

URBAN FARMING: STRATEGY TO STRENGTHEN FOOD SECURITY

Muhammad Sallehudin Ali, Nur Badriyah Kamarul Zaman, Nur Maizatul Idayu Othman

Faculty of Plantation and Agrotechnology, Universiti Teknologi MARA, Jasin Campus, 77300 Merlimau, Jasin, Melaka.
Malaysia. E-mail: badriyah@uitm.edu.my

Abstract

The agriculture sector is the most important sector that determines food security. However, agriculture sector is constantly faced with various challenges that lead to unsustainable food supply and directly threaten food security in the country. The foremost challenges faced by this sector are climate change, shrinking of agriculture areas due to pressure from rapid development of industrial areas and environmental degradation leading to unsustainable agriculture. To address all of these challenges, the Sustainable Development Goals 2 (SDG2), are designed to tackle food insecurity and malnutrition while ensuring farmer's wellbeing. The new National Agrofood Policy 2021-2030 (DAN 2.0), of which the implementation period is in line with the Sustainable Development Agenda, aims to continue the development agenda of the national agro-food sector with particular emphasis on improving the country's food security. Urban farming is a new approach in agricultural activities that is believed to be able to overcome these challenges and thus ensure food security. Therefore, the purpose of this review paper is to review the effectiveness of the urban farming activity as the effort to strengthen food security all over the world. The review is based on the integration of several past academic journals and articles discussing on the benefits of urban farming in improving food security.

Keywords: Food security, urban farming, sustainable food supply.

1. Introduction

The Food and Agriculture Organization (FAO) defines food security as a "situation that exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (Tubiello 2007). Food security comprises 4 important elements in the food supply dimension which are availability, stability accessibility, and utilization (Fraanje, 2018). The elements in food security pillars can be considered as a benchmark in measuring food security as the pillars provide a better understanding to the people of the importance of getting a sustainable food supply. Maintaining food security is quite an issue nowadays as the world needs to balance the usage of natural resources for other profitable purposes. Competition on the natural resources for development and foods becoming stiff as the population numbers keep on increasing year by year. Climate change also give a significant impact on the agriculture industry. Increasing temperatures and declining precipitation over semiarid regions are likely to reduce yields for corn, wheat, rice, and other primary crops in the next two decades, (Molly E. Brown, 2008). The problem gives a significant impact on the overall food supply and leads to a food insecurity problem. Malnutrition and farmer's wellbeing are at stake if this issue is not addressed properly.

Urban farming is the cultivation of plants and fish, and the raising of livestock within and around cities. Urban farming could mean increasing global food supply without relying on further land clearing as it utilizes the urban area as a place to grow crops, (Robert McDougal, 2018). It commands a significant level of commerce, which makes it much more than just homesteading or subsistence farming. Integrating food production with buildings offers an avenue that does not impinge on the city's many uses for available land (Kishnani 2010). In order to suit the urban environment, urban farming changes the entire system of cultivation. More technologically advanced tools are needed to aid the farming activity in the city as they have a different environment than conventional farming areas. For the last 10 years, agriculture technology has seen a huge growth in investment, with \$6.7 billion invested in the last 5 years and \$1.9 billion in 2018, (Ku, 2019). Modern agriculture practices suit the Urban Agriculture concept and can be used as part of the strategy to increase food production within the city area. Other than that, urban farming has economic, social, and environmental benefits, (Cahyaa, 2015).

Sustainable Development Goals 2 (SDG2) could be achieved through urban farming as it can tackle hunger issues in the urban area by providing an alternative way to produce food for urban dwellers. Not only tackle the hunger issue, but urban farming can also be a platform to provide better nutrition and reduce malnutrition risk to urban dwellers. The

concept of urban farming that is usually associated with the organic farming concept reduces the risk of chemical contamination in the foods that are consumed by the people. Depending on the system used the chemical exposure of the agriculture product can be minimized. Urban poverty problems can be addressed by urban farming as it can reduce the household expenditure on food and at the same time provide income elevation for urban dwellers by opening up new business opportunities. Better and efficient resource usage in urban farming activity also contributed to environmental conservation as compared to conventional farming. Urban farming can be run in a controlled environment and the size of the farm is smaller than conventional farming making it easier to be controlled.

2. Methodology

The methodology of this research is paper review. The author synthesizes the result from several past journals and articles by reviewing and summarize the current knowledge of the past research. The author then creates an understanding and discussing the finding from the past research paper regarding the similarities and contrary of the content of the past research by analyzing the result and conclusion from past research. The author review more than 30 journals and articles regarding urban farming activities, concept and how urban farming able to be part of the strategy in supporting food security.

3. Results and discussion

1. Problem Faced by Agriculture Industry in 21 century Causing Food Insecurity.

As world population increase, food security especially in concentrated area such as big cities becoming a major concern. In order to produce enough food to feed the population it is projected that more area needed to be scarified for food production purpose in the future. More natural resources such as fresh water and fertile soil is needed in order to support the agriculture system. However, there are other factor that need to be considered and becoming major problem in production of agricultural product. Climate change is one of the major problems faced by the agriculture industry nowadays. Climate change resulting various problem including deprivation of soil and increase of temperature of an area that affect the production and agricultural activity. Increasing temperatures and declining precipitation over semiarid regions are likely to reduce yields for corn, wheat, rice, and other primary crops in the next two decades (Molly E. Brown, 2008). Other than that, rapid development also contributes to the food security problem. Competition of agricultural industry with different industry in term of land usage. Conversion of agricultural land into other uses such as industrial and development. It is estimated about 68% of the world population live in the urban area by 2050 and this give a stress to agricultural land to meet the nutritional need in the densely populated areas (Kennard, 2020). The world is struggling with the expansion of population at the same time trying hard to provide the basic needs of human in term of foods, housing and other necessities causing shrinkage of agricultural land become too obvious but the demand of food is increasing day by day.

At the same time agriculture sector also struggling in maintaining natural resources as well as environment. Agriculture sector is most commonly connected to ecological and environment as they need a good environment to produce better quality and quantity of yield. With the shrinkage of agriculture land without further land clearing activity, agriculture sector must be able to increase the productivity, become more sustainable, and reliable to achieve production efficiency, and ability to renew the source to ensure the continuity of the industry (N. Abumhadi, 2012). The problem faced by the agriculture sector will affect the ability of this industry to fulfill the food security responsibility. As the problem continue to rise, food security level will become endangered. More problem such food insecurity, world hunger and malnutrition will rise in the future if this problem is not addressed properly. World food price trend can be a reference on the severity of food security level. The price trend reflects the availability of food in the market (H. Charles J. Godfray, 2010). This is important element as the availability of the food in the market will affect the other 3 of food security elements. As the shortage or unavailability of food happen in the market, the price will hike and this will affect the poor group of people causing hunger problem thus leading to food insecurity especially in low and middle-income country (Ruth Stewart1, 2013)

2. Role of Urban Farming to Assist Food Security.

In 21 century, urban farming activity is getting popular in most developed country like Singapore, China and America. Urban area is the most concentrated living area as it the center of human civilization. Urban area offers wide range of human activity from business to employment make it the most preferable place to live in. About 55% of the world population live in big cities (Frangoul, 2020). Urban farming is seen as a solution to minimize the food security problem as this program able to address food-crisis problem in the urban area. This is due to the ability to produce horticultural crops such as fruits and vegetables of foods needed by the community within the city area makes urban

farming one of the options to strengthen the food security level in city area (Frangoul, 2020). This is a very good start up moves to minimizing undernourished problem that have been faced by 821 million of people worldwide that have been reported by United Nations. It is believed that cultivating fresh food such as fruits and vegetables as well as animal product within the city area can improved local food security especially for underserved group of community (Altieri, 2019). This program also improves fresh foods availability, increasing the accessibility of food within the range of populations, giving enough nutrient for the people who practicing urban farming (Golnaz Rezai, 2015). From recent research, it is recommended to consume about 300gm of vegetables daily to meet the nutritional requirement (Altieri, 2019). In term of sustainability, urban farming is more sustain as compared to conventional farming method. It promotes the usage of organic materials such as organic waste, recyclable materials as tools and use less water than conventional agriculture. This also will give impact in term of environment, ecological, social as well as economy (Cahyaa, 2015).

The usage of modern agriculture technology in assisting urban farming activity also contribute to the success of this program. Modern agriculture technology and practices able to enhance the production of farmers even in limited size of area as well as preserving natural resources that resulting in environmental conservation. Basically, agriculture industry involves energy conversion process in order to produce input (Robert McDougal, 2018). The usage of renewable energy such as solar energy in urban agriculture manage to minimize the impact of agriculture industry towards climate change and greenhouse gas emission. The system allowing farming process to use fewer natural resources but able to produce more output makes this program more sustain than conventional farming method. Modern technologies also promote a synergy between agriculture and building in city areas. This allow farming activity to be done inside the building as well as utilizing small place such as rooftop to be converted into cultivation area. New farming technique such as vertical garden and zero-acreage benefit urban dwellers by providing opportunities for them to grow their own food in limited urban spaces (Orsini, 2020). Zero-acreage farming is getting popular in developed countries as it not only able to integrate the building and farming activity but at the same time able to provide esthetics to the urban area. The technology allows the plants to be grown in layers that can reach several story highs is the key to save space in the city as scarcity of land is quite a popular issue (Anwesha Chatterjee, 2020).

This is important to the environment of urban which normally linked with unpleasant environment such as higher temperature due to heat island and bad air quality. The presence of urban garden in the city area can help to reduce the temperature and soften the view with much green and pleasant surroundings. In term of water usage, urban farming use about 75% less water than conventional farming and a hectare of recirculating vegetable rooftop garden able to save about 75,000 tons of water annually (Susanne Thomaier, 2014). This is due to the irrigation system of urban farming that able to recycle storm water and turn it into source of irrigation input and usage of substrate for moisture retention can reduce the loss of water due to evaporation (Stuart Allan Walters, 2018). This is the success factor for urban farming in conserving natural resource and avoiding excessive usage of water. This system also helps in storm water management and able to avoid flash flood that often happen in big cities when heavy storm strikes. The system act as water reservoir and retention that prevent the storm water from causing sudden flood when the drainage system in the city fail to operate due to heavy rain. In term of production, urban farming is believed to produce more yield per square feet as compared to conventional farming (Robert McDougal, 2018). Urban farming not only able to produce higher yield but at the same time produce high quality of fruits and vegetables makes this farming system getting popular in Asian country (Orsini, 2020). In other research by (Kishnani2), urban farming is expected to increase vegetables production of Singapore up to 35.5% if combined with conventional method that currently meet only 5% of Singapore supply. In term of production cost, urban farmers can get higher profit margin as urban farming reduce the need heavy machinery and intensive labor and only depending on the manual labor which can be derived from the owner and community itself (Robert McDougal, 2018).

3. Sustainability of Urban Farming

Urban farming gives a positive impact in various aspect including social, ecological, environmental and economic that promotes food security to urban dwellers. In term of social, urban farming focus on providing and promotes health to the society as it gives opportunity for the urban dwellers to grow their own food with much healthier options. Growing their own food in their own urban garden minimize the usage of chemical in vegetable production as compared to conventional farming. This will encourage people in the city to consume healthier and fresh food as they can get an easy access to the supply (Kennard, 2020). Family that involves in urban farming are reported to have better quality and variety of diet. Urban farmers are able to produce up to 20-60% of their total food consumption (Anwesha Chatterjee, 2020). Urban farming also can be a Platform of education and development of youngsters in urban area. Progressive growth of urban agriculture can be used as a tool to increase the employment opportunity for urban

dwellers and as an education platform in educate more people on the awareness of the source of food they consume, income generation as well as environmental conservation.

In term of ecological and environmental angle, urban farming able to solve most of the environmental problem especially in the city area. The integration of agriculture activity with the urban area gives a significant impact to the esthetics of urban area and contribute to overall city metabolism (Orsini, 2020). The presence of urban farming in the big cities able to generate greenery that is important for biodiversity of the place. Green roof which is one of the urban farming system able to improve wildlife diversity by creating microhabitat that suitable for wildlife such as insect, birds and mammals (Stuart Allan Walters, 2018). The reclamation of unused space in the urban area such as rooftop of the buildings for food production purpose will enhance the food security level of urban dwellers and reducing the dependency of urban people on the supply of food from rural area resulting less land clearing in the rural area for agriculture purpose (Knizhnik, 2012). Recycling organic material into composts help reduce solid waste materials and decrease risk of environmental pollution (Cahyaa, 2015). Rooftop farm also give a benefit to the building and the people who live in it. It acts as an insulator from hot and cold weather. It helps reduce the temperature of the buildings during summer and hot days resulting less usage of electrical devices such as air conditioner and electric fan. This type of urban garden is suitable to be practice in tropical and sub-tropical country such as South East Asian region which have a hot and humid weather. The presence of urban garden in the city area also reduces the risk of heat island generated in the area. For water crisis problem, urban garden can be a way to reduce the problem. The efficiency of urban farming in the usage of natural resources such as water and organic waste material help to combat fresh water crisis as the system use 75% less water than conventional farming and able to save about 75,000 tons of water annually (Susanne Thomaier, 2014). The system also takes advantages of rain to collect water and stored them for future use also able to minimize the heavy rain impact to the city area such as flash flood.

From the economic side, urban farming give impact in term of poverty elevation, employment opportunity, business incubation and property value. Urban farming also can be seen as a tool for poverty elevation. It provides an opportunity for the urban dwellers especially underserved population to grow their own food and reduce spending of money for foods. The cost of establishment for simple urban garden is quite cheap as it only used to recycle materials. This helps poor people to start the garden without any extra cost help in reducing hunger problem among poor urban dwellers in the area (Cahyaa, 2015). Other than self-usage, urban farming also promotes business incubation for the city dwellers. As the market of the fresh, healthy and organically grown fruits and vegetables got a positive response from the urban population due to the awareness and healthy lifestyle of the urban dwellers, urban farming produce have a great potential to be sold within the neighborhood area. Flexibility of urban farmers and lower risk of the nature in the city, allow urban farmers to refine their operation and develop a devoted customer-based produce (Golden, 2012). By selling the urban farming produce to the consumer, urban farmers able to generate income and able to secure the food security level in the area they lived in. Urban farming also have a capacity to enhance and increase property value of urban farmers. As urban garden increases the esthetics and greenery to the surround area, it helps to trigger a sense of community, offering better place and environment for recreational purpose and allowing the surround residences to have a better quality of view (Been, 2018). Another research also stated that the presence of garden and beautiful environment increases the property value up to 9.4% in just 5 years of establishment (Golden, 2012). Green space also able to enhance safety feelings and enable the society to easily tied with the community (Chavis, 2015). These are the factor that able to increase the property value in the active urban farming area.

4. Conclusions

Based on the literature review of more than 30 journals and articles, we can conclude that there is a significant impact of urban farming in assisting food security. Urban farming can be seen as a tool to assist food security because it meets the requirement and the elements in food security which are availability, accessibility, stability and utilization. Urban farming brings a positive value to the urban community. The impact of urban farming is really significant to the social, environment as well as the economy of the city dwellers that resulting increase in food security level in the area. However, need to be remembered that urban farming is not the absolute solution to address food security problem but it can be one of the best solutions to minimize the food security problem faced by the people nowadays.

Urban farming can be commercialized into bigger scale and can become a real business in future. The ability of the urban farming to deliver its function in dealing food security issues in urban area and meeting the Sustainability Development Goals should be seen as a business opportunity. With current problem faced by the agriculture sector especially for conventional agriculture sector that struggling with climate change and expanding of world population, agriculture sector needs to move to more competitive and efficient way to feed the population. Urban farming has a capacity to be commercialized as it is more sustainable and efficient in term of production, distribution and

conservation of natural resources as well as more environmentally friendly. With the technological advancement in agriculture, it is possible for urban farming to be number one producer of world foods in the future. This research is just the beginning of an urban farming era in Malaysia as well as a developed country. More conclusive and evidence-based research needs to be done prior to expanding the ability of urban farming in serving the community and enhancing food security.

Acknowledgments

The authors thank and record the deepest appreciation to supervisor, Dr Nur Badriyah Binti Kamarulzaman that always giving advice, support, cooperation, and knowledge throughout the journey of making this review paper. Despite facing many difficulties during the pandemic season, we are able to work with good teamwork. Online coaching and teaching are the best platforms for us to deliver messages, connect, and conduct meetings during the time and it's really helpful in completing the research. Not to forget my beloved parents, other lecturers, and my classmates who always encouraging along the journey. Support and encouragement from them give a significant impact in this thesis. I also want to record a special thanks to the writer and researcher of the previous journal and thesis for allowing me to grab as much information and data from their research. Their contribution, report, and results regarding urban farming were really helpful for me to complete this research.

References

- Abdul Rehman, L. J. (2017). Modern Agricultural Technology Adoption its Importance, Role and Usage for the Improvement of Agriculture. *Life Sceince Journal*, 70-74.
- Abdulsalam-Saghir, (2009). Integrated Urban Micro Farming Strategy Mitigation against Food Crises in Odeda Local Government Area, Ogun State, Nigeria. *Journal of Agricultural Extension*.
- Allison Hagey, S. R. (2012). Growing Urban Agriculture: Equitable Strategies and Policies for Improving Access to Healthy Food and Revitalizing Communities. *Policy Link*.
- Altieri, M. (2019). How Urban Agriculture Can Improve Food Security. *Civil Eats*.
- Andrzej Borusiewicz*, K. K. (2015). application of precision agriculture technology in podlaskie voivodeship.
- Anwasha Chatterjee, S. D. (2020). Implication of Urban Agriculture and Vertical Farming fir Future Sustainability. *Intecg Open*, 1-9.
- Armar-Klimesu, M. (n.d.). urban agriculture and food security, nutrition and health. *Urban Agriculture and Food Security, Nutrition and Health*.
- Been, I. V. (2018). The Effect of Community Gardens. *Real Estate Economics*, 241-283.
- Cahyaa, D. L. (2015). Analysis of urban agriculture sustainability in Metropolitan Jakarta (case study: urban agriculture in Duri Kosambi). *Jakarta: ScienceDirect*.
- Campanhola, C. (2017, 11 13). Why does sustainable agriculture remain a challenge? Retrieved from IMPAKTER: <https://impakter.com/sustainable-agriculture-remain-challenge/>
- Chavis, D. (2015). The Socio-Economic Benefits of Urban Farming.
- Chopra, K. (1993). Sustainability of Agriculture. *Indian Journal of Agricultural Economics*, 1-10.
- Corbould, C. (2013). Feeding the Cities: Is Urban Agriculture the Future of Food. *Future Directions International*.
- Daniel Evans, J. D. (2020). 4 reasons why the world needs more urban farming post-pandemic. *Paris: World Economic Forum*.
- David Satterthwaite, G. M. (2010). Urbanization and its implications for food and farming.
- FlavioLupia, G. (2015). Water Use and Urban Agriculture: Estimation and Water Saving Scenarios for Residential Kitchen Gardens. *Agricultural and Agricultural Science Procedia*, 50-58.
- Food and Agriculture Organization of the United Nations (FAO), Organization of Economic Co-operation and Development. (2018). food security and nutrition: challenges for agriculture and the hidden potential of soil. *Food and Agriculture Organization of the United Nations (FAO)*.
- Fraanje, W. &. -G. (2018). Food Source Building Block: What is Food Security? *Food Climate Research Network (FCRN)*.
- Francesco Orsini, R. K.-W. (2013). Urban agriculture in the developing world: a review.
- Frangoul, A. (2020). Food Security is a Global Problem. Here How Urban Farming Could Help. *CNBC*.
- G. Fischer, E. H. (n.d.). Scarcity and abundance of land resources: competing uses and the shrinking land resource base. *Solaw Background Thematic Report*.
- Georgia Pollard, J. W. (2018). Water Use Efficiency in Urban Food Gardens: Insights from a Systematic Review and Case Study. *Horticulturae*, 1-24.

- Gianquinto, F. O. (2014). Exploring the production capacity of rooftop gardens (RTGs) in urban agriculture: the potential impact on food and nutrition security, biodiversity and other ecosystem services in the city of Bologna. 781-792.
- Godwin Anjeinu Abu, A. S. (2016). Analysis Of Factors Affecting Food Security in Rural and Urban Farming Houehlod of Benue State, Nigeria. *International Journal of Food and Agricultural Economics*, 55-67.
- Golden, S. (2012). Urban Agriculture Impacts: Social, Health, and Economic: A Literature Review. *UC Sustainable Agriculture Research and Education*, 1-22.
- Golnaz Rezai, M. N. (2015). Urban Agriculture: A Way Forward to Food and Nutrition Security. *Science Direct*, 39-45.
- Grant, (2020). Sustainability. Retrieved from Investopedia: <https://www.investopedia.com/terms/s/sustainability.asp>
- H. Charles J. Godfray, 1. J. (2010). Food Security: The Challenge of Feeding 9 billion People. *Science*.
- Hamzah, M. Z. (2017). Urban Agriculture: The Role of Knowledge among. *International Journal of Academic Research in Business and Social Sciences*, 77-85.
- Hoagland, S. H. (2016). Urban Agriculture: Environmental, Economic, and Social Perspectives. *Horticultural Reviews*, 65-120.
- Hossein Azadia1, S. S. (2011). Organic Agriculture and Sustainable Food Production System: Main Potentials. *Agriculture, Ecosystems & Environment* 144 : 92-94.
- Hui, D. S. (2011). Green roof urban farming for buildings in high-density urban cities. Hainan China World Green Roof Conference. Hainan China .
- Kanianska, R. (2016). Agriculture and Its Impact on Land- Use, Environment, and Ecosystem Services. *The Influence of Land Use and Anthropogenic Impacts of Landscape Creation*.
- Kavitha A1, S. R. (2015). Urban expansion and loss of Agriculture land - A case of Bengaluru city. *International Journal of Geomatics and Geosciences*.
- Kennard, N. J. (2020, May 13). Urban Agriculture: Opportunities and Challenges for Sustainable Development. Chapter January 2020.
- Kishnani2, L. Y. (2010). Building Integrated Agriculture: Utilising Rooftops for Sustainable Food Crop Cultivation in Singapore. *Journal of Green Building* (2010) 5 (2): 105–113
- Knizhnik, H. L. (2012). The Environmental Benefits of Urban Agriculture on Unused, Impermeable and Semi-permeable Spaces in Major Cities, With a Focus on Philadelphia, Pa.
- Ku, L. (2019, May 21). New Agriculture Technology in Modern Farming. Retrieved from Plug and Play: <https://www.plugandplaytechcenter.com/resources/new-agriculture-technology-modern-farming/>
- Mark W. Rosegrant, C. R. (2009). Agriculture and Food Security under Global Change: Prospects for 2025/2050. Strategy Committee of the CGIAR.
- Martin Wanda, V. L. (2018). Building capacity through urban agriculture: report on the askîy project. 29-35.
- Mohd Rashid Rabu, R. M. (2015). The Potential of Urban Farming Technology in Malaysia: Policy Intervention. FTTC Agricultural Policy Platform.
- Molly E. Brown, C. C. (2008). Food Security Under Climate Change. Lincoln: NASA Publication.
- Mwangi, D. F. (2000). Increasing Food Security Through Urban Farming in Nairobi. City Case Study Nairobi.
- N. ABUMHADI1*, E. T. (2012). Agricultural Research in 21st century: Challenges facing the food security under the impacts of climate change. *Bulgarian Journal of Agricultural Science*, 801-818.
- Norul Hafizah binti Yusoff, M. R. (2017). Roles of Community Towards Urban Farming Activities. *Journal of the Malaysian Institute of Planners*, 271-278.
- Nugent, Rachel. (2000). The impact of urban agriculture on the household and local economies. *Growing Cities, Growing Food: Urban Agriculture on the Policy Agenda*.
- Orsini, F. (2020). Innovation and sustainability in urban agriculture: the path forward. *Journal of Consumer Protection and Food Safety*.
- Parke, C. (2015). Impact of Technology on Agriculture and Food Production. 1-13.
- Pfister, J. F. (2006). Climate risks and their impact on agriculture and forests in Switzerland. *Climate variability, predictability and climate risk*, 79-102.
- Pozarny, P. (2016). How will climate change affect agriculture and food security? *Climate Change and Social Development*.
- Raf Aerts, V. D. (2016). Potential ecosystem services of urban agriculture: a review. Belgium: Peer J Preprints.
- Robert McDougal, P. K. (2018). Small-scale urban agriculture results in high yields but requires judicious management of inputs to achieve sustainability. Australia: School of Environmental and Rural Sciences, University of New England, Armidale, NSW 2351, Australia.
- Ruth Stewart1, 2. M. (2013). What are the impacts of urban agriculture programs on food security in low and middle-income countries? *Environmental Evidence*.

-
- Sangha, Kamaljit Kaur (2014) Modern agricultural practices and analysis of socio-economic and ecological impacts of development in agriculture sector, Punjab, India: a review. *Indian Journal of Agricultural Research*.
- Smit, N. F. (2019). The vulnerabilities of agricultural land and food production to future water scarcity. *Global Environmental Change*, 58.
- Stuart Allan Walters, K. S. (2018). Sustainability of urban agriculture: Vegetable Production on Green Roof. *MDPI* , 1-16.
- Susanne Thomaier, K. S. (2014). Farming in and on urban buildings: Present practice and specific novelties of zero-acreage farming (ZFarming). *Renewable Agriculture and Food Systems*, 43-54.
- Tubiello (2007). Global food security under climate change. 19703-19708.
- Urbanization. (2020, November 17). Retrieved from Britannica: <https://www.britannica.com/topic/urbanization>
- Walter Fraanje, S. L.-G. (2018). Building Block, What is Food Security. *Food Climate Research Network*, 4-8.
- Wibowo Heru Prasetyo, D. B. (2016). Urban Farming as a Civic Virtue Development in The Environmental Field. *International Journal of Environmental & Science Education*, 3190-3144.