

REVIEW ARTICLE ON THEORY OF RESILIENCE: MEANING, EVOLUTION, AND CONSTRUCT IN URBAN AGRICULTURE PRACTICES

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ABSTRACT

The theory of resilience has been studied in numerous disciplines as interdisciplinary research. It involved different fields of studies such as psychology, psychopathology, human development, and environmental hazard. Nevertheless, further research on the extension theory of resilience is needed in the field of the built environment. The study aims to explore the position of resilience in the built environment, specifically in urban agriculture practices. The objectives are (i) to explain the meaning of resilience, (ii) to describe the evolution of resilience concerning the built environment, and (iii) to determine the construct of resilience in urban agriculture practices. This study employs qualitative research through a scoping review and systematic literature review by three phases encompasses identification, screening, and eligibility of secondary sources. A new definition and comprehensive explanation of the evolution of resilience are proposed subject to the built environment. This review addressed four core constructs, which are the natural environment, economic environment, social environment, and the built environment. In this context, resilience has the role of adapting to the urban food insecurity stresses among urban communities. This association is believed to be driven by interdisciplinary research which is further recognized as one of the initiatives in sustainable development strategy.

Keywords: built environment; resilience; scoping review; systematic literature review; urban agriculture

1. INTRODUCTION

Resilience is defined as a flexible or elastic quality of a substance by referring to the Latin word of *resiliens*. The flexibility contributes to the integration of interdisciplinary research with multiple disciplines of humanities, social sciences, natural sciences, formal sciences, and applied sciences. Each discipline involved the various field of study, for instance, psychology (Luthar, Sawyer, and Brown, 2006), psychopathology (Bonanno, 2004), human development (Ledesma, 2014), and environmental hazard (Chong, Kamarudin, and Wahid, 2018; Summers et al., 2017). It provided the specific meaning of resilience that slightly different in terms of coping, adaptation, and recovery process of the adversity. In the context of psychopathology which involves the manifestation of behaviors and experience, resilience refers to the ability to cope with challenges and threats while maintaining an internal and integrated sense of self (Masten, 2001). Different from an environmental hazard perspective, resilience is the ability to adjust or anticipated the stress of sudden shocks through both pre-event measures and post-event strategies to prevent hazard-related damage and losses (Bruneau et al., 2003).

A review of literature, however, suggests that there are gaps in the theoretical implementation of resilience in the field of the built environment. The built environment, as a basis, referring to the interdisciplinary of applied science, mainly engineering and technology field of study together with social sciences disciplines. It is widely recognized as human-made surroundings that provide the setting for human activities. Rather than merely revising the general study of resilience, this study is striving to explore the position of resilience in

the built environment. Such attention is viewed as essential for advancing the theory of resilience from urban agriculture perspectives. This study is structured to explain the meaning of resilience, to describe the evolution of resilience concerning the built environment, and to determine the construct of resilience in urban agriculture practices. There is a need for a consideration of resilience that is intertwined with the contribution of urban agriculture. It is to ensure the continuation of urban agriculture practices by creating a resilience system and community. It is beneficial for designing appropriate prevention and intervention strategies for individuals, communities, and societies in facing the adversity of food crisis.

1.1 Overview of Urban Agriculture Practices

The application of urban agriculture is most closely associated with the issues of food insecurity and urban poverty (Kutiwa, Boon, and Devuyt, 2010; Stewart et al., 2013; Zezza and Tasciotti, 2010). These issues are predominantly faced by the urban poor due to incapability to afford basic human needs on food sources. This situation is since the urban communities depending on affordable, reliable, stable, accessible, and available food products (Rezai, Shamsudin, and Mohamed, 2016) from the formal food supply system or market dependent (Stewart et al., 2013). Incapability to afford basic needs of food is influenced by the decreasing of food sources that caused the phenomena of rising of food prices. Unfortunately, the urban poor is unaffordable to continuously invest in this formal food supply system during the phenomena. More in-depth, the food cost from a formal food supply system is higher than an informal food supply system due to the overall cost of supplying, distributing, and accessing the food product (Kutiwa et al., 2010). Against this backdrop, the urban poor tends to produce their food requirement within the house compound like rural areas. It is subjected to the interest of the urban communities to implement urban agriculture is to gain side income through the production of agricultural output (Othman et al., 2017). Having direct access to fresh food products via urban agriculture can, therefore, play important role in ensuring household food security and nutrition which later reduces the number of poverties and malnutrition among urban communities. Indeed, the policymakers, government agencies, and academics also support the competency of urban agriculture in food security and poverty alleviation (Rezai et al., 2016). Both developed and developing countries have practiced it (Duchemin, Wegmuller, and Legault, 2008; Orsini et al., 2013). Urban agriculture is impressively considered as a local urban food system. It can reduce food expenses by producing, processing, and distributing the food

product either for self-consumption or commercial value (Diehl et al., 2019). Apart from that, the more significant benefit of urban agriculture is classified as early as part of a hobby which later spread as social development initiatives. A broad overview concerning the dynamic of social interaction, including meet friends for a closer and happy relationship, create special bond and togetherness among the agriculture project members, and interact with stakeholder for continuous information and training on sustainable agriculture activities (Duchemin et al., 2008; Egli, Oliver, and Tautolo, 2016; Ghazali, 2013). For the most part, in developed countries where urban agriculture has been widely practiced, the idea of sustainability is strongly connected or incorporated into urban agriculture development (Orsini et al., 2013). Here, as another example, the development of urban agriculture through roof gardens is based on the advancement of technological innovation for energy saving particularly to achieve a green solution on building structure (Maryanti et al., 2014). The preference for this practice is subjected to its diverse contribution of economic, social, and environmental benefit (Table 1).

Reference	Contribution
Economic benefit	
McDougall, Kristiansen, and Rader (2019); Ramaloo et al. (2018); Rezai et al. (2016); Kutiwa et al. (2010)	Income generation and reduce food expenditure through direct saving on food expenses and sale of food product
Duchemin et al. (2008); Egli et al. (2016); Mackiewicz, Asuero, and Almonacid (2019); McDougall et al. (2019); Ramaloo et al. (2018); Ghazali (2013); Diehl et al. (2019)	Stability of food production for household consumption
Social benefit	
Duchemin et al. (2008); Egli et al. (2016); Mackiewicz et al. (2019); McDougall et al. (2019); Ramaloo et al. (2018); Ghazali (2013); Othman et al. (2017)	Social interaction and community engagement through agricultural and relaxation activities
Egli et al. (2016); Mackiewicz et al. (2019); Ramaloo et al. (2018); Rezai et al. (2016); Diehl et al. (2019) Recknagel, Patton, and Hugunin (2016)	Nutritious food production and a healthy diet
Duchemin et al. (2008); Ramaloo et al. (2018); Stewart et al. (2013); Recknagel et al. (2016)	Facilitate urban communities with an educational program on sustainable local agriculture and food system

Reference	Contribution
Environmental benefit	
McDougall et al. (2019); Ramaloo et al. (2018); Maryanti et al. (2014); Recknagel et al. (2016)	Improve urban biodiversity by replacing low-diversity vegetation that could provide habitat for the urban ecosystem
Mackiewicz et al. (2019); McDougall et al. (2019); Recknagel et al. (2016)	Assist in the reduction of environmental issues such as pollution, stormwater runoff, and urban heat island
Maryanti et al. (2014); Walters and Midden (2018)	Advancement of technological innovation for energy use
Ramaloo et al. (2018); Recknagel et al. (2016)	Practice sustainable waste management of composting

Table 1: *The contribution of urban agriculture in terms of economic, social, and environmental benefit*

In that sense, urban agriculture has been accepted globally as a strategy to address the adversity of the food crisis by ensuring adequate food security and nutrition. It can improve access to food and increase the income of the household through the continuous production of agricultural products. Subsequently, urban agriculture has a role to play in supplying food products, which is bound to become increasingly important with the movement of sustainable cities (Mackiewicz et al., 2019; McDougall et al., 2019; Nchanji, 2017). This condition reflects the concern on the sustainability of the built environment, which is to improve the efficiency of the urban agriculture infrastructure. It is classified as liveability and surrounding enhancement to support the local economy and urban ecosystem. Considerably, urban agriculture is seen as the most sustainable practices that are needed by the urban communities as an alternative to maintaining food production for current and future generations. Therefore, the conceptualization of urban agriculture as an informal urban food supply with the consideration of the theory of resilience is an explanation of the food crisis of food insecurity and urban poverty.

2. METHODOLOGY

2.1 Scoping review

Scoping review is a method conducted in response to objectives 1 and 2 in explaining the meaning of resilience and describing the evolution of resilience concerning the built environment. It is a method used for broad mapping topics of resilience in terms of its meaning and evolution from various fields

of study. It is essential to define the volume, nature, and characteristics of the existing literature. The overview and potentially large and diverse literature were reviewed through the database of Web of Science, one of the leading indexing systems for citation. Web of Science consists of diverse document types, such as article, proceedings paper, review, editorial material, book chapter, and book, which essential to uphold a good quality of articles reviewed in this study. The process involved three phases of identification, screening, and eligibility.

The initial search of the document in the first phase of identification implied a general keyword search of resilience by using truncation as a search query. This process yielded a result of 7,625 documents. The second phase of screening indicated the inclusion and exclusion criteria of the documents. There are no limits on the date in response to the documentation of meaning and evolution. However, the document types must be an article with open access and only focusing on the English language to avoid any confusion of work. At the same time, the snowball technique was adopted by searching relevant articles in the citations within articles. After the identification process, out of 7,625 documents to be screened, resulting in a total of 7,558 documents are removed and 26 documents added from snowball techniques. The eligibility process of the third phase involved a manual review of the title and abstract to preclude documents that did not meet the focus of the study on defining the meaning and evolution of resilience. A final total of 41 documents were selected for the review of objectives 1 and 2 (Figure 1).

2.2 Systematic literature review

A systematic literature review was conducted to respond to objective 3 in determining the construct of resilience in urban agriculture practices. This method was used to collate the empirical evidence from related studies to ensure the validity of the findings. Similar to scoping review, systematic literature review through the database of Web of Science also involved three phases of identification, screening, and eligibility. The first phase of the systematic literature review process is the identification of a broad set of documents. The identification process applied an advanced search query by using phase searching and the Boolean operator as a search string. The selection of keyword identification for information searching is subjected to the scope of the study, which are resilience, built environment, and urban agriculture. The search queries from the Web of Science core collection led to obtaining 675 documents.

The second phase consisted of a screening process to include or exclude documents according to screening criteria and double counting. Three screening criteria need to be fulfilled, which are document types, concerning time, and languages. Subsequently, those documents were screened and refined for their relevance criteria which are only document types of articles that are open access, publication within 2010 until the present, and publish in English languages. Other than that, double counting of documents was avoided as the possibility to have similar documents is due to the usage of similar keywords during the identification process. These processes resulted in a sample of 120 documents with the exclusion of 555 documents. Next, another 19 documents are removed as a sample after the double-counting process. As a result, only 101 articles are applicable based on the screening criteria that have been customized related to the scope of the study.

The third phase of eligibility consisted of thorough manual screening of the right keywords and reading of the abstract and introduction of the articles. This phase involved the selection of only relevant articles to objective 3 in determining the construct of the study. In total, 29 documents have analyzed as a sample for literature focusing on consideration of resilience in urban agriculture practices (Figure 1).

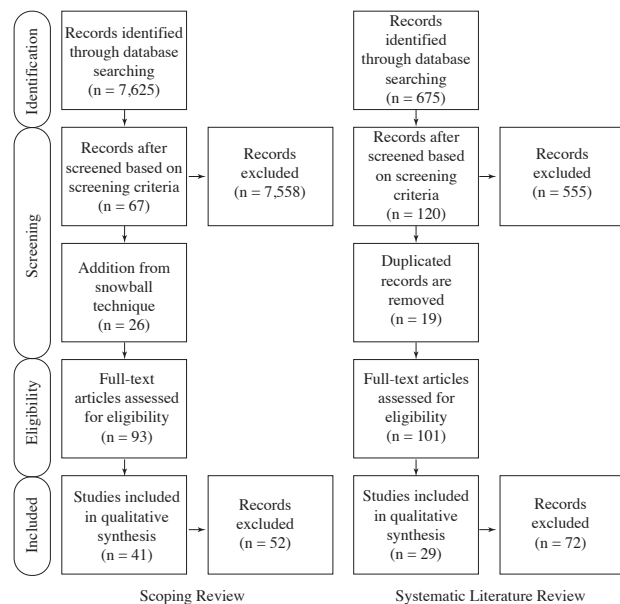


Figure 1: The flow of the scoping review and systematic literature review process

3. FINDINGS AND DISCUSSION

Based on the aforementioned methodology, the findings of this review are presented in two sections namely, the meaning and evolution of resilience in response to the built environment, and the construct of resilience in urban agriculture practices as follows:

3.1 The meaning and evolution of resilience in response to the built environment

The first section highlights a comprehensive analysis of the 41 documents in explaining the meaning and describing the evolution of resilience through scoping review with no limits on the date of publication. The content analysis on both meaning and evolution is presented into entity, attribute, component, category, and paradigm shift of resilience (Table 2).

Author	Entity		Attribute		Component		Category														Paradigm shift			
	System	Community	Stability	Resilience	Vulnerability	Recoverability	Adaptability	Transformability	Community resilience	Household resilience	Social resilience	Engineering resilience	Ecological resilience	Cultural resilience	Urban resilience	Disaster resilience	Career resilience	Organizational resilience	Infrastructure resilience	Landscape resilience	Applied ecology	Complex adaptive system	Socio-ecological system	
Akamani (2012)	/	/	/	/				/	/	/											/	/		
Akamani and Hall (2015)	/	/		/				/	/	/													/	
Akamani and Hall (2019)	/	/		/	/		/	/	/														/	
Akamani (2020)	/	/	/	/	/		/	/													/	/	/	
Allen and Holling (2010)	/		/	/			/	/				/											/	
Allen et al. (2014)	/			/			/				/	/										/	/	
Baho et al. (2017)	/	/	/	/			/	/	/		/	/										/		
Bec, McLennan, and Moyle (2015)	/	/	/	/	/	/	/	/	/	/	/	/										/	/	

Author	Entity		Attribute		Component		Category										Paradigm shift						
	System	Community	Stability	Resilience	Vulnerability	Recoverability	Adaptability	Transformability	Community resilience	Household resilience	Social resilience	Engineering resilience	Ecological resilience	Cultural resilience	Urban resilience	Disaster resilience	Career resilience	Organizational resilience	Infrastructure resilience	Landscape resilience	Applied ecology	Complex adaptive system	Socio-ecological system
Bec, Moyle, and Moyle (2018)	/	/	/	/	/	/	/	/															
Bonanno (2004)	/	/	/	/	/	/	/																
Brown et al. (2017)	/		/	/	/	/	/																
Bruneau et al. (2003)	/	/		/	/	/	/		/						/		/						
Chang (2009)	/			/	/	/									/			/					
Cumming et al. (2013)	/	/		/		/	/											/				/	
Faulkner, Brown, and Quinn (2018)	/	/		/		/	/															/	
Folke et al. (2004)	/		/	/	/	/	/			/	/											/	
Folke (2016)	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Forgaci and Timmeren (2014)	/		/	/	/	/	/								/						/	/	
Garmezy and Masten (1986)	/	/	/	/	/	/	/																
Garmezy (1991)	/	/	/	/	/	/	/																
Garmezy (1993)	/	/	/	/	/	/	/																
Green et al. (2015)	/	/	/	/	/	/	/		/		/											/	
Holling (1973)	/		/	/								/								/			
Holling (1996)	/	/	/	/	/	/	/																
Holling (2001)	/	/	/	/	/	/	/				/										/		
Ledesma (2014)	/		/	/	/	/	/								/	/							

Author	Entity		Attribute		Component		Category										Paradigm shift						
	System	Community	Stability	Resilience	Vulnerability	Recoverability	Adaptability	Transformability	Community resilience	Household resilience	Social resilience	Engineering resilience	Ecological resilience	Cultural resilience	Urban resilience	Disaster resilience	Career resilience	Organizational resilience	Infrastructure resilience	Landscape resilience	Applied ecology	Complex adaptive system	Socio-ecological system
Ludwig, Walker, and Holling (1997)	/		/	/	/	/	/																
Luthar, Cicchetti, and Becker (2000)		/	/	/	/	/	/																
Luthar et al. (2006)		/		/	/	/	/																
Masten (2001)	/			/	/	/	/																
Olazabal et al. (2012)	/			/	/	/	/	/	/					/									/
Olsson et al. (2006)	/	/	/	/	/	/	/		/	/	/											/	
Peterson, Allen, and Holling (1998)	/		/	/	/	/	/			/	/										/		
Pimm (1984)	/		/	/	/	/	/														/		
Preiser et al. (2018)	/			/		/	/				/	/										/	/
Rist et al. (2014)	/		/	/								/											/
Samsuddin, Takim, and Nawawi (2016)	/	/		/	/	/	/								/								
Southwick et al. (2014)	/	/	/	/	/	/	/		/	/	/	/											
Smyntyna (2016)		/		/		/	/					/	/										/
Walker et al. (2004)	/		/	/	/	/	/				/	/									/	/	
Webb (2007)	/	/	/	/	/	/	/				/	/									/	/	/

Table 2: Findings on the meaning and evolution of resilience

3.1.1 The meaning of resilience

First, entity refers to the subject of resilience either to explain the system and/or community. The system refers to a set of procedures that involves a systematic process of mechanism and is influenced by its environment. Meanwhile, a community is a social unit of people that shared similar norms, values, customs, and identities through communication platforms in an area. Second, the attribute of resilience is influenced by stability. Third, four components of resilience are acknowledged as vulnerability, recoverability, adaptability, and transformability. These components are also considered influential factors in determining the category and paradigm shift of resilience. Throughout the analysis, there are 12 categories of resilience are found which are community resilience, household resilience, social resilience, engineering resilience, ecological resilience, cultural resilience, urban resilience, disaster resilience, career resilience, organizational resilience, infrastructure resilience, and landscape resilience. It can be explained based on three phases of paradigm shift of applied ecology, complex adaptive system, and socio-ecological system.

Armed with this set of key points, resilience involves the progress on the capacity of the system and ability of the community through a positive coping mechanism to maintain stability, adaptation to the changes, and transformation of the development. The theory of resilience, as applied to a system, is mainly defined as the capacity of a system to absorb adversity, and reorganize changes by remaining the function, structure, identity, and feedbacks of the dynamic system. This understanding is performed by maintaining a stable function of the system which encompasses the social aspect to increase anthropogenic changes (Webb, 2007). Since resilience is not driven solely by the system, resilience is also illustrated as the ability of people, communities, societies, and cultures to anticipate, resist, persist, and respond to abrupt changes and crises. It creates an opportunity to survive, return, recovery, improve, evolves, innovate, and develop upon a perturbation or recovery time. The explanation of these opportunities involved the concept of thriving that are explained during or after facing adversity. The concept of thriving refers to the ability of an individual to transform into a positive state of functioning by surviving, recovering, and enduring the repeated hardship through cognitive shift (Ledesma, 2014). The ability is related to human adaptational systems, by understanding the process involved for good outcomes that encompass of protective, compensatory, and challenge model.

Another important finding was that the meaning of resilience has also extended to the 12 categorizations of resilience, which is derived from the analysis of Table 2. These categories are summarised to differentiate the definition of each category as shown in Table 3. The summary concluded that the differences are subjected to the cross-scale dimension, the circumstances of the adversity, and the focus of the outcome. For instance, household resilience, community resilience, and social resilience are explaining similar entities of community with differences on the scale of the community. Household scale refers to an individual or a family (Akamani and Hall, 2015), community scale refers to a group of family within an area (Bec et al., 2015), and social scale refers to a group of community or organizations (Folke, 2016). Other examples of the circumstances of the adversity can be explained through disaster resilience. These types of resilience always involve both the system and community by focusing on the pre-event vulnerability and post-event recoverability (Bruneau et al., 2003). Next, cultural resilience is an example of a category of resilience that explains the focus of the outcomes on the cultural identity, cultural knowledge, cultural practices, and cultural background (Smyntyna, 2016).

Category	Definition
Community resilience	The process of linking a network of adaptive capacity by addressing the cycle of natural ecosystems and communities for adaptation of adversity.
Household resilience	The ability of the household to provide capital assets directly influenced the well-being of the household.
Social resilience	The ability of communities to cope with external adversity and sustain well-being, significantly through a modification of behavior or social frameworks.
Engineering resilience	The length of time required by a system to return to equilibrium due to the face of perturbation.
Ecological resilience	The amount of perturbation a system can withstand before moving into a different stability domain.
Cultural resilience	The ability of the system by emphasizing on the community and cultures or past human response based on human behavior (cultural identity, cultural knowledge, cultural practice, cultural background) to endure the adversity despite adaptation or transformation of the element to support the persistence identity of the system.
Urban resilience	A process of reconnecting people in the cities by considering the urban development and transformation across the temporal and spatial scale to the biosphere and ecosystem services for urban sustainability.
Disaster resilience	The ability of organizations or communities to mitigate hazards and provide recovering activities to minimize social disruption with little or no outside assistance.
Career resilience	The ability of an individual to resist career disruption and could handle the stress of a poor working environment.

Category	Definition
Organizational resilience	The ability of an organization to create an environment that could enhance the career resilience of the employees.
Infrastructure resilience	The ability to reduce the magnitude, impact, or duration of disruption concerning the performance of engineered elements and systems.
Landscape resilience	The ability of a system to cope with adversity with the concept of sustainability for an entire landscape that includes social and ecological components, adaptation, interaction, and innovation.

Table 3: The categorization of resilience

However, in the context of the built environment, the most related category that needs to be considered in the formulation of meaning for resilience are community resilience and urban resilience. Community resilience is concerning the capability to withstand the stress of adversity such as urbanization which affects the social life of the urban communities (Mohamad, Jusoh, and Kassim, 2019) that includes fatality, physical damage, and environmental damage (Ridzuan et al., 2016). These negative consequences required the collective ability of the urban communities to deal with the adversity and resume their daily life activities through cooperation. This is because the communities need to work together as a strategy for surviving and thriving in the face of adversity. Apart from that, since the study involves urban communities, it is compulsory to consider urban resilience as one of the categories in defining the meaning of resilience from built environment perspectives. Urban resilience is demonstrated as an innovation center with an important effect on the human-dominated ecosystem at the local and regional scale encompassing technology, economy, and social organizations (Ernstson et al., 2009). The innovation at the local scale is dedicated to community development includes social and ecological interaction to meet the social needs while improving the urban ecosystem. Meanwhile, urban resilience at the regional scale involves the cooperation of stakeholders for a broader scale of innovation, performance, and sustainability such as appropriate planning and design for infrastructure and utilities for urban communities.

Therefore, it is believed that community and urban resilience play a vital role in understanding the scope of the study (built environment) which involves anthropogenic changes and sustainable development. Importantly, the focus is on the application of urban agriculture practices mainly by the urban poor, who are facing the food crisis of food insecurity and urban poverty. As such, the operational definition of resilience from built environment perspectives, mainly urban agriculture consists of both entities of system and community.

It defined as the capacity of a system to improve and transform existing agricultural practices into innovative and sustainable practices for the benefit of the community by emphasizing the ability of the community to maintain the production of an agricultural product that is environmentally friendly, socially responsible, and economically profitable in the face of adversity.

3.1.2 The evolution of resilience

Turning now to the evolution of the theory of resilience, the finding suggests that there are three phases of a paradigm shift in explaining the theory. It is known as traditional or applied ecology, complex adaptive systems (CAS), and socio-ecological systems (SES) (Table 2). The evolution is mainly presented in terms of meaning, domain, and attribute that is involved in each paradigm shift as shown in Figure 2.

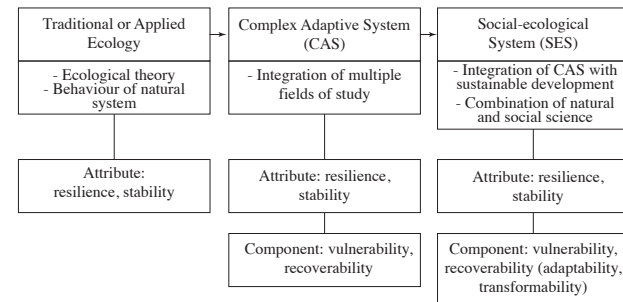


Figure 2: The evolution of resilience through three phases of paradigm shift

Firstly, the phase of paradigm shift and the idea of resilience on traditional or applied ecology was proposed by Holling (1973), from the perspective of ecological theory and the behavior of natural systems for both theory and practice application. This perspective explains that the behavior of ecological systems is defined by the domain of resilience and stability. Stability refers to the ability of a system to return to equilibrium after experiencing temporary adversity (Holling, 1973). Meanwhile, the duration of a system to return to equilibrium is known as resilience (Pimm, 1984). Hence, it is a measure of persistence on the ability of the system to absorb changes of constructs and changes of interaction within a system. Very close approximations on the earliest theory of resilience explained on the applied ecology that involves the entity of the ecosystem and the organism within the ecosystem. Both ecosystem and organism have interrelated each other as two interacting populations are considered in the behavior of ecological systems. The hypothesis explicates that a phenomenon with a high degree of stability produces a lower resilience and vice versa.

Secondly, the integration of multiple fields has broadened the paradigm shift of resilience into complex adaptive systems (CAS). It provides a broader scale pattern of new constructs subjected to the interaction and connection of multiple fields that often occur unpredictably (Folke, 2016). The interaction and connection of the constructs create dynamic and adaptive changes, also known as attributes and components due to the emergent and adaptive response of new constructs. The essential elements that need to be considered in viewing CAS are the individuality of the constructs (persistence), sustainability of the diversity (stability), localizing the interaction among the constructs (variability), and independent process of the local interaction, replication, and enhancement (vulnerability and recoverability) (Holling, 2001). These elements will be able to determine which degree of changes influenced the constructs, for example, environmental condition, and which degree of results are befalling, for example, self-organization. Thus, the paradigm of CAS explains how the interaction and connection of a complicated pattern of constructs can happen through exciting but straightforward variations.

Thirdly, within a broader context, the integration of CAS with sustainable development in resilience is known as social-ecological systems (SES). The need for a social dimension in responding to the disturbance will contribute to the understanding of how society develops sustainability. SES is a bridge for a different combination of natural science and social science disciplines. The natural science of ecological systems refers to the self-regulating actions of an organism by interacting with each other and with the surrounding (Walker et al., 2004). The social science of social systems refers to the ethic of the human-nature relationship that dwells with different systems of knowledge of environment and resource use. Research on resilience from the perspective of social-ecological systems is designed to clarify the relationship between community capacity and community resilience by explaining the structural sources of community resilience (Akamani, 2012). The approach of SES emphasizes the equal consideration of social and ecological dimensions in the function and maintenance of the ecosystem. Outlining these understanding, SES is an integrated concept of human-in-nature in which human deals in a manner through the adaptability and transformability to respond, change, and shape the changes without causing the loss of future options. It is usually discussed in six integrative areas of environmental ethics, political ecology, environmental history, ecological economics, common property, and traditional ecological knowledge.

Based on the three phases of the paradigm shift, the attribute that identified through the evolution of resilience are technically considered in the form

of vulnerability and recoverability, respectively (Folke, 2016). However, the previous analysis showed that recoverability intertwined with the complementary attributes of adaptability and transformability (Olazabal et al., 2012). There was a significant difference between the two attributes. Adaptability is the capacity of people to learn, combine, innovate, and adjust their knowledge and experience persistently to the changing environment both external and internal for sustainable development (Walker et al., 2004). The people can manage and influence the system, either intentionally or non-intentionally, which will determine the success of the system, either desirable or undesirable system. By contrast, transformability refers to the shifting development into emergent or creation of a new alternative. It is the capacity to define and create a new stable system by introducing new components and ways of variables due to the untenable ecological, economic, or social condition of the existing system (Olsson et al., 2006).

Therefore, in the context of the built environment, specifically on urban agriculture practices, this study implies the most related paradigm shift of socio-ecological systems (SES). The concern of the study that is focusing on the community and urban resilience that has been mentioned in the categorization of resilience is imparted the close relationship on the social and ecosystem aspect of urban farmers and urban ecosystem, respectively. For this reason, the importance of resilience in urban agriculture practices varies considerably between food sovereignty, environmental sustainability, and community building. Urban agriculture has offered resilience capacity through food diversification to the household level, which further can be developed for the local and global food market in support of economic stability. Urban agriculture also can improve the urban ecosystem through the generation of ecosystem services of provisioning, regulating, supporting, and cultural services. Collectively, it simultaneously promotes community and urban resilience through enhancement of socio-cultural ecosystem services, for instance, empowers young adults to understand and aware of the role and contribution of urban agriculture to the urban communities and environment.

3.2 The construct of resilience in urban agriculture practices

The second section of findings is analyzed using 29 documents that are reviewed through systematic literature review in determining the construct of resilience in urban agriculture. The selected 29 documents consist of publications from 2010 until the present on urban agriculture practices that consider the aspect of resilience in their study. Most of the study on urban agriculture has a close relationship with urban food insecurity and an indirect relationship with resilience. The necessity to have urban agriculture practices

that are resilient was brought due to the stress of urban food insecurity. There is, however, a prior initiative on reducing the risk and impact of these stress through the identification of construct in resilience by focusing on the community and urban resilience which are compatible with urban agriculture practices. The analysis of the study proposed list of constructs presents four core constructs, which are natural environment, economic environment, social environment, and built environment (Table 4). It is developed by considering the contribution of urban agriculture, as mentioned earlier. However, the construct of resilience is changeable depending on the context and its adverse situation. The suitability of constructs needs to be equivalent to the scale of society either individual or communities and the size of urban agriculture itself. Thus, it is essential to emphasize that urban agriculture is a coping strategy for urban communities.

Author	Natural environment			Social environment						Built environment		
	ML	Economic environment		Social service			Social character		Local Knowledge		Infrastructure	
		SED	EP	SAS	CS	LT	DG	SC	TE	CEE	UT	APD
Ahern (2011)		/	/								/	/
Akamani (2012)		/	/	/	/	/	/	/	/	/	/	/
Barthel and Isendahl (2013)	/	/						/	/		/	/
Barthel, Parker, and Ernstson (2015)	/	/						/	/		/	/
Bec et al. (2018)		/		/				/	/	/		
Ding, Liu, and Ravenscroft (2018)	/	/	/	/	/	/				/		
Faulkner et al. (2018)				/	/			/	/	/		/
Folke (2016)	/	/		/	/	/		/	/	/		
Hecht et al. (2019)	/			/	/	/		/	/	/	/	
Kanosvambira and Tevera (2019)		/		/	/			/	/	/		/
Korir, Rotich, and Mining (2015)			/	/				/	/			/
Kutiwa et al. (2010)		/	/		/			/	/	/	/	/

Author	Natural environment			Economic environment			Social environment					Built environment	
	ML	Socio-economy		Social service			Social character		Local Knowledge		Infrastructure		
		SED	EP	SAS	CS	LT	DG	SC	TE	CEE	UT	APD	
Martin, Clift, and Christie (2016)		/	/	/				/	/	/	/		
Mohamad, Jusoh, and Kassim (2019)	/	/	/	/	/			/	/			/	
Okvat and Zautra (2011)	/			/	/			/	/	/	/		
Olazabal et al. (2012)		/						/	/	/	/	/	
Omar Chong et al. (2018)	/	/		/	/	/		/	/	/	/		
Othman et al. (2017)		/						/	/				
Panagopoulos, Jankovska, and Dan (2018)		/	/	/	/			/	/			/	
Patel et al. (2017)		/						/	/	/	/		
Pulliat (2015)	/	/	/			/	/	/	/	/	/	/	
Ramaloo et al. (2018)		/		/	/			/	/				
Rangwala et al. (2018)				/	/			/	/	/	/	/	
Ridzuan et al. (2016)				/				/	/	/			
Sharifi (2016)	/	/	/	/	/	/	/	/	/	/	/	/	
Summers et al. (2017)	/	/	/	/	/	/	/	/	/		/		
Thornbush (2015)	/	/	/									/	
Tiraieyari and Hamzah (2015)			/		/	/		/	/	/			
Zainal and Hamzah (2017)		/			/			/	/	/			

Marginal Land (ML) Community Service (CS) Training and Education (TE)

Social Economic Diversity (SED) Labour/Trade (LT) Collective Efficacy and Empowerment (CEE)

Employment (EP) Demographic (DG) Utility (UT)

Safety and Security (SAS) Social Cohesion (SC) Adaptive Planning and Design (APD)

Table 4: The proposed list of constructs for urban agriculture

3.2.1 Natural environment

Marginal land is fast becoming the construct of the natural environment. It explains the functional diversity of human intervention of a system through various agricultural practices such as edible gardens, allotment gardens, and community gardens. The innovation of agricultural systems is further contributing to the application of urban agriculture in a limited area (vertical farming), implementation with soilless culture (hydroponic technique), and practices of resource management (composting technique) (Sharifi, 2016). The transformation of the urban area into an environmental area that imitates the existing nature is conceptualized through the urban ecosystem. The imitation is realized through the reduction of food transportation, reduction of an urban heat island effect, and improvement of stormwater mitigation (Thornbush, 2015). From other perspectives, this transformation could help in creating the identity of the urban areas or urban communities. Nevertheless, it is influenced by topographic, historical, political, and economic factors of the area and community. For instance, urban low-income communities in Hanoi unintentionally create their own identity and uniqueness through the production of their staple food of leafy vegetables of morning glory (Pulliat, 2015). This scenario contributes to the self-reliance of agricultural products and reduces the dependence on the market by making use of the available land area to produce daily food consumption.

3.2.2 Socio-economy

In the socio-economy construct, social-economic diversity and employment have become a sub-construct for urban agriculture variables. First, social-economic diversity refers to the diverse array of business sectors that can be produced by the urban communities through urban agriculture. The business sector usually emphasizes innovations that could foster socio-economic novelty and diversity of products (Folke, 2016). Other than focusing on the production of fresh agricultural products, urban communities also have an opportunity to generate income through the production of the downstream product. This scenario has been practiced by the urban farmers in Shanghai, China by offering value-added products of handmade tofu, strawberry jam, flowers, seedlings, handicrafts, and medicinal materials (Ding et al., 2018). Meanwhile, urban communities that implement urban agriculture in Malaysia are actively conducted environmental sharing of kitchen waste composting as well as selling the compost product to the surrounding communities (Ramaloo et al., 2018). In the interim, the second sub-construct of employment explains the unemployment rates, underemployment rates, and formation of human

capital (Sharifi, 2016). The role of urban agriculture to provide a source of employment can be seen through the related issues of a food crisis such as food insecurity and urban poverty. The adaptation process to overcome these food crises creates an opportunity for the role of urban agriculture as additional sources of income that are usually practiced by the housewife and retiree (Martin et al., 2016). These initiatives on social-economic diversity and employment are subjected to the encouragement of urban agriculture practices particularly for urban low-income communities as a supplementary source of household income and reduction on the food expenditure, particularly vegetables.

3.2.3 Social service

The construct of social service consists of three sub-construct which are safety and security, community services, and labor or trade. First, safety and security represent the interaction of stakeholders, leaders, and urban communities. Stakeholders include governmental and non-governmental organization plays a vital role as facilitators in supporting the engagement of urban communities on agricultural practices at the household and community level (Kanosvamaha and Tevera, 2019). It follows that the involvement of leadership and active participation of urban communities by having good communication and understanding with stakeholders will be able to come out with strategic planning in creating a resilient urban agriculture practice. Importantly, the leaders should be able to coordinate their actions based on the local needs and ability with diverse biophysical conditions and constraints (Panagopoulos et al., 2018). This interaction could portray transparent cooperation that contributes to the development of trust among stakeholders, leaders, and urban communities to build support action specifically during disruption (Folke, 2016; Hecht et al., 2019). Correspondingly, the construct of safety and security can best be explained through the second sub-construct of community services on the availability of services, education, healthcare, and cultural services. The existence of diverse facilities as part of a strategy for improving the social, economic, and environmental conditions of the urban communities could encourage engagement in urban agriculture. On the contrary, a more comprehensive explanation of the third sub-construct of labor or trade would include the availability of skilled labor that is compatible with the agricultural sector such as carpenter, bricklayers, engineer, roofers, and construction workers. It involves intercommunity and diverse trade of skills that can be pooled together at the time of crisis (Olazabal et al., 2012; Sharifi, 2016).

3.2.4 Social characteristic

Social characteristics distinguish two sub-constructs of demographics and social cohesion. First, demographics refers to the general population of age structure, population size, ethnicity, and socio-economic level (Mohamad et al., 2019; Sharifi, 2016). Urban agriculture is mostly practiced by the urban low-income communities specifically housewives as an adaptive response to the food crisis by emphasizing the economic values (Kutiwa et al., 2010). Urban agriculture is implemented for a predictable agricultural yield either for self-consumption or additional commercial return. Whereas the retired urban communities interested in urban agriculture are mainly for social values which started as a hobby for leisure time (Othman et al., 2017). On that account, Slovakia introduces the term of hobby gardens to explain the existence of urban agriculture that was developed as a hobby in their communities (Panagopoulos et al., 2018). Considering the situation, the sub-construct of demographics is further influenced by the sub-construct of social cohesion. Social cohesion highlights the community networks, which allows the community to rely on neighbors at times of crisis and community interaction that could increase the livelihood, particularly a sense of place. This situation could foster social networking, communication, and build trust among the urban community (Folke, 2016; Sharifi, 2016).

3.2.5 Local knowledge

The construct of local knowledge consists of two sub-constructs of training and education and collective efficacy and empowerment. First, training and education mark on community education and activities, for example, the knowledge on agricultural activities has been shared in the education within standard education curricula (Patel et al., 2017). The initiatives in providing training and recruiting volunteers among youth are adapted as a strategy in encouraging the practices of urban agriculture among the youth generation (Tiraieyari and Hamzah, 2015). This is because the acceptance is influenced by the knowledge on cognitive, affective, and behavioral of urban agriculture (Zainal and Hamzah, 2017). In comparison, the second sub-construct of collective efficacy and empowerment signifies the flexibility and sustainability in the use of diverse and local resources, local knowledge, and local culture that could meet societal goals (Folke, 2016; Olazabal et al., 2012; Sharifi, 2016). Importantly, these variables highlight female empowerment in urban agriculture practices (Sharifi, 2016). For the most part, urban agriculture is dominated by the female of middle-aged and elderly women because technically women are the head of the household in organizing the food sources and have the most time to maintain the agricultural area rather than men.

3.2.6 Infrastructure (built environment)

The explanation of the infrastructure for the built environment is divided into two sub-constructs of utilities and adaptive planning and design. First, utilities mention the availability and accessibility of resources or infrastructure base, including water supply, energy network, and transportation (Sharifi, 2016). It is vital to have an excellent hydrological process, sustainable soil management, and climatic modification as it is among the fundamental factors in developing urban agriculture (Hecht et al., 2019). Second, adaptive planning and design from urban agriculture perspectives represent the setting of urban informal open space for human activities. These open spaces can be beneficial in terms of their ecological, cultural, social, and socio-economic values in creating a sustainable urban form for urban communities (Panagopoulos et al., 2018). The functionality of the urban form is depending on the connectivity that is beneficial for public space and communal activities, green and blue infrastructure that supports biodiversity, and aesthetic and visual quality for imitation of the natural landscape (Olazabal et al., 2012; Sharifi, 2016). As a consequence, this sub-construct is embedded as the element of place attachment that involves the affective, cognitive, and material relationship of urban communities in the urban agricultural area such as community gardens (Faulkner et al., 2018).

4. CONCLUSION

This study was developed for reviewing and analyzing the role of resilience in the built environments particularly for urban communities through urban agriculture. The findings show that the resilience viewpoints of the built environment can yield a very different paradigm to the management of resources. The development of the operational meaning of resilience from built environment perspectives emphasizes both the entity of system and community, aspect of vulnerability and recoverability, and the complementary attributes of adaptation and transformation. The interrelationship between urban agriculture and the evolution or paradigm shift of resilience are emphasized through the integrated concept of human-in-nature that are developed in the third phase of socio-ecological systems. Thus, the application of the theory of resilience in urban agriculture significantly would be focusing on the community and urban resilience in which the need to view from the local context, and the need to emphasize heterogeneity subjected to the need of the urban community. This condition is outlined based on the potential of urban agriculture as a strategy to address the food crisis by ensuring adequate food security and nutrition.

Off this concept, the consideration is not only focusing on the reduction of hunger, poverty, food insecurity, and malnutrition, yet it is an effort to achieve sustainable agricultural development. The needs for urban agriculture are growing due to its capability in reshaping the urban landscape as the co-creation of green spaces and landscape beautification through technological innovation. By reflecting the position of resilience in urban agriculture practices, it introduces a program to alleviate the low malnutrition among the low-income population through the production of their food. Hence, this study breaks new ground in community development by linking resilience to urban agriculture that acts as an element of urban resilience for sustainable development.

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