

# “Connecting and Going Together” - The Broker Roles of Community Network for Carbon Emission Reduction in Khon Kaen City, Thailand

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**Abstract:** *The objective of this research was to study the roles of the broker of community network for carbon **emission** reduction in Khon Kaen city, Thailand. Data were collected via in-depth interviews as well as by participatory and non-participatory observations with 24 key informants who were the community heads and members from 4 communities in Khon Kaen city. Data analyses were content analysis with ATLAS.ti program and social network analyzed by UCI-net program. The results of the study indicated that the major role of the broker of community network is linked the network together by function of waste management committee. There are three types of broker role in theses network; One-broker, Dual- broker, and no broker in full network.*

**Keywords:** carbon emission reduction, community network, social network, broker

## INTRODUCTION

Today, various countries of the world give precedence to solve the climate change problem which as a result of global warming [1]. The “Paris Agreement” is the starting point to hold the increase in the global average temperature to well below 2 °C above pre-industrial levels [2]. The increase in the global averaged temperature since the mid-20th century results from the increase in anthropogenic greenhouse gas concentrations [3]. In 2014 more people lived in urban areas than in rural areas, with 54% of the world’s population and will be 66% in 2050 [2]. In the energy sector that is the highest proportion of all carbon emission sectors, urban area release carbon 71-76% of global carbon emission [4]. We can conclude that the first priority solution for solving climate change is carbon emission reduction in urban areas.

On the way of trends, the low carbon city is an area base management to meet the target of city carbon emission reduction. There are three solutions for low carbon city driving, technology development, infrastructure investment, and lifestyle change [5]. The lifestyle change is the significance solution for low carbon city driving at present and future [6]. There are two main solutions for low carbon city driving, technical solution and lifestyle change solution. The first depends on science or technology knowledge and high budget and also relate to many stakeholders. But the second does not depend on knowledge and budget like the first or depend on only a few budgets moreover, it can proceed immediately [7].

The almost all activities in human’s everyday life concern to carbon emission more or less so that the individual behavior changing can reduce carbon emission. Even though human’s everyday life is dominated by consumerism cause of individual losing but this dominance is not complete. A human has the potential and strategy that scrambles the benefits from structure of social [8]. Therefore, human can

change carbon emission behavior in their everyday life and these changes will be the significance solution for low carbon city driving at present and future.

One of means for develop the carbon emission behavior in everyday life of the people is collaborative action in form of networking. The social network is the one of major concept for urban study. It use to focus in individual behavior [9][10], but now extended to study group of urban people as community network. Also, the growth urban in the Northeast of Thailand, "Isan", such as Khon Kaen city.

Khon Kaen is a center of commercial, investment, and transport in the Northeastern of Thailand where are the part of Greater Mekong Sub-region. It is determined to be a MICE city and ICT city so that economic growth and population in urban areas are more and more. Besides the goal of the Khon Kaen Municipality in their master plan (2015-2018 and 2018-2021) is a low carbon city [11]. One of their main solutions is promoting citizen to improve their knowledge how to reduce carbon emission. They expect that when citizen gain the knowledge, they will change their behavior in everyday life to reduce carbon emission.

The carbon emission reduction network of each group may like or different, it depends on their context. Thence, if we understand the carbon emission reduction network and the factors that influence the carbon emission reduction network strengthening these will be an important tool for Isan Urban as Khon Kaen Municipality policy maker to drive the city to be a low carbon city.

From the reasonable above lead us to solve the research's questions as *"How to develop the strengthen community network for carbon emission reduction in Thai-Isan Urban?"* However, this article is the first phase result of the research project with the objective was to study the roles of the broker of community network for carbon emission reduction in Khon Kaen city, Thailand.

## **THE THEORETICAL FRAMEWORK**

In order to understand social network relationships of Isan urban community, it was necessary to apply an appropriate concept, i.e., the social network concept, which has an assumption that the social network consists of persons or actors who are related with one another according to the roles or functions of each individual or partners. Each person does not take only one role but many in the daily life. The relation among people in the social network may follow the Exchange Theory because a person does not only act according to his role, expected social function or according to the transferred standard; but relation among individuals also depends on perception and decision for exchange between the pair [12][13][14][15][16].

It can be said that the social network concept focuses on the presence of social relation web among individuals which extends and covers all of the society. The analysis of social network in terms of sociology, on the contrary, focuses on social relation among individuals in the social network, to see if and how this influences the behaviors expressed to others. The patterns and characteristics of the social network must be used to explain an individual's behaviors. In this respect, Wasserman and Faust [14] applied the concept of Boissevain [12] to develop the framework for studying and analyzing the social network by dividing into 4 dimensions as follows [13][14]:

The first dimension is the roles of social network members. They are the factors behind multiplicity of relations, which can be explained by the Role Theory. A social network consists of individuals who have relationships with one another according to their roles or functions. Each person does not have only one role but many roles to act each day. Therefore, two persons can have relationships both in one role or many roles, which can be referred to as Uniplex or Single-Relation and Multiplex or Multi-Relation, respectively. The role of each case will have the norms or expectation as the lead for behaviors acted towards one another.

The basis of relationships in the social network was considered to be the second dimension. This usually was hidden in the Exchange Theory. It was believed that social relation among individuals in the social network is based on the Benefit Exchange or Transactional Contact. An individual does not act his role or does according to the norm being transferred to him, but the relation also depends on perception and decision to exchange between the related pair in terms of materials such as money and things, of the mind such as assistance that brings about indebtedness to be returned in the future, or personal admiration and respect. The person would decide what to select, what behavior, what to exchange with the other through consideration of appropriateness and satisfaction obtained from the exchange.

The third dimension is the directional flow. It was the factor causing social relation which could have equal and unequal characteristics since social relationship among individuals on the exchange basis can result in cooperative and competitive relationship and bring about balance reciprocity as well as negative

reciprocity. Here, it means obtaining benefits from each other both equally and unequally with one party obtaining more than the other.

Finally, the frequency and duration of relationship was the factor leading to quality of relation, especially the attachment and influence on one another in terms of behaviors. In other words, when a person is frequently related to the other and the duration of relation is long, then the relation between the two will influence and establish the behaviors between each other owing to a lot of attachments. However, frequency of relation is not only sufficient to predict the influence of personal relation or individual relation. There must be the factors of time and roles of relation, too.

According to thesis statements above, a concept of social network is implemented in this paper as a framework to investigate the pattern of community network for carbon emission reduction in Thai-Isan Urban. The form of relationship within social network, and embed within the network until it becomes the pattern of community network for carbon emission reduction, which is mentioned in the following chapter. Moreover, social network can be considered as another type of collaboration among people within the network, and it is useful to analyze behavior of people. Social network is a social phenomenon that expresses social relations among individuals [17].

## RESEARCH METHODOLOGY

The study applied qualitative methodological approach to investigate the pattern of community network for carbon emission reduction in Thai-Isan Urban as Khon Kaen city. Key informants consisted of twenty four community heads and members from 4 communities in Khon Kaen city; Non Nong Wat, Bann Bakhm, Karn Keha Khon Kaen and Bann Hua Tanon. The community heads and members in each community were selected by purposive sampling technique.

For data collection, the study applied in-depth interview with interview guideline to collect field data from the key informants in community mentioned above. Participatory observation and non-participatory observation were also applied to the study to observe characteristics and scopes of relationship with the networks, elements of the social phenomenon, and behavior of individuals [17]. We conducted interviews in research sites as mentioned earlier, and observed general contexts surrounding the targeted key informants in order to obtain more information. In addition, we used field note, voice recording, and camera to collect the data with permission from key informants and related stakeholders. In case the permission was denied, field note would be used instead. Data from the interview and the observation would be categorized and edited every day in order to update the data completely.

Regarding validity and reliability of qualitative data in this study, triangulation method was introduced. Data was collected from different sources among four research sites. Validity and reliability of data was cross-checked several times in each day. Questions on the interview guideline were asked at different times, and questions would be updated all the time in order to meet interviewee's manners. In addition, data was checked by traceability method with the interviewed farmers to prevent data discrepancies, and to ensure that the data was reliable [18].

Data was updated every day in order to check the completion of data. Later on, data was categorized by topics investigated. Data was comparative analyzed and constructed the summary. Data from in-depth interview was arranged by the transcription of audio recordings and the field note editing. Then, data was typed with Microsoft Word Program, and was prepared for qualitative analysis by the ATLAS.ti program. We then assigned quotations, coding, categorizing, and networking data. Once the data was ready for analysis, content analysis method was implemented to interpret data to find relationships and patterns within social phenomena in order to construct the inductive conclusions [17].

Finally, we applied simple social network analysis method by the UCI-net program, and construct the virtual network modeling through the program code directly [15]. Data analysis began with the matching of relationships among key informants, and then ran a program to display the relationship. In addition, the social network scenario was displayed via the Netdraw Program. Analytical description was used for data presentation together with diagrams and photos in order to make a clear presentation.

## IMPLEMENTING COMMUNITY NETWORK INTO THE LOW CARBON CITY OF KHON KAEN CITY

Khon Kaen city established in 1797, or estimated 200 years ago. Khon Kaen city was established by a Laotain leader, named Pea Mueng Pan ("Pea" represented a governing position in the ancient Lao kingdom). Pea Mueng Pan and his people about 330 people moved from Ban Chee Loan (currently located in At-Samat district, Roi-Et province) to Khon Kaen city. In 2442, they had a second movement and settled

community at the north of Kaen Nakorn pond, where located in Khon Kaen city at present. Khon Kaen city nowadays is a major city of northeastern region of Thailand. The city is the fifteenth largest city of Thailand by area, and it is the fourth populated city of Thailand. In addition, Khon Kaen have a Gross Domestic Product (GDP) of 145,275 million Baht, which is the city with the second highest GDP in northeastern Thailand [19].

The rapid growth of Khon Kaen city has been caused by many factors. For instance, the city is a hub of finance and banking in northeastern region. The city also is an education hub of northeastern region especially Khon Kaen University, where is the biggest university in northeastern region. These factors boost rapid growth to Khon Kaen city. The city currently has become center of transportation, industrial sector, healthcare, and administration of the region. Moreover, the city located on a strategic area where Mittaphab Road (a main route of northeastern region) and the East-West Economic Corridor (EWEC) where connects Indo-China region, cross to each other. This advantage is a highly focus and includes in the Strategic Development and International Cooperation Projects such as the Greater Mekong Sub-region (GMS) and the Ayeyawady-Chao Phraya-Mekong Economic Cooperation Strategy (ACMECS). Due to those positive factors, it contributes rapid expansion to the city, and the city is expanding align with Mittraphap Road and other main roads of Khon Kaen city such as Maliwan Road, Srichan Road, and Khon Kaen - Yangtalad Road [20].



**Fig 1:** Location of Khon Kaen city

At present, Khon Kaen city has focused increasingly on the reduction of carbon emissions. Khon Kaen Municipality Office and other 25 organizations in the city have launched programs on the low carbon city including 1) Khon Kaen : Low Carbon City, and 2) Zero Waste Office. These programs are operated through sustainable urban development scheme in line with provincial strategic development plans such as strategy of non-polluted society, strategy of energy saving society, and the green society strategy [21]. This reflects that Khon Kaen city and city stakeholders is committed to become a low-carbon city with a variety of supporting strategies, authority decentralization to local community, and community participation in form of "community network"

Based on data collected from 24 key informants in four communities of Khon Kaen Municipality, community networks represented in forms of community committees and village health volunteers. In general, those two groups shared the same members and worked under supervision from governmental agency, which was Khon Kaen Municipality Office. In 2015, however, Khon Kaen Municipality Office decentralized its authority on waste management and environment to local community under the strategy "Small municipality under the big municipality". The strategy convinced communities in Khon Kaen city to have more roles in environmental management. Therefore, community networks were constructed with an efficiency of environmental management, and the networks contributed significantly to the reduction of carbon emission in community through several activities of community network.

Although the programs of "Khon Kaen: Low Carbon City" and "Zero Waste Office" had initiated by Khon Kaen Municipality Office, the programs were rarely to be success without participation of people in community especially since the authority decentralization. According to a study in four communities, it was found that all the communities had problem on too much waste. Waste disposal, by Khon Kaen Municipality Office, was not effective enough to get rid of waste at all communities, and it resulted in

waste pollution in communities. Moreover, communities had to pay an expense on waste disposal to Khon Kaen Municipality Office a lot. In 2013, situation of waste disposal in Khon Kaen city was more serious when villagers who lived in Kham Bon village, where Khon Kaen Municipality Office used as the landfill of waste disposal, started protesting because they did not want to receive waste from Khon Kaen city anymore. The landfill was closed for two weeks, and it resulted in community in Khon Kaen city had a huge waste awaiting for disposal. Moreover, it was reported that there were no waste separations within households. Organic waste was mixed with other kinds of waste, and it produced waste pollution disturbing people in community.

Communities, therefore, were increasingly aware of waste management in community. Many communities, represented as community network, applied those two programs as a pilot to initiate waste management activities under financial support and training from Khon Kaen Municipality Office and the Khon Kaen Environmental Office. Background of the activity was told by *Mr. Kritpas*, the community leader, as quotation below.

*"In 2013, the high-ranked municipal administrators began to pay attention to waste problem because the municipality paid a lot for waste disposal expense. Therefore, they started the training program on waste separation, and provided the program to communities in the city. The Khon Kaen Environmental officers were responsible to train us by firstly started with community committee and then extended to the village health volunteers"* (interviewed on August 15, 2018)

Waste management programs in each community had different patterns and methods depended on community network's decision and agreement. However, at least three main activities were included.

(1) Household waste separation; this activity was considered as the most difficult activity of community network, since the activity was an attempt to change behavior of people in community. Some households might not concern about waste separation because they did not want to have any difficulties on waste separation, or they were not aware of waste separation. The community network worked hard on this issue at the beginning stage of activity. The village health volunteers spent much time to provide knowledge on waste separation to all the households in four communities. However, only one third of the households decided initiating waste separation as a statement below from *Ms. Ura*, leader of Karn Keha Khon Kaen community.

*"The activity at early stage was quite difficult because people did not expect to succeed the activity. Someone thought that only paid the waste disposal fee for 10-20 THB per month to Khon Kaen Municipality Office was enough to get rid of waste from their houses. It was hard for the village health volunteers to convince people concerning this issue and started separating waste in households"* (interview on August 15, 2018)

The activity was not easy to succeed because only a few households were aware of waste separation. Therefore, the community network tried to find ways to motivate the households to focus on waste separation. All the four communities used a same way by showing an example of waste separation to the households. For instance, Bann Hua Tanon community assigned responsibility to a village health volunteer to manage waste in public areas. Each volunteer covered 15 households in community. The volunteers started asking collaboration from households to separate waste. The community network would support a garbage bag to all households, and then the volunteers brought all the garbage bags to the disposal site in community. While Bann Bakhom community and Non Nongwat community had volunteers to collect waste in community. The volunteers collected the household waste and separated waste every day until the community members realized on an advantage of waste separation. When many households saw advantage, they turned themselves to start waste separation as the volunteers did.

(2) Organic waste disposal; in the past, communities disposed organic waste by putting in the garbage bag and waited the Khon Kaen Municipality Office for disposal, or they burned waste in house area so that it caused pollution in community especially smoke or dust pollution. When smoke or dust flow to water source, people in community could not use water for household consumption. However, after the success of household waste separation, the success contributed more convenient to the community network in order to run waste disposal activity. It was to say that they were able to identify types of waste. They knew which type had to dispose out of community and which type could be recycled or used for value added. The community realized that organic waste were able to utilize as the bio-fertilizer. Therefore, all the communities asked their community members for a help in separating organic waste. The households or community networks would put organic wastes in the "organic waste stall" they provided. The stalls were mostly made by bamboo. The bottom layer was used for organic waste, such as

food, while the top layer of the stall was used for dry waste such as leaf. This method prevented stinky smell and the fly, which might be a carrier of disease.

When organic waste was stalled, the community network processed organic waste as fertilizer in both liquid form and solid form, and gave to the households to use in their farms. Some communities, such as Non Nongwat community, had an effective production until they were able to produce commercially as a below statement from *Mr.Jaroon*, community leader of Non Nongwat community.

*"My colleagues and I picked the waste up every day. Each households helped us separating waste. Waste such as foods, fruits, or vegetables from the market were brought to our stalls as well. We processed the waste into fertilizers and liquid compost. I firstly used at my farm, or gave fertilizers to the households in community. When we had a lot of production, we decided doing commercially. We contained it into bottles and sold. Now it becomes community product"* (interviewed on August 17, 2018)

(3) Waste banking; the activity was a part of the Khon Kaen: Low Carbon City program, initiated by Khon Kaen Municipality Office. Later on, the program was sent to all 95 communities in Khon Kaen Municipality under supervision from governmental agencies. At present, President of the program is *Mr.Jaroon*, Non Nongwat community leader. Secretary is *Ms.Ura*, Karn Keha Khon Kaen community leader, and registration officer is *Ms.Toy*, Bann Bakham community leader

Brief concept of the activity was that each community sent invitation to all the households to sell their recycle waste to the program. Then, the program sold all the recycled waste to waste disposal operators. Households would have accumulated saving accounts from the sale of the waste on a regular basis for 6 months. When the money was accumulated up to 300 Baht, they were able to withdraw the money. In case member of the household died, the program would give a funeral fee of 2,000 Baht, deducted from the account. It is possible to increase the cremation fee if there are more project members in the future. This concept was a good choice to motivate households attending the program. Households would separate waste, and took recycled waste to the community network on monthly basis in order to generate household income. It was beneficial to all the households, and it was better to attend the program than leaving waste without any benefits. *Ms.Banyen*, a member of Karn Keha Khon Kaen community, stated as below.

*"At first, they were not interested in the program. When we applied the funeral fee to the program, many households started separating waste and sold to us. They would not get the money at time, but the money would be accumulated as the saving account. Moreover, I thought it was an additional income. If someone in the households died, we still had 2,000 Baht to manage the funeral"* (interviewed September 5, 2018)

Besides those three waste management activities, four community networks in Khon Kaen city also had activities that contributed reduction of carbon emissions in urban area. It was not quite successful. However, it was a beginning step to become low carbon city. For instance, the campaign to save energy by turning off air conditioner at least one hour per day, run by Bann Bakham community, the campaign to clean the public road at Karn Keha Khon Kaen community, and the campaign to stop using plastic bag in which the activity operated by Khon Kaen urban community network. This activity received a positive feedback from major markets in Khon Kaen city.

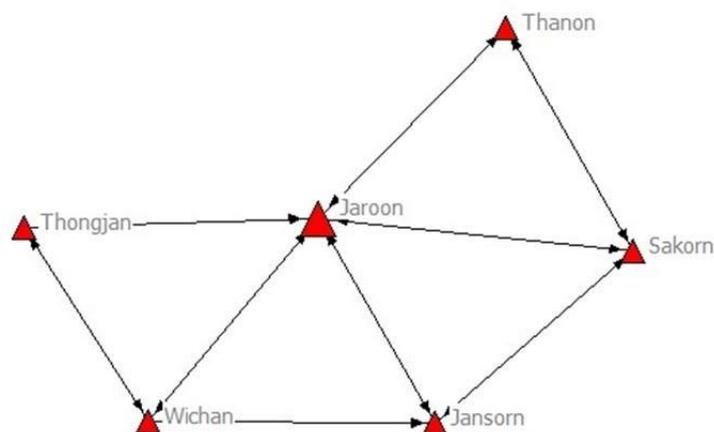
Based on the overall success of carbon emission reduction in urban areas which operated by, researchers analyzed patterns of community network by considering contexts in each community. Contexts of community included roles of member in the network, particularly exchanging relationship, frequency and duration of interaction, and direction of relationship, that were effective to contribute those three community networks to become a pioneer of the low carbon community in Khon Kaen city.

## THE ROLES OF THE BROKER OF COMMUNITY NETWORKS

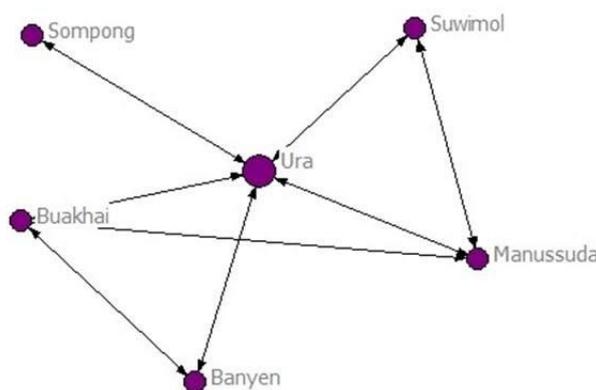
Considering all four community networks, the study analyzed the network members who played major roles in the community network. Each network has six members, which is a proper size for social network analysis in terms of working and decision-making [22]. Researchers implemented center of network in the study in order to identify patterns of community network for carbon emission reduction in urban areas. The results identified 3 roles of the community network center included (1) One-broker, (2) Dual- broker, and (3) No broker in full network. Details of each roles are as follows.

(1) *One-Broker*; is the community network with one centered-individual who linked social network in community. This pattern of community network was found in Non Nongwat community and Karn Keha

Khon Kaen community. Model of those two community networks were presented as in figure 2 and 3 respectively.



**Fig 2:** model of Non Nongwat community network



**Fig 3:** model of Karn Keha Khon Kaen community network

Considering both community networks, the center of Non Nongwat community network was *Jaroon*, and the center of Karn Keha Khon Kaen community network was *Ura* respectively. When considered relationship pair between centered persons and their network members, both of them interacted closely with all members within the network. Considering the role within the network, found that they were community leaders who had an outstanding role in implementing low carbon emission activities in community especially the Low Carbon City program and the Zero Waste Office program. In 2018, the two communities qualified to the final round of the national waste-free community competition, which sponsored by the Ministry of Natural Resources and Environment. Both communities won the prizes. Non Nongwat community won the 1st runner up of the big-size community category, and Karn Keha Khon Kaen community won the 1st runner up of the medium size community category.

Regarding the benefit exchanges within both community networks, the benefit exchanges were different. The network members in both communities exchanged benefits through the waste bank activity. All members of the network were committees of the community waste bank, and they got paid for the waste bank activity in monthly basis. Although they got few amount of payment, they had benefits of being a committee in which it was a social privilege in the community. This privilege represented their attempts to help the community becoming a waste-free community that won the national competition. However, researchers found the differences between the two communities in terms of benefit exchange. Non Nongwat community had entrusted its members to maintain cleanliness on main road of the community, where also was a main road of Khon Kaen city. Three network members, *Wichan*, *Jansorn*, and *Sakorn*, got trust from *Jaroon* to take care of the road. Their roles were to keep cleanliness of the road and observed general incidents on the road. They received monthly payment from the Khon Kaen Municipality Office in accordance with a decentralization policy on "Small municipality in a

big municipality" which mentioned in the previous topic.

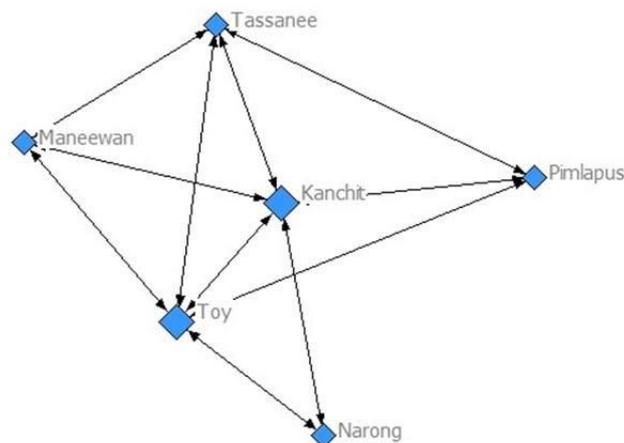
In terms of frequency and duration of relationship, although both urban communities were comprised of residents who came from many places, those residents had stayed in communities for a decade. They met each other and always participated in community, so relationship of network members was quite strong. These relationships of the network members were linked by the network center. Some members had to use the center to link relationship to other members. For instance, *Sompong*, the community philosopher of Karn Keha Khon Kaen community, who had close relationship and worked with *Ura*. When he wanted cooperation from other network members, he always asked *Ura* for a help. It was considered as the cut point of the network [14].

Regarding the direction flow of relationship, direction was clearly spread out from the center. Both *Jaroon* and *Ura* were leaders who commanded and asked the network members for cooperation, but they did not command the network by using priority of leader position. They used a relationship as "neighbors" or "siblings" in developing their communities. It was reflected by a statement of *Banyen*, a village health volunteer, as below.

*"We came from different places. It was difficult to find Khon Kaen born-people in our community. Since we have lived together, relationships were getting closer. When Ura volunteered to work as community leader and leader of the village health volunteer, we all agreed with her. We were happy to do things when Ura needed our help"* (interviewed on August 15, 2018)

Moreover, patterns of both community networks were performed as the density knit, since relationships between members in the network related to each other. At least 2 relationship pairs were presented between the center and the members (except a case of *Sompong*). This reflected the strength of the social network which correlated to the number of individual who had relationship to each other [13][14].

(2) *Dual--Broker* is a pattern of community network with two centered-persons who served as a link within social network. This pattern of community network was found in Ban Bakham community. Model of community network was presented as figure 4.



**Fig 4:** model of Ban Bakham community network

Considering pattern of community network, the center of network was *Toy*, who was community leader for more than 10 years, and *Kanchit*, who acted as the right-handed man of *Toy*. Considering the number of relationship pairs within the network, both the centered-persons had closely relationships with all the members in the network. They helped each other to run activities of the community. *Toy* was those who run the Zero Waste Office program. In addition, Ban Bakham community was a pilot community since 2013. The community was able to develop bio fuels from organic waste before they transferred technology to Khon Kaen Municipality Office in order to avoid any dangers from the production process within community.

Considering the benefit exchanges within community network, the exchanges were similar to Non Nongwat community and Karn Keha Khon Kaen community. The network members got benefits from the waste bank program. In addition, some network members, Narong and Tassanee, were assigned to oversee main road in community. They received monthly payment from the Khon Kaen Municipality Office as well.

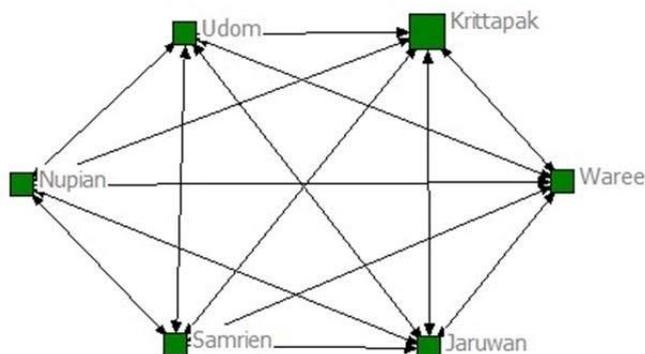
In terms of frequency and duration of relationship, Ban Bakham community was originally a suburban community, where people had rural lifestyle. When Khon Kaen city grew, urbanization invaded a community until it became an urban community. Community members were those who have lived for decades and the "new comer" who mostly were young students from various provinces, studying in Khon Kaen city. There are 24 student dormitories in community. Although they came from different places, they have stayed long enough until they had closely relationships to each other. They participated in community activity and worked together. It resulted in the relationships between community members were quite strong. It is noticed that members of this community network had more than 2 relationship pairs. *Kanchit* stated about this matter as below.

*"I came to this community as a son in law twenty years ago. I firstly worked alone, and Toy later invited me to work for community. I had a good feeling when I did something good to others....The people here were the elderly. They knew each other very well. The community committee here worked together for a long time. They never had a serious fight between them"* (interviewed on July 10, 2018)

The direction flow of relationships was performed as the distributing relationship. Both *Toy* and *Kanchit* worked together in the community. They asked for cooperation from community members by distributing orders or policies from governmental agencies to community members. At the same time, they allowed members of the community to provide suggestions or started activities that were useful for the community. This made a community improving. It is undeniable that those who played a major role in decision-making were *Toy* and *Kanchit* as a reflection from *Manewan* below.

*"... Normally Toy assigned roles to us when we had activity or community project. We trusted her because she had experiences in community activity. She made our community in peace and solidarity. Later, Kanchit came to support toy's work. So, works within community were more flexible and smooth"* (interviewed on July 10, 2018)

(3) *No broker in full network* is a community network without the network center because all the members have good relationships and solidarity. Hua Tanon community network was a community with full network. The community was a suburban community of Khon Kaen city, where had been widely recognized as a waste-free community. The community won the King Rama 9<sup>th</sup> national championship in 2015 which brought the most proud to people in community. Model of community network was as shown in Figure 5.



**Fig 5:** model of Hua Tanon community network

This pattern of community network assigned equally role to members in community network. All the members played important role in driving carbon emission reduction in urban areas especially the development of a waste-free community program until the community achieved at national level. Udom, the ex-community leader who worked along with *Krittapak*, a current leader, gave statement below.

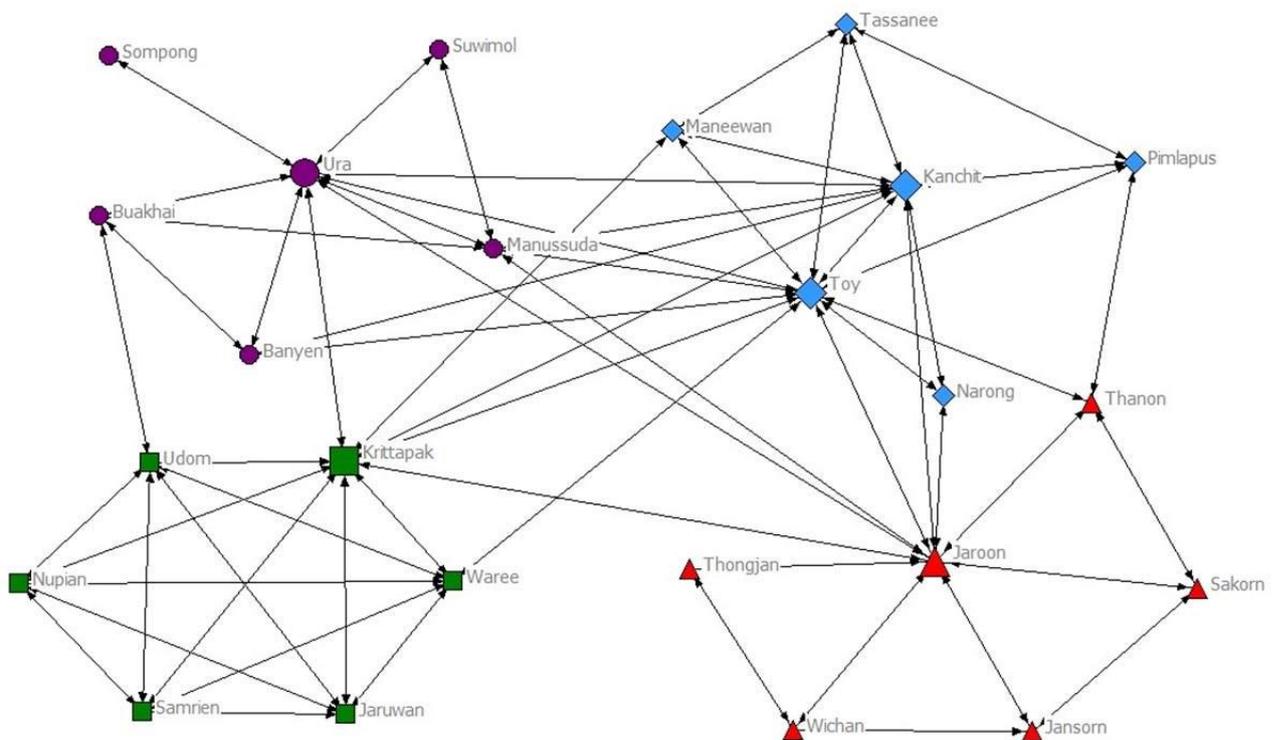
*"... We were working together like brothers. We all knew well about our roles and functions. When our tasks finished, we would help others. We did everything together..."*  
 (interviewed on July 18, 2018)

Considering the benefit exchanges within community network, the benefit exchanges were done through the waste bank program as same as other communities. Hua Tanon community developed the program, and they were able to develop a waste management learning center, funded by various agencies. The community became a learning source for those who interested over the country. On average, there were at least 20 visits per month from agencies over the country. This stimulated community members to be active and always welcomed guests. Community members also had chance to get small incomes from being a lecturer at the learning center and souvenirs. These incomes became a motivation for community members to work for community.

Considering frequency and duration of relationship, the community was a suburban community with those who have lived together for decades. So, they were very close friend. Community members worked together for a long time, and there were community activities every week. They also had to take care of visiting groups from over the country. This caused relationship of network members was very strong, it was noticed that all the network members had relationships to each other as a full network [13][14].

According to above pattern, direction flow of relationship of Hua Tanon community network was dynamic. Relationship was not depending on any community network members. *Krittapak* was those who represented as a community leader, and he did any actions based on the position he took.

In addition, when considering the connection among four community networks, it was found that the centers of the community network serve as a network connecting point, whether *Jaroon* of Non Nong Wat community network, *Ura* of Karn Keha Khon Kaen community, *Toy* and *Kanchit* of Ban Bakham community network, and *Krittapak* of Hua Tanon community network. Model of Khon Kaen urban community network is presented as in Figure 6.



**Fig 6:** model of Khon Kaen urban community network

## SUGGESTIONS

The result points out that the social network of the Thai-Isan communities is a key tool to carbon emission reduction in terms of recycles practices, waste management, and quality of life upgrading. The social network is also an important mechanism that provides benefits to community members through green environment and some benefit from activities. Therefore, if the Khon Kaen Municipality and other Thai government agencies apply functions of the social network to empower the social network of community through the supporting and decentralization, it will be opportunity to improve Thai-Isan Urban to carbon emission reduction. In addition, empowering social capitals through the social network is beneficial to urban people who can construct and extent the network to other community, and are able to live together in society sustainably.

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