Motives and Dynamic of Community-Based Aquaponics for Urban Farming in Semarang

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Abstract. Urban farming through aquaponics has begun in Semarang, since 2016. More than eighty people formed an aquaponics community. The community has conducted routine training on aquaponics to develop urban farming through this system. But the number of aquaponics was unstable. Therefore, the purpose of this research was to find out the motives and dynamics of the aquaponics community in supporting urban farming. The method of this research used a qualitative approach. The results of studies with the analysis of the theory of motives and group dynamics show that this community was in the class of altruism and collectivism motivation so that it has a chance of sustainability even though at certain moments it decreases. As for the dynamics of some actors who think that they weren’t in line with expectation, factors emerge that weaken the community in aquaponic. However, those who have altruism and collectivism motives will tend to survive because they got personal satisfaction and a good impact on their environment. Therefore, when many actors leave this system, they keep trying to return to carry out aquaponic activities in support of urban farming in Semarang.

1. Introduction

Food and Agriculture Organization (FAO) as a driver of the world hunger-reduction program has several strategies to increase access to food in urban areas, one of which is urban farming. The urban farming program is a nursery, planting, processing and distribution of a diversity of agricultural products, using human resources, land and water, products and services found in urban areas [1]. Urban farming is the planting, processing, and distribution of food and other products through intensive crop cultivation and animal husbandry in cities and the surrounding area, and reuse of natural resources and urban waste, to obtain a diversity of crops and livestock. In other words, urban farming is a food production activity in urban areas to facilitate access to food for urban communities. This activity has several benefits for the environment, health, and socio-economic community [2].

The benefits of urban agriculture for public health are improving nutrition through fresh food. As a result of research in the United States that shows the population of cities that do urban agriculture with vegetable and fruit commodities affect the diet and nutrition of these people [3]. With these many advantages, FAO has, on various occasions, launched urban agriculture programs, and can be used as a forum to open jobs and increase citizens' incomes [4]. The social benefits of urban agricultural activities include creating a safe and comfortable environment, community development, and building social capital, educating and developing the young generation. The results found that gardens and agriculture
can beautify the environment as well as employ and benefit the residents. The maximum effects of urban farming can be achieved by active community participation [5].

Urban farming on a small scale has a land area of 92-1,000 m², and a large scale has an area of more than 1,000 m². The agricultural size has a different function where the small scale is used as a garden for educational programs, composting, plantations of medicinal plants and vegetables, and fruits that can be eaten immediately. In contrast, the large size is used as urban community agriculture, nurseries, animal husbandry, and horticulture [6]. According to the type of activity, urban agriculture is divided into four general categories, namely community-based, institutional, public, and commercial [7]. Community-based urban farming has small-scale agriculture and community gardens that are voluntarily managed by non-profit organizations. This community-based urban agriculture aims to develop communities and provide social and educational programs. In the application of community-based urban agriculture, it is essential to recognize, understand, and respect the values, desires, and motives of the actors. Middle-income people in middle-income areas most often practice Urban agriculture. Many of the benefits of urban farming reflect the beliefs and motivations of these practitioners and their communities. Like community-based activities, the best results occur when community members identify priorities and set goals for the project and then work together and with community partners to achieve these goals. Without community support, urban agriculture faces enormous obstacles [6-8].

Most urban agriculture uses conventional methods with planting media in the form of soil so that many still use pesticides, which endanger health. Therefore, with the reason to get healthier agricultural products and limited land, the community began to use aquaponics technology. This system is a combination of aquaculture without using plants media in the form of soil which can be placed on limited land [9, 10]. The aquaponics is a farming system that utilizes fish manure as a source of nutrition for plants and the utilization of plants as a controller of water quality for fish, hence it is said that aquaponics is a method of sustainable agriculture and aquaculture, both of which form mutualism dependency. The aquaponic results are organic vegetables and fish that are very good for human [10-12].

Besides, community-based urban farming activities are driven by the motivation of each individual to achieve the goals they have. Motivation can be defined as the forces within a person who drives to satisfy himself [13]. Everyone has the motivation to reach the goal. Particular interest is a powerful and pervasive motive even though the human capacity to care and participate is not limited to interests. Community involvement will strengthen when understanding what reasons make individuals care for the welfare of others and society in general [14].

In Semarang, the existence of aquaponics urban farming is carried out by people who have a hobby of agriculture and motivation to meet the needs of healthy fish and vegetables. Awareness of the fulfilment of healthy food is developing in aquaponics farming communities in various places, one of which is the aquaponics community in Kandri Village, in the District of Gunungpati Semarang. The residents who attempted to develop an aquaponic in their private house and public area since 2016 [15]. Then, urban farming through aquaponics spread in various places in the city of Semarang, both developed by individuals or groups. The number reached more than 80 aquaponics. Although, urban farmers, through this system will be easier to do by creating an aquaponic community for mutual learning. Then, the existence of the aquaponic community, urban agriculture, can be running well in Semarang. But in reality, there is still an increase and decrease in the number of aquaponics systems in the development of urban agriculture. This condition indicates that the group experienced internal dynamics. From a research standpoint, groups are several people who join in interaction with each other at one or a series of meetings, where each member receives impressions or perceptions of other members that are different enough to be able to react to each other. The group define as two or more people involved in psychological relationships with each other so that they can influence each other [16]. The group is a community consisting of one or more individuals who interact with each other to accomplish a specific goal. The groups are created formally and informally within the organization at different times and for different purposes. Those groups have negative and positive influences on the organization structure and function [17]. Therefore the focus of this study is to analyze the motives and dynamics of community-based aquaponics in developing urban farming in Semarang.
2. Methods

The study explores the motives and dynamics of community-based aquaponics for urban farming in Semarang so that qualitative methods are expected to be able to explain these issues. This method was chosen to collect descriptively about urban aquaponics phenomena, which provides a more comfortable response to those interviewed. The method was used to examine the condition of a natural object, where the position of the constituent is as a key instrument, sampling the data source. Data collection in this study was conducted both primary and secondary such as literature review, documents, interviews, and observations. This study applied semi-structured interviews where interviews of this type were also included in the category of in-depth interviews [18, 19]. Some of the initial interviewees were able to express their motives for engaging in urban agriculture through aquaponics. The participants are key persons who involve in aquaponic urban farming in Semarang. Based on the case study rules, the researcher will be open to all data that can explain the case so that here the data will be combined with triangulation. Tools and techniques such as observation, in-depth interview, preliminary meetings, inter-group meetings, and workshops were used to gain stakeholders’ participation [20, 21]. Therefore, researchers sought to obtain information through interviews, following members of the aquaponic community social media groups, both WhatsApp, aquaponiksemarang.blogspot.com, and their social learning processes.

3. Result and discussion

Semarang urban farming through aquaponics began from Kandri Village in 2016. From this village, the community had done agriculture with a minimal area. They believe urban farming with aquaponics is one of the solutions to meet healthy food needs. The activity shows that the current form of urban agriculture has very diverse systems. In the past, people planted the media using soil in pots in their home yards. At present, people are doing urban farming without using soil media, as seen in this system [15]. Some small aquaponics that is still running can be seen in figure 1. Small vertical aquaponic system and figure 2. Small aquaponic in private area.

Aquaponic urban farming activities go hand in hand with programs of the agriculture service to continue to promote urban farming programs in various places. Moreover, Semarang City has been declared as one of the 100 resilient cities programs. The local government continues to encourage people who live in urban areas to utilize the narrow land around the house for urban farming. The pattern of
farming is beneficial because it can provide additional family income. One of the government's efforts to support these activities is to hold an urban farming environment competition [22].

3.1. Community motivation in urban farming through aquaponics
In conducting urban farming activities through aquaponics, each individual or group has a motivation. Motivation is an internal condition that arouses a person to action, encourages individuals to achieve specific goals, and keeps individuals interested in certain activities. Other meanings, motivation is an internal and external impulse in someone who is indicated by the existence, passion and interest, encouragement and needs, hopes and ideals, appreciation, and respect [23]. Motivation in the community to participate in group activities which are classified into 4 (four), namely egoism, altruism, collectivism, principlism [14]. See in table 1.

| Motive     | Ultimate Goal                          | Strength(s)                                      | Weakness(es)                                                                 |
|------------|----------------------------------------|--------------------------------------------------|------------------------------------------------------------------------------|
| Egoism     | Increase one’s welfare.                | Many forms; easily invoked; powerful.            | Increased community involvement relates to the motive only as an instrumental means or unintended consequence. |
| Altruism   | Increase the welfare of one or more other individuals. | Powerful; may generalize to group of which other is a member | May be limited to individuals for whom empathy is felt; increased community involvement relates to the motive only as an instrumental means or unintended consequence. |
| Collectivism | Increase the welfare of a group or collective. | Powerful; directly focused on the common good. | May be limited to the ingroup. |
| Principism | Uphold some moral principle (e.g., justice). | Directed toward universal and impartial good. | Often seems weak; vulnerable to rationalization. |

Source: [14]

3.1.1. There are less egoism and more altruism motives. For aquaponics participant, the egoism motive is not the main thing. The desire of individuals who are members of the aquaponic community is the existence of hobbies and habits in farming and the nature of the farmers, but limited land ownership. The interest of aquaponics farmers then developed into motivation to support the government's urban agriculture program as a goal to fulfill their hobbies and talents. This interest encourages farmers' motivation to get personal satisfaction in pursuing a hobby such as seeing green land that grows well around them. At some stage, aquaponic farmers have motivated altruism to participate in the urban agriculture program in Semarang. They provide fish and vegetable production for neighbours, in the form of fish and vegetables free of charge or sold at low prices. Communities with altruistic motives argue that the impact they feel is more beneficial. They can consume their agricultural products and get healthy food.

Local initiators play an essential role in aquaponic development because this urban farming model is technology transfer. There are various disciplines in this system, namely mechanics, biology, nitrification, and others. The desire to implement this technology became a strong initial motive for the community. They often didn't care about the cost of making aquaponics quite expensive, because they didn't expect money profits. Besides, there is a neighbourhood leader who has a motive for improving the quality of their settlement. The urban farming program provides funding for settlement development through competitions and environmental improvement programs. From the results of the forum group, the discussion indicates that aquaponic development cannot be alone, must work together with others. Togetherness through social media and regular meetings as part of the aquaponics community is very important to do. Urban agriculture with altruism motives at a particular stage can provide benefits to the
community, resulting in a reasonably big trend reaching more than eighty aquaponic farmers in 2018 in Semarang [15]. Aquaponics activities require collaboration with others. Every person who wants to have aquaponics, he must learn this system from people who are experts, one of which is the aquaponics community, as seen in figure 3, elaborated on the motivational process in altruism.

![Figure 3. The motivational process in altruism](image)

Figure 3. The motivational process in altruism

However, there are many problems faced by these farmers, which are related to the use of aquaponic technology. Another problem is the difficulty in breeding and aquaponic management costs, which are quite expensive. If they do not find a solution to this problem, then some of them will stop temporarily to do aquaponics. The results of field observations show that various obstacles have brought together aquaponic farmers to solve problems as a group. Groups are factors that have a physical and social order with characteristics that build and unite individuals [17]. The group struggles to survive and protect its existence. They take steps towards the inevitable risks of every living thing, such as separation, disintegration, and making efforts to grow and develop using their environmental opportunities. However, it is the same with living things and individuals; if some problems and risks cannot overcome with them, then discomfort, instability, and disruption can also occur in groups. Over time, this group can separate or join other groups or disappear.

According to [24], in group formation, several things underlie it, including (a) social interaction, (b) stable structure; (c) similarity of interests; and (d) see themselves as part of the group. Informing aquaponic groups, the stages described as follows:

a. Social interactions. One of the essential characteristics of the group is that more than two people do social interaction. In other words, group members must influence one another. Communication between individuals consists of verbal and nonverbal. Oral is an interaction such as conveying strategies to achieve targets and nonverbals such as smiles, gestures, and facial expressions that can have an impact on each other. Community interest in supporting urban farming through aquaponics has been primarily due to this process of social interaction.

b. Stable structure. In theory, groups must have a stable structure even though reactions in groups can change. A stable relationship within the group is needed to keep the group more harmonious and function optimally as a whole. Therefore, the aquaponics community formed The Aquaponic Farmers Group organization. In it, there is a clear division of tasks to carry out activities to support urban farming.
c. The similarity of interests. The similarity of interest in a group is one of the characteristics of the group. Equality of interest has a sustainable impact because group members will be more integrated and provide discussion in the group.

d. Look at themselves as part of a group. The group consists of several people who are aware that they are part of a community and can distinguish themselves from people outside the group. The character possessed by members of this group can form responsibilities within group members and will have an impact on organizational behaviour.

Besides, this aquaponic community has several types of groups, namely formal and informal. Kinds of groups are seen from how groups develop, hierarchies and tasks, and relationships between group members. Legal groups formed with the goals and tasks that bind members to achieve essential goals. While informal solely develop groups to provide solutions to problems. Formal groups work together with various institutions and other legal parties; the form of this official aquaponic group is a cooperative business entity.

3.1.2. Collectivism motives are characteristic of the aquaponics community. The obstacles faced affecting the behaviour of the aquaponic community. Most stopped temporarily, but there is a small portion of aquaponic activists to continue supporting urban agriculture. Related parties such as the agriculture service, universities, and other associated services still provide support for active farmers such as seed assistance, aquaponic equipment support. The basis of collective and principles motivation causes the community to set aside obstacles and minimal profits from urban farming activities through aquaponics. The existence of the moral tenets and togetherness between members, creating these aquaponics activities, still survives. For those who only have egoism motives, such as an interest in aquaponics to find just profit, their aquaponics activities no longer last.

For new participants to become members of the aquaponic community, they will take part in pre-basic training activities and workshops. Prospective participants must attend basic training and aquaponic production workshops. As for the next, they will learn together through social media and regular meetings with the term 'Chat with the Aquaponic Communities'. The process of collectivity in the aquaponic community can be seen in Figure 4.

![Figure 4. The process of collectivity in the aquaponic community (Analysis, 2019)](image)

The participation of individuals in the aquaponic community can be explained by reasons, namely: (a) Fulfilling hobby interests for farming, (b) get a sense of security in joining the group, so that aquaponic problems can have a solution, (c) meeting social needs; and (d) increase self-confidence. Fulfilment of interests among members by uniting in groups can share interests and hobbies and help
one another in achieving common goals. Getting a sense of security in participating in groups is manifested in how members protect one another from conflicts outside the group. The next reason is to meet the social needs that realised in becoming active members who help other members in meeting aquaponics needs with other members. The last reason is to increase self-confidence on aquaponics. As seen in tabel 1. Four Motives for Community Involvement, hence collectivism is characteristic of aquaponics activities to support urban farming.

3.2. Dynamics of community-based aquaponics

At the beginning of the aquaponics activities, there was a central figure who ran this system. Within a few months, many people were interested in learning and having aquaponics. Then formed an aquaponic community to support urban farming activities. Because government funding and other parties support this activity. So there are various dynamics in the management of aquaponics by this community. An understanding of group dynamics in the aquaponic community is to find out how to deal with a group's problems. Failure to see group dynamics can lead to unproductive group meetings and member disharmony. Group dynamics according to [25], are divided into 5 five fundamental concepts that can be seen to overcome group failures, namely (a) communication processes and interaction patterns; (b) interpersonal interest and cohesion; (c) social interference and influence; (d) power and control; and (e) the culture described as follows:

The communication process and interaction patterns are fundamental group dynamics and components of social interaction that affect the behaviour and attitudes of group members. Communication includes verbal, nonverbal or virtual. Verbal communication occurs in groups that meet directly, whereas virtual communication occurs in-group members who communicate via mobile phones or through social media. This virtual communication called one-way communication, where the sender only respond after the message has been sent. Verbal communication is done by conducting aquaponics training in community groups after registering for a practice. After getting aquaponics understanding, then they develop in their public or private area since 2016. However, there are aquaponics owners who don't participate in the training, so they don't understand the technology. As seen in table 2, the dynamic of community-based aquaponics in Semarang.

Table 2. The dynamic of community-based aquaponics

| Participant understanding                                                                 | Participation in training | Aquaponics condition                                      | Aquaponic community relation                 | Aquaponic existence                      |
|------------------------------------------------------------------------------------------|----------------------------|------------------------------------------------------------|---------------------------------------------|------------------------------------------|
| Understand the system and know how to care for aquaponics                                | Participated in training and active | Use the principles of the aquaponic system correctly       | Actively involved with the aquaponic community | Still running                            |
| Lack of understanding of the system, but also participate in aquaponics                   | Less participation          | Simple water circulation in aquaponics device              | Rarely communicate                          | Still running, but not following the principles of the aquaponic system |
| Understanding of the system, and had an aquaponic                                        | Participated in training and was active | Had used the principles of the aquaponic system correctly | Had involved, but broke away from the community | Stop running aquaponic                    |
| Lack of understanding of the system, despite having had an aquaponics                     | Less participation          | Simple water circulation in aquaponics device              | Having a relationship, but limited to purchasing an aquaponic device | Aquaponic paused while repairing the system |

Table 2 shows that many participants have to understand the system and know how to care for aquaponics, but some other participants did not understand this system. Aquaponics learning community always active on social media; this forms new knowledge about urban farming. Every aquaponics communicator, they send a message that has meaning for changing the perspective of agriculture and raising fish. Current champions read and understand the meaning of the word carefully. In a face-to-face meeting, aquaponic members always communicate, even if they do not communicate verbally.
nonverbal behaviour can be observed to find out the message delivered. In contrast, verbal messages from mobile and virtual groups have essential implications for aquaponics. It happens at various levels, both central and regional, thus creating an individual or interest group aquaponics.

In theory, the most effective way of group communication to ensure that the recipient understands the meaning of the sender is for the recipient to provide feedback about the sense that he understands. Group members can give several questions to emphasise the intended purpose to prevent distortion in communication. Toseland and Rivas (2001) in [25] argues that useful feedback must (i) describe the content of communication as felt by members; (ii) immediately sent to members who send messages after the message received; and (iii) expressed tentatively so that it is clear that feedback is intended to clarify the original message rather than confront or attack the sender. For aquaponics, discussion in social media is a significant activity, to increase their understanding.

The pattern of interaction is also a fundamental group dynamics process. Some common trends of cooperation include the main pillar, where the aquaponic leader is the central figure, and most of the communication takes place from member to leader to member. Interaction patterns are influenced by the tendency of members to communicate. Some members are friendlier than others and bring more opportunities to interact so that the aquaponics community can running well.

Interaction patterns are influenced by verbal and nonverbal cues such as comments, eye contact, and other expressions. The status and power relations in this aquaponic community also influence patterns of interaction. Members with higher status tend to communicate more than members of lower rank. Interpersonal attraction and emotional bonds that form between members also affect patterns of interaction. For example, members of subgroups tend to interact more with each other than with other group members. Group size also affects interactions. The smaller the group, the more opportunities each member has to communicate. Physical arrangements can also have an essential impact on patterns of interaction. The most important thing for the aquaponic community is to have several members who take the role of facilitators to complete tasks and other members who take parts that meet the social-emotional needs of members. Thus the members who guard the group on duty are empathetic, and some help the group develop positively. Although not all members can running as expected.

4. Conclusion

Regarding the discussion above, especially the motives and dynamics of community-based aquaponics for urban farming in Semarang, the outcome as follows: Community-based aquaponics plays a role in supporting urban farming activities. The members collaborate based on abilities and capacities in aquaponic development with social learning. So that their motives that can survive are altruism and collectivism, this motivation is the character of an aquaponic participant. In the aquaponics development process, there are differences in knowledge and understanding among the participants, which is due to group dynamics. Most of them feel comfortable and continue their activities. However, some members lack knowledge of the aquaponic system, and their device stops running temporarily.

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