Roof garden includes two forms i.e. extensive and intensive. Moreover, roof garden has more benefit for cities and people. For example, this technology can reduce heat flux and runoff and can provide better water quality. Other positive effect of roof garden includes noise reduction.

Roof garden is a help in growing the agriculture and also this technology can save the owner's cost. Also, one of the perfect facilities of roof garden is a place for food production and local vegetables on a roof [28]. In addition, Singapore does not have enough land to carry out agriculture because the structure of buildings has been reduced in this country.

Finally after review of some subjects related to roof garden, we concluded that use of urban agriculture at roof garden is one a good suggestion for people who live in the high-rise building and they have not enough land for urban agriculture. Figure (14)

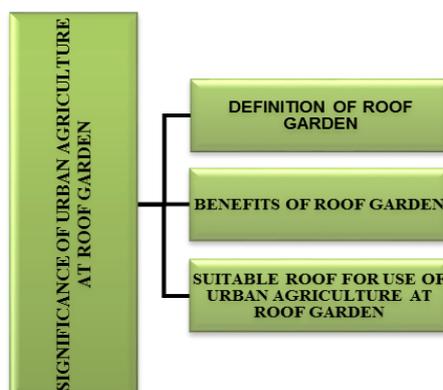


Fig. 10: Conceptual framework of urban agriculture at roof garden

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