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Effects of Urbanization, Climate Change and Vulnerability: A Case of Households in Khon Kaen Sub-Urban, Thailand

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***Abstract**: The purpose of this study is to understand the factors determining urbanisation, climate change vulnerability of household in Khon Kaen sub-urban. Primary data were collected by use of the interview schedule, we adopt a simple random sampling, a total of 240 samples selected respondents. The data collected were analysed using descriptive statistics, multivariate and multiple regression. We found that community emergency plan in response, economic response, number of farmlands, households without land, household income, and members have a positive associated with the vulnerability. Our model indicates that household vulnerability (R^2 = 0.249), accounts for approximately 24 percent of the model's predictive accuracy. This has significant implications for policies to future climate changes resulting from household vulnerability.*

***Keywords**: Urbanization, Climate change, Vulnerability, Sub-urban community, Thailand*

1. INTRODUCTION

With the past two recent decades, Thailand has been as a hotspot of urban growth in climate stressor and vulnerability areas in developing countries (Kaothien, 1991; Lebel et al., 2011). As previous scholars defined that transformation of rural extension, community growth and economic development have been a key factor in household vulnerability areas (Bennett et al., 2015; Beringer & Kaewsuk, 2018). Changing in residence and living area provided rapidly growing economies like Thailand has altered vulnerability to climate change in a sub-urban (Thanvisitthpon et al., 2018; Chamaratana et al., 2020). The urban growth has given a rise of modern cities leading to vulnerabilities of household in sub-urban community.

Urbanisation problems in Thailand's has been implemented of the 1st National Economic and Social Development Plan 1961–1966 (NESDP 1961–1966) in rapid industrial economic growth (Rimmer, 1995). It was clearly launched of the 5th NESDP 1979–1982 provides for national policy to urbanisation problem-solving such as city plan, industrial regulation and low-carbon city model. Economic growth areas have become the fastest-growing industry, real estate development and community its peak in recent decades, also becoming one of the biggest problems in Thailand. However, urbanisation can be one of the key contributors to rapid industrialisation and economic growth. At the same time, urban growth may impact on people in the lower urbanised community are more vulnerable, increased weather variability and lack of awareness on the environment (Nguyen & Nguyen, 2018).

The Khon Kaen city is located in the northeast region of Thailand in rapid growth of urbanisation. The rapid growth of the city has generated several causes, particularly the hub of finance and banking, which was a centre of regional economy and administration (Glassman & Sneddon, 2003). This city was designated as the targeted province in order to spread urbanization, trade and investment (Thongyou et al., 2014). The key factor drivers Khon Kaen's growth of urbanisation including industrial sector, real estate development, community-based and intensity of household. According to Glassman and Sneddon (2003) reports that the gross provincial product was 190,826 million Thai Baht, 38.77 percent of industrial sector and 14.29 percent of the agricultural sector.

The rapid growth of Khon Kaen sub-urban area has been driven economic growth, which was increasingly complicated of urbanisation problems. While urbanisation has grown, increasing vulnerability has caused a shift towards the climate change area. Previous studies have suggested that urbanisation is a complex interaction between people, vulnerability area, and resilience in the face of climate change (He et al., 2019; Williams et al., 2019). However, it has also been evidenced that the social-environmental fragmentation patterns and residential vulnerability to climate-related hazards (Krellenberg et al., 2017). In this context, vulnerability, urbanisation and climate change have been widely accepted as the results of a social-economic system, community extension and industrial sector that put household at risk (Li et al., 2016; Pandey et al., 2018).

Several theoretical frameworks have been proposed to examine the vulnerability to urbanisation (Bennett et al., 2015; Krellenberg et al., 2017; Beringer & Kaewsuk, 2018; He et al., 2019), but few studies investigate the effects of household levels. Evidence shows that economic growth policy should be affected on household vulnerability to climate change in urbanisation (Ge et al., 2017; Singh et al., 2017; Pandey et al., 2018). Household vulnerability is rational urban growth, but their ability to make effective management differs depending on the level of climate change impacts (Huong et al., 2019). Therefore, in our study examined the effect of vulnerability, urbanisation and climate change of household in Khon Kaen sub-

urban. This study, therefore estimated the effect of the different household vulnerability to climate change in an urbanisation.

2. LITERATURE REVIEW

Vulnerability

Lankao and Qin (2011) developed a fundamentally of the vulnerability concept as "the propensity and disposition to be adversely affected" to cope and adapt of sensitivity to global climate change. Earlier studies have considered the vulnerability as a function of sensitivity, adaptive capacity, Brooks et al. (2005), who defined "the degree to which a system is affected and a system's ability to adjust to climate change of national level. Some studies have determined the vulnerabilities to sub-urban area with specific domain of the climate stressors and potential receptors (Tapia et al., 2017). This research focused on impact chains such as heatwave, on human health, drought on water planning, flooding on the social-economic and urban fabric. The present studies examined the vulnerability is the complex of socio-ecological system, social inequalities, economics and politics to climate-related hazards at the city level (Krellenberg et al., 2017; Salas & Yepes, 2018; Dong et al., 2020).

Vulnerability on climate change literature, Otto et al. (2017) defined four vulnerability dimensions: health, safety, food security, and displacement at community level. For example, urban community studies show that vulnerability can cause significant social and cultural shifts through economic and social conditions in complex networks (Wei et al., 2018; Wen & Deng, 2020). Previous scholars have conducted two-factor: vulnerability as outcome (e.g. social, cultural, institutional and economic structures) and contextual vulnerability (e.g. natural system, environmental, physical and global warming) (Otto et al., 2017; Beringer & Kaewsuk, 2018; Salas & Yepes, 2018; Monno & Serreli, 2020). Our study focused on vulnerability as the outcome of a key dimension of household in sub-urban areas, the crack in the current conceptual framework existing with research (Füssel, 2007; Schmidtlein et al., 2008; Ionescu et al., 2009).

Urbanization

The concept of urbanization can be considered a relevant of economic, political and geographic connection (Zhang & Zhao, 1998). Urbanization views "modern" of social transformation is a complex matter, the well-known debate between structuralist and functionalist approaches towards economic growth. Originally, Osborn (1965), who developed urban sprawl based on single-use development around the periphery of a city. The current studies have defined unplanned beyond the urban fringe, peri-urban interface and geographic connection with new city-based and land-centred urban transformation (Lin, 2007; Schmid et al., 2018). At the same time, some scholars have defined the concept of urbanisation expresses

a new quality of the urban process as the cores and periphery (Cobbinah et al., 2015; Imai et al., 2017).

As rapid urbanisation lead to increase household attainment, a phenomenon associated with many parameters: household size, changing community, new housing and public facilities (Wu & Zheng, 2018). As sub-urban area evolves from low to middle-stage development, community extension, economic growth, which were shifted from an industrial sector to a service economy (Fremstad et al., 2018). Zhang and Hassen (2017) argued that the hypothesis that the relationship between urbanisation and household are homogenous for all countries may be unreasonable. In term of household-level analysis, the present focuses on a positive relationship between urbanisation and household effect on vulnerability in in north-east Thailand (Nansaior et al., 2011; Beringer & Kaewsuk, 2018).

Climate Change

The concept of climate change in the literature on disruptive effects on human society, particularly in economic, cultural atmosphere and sub-urban growth (Gu et al., 2011). The growth of sub-urban area has increasingly drawn the scientific community's attention to household and community (Chapman et al., 2017). According to the Intergovernmental Panel on Climate Change (2001), who defined climate change: adoption (e.g. natural resources, weather and variability) and human ecology (e.g. hazard, risk, and vulnerability). Some scholars defined that climate change based on the economic sources of vulnerability, natural disaster and hazard management driven urbanisation (Henderson et al., 2017).

While our study focused on the impact of urban climate change, the spectre of household resilience seeks to diminish through its "response" and "adaptive" in sub-urban area. Glassman and Sneddon (2003) argue that unfavourable community growth, economic extension, and sub-urban area in Khon Kaen city is highly uncertain, further driving future climate change. Lebel et al. (2011) suggest that climate change in Thailand is technical elites, single-level, concentration of community capacity, and unfold crisis management. Our study focused on climate change in sub-urban centred on its "sample human ecology model that assumes household, purposeful adoption" to prevent adjustment for reducing damages (Intergovernmental Panel on Climate Change, 2001). This emphasis on household solutions to minimize losses seeks to preserve the existing "resilience adaptation" of urban climate change (Tyler & Moench, 2012).

3. METHODS

Study Sites, Participants and Procedures

The study uses a quantitative approach, the data set that household vulnerability in Khon Kaen sub-urban, Thailand. The study located in the three sub-urban community, including Ban Lao Kwian Hak village, Ban Thum subdistrict, Ban Bueng Niam village. The areas generally

have residents with relatively low-incomes, risk in agricultural production and farmland sensitive to climate warming. Because of the large area is rapidly growing in sub-urban growth at the community level, socio-economic and infrastructure change. Moreover, the location of sub-urban community has received directly impacts from urbanization, climate change risk, flooding and drought in the Khon Kaen city.

Unit of Analysis

The population data we used to conduct in household levels, we located in sub-urban community in the Khon Kaen city. These households were impacted of urbanisation, economic growth and climate change resilience. Our random sample of 619 households (311 households in Ban Lao Kwian Hak and 308 households in Ban Bueng Niam village). We calculate our sample size from Krejcie and Morgan's equation with 95% confidence level (Krejcie & Morgan, 1970) as follows the equation:

$$\square = \frac{\square^2 \mathrm{Np}(1-\square)}{\square^2(\square-1)+\mathrm{x}^2\square(1-\square)}$$

Number represented in equation:

$$\square = \frac{3.841\square\ 619(0.5)(1-0.5)}{0.05(0.05)(619-1)+3.841\square 0.5(1-0.5)}$$

$$\square = \frac{594.395}{2.50525}$$

$$\square = 237.260$$

A total sample size was 240 households

Sampling and Instruments

We used a simple random sampling, the approach focused on community leaders in Khon Kaen sub-urban city. The interview schedules based on probability proportionate to size, of 240 households (120 in three communities). The households are representative of the community levels as well as in sub-urban area. Our interview scheduled to contain a set of question related to household characteristics, socio-economic conditions, urbanization and climate change resilience and vulnerability. To ensure the validity of interviews scheduled, we selected three professional experts on household vulnerability to evaluate the pilots of the item in the development stage.

Measures

Independent Variable

All items of independent variables were assessed on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). We measured the household characteristics (e.g. including sex, relationship with the household head, and education). The socio-economic factors were assessed using the main occupation of household members, income, migration, the number of household members, the number of labour-age household member, number of dependent household members, residential ownership, and land ownership. The study measured the urbanization and climate change resilience (e.g. environmental resilience, social resilience, economic resilience, infrastructure resilience, resilience in leadership and participation and resilience on community emergency planning).

Dependent Variable

We assessed the vulnerability consisted of seven aspects: livelihoods, food accessibility and sufficiency, water supply, health, receiving aid, giving aid, and vulnerability to disaster and climate change. All items of dependent variables were assessed on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Our study develops an index of household vulnerability in the Khon Kaen sub-urban.

Analyses

To analyse the effect of urbanisation and climate change effect on household vulnerability in Khon Kaen sub-urban. Data analysis was provided the three-levels, wherein descriptive statistics, multivariable analysis and regression analysis. The model was analysed for such errors in both independent and dependent variable for each effect size. In the first step, we were a dummy variable of independent variables. For the data analysis, the model imposed by using instrument must be valid model. We developed model 1 (household characteristics), model 2 (socio-economic) and model 3 (vulnerability). In order to ensure model results, the hypothesis 1 and 2 were tested in regression analysis model.

4. RESULTS

Descriptive Analysis

Our sample indicates that the female is about 68.8 percent, male approximately 31.2 percent. Of these, 62.5 percent completed a primary school, 46.7 percent of family members more than 5 personals, 51.6 percent of occupations in the agricultural sector, and 32.5 percent has income between 50,000 and 100,000 Baht per year ($1,600–3,200), and 89.5 percent have owned land. The following table gives more detailed information on household vulnerability (see Table 1, 2 and 3).

Table 1. Descriptive analysis of household vulnerability

Location	Livelihoods	Food accessibility	Water supply	Health	Receiving social network	Giving social network	Climate change
Lao Kwain Hak	2.9	3.4	3.3	4.5	3.9	3.8	3.6
Beung Niam	3.1	3.3	2.9	4.6	3.5	3.4	3.1
Mean	3.0	3.4	3.0	4.5	3.7	3.6	3.4

Table 2. Descriptive analysis of household resilience

Location	Environment	Social	Economic	Infrastructure	Leadership and participation	Community's emergency resilient plan
Lao Kwain Huk	2.7	3.0	3.8	3.2	2.4	2.7
Beung Niam	3.4	4.1	4.0	3.1	2.5	3.7
Mean	3.0	3.6	3.9	3.1	2.5	3.2

Table 3. Factor influences on household vulnerability

Variable	Vulnerability level													
	V1		V2		V3		V4		V5		V6		V7	
	□²	CC	□²	CC	□²	CC	□²	CC	□²	CC	□²	CC	□²	CC
Gender	4.68		1.25		1.56		.03		2.81		4.23		.23	
Education level	28.01	.32*	7.31		8.81		10.21		24.27	0.30**	21.53	0.28**	9.78	
Family member	6.54		3.15		1.74		8.37		8.53		5.66		5.88	
Occupation	3.05		4.54		1.00		7.25		1.72		3.04		5.77	
Household income	21.27	.28**	15.45		18.59		7.48		21.58		24.09	0.30**	12.86	
Number of labours	6.9		5.7		1.9		2.0		3.2		1.6		1.6	

	0		9		1		4		4		5		2	
Vulnerable people	1.55		.85		1.70		13.94	.23*	7.57		1.04		2.37	
Living size	10.20		3.37		8.14		8.54		5.18		1.88		9.35	
Land size	15.58	.24**	21.07	.28*	9.23		12.71		10.54		7.91		13.24	
Community climate	5.58		29.18	.32**	21.95	.29*	1.23		2.90		4.65		24.62	.30*
Social community	1.46		4.69		6.40		4.44		6.73		8.65		11.22	.21**
Community economic	10.87	.20**	35.09	.35**	18.17	.26*	9.97	.20**	3.13		9.42		.31	
Community structure	1.02		8.41		1.10		6.03		1.53		2.02		8.31	.18**
Leadership	4.41		24.01	.30*	13.47	.23*	11.62	.21**	9.85	.19*	2.93		5.70	
Environmental management	5.22		20.34	.28*	38.26	.37*	2.06		7.45		14.98	.24*	35.13	.35*

Note: $*p < .05$, $**p < .01$

Regression Analysis

In order to assess the urbanization and climate change effect on household vulnerability in Khon Kaen sub-urban areas. Our model 1 indicates that household characteristics, we found 3.00 percent of the variance in explaining the household vulnerability ($\square^2 = .03$). in model 2 shows 9.70 percent of the variance in explaining the household vulnerability ($\square^2 = .09$). The full model 3 illustrates 24.90 percent of the variance in explaining the household vulnerability ($\square^2 = .24$). All coefficients among household vulnerabilities are presented in Table 3.

Table 3. Regression coefficient results

Variables		Model 1	Model 2	Model 3
Household characteristics				
	Female household head (1)	-2.35	-1.79	-3.79
	Household head with lower grade 9 education (2)	-3.50	-1.30	-2.09

Variables		Model 1	Model 2	Model 3
	The number of household members	–1.21*	–1.28*	–1.98*
Socio-economic of households				
	No employment (3)		–4.70	–7.99
	Non-agricultural occupation (3)		–1.18	–1.33
	Household with annual income < 150, 001 Baht (< 3,200) (4)		–2.72	–4.11*
	Number of labour-aged household member		–0.47*	–.06
	Number of vulnerable household member		1.62	1.26
	No owned land or unable to sell (5)		3.04*	2.62*
	Number of farmlands with title		–.31*	–.30
Resilience of households on urbanization and climate change				
	Environment			–.03
	Social			–.04
	Economic			–.90*
	Infrastructure			–.43
	Leadership and participation			–.55*
	Community's emergency response plan			–2.14**
	a	184.62	184.87	190.74
	R^2	.03	.09	.24
	F	2.45	2.98	5.36
	Sig of F	.04	.03	.00

Note: $\square^2$ = .24, F = 5.36, Sig. of F = .00, *p < .05, **p < .01

Robust Test

Our final model shows that the number of household members has a negative effect on the vulnerability (β = 1.98). When member of the suburban households decreased by 1 person, the vulnerability of the suburban households increased by 1.984. The decreasing of household members affected household income so that households had limited income for living expenses. If the number of household members increased, the vulnerability of the suburban household would be less.

Based on the household's socio-economic factors, we found that household with annual income lower than 150,001 Baht has a negative on vulnerability (β = 4.11). Household with annual income lower than 150,001 Baht would have more vulnerability than Household with annual income more than 150,001 Baht by 4.117. According to Thailand poverty line,

household with annual income lower than 150,001 Baht were dealing with economic insecurity because their incomes were below the Thailand poverty line. It was clear that they were at risk than households with higher income.

We found that households without lands or unable to sell has a negative effect on the vulnerability (β = 2.62). Households without lands or unable to sell would have more vulnerability than households with lands or be able to sell by 2.62. Households without lands or unable to sell did not have physical security especially on land title and ownership of living facilities, so they would be at risk more than households who had own land.

The number of farmlands with title has a negative effect on the vulnerability (β = .30). When the suburban households had more farmlands by 1 unit, the vulnerability of households would decrease by 0.30. Households with farmlands normally were engaging in agricultural activities so that they had more options to generate income. Moreover, they were able to access natural resources in own farmlands to reduce household's vulnerability.

The important of resilient effectiveness of households on urbanization and climate change factors, the model indicates that resilience on economic has a negative effect on the vulnerability (β = .90). When the suburban households assessed that community had more resilience on economic by 1 unit, the vulnerability of the suburban households would decrease by .90. If community had good resilience to economy, such as access to financial sources, supports of conducting various agricultural activities, their households might have better chance to maintain livelihood security.

Resilience on community's emergency response plan had negative effect on the vulnerability (β = 2.14). When the suburban households assessed that community had more resilience on community's emergency response plan by 1 unit, the vulnerability of the suburban households would decrease by 2.14. If community had had well preparation on emergency response planning and allowed community stakeholders to participate in planning process together with leaders and governmental organizations, the suburban households would have more confidence on community's capability so that both communities and households had less vulnerability.

Table 4. Full model results

Variable	β	SE	Sig.	Influential order
Household characteristics				
Female household head (1)	–3.79	–.09	.115	
Household head with lower grade 9 education (2)	–2.09	-.51	.45	
The number of household members	–1.98	-.10	.01	6
Socio-economic of households				

Variable		β	SE	Sig.	Influential order
	No employment (3)	7.99	.09	.16	
	Non-agricultural occupation (3)	–1.33	–.0	.57	
	Household with annual income < 150, 001 Baht (< 3,200) (4)	4.11	.10	.02	5
	Number of labour-aged household member	–.06	–.00	.95	
	Number of vulnerable household member	1.26	.08	.22	
	No owned land or unable to sell (5)	2.62	.11	.02	4
	Number of farmlands with title	–.30	–.13	.04	3
Resilient effectiveness of households on urbanization and climate change					
	Environment	–.03	–.007	.93	
	Social	–.04	–.009	.92	
	Economic	–.90	–.150	.04	2
	Infrastructure	–.43	–.052	.39	
	Leadership and participation	–.55	–.049	.50	
	Community's emergency response plan	–2.14	–.393	.00	1
	a	190.74			

Note: $\square^2$ = 0.24, F = 5.36, Sig. of F = .00, *p < .05, **p < .01

5. DISCUSSION

The model shows that environment, social, infrastructure, leadership and participation and community's emergency response plan have a negative influence on household vulnerability. This aspect of the model makes it possible to incorporate more realistic in urban area growth (Glassman & Sneddon, 2003; Lebel et al., 2011; Bennett et al., 2015; Beringer & Kaewsuk, 2018) and may lead to negative effect on household vulnerability. These results support Brooks et al. (2005), Füssel (2007), Cobbinah et al. (2015) and Ge et al. (2017), who argues that in an economy with a large extended sub-urban area will compensate for the increasing a negative impact, which important of considering the impact of climate change.

Studies using the aggregate of household vulnerabilities cause risks and insecurity of in communities regarding occupations, incomes, and quality of life (He et al., 2019). In turn, our study shows that household resilience has a higher-level effect of economic, social, and emergency response planning. Moreover, it has found that emergency response planning lead to high effect on household vulnerability. This means that households play importance in preparing to solve problems especially households in areas where are at risk of emergencies such as floods or droughts. In response to the increase problems cause the loss of property and result in household vulnerability.

This finding is consistent with Few (2007) suggested economic livelihood, physical location, education and protective behaviour combined to influence the household vulnerability. This study indicated that if the households have a good response plan to cope with emergencies, it will be able to reduce vulnerability effectively. This is in line with Few and Tran (2010) investigates the preparedness of community response in Vietnam. The study shows that households that have ever experienced in disaster would have a good preparedness when disaster comes. For instance, ability to make decision, receiving information, evacuation, food preparation, accessing to relevant knowledge, which is the complex shaping of vulnerability.

Regarding economy factor, we found that the household resilience in the economy is at a high level because both two communities have job sources near communities. We found that community has a job, income and they can go to work and stay home as the commuters. This result supports Jones and Tanner (2017) defined the suburban community is placed surrounds the city and not far from urban areas of the city. People engage in agricultural activities together with non-agricultural activities. However, preparedness on economic resilience means that households and communities need to have a plan or guideline to prevent problems especially about occupations and household incomes. It is found that households with annual income below 150,001 Baht is a factor influenced the vulnerability of households.

We found in Ban Lao Kwian Hak village, most villagers are dealing with limits on income because their main household incomes come from non-agricultural activities such as self-employed in various sector, employment in industrial plants, etc. This is a result of the development of "secondary urban centres" in accordance with Growth Poles theory which contributes industrial growth in urban areas and develops the secondary urban centres to reduce dense of population and pollution of major cities (Glassman & Sneddon, 2003; Chamaratana et al., 2020).

Industrial development in suburban areas has resulted in people nearby relying on limited employment for their occupations. While occupations engaged in the agricultural sector have been decreasing, or it is just the second job of the household. Many suburban households have lived without own lands because lands are sold to capitalists or investors who saw the benefits of the Khon Kaen economic area. This can be considered that the number of farmlands is one of the factors influenced the vulnerability of suburban households. The result is similar to Pruksanubal (2015), who examined land use changes due to urban expansion in Chachoengsao Province. The study found that farmers in suburban areas lost their farmlands so that it consequences change in farmer's activity from farming into industrial works. However, this study provided output differ from Hahn et al. (2008), who exposed that households are vulnerable to income because the vulnerable households lacked of agricultural activity.

Drawing on experiences from related fields, the study found that water vulnerability also relates to climate change which possibly occurs, such as rainfall, flooding, drought and

temperature increased in suburban areas (Bennett et al., 2015; Beringer & Kaewsuk, 2018; Chapman et al., 2017; Imai et al., 2017). This could lead to risks, which is increased of temperature that could affect the growth of agricultural crops, or health effects. It is reported that both suburban communities have affected dust problem especially the PM 2.5. there are increasing number of households affecting dust problem in suburban communities. Household members get illnesses from allergies caused by air pollution (sugarcane burning), and they have to deal with this problem without any mitigating plan from relevant stakeholders.

Practical Implications

In practical implications, we found that urbanization is resulted of climate change in the livelihoods of agricultural and non-agricultural communities: self-employ workers and non-agricultural workers. It should be furthered study of livelihood patterns of suburban households to find out the significant conditions that lead to an improvement of suburban households on land use change. The developing recommendations are suggested as follows.

These results highlight the agency response to water management, such as the Office of Groundwater Resources, should study and promote the development of groundwater resources at village level. In household levels, they are vulnerably occupied, such as low-income, the government agencies should pay role to take care them. In the community level, it should develop for public areas at group level such as households without farmlands to improve the household's food security issues. The community should prepare self-management to cope with vulnerabilities at household level and community level, and they should develop the practice guideline to use in the future.

In research implications, which is responding the guideline for developing the pilot research with existing in area levels. The development adopts the framework of urban development and mitigation of climate change, developed by ACCCRN and ISET, and the Urban Resilient Framework into the guideline for developing suburban area to create sustainable urban development. This development guideline should be emphasized the development of knowledge and integration between scientific knowledge and local wisdom to build knowledge, understanding, and capacity of individuals and organizations. Three important functions are as following details:

First, in the *system* should be focused on ecological infrastructure of the city. The stakeholders have identified at the fundamental capacity of communities and ecosystems, and then create databases for dissemination and implementation. Moreover, some stakeholders can establish a mutual agreements and practices to prevent unexpected changes in communities.

Second, in the *agency* should be focused on individual, agency and organization levels, who joined to determine and design a learning approach and build understanding to all stakeholders about the changes and the needed responses. The agency plays a role to organize learning activity, create awareness, and implement activities to prepare for the changes.

However, it emphasises on the agency to establish a plan and practical guideline between individuals, communities and organization levels.

Third, in the *institution* should be focused on agreement, rule and practice to create a plan for coping with the changes effectively.

Finally, in *learning process* is based on the data analysis for participation in the development of the local community is a vital key to create sustainable urban growth. Stakeholders would have a chance to review their weaknesses and strengths for further development. These steps can formulate the strategic planning to cope with vulnerability context in urbanization related to climate change.

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