

Urban Farming Activities in Southeast Asia: A Review and Future Research Direction

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Abstract. The activities of urban farming in Southeast are still limited and scattered. In order to give valuable insights into the urban agriculture of Southeast Asia and to support researchers, we need to know in details the available options and gaps in this research direction that will serve future researchers. Thus, in this study, a review is conducted to map the research landscape into a coherent taxonomy. The research procedure focuses on all these subject matters related to urban farming system activities, technology application and their use in the urban farms and smallholder farming activities in Southeast Asia. These studies selected from the three major digital databases, namely, the ScienceDirect, Web of Science, and Scopus. The study selection process consists of research into literature sources, followed by three iterations of screening and filtering, excluded duplicate articles, screening the titles and abstracts and reading of the full-text articles. The final included result is 88 articles, which will be adopted on in this study. Further, a review in details of the layout of the research landscape of literature is conducted into a cohesive classification with its descriptive analysis. We also identify the essential characteristics of this emerging field in the following aspects: benefits of using urban farming activities in Southeast Asia, challenges hindering utilization, and recommendations to improve the acceptance and use of urban farming applications in literature. □

1 Introduction

Urban farming or urban agriculture refers to the farming activities in urban areas, which are commonly used for income or food. It contributes to food security, food safety, and improve the quality of the environment and greening the country, especially the urban area [1]. The urban agriculture program focuses on providing food security to people in urban areas and economic diversification. The program also supports the use of unproductive land and encourages the population to construct small farm gardens in homes by following spatial characteristics in each region. The creation of an agricultural community in each target city leads to increased environmental awareness [2].

Urban farming activities are essential in urban areas as they grow to meet the needs of a constantly evolving urban life. A variety of systems may fall under the concept of urban agriculture in a different range and possession, ranging from small community gardens [3], peri-urban farming [4], [5], small farming, urban gardens, the building of vertical farming or greenhouse [6]. These farms provide a part of the community with the self-sufficiency of the food system and food safety.

Urban farming has real potential for achieving more productive and sustainable agricultural production for urban areas. Intelligent agriculture is the application of modern information and communication technology within agricultural fields. These technologies can control agricultural fields, such as precision equipment, internet of things (IoT) [7], [8], [9], sensor devices [10], [11], geographic positioning systems (GPS) [12], data collection devices [13], robot devices [14] and etc. This technology contributes and helps many farmers to monitor the farms in a simplified and accurate way that causes the success of agriculture. Assessment devices utilised by measuring, agricultural crops, soil properties, organic substance content, moisture levels, nitrogen levels, etc. Thus, the current study aims to shed light on the efforts of researchers in response to new and disruptive technology and the research landscape from the literature into coherent taxonomy. It also determines the various features that characterize this emerging line of research in urban farming activities, technology applications and their use in urban farms and smallholder farming activities in Southeast in various topics. The remainder of this paper organised as follows: In section 1, presents the introduction of urban farming activities in

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Southeast Asia. In section 2, presents research methods steps, research scope, literature sources and steps of the filtering process. In Section 3, the paper will provide results and statistical information of the included articles. In section 4, it presents benefits, challenges, and recommendations. Section 5 and 6, presents the limitation and conclusion of the review paper.

2 Research method

The keyword in the scope of this paper is “Quality of Life through Urban Farming Activities in Southeast Asia.” It excludes any Urban Farming Activities not related to Southeast Asia such as those found in China, Japan, Taiwan, Korea, and other countries. We also limit our scope to the English literature, but consider all studies in exploring determinants towards enhancing the quality of life through urban farming activities in Southeast Asia. Three digital databases were explored to search the target articles. Web of Science database cover services indexing cross-disciplinary research in agriculture, engineering, medical and life sciences, biological sciences, physical and chemical sciences. ScienceDirect and Scopus is the largest scholarly research database that provides the most reliable and wide range of topics such as, monitoring system, IoT applications, urban farming support livelihood, food, and few more related topics. These three databases sufficiently cover the agriculture studies, especially topic the urban farming activities in Southeast Asia. □

Study selection involved a search for literature sources, followed by three iterations of screening and filtering. The first iteration process excluded the duplicate papers between databases. The second iteration process screening the titles and abstracts papers and excluded separate articles, while another iteration of items after a thorough reading of the full-text articles examined by the second candidate. The search was conducted in November 2017 using the search boxes of ScienceDirect, WoS database and SCOPUS. We used a mix of keywords that contained "smart farming", "home farming", "town farming", "city farming", "homegrown farming", "home-grown farming", "home-based farming", "Precision Livestock Farming", PLF, "urban farming") on different variation and combined with the "OR" and "AND" operators followed by Southeast Asia countries (Malaysia OR Brunei OR Cambodia OR Indonesia OR Laos OR Myanmar OR Philippines OR Singapore OR Thailand OR Vietnam OR "Southeast Asia"). The exact query text is shown in Figure 1 below. The advanced search options in the search engines were used to exclude book chapters, short communication, correspondence, and letter and gain access to current scientific works relevant to urban farming activities in Southeast Asia. We analyse the final articles by using Microsoft words and Excel formats. Notably, the final set of articles was categorized in detail using taxonomy. This taxonomy is classified into several classes and subclasses. The text is categorised according to the preferred author style, and the collected data and related information are saved in Word and Excel files. All

articles are analysed from a variety of sources in depth to give readers a comprehensive look at the subject.

3 Result and statistical information of articles

The initial query resulted in 851 papers: 17 from the Web of Science database, 378 from ScienceDirect, and 456 from Scopus. The filtered articles published until 2017 were adopted in this research and divided into three categories. In the three databases the included papers are filtering in three parts; the first part, 2 out papers were duplicates from the total number 851, the second part, after reading the titles and abstract, 761 excluded from the number of 849, the result becomes 130, in the second parts of the filtering process 42 papers were excluded, from the number of 130 the final included papers 88 eighty-eight. □

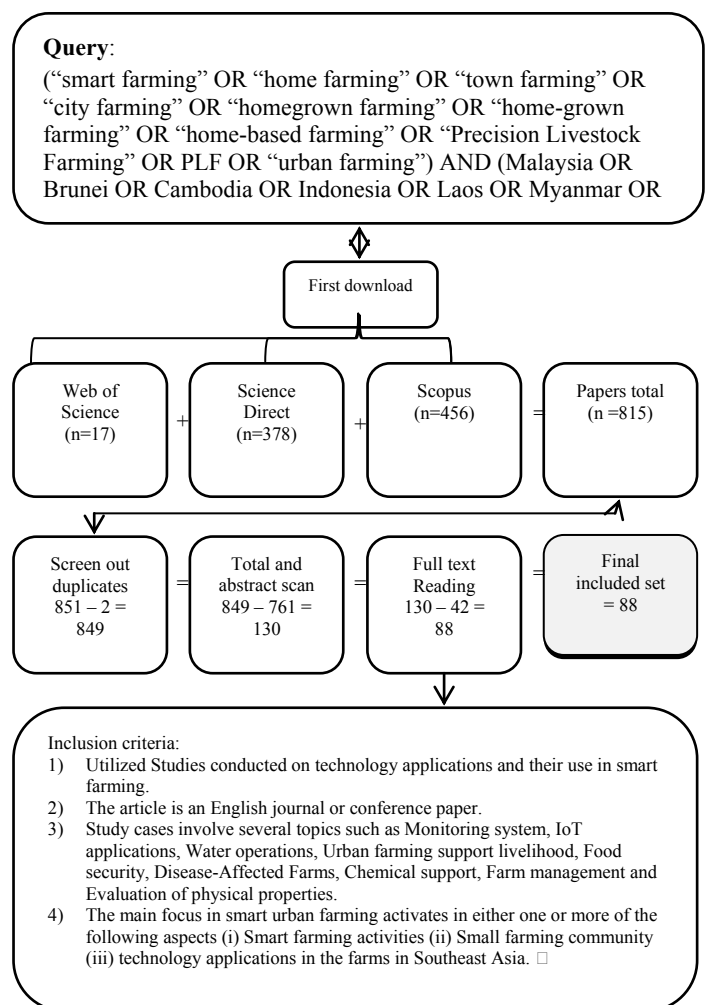


Fig. 1. Flowchart of study selection, including the search query and inclusion criteria □

4 Discussion

This study provides the latest studies and state-of-the-art urban farming activities in the environment of Southeast Asia. This study aims to highlight the future research trends in this research area. The classification of the study based on the purpose of studies, especially in an emerging field, would provide more benefits. On the one hand, the classification of published works is organised according to different publications. This study helps the researcher to find a general overview of the latest urban farming activities in Southeast Asia. The classification of relevant literature helps to classify these different actions and activities into meaningful, manageable and cost-effective planning. To know first possible research trends in this area, mapping on urban farming activities in Southeast Asia in distinct categories highlights the weak and powerful features regarding research coverage. □

4.1 Benefits of urban farming activities

Studies that provide the discussion on urban farming benefits are immersed. Thus, this section will provide a review of urban farming activities. The development of new technology for agriculture purposes has actively implemented. For example, the use of Electrical Conductivity sensor (ECa) in agriculture provides a huge impact. This technology is fundamental to improve the field management and evaluation of soil chemical, physical properties such as nitrogen (N), exchangeable potassium (K) and available phosphorus (P), and biological parameters, and crop yields. It also helps farmers to manage farms, improve the production costs and reduce environmental degradation by applying the optimal quantity of the required nutrients [18], [23], [15], [16], [11], [10], [24]. This study uses Organic Matter Sensor (SOMSENSE) technology with the integration of software developed using MATLAB based on Red, Green, and Blue (RGB) scales to help the farmers to manage the farm and measure the soil properties. This technology relies on the smart camera, where the farmers will take pictures and then analysed using the laboratory analysis [25]. Another study presents Visible and Near Infrared Reflectance Spectroscopy technology to evaluate the soil properties such as moisture content, bulk density, silt, clay and sand in Malaysian paddy field [19], [14]. Modern agriculture is moving towards the utilisation of robots to inspect crop, check the weather conditions, soil fertility, and soil and crop diseases [17]. Few studies have discussed the utilisation of smart farming technologies. For example, a study has discussed the use of soil saturated hydraulic conductivity (Ks) devices to measure and calculate the irrigation requirement of the water balance equation in the soil farm, and also measure soil physical and chemical properties such as sand, clay and dry bulk density [26]. This study displays technology Microflex-C sensor for measuring evaporation within agricultural crops and crop water requirements inside the farm [25], [27].

4.2 Challenges of urban farming activities

Despite numerous benefits acquired from urban farming activities, some challenges and disabilities are facing from this activity that been discussed in past studies. For example, the excessive use of animal fertilizers would affect the properties of the arable soil. It is difficult to see how animal fertilizer is considered a valuable source of crop nutrients. Some fertilizer is not a soil nutrient, and an increase in fertilizer usage has caused damage to agricultural crops [28]. Some fertilizers also contain harmful properties that will lead to many adverse effects on the environment and the characteristics of the soil on the farm and production efficiency as well as on the crop itself [18], [25]. The excessive use of pesticide has led to the failure of pre-harvest agricultural soils in many urban farms in Southeast Asia. Pesticide residues affect consumers' and farmers' health, environmental pollution and limited trading opportunities. The farm's that close to railways, car roads and industrial zones can be contaminated with heavy metals such as lead, sulphur, and nitrate. These toxic materials will be transported to farms and cause a lot of diseases [24]. Some organic waste is harmful and effects on urban agriculture because it may cause crop and vegetable crops to be damaged and render crops inedible [29], [30]. In Southeast Asia some plantations in urban areas use a large proportion of nitrate fertilizers to increase the productivity of vegetables, vegetables and water may contain higher concentrations of nitrates and may cause a serious threat to human health [24].

4.3 Recommendation of urban farming activities

Despite the poor management of small farms in many areas of Southeast Asia, few recommendations have been discussed in past studies. For example, it recommended that the local authority to establish close cooperation with the Government to draft protective laws and regulations for open spaces farming. Such cooperation contributes to the success of small farms, for example, climate reporting, waste management, grain, and fertilizer supply and water management. This effort will facilitate the successful uptake of gardening programs [31], encourage small-scale urban agriculture in buildings leading to a sustainable economy [4]. In another study, it also recommended that attention to be given in developing and increasing the spread of small farms, advocacy training and gardening and address issues that could hinder the success of the home gardening inside the urban cites in Philippines. A comprehensive policy is also required for joint management in city authorities as cities become larger, more ethnically diverse and with larger numbers of the population [29].

5 Limitations

The limitations of this survey are that, the number and identity of the databases sources that have been highlighted in this research, although we believe that these sources are a reliable and representative collection and cover the subject of wide-ranging research. Second,

rapid progress in this study determined by a specific time of the survey. Third, we emphasize in this research the limited application of urban agriculture in Southeast Asia research, which happens to be our own goal in this article. □

6 Conclusions

In this research, all applications of urban agriculture in Southeast Asia countries reviewed all directions. This kind of research continues on this trend. Through deep research in previous studies, we found that there were descriptions and restrictions still vague. The main objective of this study is to highlight the applications of urban agriculture in Southeast Asia for knowledge of developments and discuss in detail the challenges and motivations facing this type of study. □

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