



UNIVERSITAS
INDONESIA
Veritas, Probitas, Justitia



ASEAN
University
Network



UNIVERSITI
KEBANGSAAN
MALAYSIA
*National University
of Malaysia*

12-31-2022

Urban Farming: Empowerment to Increase Economic, Education, and Nutritional Benefit for the Sub-Urban Community

Nasruddin Nasruddin

Universitas Indonesia, Indonesia, nasruddin@eng.ui.ac.id

Yusuf Donner Dwiyantama

Universitas Indonesia, Indonesia, yusuf.donner01@ui.ac.id

See next page for additional authors

Follow this and additional works at: <https://scholarhub.ui.ac.id/ajce>



Part of the [Agricultural Education Commons](#), [Electro-Mechanical Systems Commons](#), [Environmental Education Commons](#), and the [Manufacturing Commons](#)

Recommended Citation

Nasruddin, Nasruddin; Dwiyantama, Yusuf Donner; Muhammad, Banu; Bowalaksano, Anom; Ayubi, Dian; and Pertiwi, Sarah Islamiati (2022). Urban Farming: Empowerment to Increase Economic, Education, and Nutritional Benefit for the Sub-Urban Community. *ASEAN Journal of Community Engagement*, 6(2), 294-306.

Available at: <https://doi.org/10.7454/ajce.v6i2.1159>

Creative Commons License



This work is licensed under a [Creative Commons Attribution-Share Alike 4.0 License](#).

This Case-Based Article is brought to you for free and open access by the Universitas Indonesia at ASEAN Journal of Community Engagement. It has been accepted for inclusion in ASEAN Journal of Community Engagement.

Urban Farming: Empowerment to Increase Economic, Education, and Nutritional Benefit for the Sub-Urban Community

Nasruddin,^{1*} Yusuf Donner Dwiyantama,¹ Banu Muhammad,²
Anom Bowalaksono,³ Dian Ayubi,⁴ Sarah Islamiati Pertiwi¹

¹Department of Mechanical Engineering, Faculty of Engineering, Universitas Indonesia, Indonesia

²Department of Economics, Faculty of Economics, Universitas Indonesia, Indonesia

³Departement of Biology, Faculty of Mathematical and Science, Universitas Indonesia, Indonesia

⁴Departement of Health Education and Behavior, Faculty of Public Health,
Universitas Indonesia, Indonesia

*Correspondence email: nasruddin@eng.ui.ac.id

Received: August 24, 2021, Accepted: November 25, 2022

Abstract

This article discusses the urban farming program at Sekolah Master in Beji, Depok, Indonesia, which aims to provide the community with broader benefits, such as economy, education, and increased nutritional value. The project involves planting method that was introduced to this school community. The program itself consists of several stages, starting from the preparation—dissemination of the program and designing a plan for the greenhouse, the implementation—constructing the greenhouse and installing the automatic water system, planting the vegetation, and monitoring and evaluation of the program. Eventually, an evaluation of the successful program is required to determine whether the program can be implemented in the following year. As a result of the evaluation, the program has succeeded in completing several objectives. The urban farming program has also benefited the community through the natural science education program and also increasing nutritional value. Therefore, such programs should be continued in the following years so that the impact can be broader and more progressive.

Keywords:

urban farming; greenhouse; natural science education; increasing nutritional value; social community; sustainability.

1. Introduction

Urban agriculture is currently considered a solution to overcome air pollution in urban areas and a solution for adapting to climate change. According to De Zeeuw (2011), urban agriculture plays a significant role in greening cities and improving the quality of the city's microclimate, while stimulating productivity by reusing waste organic and reducing excessive energy usage. Agriculture urban areas are also very beneficial for environmental sustainability, reduce pollution air, and create beauty and coolness in people's residences (Cahya, 2014). Therefore, the existence of urban agriculture not only improves air quality but directly reduces the burden on the city in accommodating garbage from the home ladder and industry.

Due to the very fast infrastructure development, large population and high levels of urbanization, there is a decrease in the agricultural land area, which then contributes to the continuous decline

of agricultural production. It is estimated that 65% of the Indonesian population is living in the city (The World Bank, 2018). Reduced agricultural land converted into settlements and industrial land has become a threat and challenge for Indonesia to be an independent nation in food provisioning. Indonesia can be prone in terms of food security. This is indicated by the number of food insecure populations with a consumption level <90% of recommendations of 2000 kcal/day and consumption level <70% of recommendations which are still quite large, 36.85 million and 15.48 million people in 2002. Furthermore, the situation is also worsened by a large number of malnourished children under five, i.e., 5.02 million and 5.12 million people in 2002 and 2003 (Cahya, 2014).

Urban farming is also good to increase economic value not only for nutrition and the environment. Studies on city farms in the yard of Philadelphia found that communities with low income who have yards can save expenses for food USD150 per planting season on average (Pinderhughes, 2004). On the other hand, there is a need for productive planting, not only for nutritious consumption but also to improve the environment's air quality and soil conditions. The use of yard land for horticultural crops (vegetables, fruits, and ornamental plants), spices, medicines, herbs, etc., can benefit the owners of the yard in particular, as well as the benefits to the general public. Urban farming arguably can be one of the city's national policies to increase impact.

In Indonesia, the development of a region is always accompanied by increased economic growth and community welfare. Economic growth in the region is dependent on the excellence or competitiveness of sectors located in the region. Growth in people's welfare is consistent with the literature's definition of social growth, including the development in the fields of health, education, and housing (Pudjianto & Syawie, 2015). This paper sees nutrition as a further issue that exists in urban areas. The number of nutrition problems in urban areas is greater than the number of nutritional problems in rural areas (Dwiningsih & Pramono, 2013). One of them is the fact that the overweight problem among adolescents in urban areas is worse than in rural areas. As a result, there is a need to diversify foods for adolescents in urban areas, in particular vegetable consumption.

The acceleration of urbanization and city development in Depok will certainly cause various problems. Significant increases in urban population without the support and offset by the amount of food supply, employment, housing, facilities, and infrastructure, law enforcement officials, etc., are issues that must be handled properly. With these conditions, the government or residents of urban areas should begin attempting to meet the nutritional needs of their citizens while improving environmental conditions to create a healthy and quality environment (Noorsya & Kustiwan, 2013). Thus, urban farming is once again one solution to the problem.

This article aims to discuss the results of the urban farming program conducted at Sekolah Master in Beji, Depok City. The program aimed to provide broad community benefits in terms of economy, education, and increased nutritional value, with a focus on educating about natural science. Sekolah Master was established in 2013. It is located in Kemiri Muka in Depok and has been active in the community for seven years, working to improve the health, education, and social well-being of the surrounding community. Every year, Sekolah Master organizes various activities such as a school for street children, a reading park, parenting for parents, regular health checks, and various other social and religious activities. This urban farming program is being held at Sekolah Master to provide broad community

benefits in terms of economy, education, and improved nutritional value. We chose Sekolah Master because it has many students from the streets who are educated and nurtured, and they need to be developed in terms of economy, education, and nutritional value so that the goal of urban farming can be met.

2. Urban Farming and Greenhouse

Historically, urban farming appeared in the era of ancient Egypt where waste from society at that time was used for agriculture. Afterwards, at the beginning of the 19th century, the concept of individual or allotment gardens in Germany. During World War I and II, the United States, Canada, and England develop gardens filled with various vegetables and fruit plants. At that time, agriculture in urban areas is intended to fulfil the food needs of the world war.

According to the Food and Agriculture Organization, urban agriculture is an industry that produces, processes, and markets biofuels and products, particularly in response to the daily demand of consumers in urban areas (Food and Agriculture Organization, 2008). It applies the method of intensive production, utilizing and recycling resources and waste in urban areas to produce a variety of crops and livestock (Smit et al., 1996). Other definitions of urban farming can also include agriculture and animal husbandry that are available in and around the city.

In the application of urban farming, several gardening methods can be used. These gardening methods are strategically chosen based on the context in which urban farming takes place. Several methods, techniques, and mediums of gardening in urban farming can be employed. The first method is *verticulture*, which is a system of plant cultivation stratified or stacked upwards. This planting method requires a place for plants to then be arranged vertically. The purpose of vertical is to make optimal use of narrow land. Planting vertically has a level of difficulty that depends on the model and additional systems used. In the simple model, the basic structure used is easy to follow and the materials are easy to find, so it can be applied in homes.

The second method is *tabulampot* (abbreviation of *Tanaman Buah dalam Pot*). *Tabulampot* is a method of growing fruit plants in pots and is one of the urban farming techniques that can answer the small space area problem. The fruit plants chosen are usually tall with deep roots. This plant needs space to grow quite large. This is of course difficult for an urban population with very limited land. The best plant variant that utilizes this method is vegetable variants. This method have expanded across contexts, both in terms of technology and the number of plant species fruit that can be used as *tabulampot*. Almost all types of plant fruit can grow in *tabulampot* form, but not all *tabulampot* can produce fruit. Because even though it can grow fertile, certain types of plants have not been able to bear fruit in *tabulampot* environment. Several types of *tabulampot* can be cultivated and the success rate of fruiting using *tabulampot* is categorized into easy, difficult, and has not succeeded.

The next gardening method is done through selection of planting medium. The selection of planting medium is one of the keys to doing urban farming planting. The planting medium is a matter that is used to grow plants, root positions, or roots that will grow and

develop. It is often used to keep the roots in place so that the plants can stand securely on the media and support the plants. There is also a possibility to use planting media made from mushroom bag log waste. Such medium is selected to also address the issue of garbage in urban areas. Waste bag log mushrooms are typically made from a combination of materials including sawdust, bran, lime, and casts (Susilowati & Raharjo, 2010). The waste bag log mushroom's content is still suitable for use as a planting medium.

Lastly, the greenhouse method utilizes a building for cultivating plants that has a translucent roof and wall structure (Ponce et al., 2014). Initially, the term greenhouse was used in the process of crop production in subtropical areas because during winter the plants in the structure always looked green all year-round while outside the plant house the plants could not survive. This can happen because the temperature inside the plant house is higher than the temperature outside. A greenhouse is a building that transmits solar radiation and its efficiency depends on the location, structure, and planning of the greenhouse (Kumar et al., 2011).

3. Methods

The methods used in this urban farming program to achieve the goals, which is carried out in several stages that are conducted in a one-year time frame. It consists of three stages, namely the preparation stage, implementation stage, and monitoring and evaluation stage.

3.1. Preparation stage

The first activity is dissemination of urban farming, which aims to create good communication with the community. It is a concern that public awareness and knowledge about how to plant, especially the idea of urban farming. Therefore, it is necessary to communicate with the community first. The dissemination process builds community interest in playing a role and being involved in the program (Hadiyanti, 2008). When a good relationship with the community is formed, this program will most likely be smoother to be conducted. This activity is expected to provide people with knowledge of the potential of urban farming and to gain their awareness and knowledge about how to plant and manage urban farming. Through the activity, the member of the community can get the benefit to increase their economic, educational and nutritional value, and awareness and knowledge of urban farming and quality environment. The dissemination in the community empowerment program helps improve the understanding of the community and related parties about the program of urban farming. The goal of this dissemination is to provide expert training and practice for students and residents in the Sekolah Master area on how to plant and manage urban farming.

The dissemination activity consists of two steps. The first step is to meet and discuss the program with the community, consisting of students, the administrator of Sekolah Master and the residents around the Sekolah Master. The second meeting is made for the training of urban farming. There are around 50 people joined the meeting— students and the administrator of Sekolah Master. There are 14 students who attended online session and 35 students who attended offline session. Due to COVID-19, the training must be held online using zoom meetings. This training is taught by an expert in agriculture. The expert shared the importance of urban farming, and how to plant and care for crops in a greenhouse. The sharing session is very useful to reach the goal of this program

so the community could have the knowledge of planting and caring for the crops, and constructing a greenhouse.



Figure 1. Offline and online dissemination of urban farming to the Sekolah Master community

Before and after the early discussion and training, the participants of the training were given a questionnaire as a pre-test and post-test regarding their know-how of urban farming. After the dissemination, the questionnaire was filled out to see the condition of the respondents. These measurements are conducted quantitatively to obtain primary responses from the community about urban farming, the benefit of urban farming, the understanding of planting and maintenance of crops, as well as the environmental quality.

In subsequent to the dissemination activity, the next activity is planning and designing greenhouse in Sekolah Master. This activity aims to plan and prepare the construction of the greenhouse that is to be built in Sekolah Master. A master design of a greenhouse was created for the Sekolah Master to ensure a systematic urban farming development program in the future in Sekolah Master. The location for greenhouse must have access to daylight all day, although not all plants need daylight all day. However, this can be circumvented by using a net on the roof and places that are easily exposed to raindrops. For plants that need a little amount of water, the greenhouse is designed with a net as well. The position of the greenhouse is also adjusted to the position of the school building according to several of the requirements that have been discussed in Sekolah Master. Eventually, the final position is on one of the school building's rooftops to maximize building function and small space area because there aren't many free space areas in Sekolah Master.



Figure 2. The design for the urban farming program

This community project is a response to the condition of the Sekolah Master, in particular, to improve economic and environmental quality. This project is followed by designing the greenhouse layout, and the construction of the greenhouse and the automatic watering system. With this project, it is hoped that the community can succeed in harvesting crops, combined successfully with natural science education sustainably.

3.2. Implementation stage

The planning and construction stage of the greenhouse buildings and watering installations aim to provide a place for planting as well as to make it easier for students and administrators to learn and nurture the crops. This greenhouse is planned for a series of urban farming activities in the small areas in Sekolah Master, calculating a long-term goal which is a productivity increase in urban farming. When the plants are watered correctly at the right time and intervals, the plants will maximize the crop yield. The greenhouse is built for vegetables; thus, the watering system does not need to provide a lot of water but at a particular time (Gonani et al., 2011).

The design of the greenhouse depends on the plant variation, location, structure, and layout of the greenhouse. The greenhouse must be well designed to maximize the production of the crops and also to maximize small areas of free space. Plant like vegetable does not require a high intensity of sunlight and water, so nets can be used to reduce sunlight, protect from raindrops, and reduce insect attacks. An automatic watering system is designed in this greenhouse to maintain fertility and water content.

The implementation of planting process aims to put into practice what was learned during the dissemination activity. This is the initial process of demonstrating urban farming. The crops planted are types of crops, i.e., kale, lettuce salads, bok choy, and leeks. In this program, the planting use *tabulampot* to save space and a combination of planting media. *Tabulampot* is considered easier and can be arranged neatly as they use the pots. This would be a benefit, as such an arrangement is quite simple and beautiful. After planting the vegetables, the participants start to maintain the greenhouse and nurture the planting.

On the other hand, the planting media used had to meet certain criteria, such as not containing insects, diseases, or weed seeds (Gonani et al., 2011). It also should be able to retain water and also able to dispose of or drain excess water, being crumbs, and be porous (loose) so the roots could easily grow through the planting media. The acidity should also be maintained, as the higher the degree of soil acidity (pH), the better the soil quality. For vegetables, slightly more acidic soil is needed than neutral soil pH.

The requirements of a good breeding media are light, cheap, easy to get, porous (loose), and fertile (rich in nutrients). Planting media materials can be made from a single material or a combination of several materials, as long as it still serves as a growing medium (Prastowo et al., 2006). However, on this occasion, the planting media is made from waste bag log mushrooms and other material mixtures, taking into account the value of nutrients and soil surfaces. As a result, this also addresses the issue of garbage in urban areas. Waste bag log mushrooms are typically made from a combination of materials including sawdust, bran, lime, and casts (Susilowati & Raharjo, 2010). The waste bag log mushroom's content is still suitable for use as a planting medium.



Figure 3. The construction of greenhouse and installation of automatic watering system.

3.3. Monitoring and evaluation

The activity is conducted to monitor the progress of the crop maintenance performed by the students and the greenhouse volunteer in Sekolah Master. Important points that must be monitored are the time and interval of watering, the sun exposure and its intensity, and fertilization. When it is monitored properly, the plants can produce maximum results when harvested. Monitoring is done to keep track of the plant development process. So that when the plants are harvested, the students and the Sekolah Master can produce the best results possible.

The evaluation was conducted to find out the results of the program and the program's effect on the environmental and social quality improvement as indicated by the number of crops harvested and the impact on the students and residents around Sekolah Master. This method is a quantitative approach, where the improvement of the environment is seen from how successful crops are harvested. In terms of social advantage, the quantitative approach is carried out by reviewing how many participants get benefit from the crop yields of urban farming and the program.

4. Result and Discussion

4.1. Dissemination of the potential urban farming and training of urban farming

The dissemination activities are successfully held and the questionnaires are also filled out by the participants. Table 1 shows the results of the dissemination and questionnaires from the participants.

Table 1. Results from before and after questionnaires

No	Item	Before Dissemination	After Dissemination
1	Know or not know about urban farming and its benefits.	30% know	100% know
2	Student knowledge about urban farming and planting media methods in urban farming.	10% know	100% know
3	Community awareness of urban farming and environment friendliness.	5% aware	95% aware
4	The desire of the community to participate in urban farming.	10% want	70% want
5	Level of community approval if urban farming is built in Sekolah Master.	10% agree	100% agree
6	Public knowledge about environmental quality.	30% know	95% know

The questionnaire results show that the dissemination successfully provided initial information about urban farming and made the participants aware of the importance of urban farming and good environmental quality. The dissemination also successfully persuaded the students to participate in urban farming. Before the dissemination was carried out, the community knew only little about urban farming and its benefit; a few knew that planting media in urban farming. After the dissemination, there is an increase in knowledge—particularly in accordance to awareness and the level of community’s approval— about urban farming and planting media methods to be around 70% and 95%. But the results on participation in urban farming are not too high when compared to the previous results. This result is different from the awareness of good environmental quality. These last items reached 95% value after dissemination. It can be concluded that the dissemination has successfully change the awareness and knowledge of the student and resident Sekolah Master about urban farming. Dissemination is the basis for this program after community-based. After reviewing this phase as a success, this program can go further to the next step.

4.2. Planning and designing greenhouse in Sekolah Master

A greenhouse design was created for the entire community of Sekolah Master—students, administrators of Sekolah Master, and the residents nearby. The layout suggests how urban farming is designed in the area of Sekolah Master, which is adjusted to the position of the school building and to maximize the function of the building in a small space area in Sekolah Master. Generally, the greenhouse will be used for housing urban farming activities. The greenhouse is designed with the consideration of several requirements to maximize the production of the crops, i.e., the amount of daylight, the water from raindrops when it rains, and the pipeline route for automatic watering systems. The greenhouse and its water system are designed in such a way that it will be easy for anyone to maintain and manage urban farming. The design calculates watering system installation with an automatic system, making it easier for the volunteer of the greenhouse to care for the crops and to ensure that watering is at the right time and interval.

4.3. Planning, constructing the greenhouse, and installing auto watering systems

In the implementation, a greenhouse with an area of sixty square meters is built along with the automatic watering system installation for two plant racks and 400 flower pots. The construction of the greenhouse itself was funded by the Directorate of Research and Community Service, Universitas Indonesia. This greenhouse development is considered effective in introducing urban farming and in making people accept urban farming easily because the community saw and experienced that greenhouse is made easy to learn and construct and use for planting. The most common obstacle encountered during the construction of a greenhouse is the transportation of construction material, in particular related to the roof. However, this problem can be resolved with the help of the Sekolah Master's administrator.

This construction is made from several requirements based on the type of plant to be planted, namely vegetables. Therefore, the design considered the roofing and shading materials, so the vegetables can get enough daylight and water, particularly in the morning. The greenhouse construction is also equipped with nets around the building to reduce the amount of sunlight, water from rain, and attacks from insects. The construction is made within ten days. Starting from constructing the frame structure, installing the nets wrapping around the framework, to completing the inside of the greenhouse. Inside, there are two racks of crops and automatic watering systems. After finishing the construction, the greenhouse is ready to use for learning and maximizing the production of the crops.

4.4. Planting, treatment and harvesting of urban farming

The first step in this process is planting, which sounds simple but not easy in process. To nurture the plants, several steps are required within two weeks until the plants are ready to be planted in a pot. After that, the planting media that contain mushrooms' bag logs waste is prepared. The mushroom's bag log waste content is still suitable for use as a planting medium. It is then to be mixed with the soil and fertilizer. The participants learned that the soil condition should be mixed properly with the right amount so that the root will grow deep and strong. This is all as it was taught during the training. Planting is carried out twice, the first during the joint planting training and the second by the participants.

The maintenance of the planting must be conducted continuously. The plant cannot be harvested if they are not properly cared for. The participants treat the plants through regular treatment and special treatment. Regular treatment means watering the crops in the morning and cutting the weeds which grow around the crops. Special treatment of these plants consists of giving fertilizer every two weeks, providing organic vitamins every two weeks, and checking the acidity level of the soil and nutrient contents. These treatments are needed to maintain plant fertility and development.

Since the beginning, the program has been running for about six months. So far, urban farming harvested twice. There are different results for the crops depending on how well the greenhouse is maintained. The cycle from planting to harvesting was recorded for three months with a harvest of 40 kgs of vegetables of various types. A good treatment produced greener, bigger, and heavier crops. So far, urban farming is still running and managed by the community of Sekolah Master.



Figure 4. Series of activities—growing plants, soil checking, and harvesting crops

4.5. Evaluation of program success

The program was evaluated at the end of the first year. The results show that the program succeeded in achieving its multiple objectives—successfully installed greenhouse, automatic watering system, and its installation. It is also considered a success in forming urban farming in a way that can maximize the results in such a limited space in Sekolah Master. Aside from the success in harvesting the crops, it also successfully introduced natural science education in Sekolah Master through the planting workshop and even food diversification programs—variants of three types of vegetables—used in the public kitchens held by the community Sekolah Master increased.

There are several volunteers in this program who focus on managing urban farming, as urban farming must be maintained and checked regularly. Students are unable to become permanent administrators of this program as they have limited time for this and must concentrate on their studies. However, urban farming is successful to engage them in learning and participating in the program.

The most important point to reach the goals is community support and participation. If there is no support and participation, in particular, to maintain urban farming regularly, the program cannot be sustained. This also concerns the method that should be conducted sequentially, as step by step process, composing a complete planting cycle. However, this community program is successful in the first year, as it could achieve several goals at once, even though there is still much room for improvement.

5. Conclusion

The project of urban farming was successfully conducted starting from the preparation stage to the monitoring and evaluation. It is successful due to the support and discipline of the Sekolah Master community and also the utilization of greenhouse design and technology, i.e., automatic watering system. Urban farming was then successfully introduced to the community of the Sekolah Master community so they could participate and benefit from this program and the crops were successfully harvested. Almost 100% of the crop produced by urban farming is distributed directly to them and the crop's nutritional value is immediately felt by a larger number of people.

However, the future challenge is to expand such a program in terms of economic and technological aspects in maintaining crops' freshness. This is to aim for maintaining the nutritional value and also its economic value, as this can affect the long-term viability of this urban farming program. If this program can add economic value, urban farming can run more efficiently and provide direct economic benefits to the community. It allows for inviting a larger community to participate in urban farming on a steady basis. This program provides them insights into the benefits of urban farming and the importance of using limited space to become urban farming.

In the meantime, the program is just a pilot project, but based on the good feedback and the response from the participants, this program can be continued. It can be repeated the following year so that the impact can be broader and developed progressively to the need of the community. The need for dry storage for the harvest would be beneficial to such urban farming programs. Due to the hot and humid climate in Indonesia, the dry storage technology can help maximize the quality of the crops, keeping them fresh for a longer time. The urban farming movement can be one of the advantageous programs in Indonesia, in particular, to increase Indonesia should make urban farming one of the national and regional policies not only to help the economy of the community, but also to provide the family with better quality food, improving the environmental quality through greeneries, and at the same embedding it as a hands-on educational program at school.

Author Contribution

All authors were involved, together with the community, when implementing the program. Nasruddin supervised the construction of the greenhouse along with automatic watering systems and ranging from the purchase of building materials to the greenhouse that can function properly. Anom Bowolaksono is responsible for providing program dissemination and the concept of natural science education to the student and monitoring from planting to harvesting. Banu Muhammad provides a concept for increasing the economic value of the crop and the sustainability from an economic aspect for the next year program.

Acknowledgements

Authors would like to thank the Directorate of Research and Community Service, Universitas Indonesia (DRPM UI) for the financial support of this program.

References

- Cahaya, D. L. (2014). Kajian peran pertanian perkotaan dalam pembangunan perkotaan berkelanjutan (Studi kasus: Pertanian tanaman obat keluarga di Kelurahan Slipi, Jakarta Barat). *Forum Ilmiah Indonusa*, 11(3), 323–333.
- De Zeeuw, H. (2011). Cities, climate change, and urban agriculture. *Urban Agriculture Magazine*, 25, 39–42.
- Dwiningsih, D. & Pramono, A. (2013). Perbedaan asupan energi, protein, lemak, karbohidrat dan status gizi pada remaja yang tinggal di wilayah perkotaan dan pedesaan. *Journal of Nutrition College*, 2(2), 232-241. <https://doi.org/10.14710/jnc.v2i2.2748>
- Food and Agriculture Organization (FAO) (2008). *Urban agriculture for sustainable poverty alleviation and food security*. FAO. https://www.fao.org/fileadmin/templates/FCIT/PDF/UPA_-WBpaper-Final_October_2008.pdf
- Gonani, Z., Riahi, H., & Sharifi, K. (2011). Impact of using leached spent mushroom compost as a partial growing media for horticultural plants. *Journal of Plant Nutrition*, 34(3), 337–344. <https://doi.org/10.1080/01904167.2011.536876>
- Hadiyanti, P. (2008). Strategi pemberdayaan masyarakat melalui program keterampilan produktif di PKBM Rawasari, Jakarta Timur. *Perspektif Ilmu Pendidikan*, 17(IX), 90–99. <https://doi.org/10.21009/PIP.171.10>
- Kumar, K. S., Tiwari, K. N., & Jha, M. K. (2009). Design and technology for greenhouse cooling in tropical and subtropical regions: A review. *Energy and Buildings*, 41(12), 1269–1275. <https://doi.org/10.1016/j.enbuild.2009.08.003>
- Noorsya, A.O. & Kustiwan, I. (2013). Potensi pengembangan pertanian perkotaan untuk mewujudkan kawasan perkotaan Bandung yang berkelanjutan. *Jurnal Perencanaan Wilayah dan Kota B SAPPK*, 2(1), 89–99.
- Pinderhughes, R. (2004). *Alternative urban futures: Planning for sustainable development in cities throughout the world*. Rowman & Littlefield Publishers.
- Ponce, P., Molina, A., Cepeda, P., Lugo, E., & MacCleery, B. (2014). *Greenhouse design and control*. CRC Press.
- Prastowo, N. A., Roshetko, J. M., Maurung, G. E. E., Nugraha, E., Tukan, J. M., & Harum, F. (2006). *Teknik pembibitan dan perbanyakan vegetatif tanaman buah*. World Agroforestry Centre (ICRAF) & Winrock International. <http://apps.worldagroforestry.org/downloads/Publications/PDFS/B13893.pdf>
- Pudjianto, B. & Syawie, M. (2015). Kemiskinan dan pembangunan manusia. *Sosia Informa: Kajian Permasalahan Sosial dan Usaha Kesejahteraan Sosial*, 1(3), 231–246. <https://doi.org/10.33007/inf.v1i3.167>
- Smit, J., Ratta, A., & Nasr, J. (1996). *Urban agriculture: Food, jobs, and sustainable cities*. UNDP.
- Susilowati & Raharjo, B. (2010). *Petunjuk teknis: Budidaya jamur tiram (Pleurotus ostreatus var Florida) yang ramah lingkungan* (Report NO. 50. STE. Final). BPTP Sumatera Selatan.
- The World Bank (2018). *Urban population (% of total population)—Indonesia*. United Nations Population Division. <https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS?locations=ID>

Author Biographies

Nasruddin is a Professor of Mechanical Engineering at Universitas Indonesia. He completed his doctoral education of Mechanical Engineering at RWTH Aachen, Germany in 2005. Aside from teaching at the Department of Mechanical Engineering, he is also the Head of Laboratory of Engineering Refrigeration Department of Mechanical Engineering, focusing on optimization system and energy and energy conversion. (<https://orcid.org/0000-0002-5289-0039>)

Yusuf Donner Dwiyantama completed his master's degree from the Department of Mechanical Engineering at Universitas Indonesia. Since 2014 he has been involved as a socio-preneur, starting from social projects for children's education to social projects for waste management that help clean up the environment. With current experience, he is involved in urban farming projects.

Banu Muhammad Haidlir is a full-time lecturer and researcher at Universitas Indonesia. He obtained his bachelor's and master's degree in Economics from Universitas Indonesia. He worked as a director of research at PEBS FEB UI (Pusat Ekonomi & Bisnis Syariah FEBUI–Center of Islamic Economics and Business) from 2013-2018, as well as a consultant and expert staff for local governments in Indonesia. (<https://orcid.org/0000-0003-2095-3135>)

Anom Bowolaksono is a member of the lecturer and research staff at Department of Biology Universitas Indonesia since 1998. He obtained his doctoral degree in Reproductive Biology from Okayama University, Japan. His current research interests are in the area of reproductive biology. He joins collaborative research in Indonesia Reproductive Medicine Research and Training Center (INAREPROMED). At the same time, he is also a associate researcher in several research centers, i.e. Research Center for Climate Change University of Indonesia (RCCC-UI) and Center of Ageing Study University of Indonesia (CAS-UI). (<https://orcid.org/0000-0003-3180-1460>)

Dian Ayubi is a lecturer at the Faculty of Public Health Universitas Indonesia. She obtained her doctoral degree from Universitas Indonesia in 2006. He was an assessor for the National Accreditation Board for Higher Education (BAN PT) in 2011-2015. Currently, he is a facilitator, assessor and validator at the Independent Accreditation Institute for Higher Education Health (LAMPTKes). He is also an editorial board at Journal Malahayati. (<https://orcid.org/0000-0002-9984-0928>)

Sarah Islamiati Pertiwi obtained her master's degree from the Department of Mechanical Engineering Universitas Indonesia. Since 2014 she has been involved in the world of research, ranging from technical engineering manufacturing to waste gasification and biomass to produce energy and help clean up the environment. With current experience, she is involved in the urban farming project.