CHAPTER 2

Literature Review

This research was aimed to study the creation of data center for community using community ICT learning center or community digital center as a tool to drive and meet the demand for practical use and to address the problems that occur in the community. In addition, this research would facilitate citizen involvement in the community and thus the contents involve the problems and the demand of information for practical use. The Mae Tao river basin, Mae Sot district in Tak province, Thailand which was chosen for this study because it has been affected by cadmium contamination from mining operations for a decade and requires the use of information or knowledge to solve this problem and develop its community and for the establishment of tangible information center in the area. This research entailed the management, development and verification methods of the developed information center. Therefore, Chapter 2 would describe literature review and relevant reports which was categorized as follows:

1) The development of ICT at a community level in Thailand

2) General Information of Mae Tao River Basin

3) Data and data management

4) Information system and community information system

5) System development

6) Information technology service management

7) Citizen involvement

8) Data privacy and data security

9) Literature review

The development of ICT at a community level in Thailand

1. Community ICT learning center project in Thailand

Ministry of Information and Communication Technology is in charge of driving and developing Information and Communication Technology in Thailand and following up the evaluation process according to country's ICT development policy. One of the projects stemmed from such policy of ICT Ministry with an aim to develop Thailand to become the society of wisdom and continual learning was 'Community ICT Learning Centre Project'. This project was aimed to not only develop learning experience to local villagers by using ICT as a tool, but also provide economic-social benefits via new media tools or ICT through the concept of globalization. This concept was used to build new knowledge, wisdom, exchange of goods, and also enhance competitive capacity in the knowledge-based economy in this era. This project was initiated in 2007 and continued to 2013 and there are 2,157 community ICT learning centers across the country up to now. There are 500 centers in Central Thailand, 106 in the West, 120 in the East, 673 in the Northeast, 310 in the South and 268 in the North (Ministry of Information and Communication Technology, 2013). Ministry of Information and Communication Technology (Now known as The

Ministry of Digital Economy and Society) has defined 'Thai Telecenter' as 'The place that provides basic ICT tools to serve everyone in the community in need of ICT tools to develop oneself and also community altogether'. However this Thai telecenter has different name depending upon the definition by each organization such as Community ICT Learning Centre, Community Internet Centre, Telecenter/Tele-Centre/Community Telecenter, for examples (CCDKM, 2009). Ministry of Information and Communication Technology has stressed on the significance of ICT by designating ICT as a very important tool to Thai Government and the Ministry for building knowledge-based society and also designating 5 E principles of Community ICT Learning Centre as follows (Kittivaraporn, 2011):

1) E-Government: The implementation of IT for Government reform to enable Thai citizen to use governmental service in electronic form leading to Smart Government and Good Governance.

2) E-Commerce : The implementation of IT to enable Thai citizen to use it as tool to sell community goods and products and also exchange knowledge and experience about the products, an alternative channel for marketing that results in Smart Marketing.

3) E-Industry : The implementation of IT to enable Thai citizen to enhance effectiveness in production in a sustainable manner and enable competitiveness at the global scale leading to Smart Agriculture and Smart Service.

4) E-Education : The implementation of IT to enable Thai citizen to gain access to and make use of information and use it as searching-for-information resource in the community and also as e-learning database center and independent study center leading to Smart Learning.

5) E-Society : The implementation of IT to enable Thai citizen to reduce the gap of inequality in gaining access to database and knowledge, reduce the gap of inequality in gaining access to basic service necessary to community leading to Smart Society.

In the early phase of community ICT learning center project initiation, the personnel who was in charge of each community ICT learning center from each region was asked to take part in the training course for executives and care takers of ICT center. The content of the training course regarding the framework of ICT center administration and management is shown in Figure 2.1 (Office of the Ministry of Information and Communication Technology, n.d.).

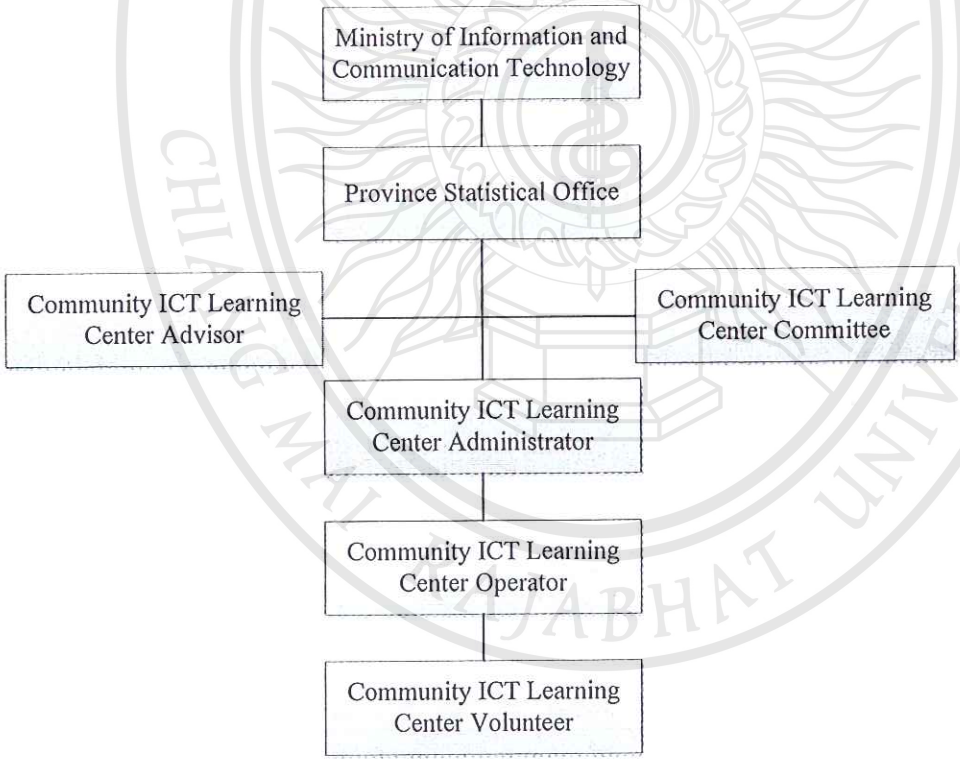

Figure 2.1 Community ICT Learning Center administrative stucture

Source: Office of the Ministry of Information and Communication Technology (n.d.)

Each center has allocated the roles and duties and importantly has composed of the head executive, administrative committee and administrator. The Ministry aimed to encourage the local villages to participate in the role of administrative committee and also the administrator acted as a driving force to make it happen. Each province has a Provincial Statistics Department to govern, look after and coordinate between each center and the Ministry. In addition, administrators of each center were selected to become representatives of administrative committee with the main role as coordinators between nearby centers and also between Provincial Statistics Department and the Ministry.

Some suggestions to build the service for the citizen in the community have been made such as e-learning system, e-commerce of local goods and products, governmental news service and distribution of information in the community (Wunsuk & Thamsatitdeg, 2011). Furthermore, it was proposed to collect essential information to develop career prospects, quality of life, safety, environments, biodiversity and resources, ecosystem for the sake of equality of each community. These demands were in accordance with the aim of this research to build the ICT center to meet the demands and resolve the long overdue issues occurring in Mae Tao river basin that have adversely affected local people in many aspects including occupation, culture and environment (Kumsopa, 2010).

2. Digital development for economical-socio plan to promote the role of community ICT center to community digital center

The Royal Thai Government has laid out the plan to develop and reform the country under the name 'Thailand 4.0' in order to accomplish the policy vision in driving and developing economy and society to stability, prosperity and sustainability.

Every Ministry and organization must follow this plan and execute it accordingly. The proposed plan of digital development for economic-socio purpose from the Ministry of Information and Communication Technology was approved by the Ministers on 5 April 2016 (Ministry of Information and Communication Technology, 2016). The plan was a development from the previous ICT report that is in effect for 20 years and categorized into 4 phases : Phase 1) emphasis on investment and build Digital foundation for economic-socio development which takes 1.5 year; Phase 2) emphasis on participation from every sector for economic-socio development (Digital Thailand I: Inclusion) which takes 5 years; Phase 3) emphasis on Digital Thailand II: Full transformation which takes 10 years and Phase 4) upgrading Thailand to become a developed country by using digital technology to add the value socioeconomically in a sustainable way. The urgent project to be initiated in Phase 1 of the plan directly involved in the creation of community ICT learning center was the extension of community digital technology networks by increasing the numbers of community ICT learning centers and upgrade them to community digital centers. In 2016, 600 community ICT centers were further established across the nation. In Mae Tao river basin area, there are 4 community digital centers in Phra That Pha Daeng subdistrict, Mae Ku subdistrict, The border in Tak province and Intarakiri 1 community.

From the above plan, the Ministry has designated the strategy for digital development for socioeconomics in 6 parts including 1) A strategy to high efficient basic digital technology across the country, 2) A strategy to drive digital technology economy, 3) A strategy to build quality society with equality to access digital technology, 4) A strategy to reform the governmental sector to become a digital government, 5) A strategy to develop workforce to be ready to enter digital

socioeconomic era and 6) A strategy to build a peace of mind in using digital technology. Especially the strategy 3 was relevant to this research where quality society with equality to access digital technology was to be established and was supported by important plans to (1) create opportunity and equality in access to and making use of digital technology for its citizen especially the senior, the disabled, the distant-living inhabitants, to extend ICT centers to every subdistrict and promote them to be integrated service centers, to cooperate between the governmental sector and the villagers and provide all services to citizen, to act as the service center that provides knowledge about business management and marketing via e-commerce in the community for socioeconomic activities especially academic, agricultural, healthcare, trading, tourism, rights and welfare services, (2) to develop citizen capacity in making use of digital technology for best benefits and creativity including ability to analyze and discriminate digital information in a wide-open and independent era, to build the mechanism to follow online news, information and monitor deteriorating piece of information to society in real-time, (3) to build media, database, and digital learning centers for life-long learning experience for people to gain access readily through telecommunication, broadcasting system and mass media by encouraging the owners of information resources such as important official documents, data, statistics, knowledge, occupation, cultural legacy, local wisdom and entertainment to produce or translate these documents into digital forms and allow people to access them and also included the mechanism that enabled people to make a further use of them and support the building of digital knowledge at national, local levels for everyone to rely upon. The measures to be implemented included creation of networks between knowledge developers to give funding, support the project, create platform, verify

data reliability and knowledge, integrate knowledge for people to gain access to these easily. Moreover, private sector and general public were encouraged to produce digital media useful for the public such as producing media through activities responsible for society by private sector or producing local wisdom by local people and community. In addition, there was a plan to support platform development for data collection, knowledge, individual capacity especially the retired citizen, community sages, academics and volunteers to exchange their experiences among one another and transfer the knowledge and experience from one generation to the next, from once community to another community leading to sharing economy and society. From the above mentioned strategies and plans, it is a good opportunity to support this research to fulfill its vision and benefit the local people directly.

Not only the community ICT learning center provides computer service and access to internet networks, but also provides information to community including Top-Down information transfer (from the governmental organizations to citizen) and archiving data themselves and distribute them also. The data was collected from Bottom-Up by gathering the data the community wanted altogether with their best efforts. However, there is no practical guideline to create such thing at community ICT learning center at the moment and thus this research was aimed to study management process of community data with the help from community digital center and its citizen in order to act as a model for other ICT centers to learn from.

The community ICT learning center in Thailand has been created to serve the public similar to Telecenter in that it provides IT in many forms to local people. Each center has its own way of service depending upon its guidelines since the fiscal year 2007. Siribut (2013) found that the gap of knowledge and understanding and IT skills in

local people with lifestyle tightly bonded to agriculture resulted in realization in lack of IT service and sustainability of center administration. Before building and developing the center, it was proposed that one had to consider 1) capacity of community 2) concept in building/designating center format that meets the community demand 3) planning/administrating of the center with citizen involvement 4) support to community 5) service format of the center and 6) support to other aspects. From the mentioned subjects, I thought that the committee should be in charge of studying the capacity of each community before initiating the ICT center, however in other aspects we can conduct our work to meet the demands and suggestions from other people by encouraging citizen to get involved in discussion of how they would like to run the ICT center and how to provide other services to community. They should provide data and information support to ICT administrator, monitor the frequency of IT uses by the local people and build the local database for community data collection. In addition, the scope of this research was in agreement with the guidelines for sustainable ICT centers in other communities. For instance, Short and Rice (2002) stated in the manual "Ten Steps for Establishing a Sustainable Multipurpose Community Telecenter" about 10 steps in building sustainable ICT service center. Roman and Cole (2002) studied the format and important subjects that have effect on sustainability of community IVT service center by collecting data from Hungary and Canada. They discovered that gaining access to IT appeared to be the most important issue and 9 subjects were proposed to deal with this problem including IT related to service providing and creating realization in benefits of IT service center to citizen. Shadrach and Sharma (2011) studied factors affecting sustainability of ICT service center and observed that lack of realization in benefits of

IT service center, lack of good services, lack of IT assistance were the main causes of non-sustainable ICT centers. Developing content to meet the demand of the community and searching for services that meet the demands of the people were proposed to be the solution to the problem.

To support the socioeconomic reform of community ICT center, 3 strategies were carried out; (1) Strategy and direction of community ICT center process (2) Main process relating to administrating community ICT center and main direction and strategy to build community ICT center. Nilsook *et al.* (2012) conducted the survey in all ICT staff in 260 ICT centers founded between 2007-2009 and personnel in organizations related to community ICT center, 344 staffs from the Ministry of Information and Communication Technology by using the evaluation forms of community ICT center performance and the evaluation form in support of the socioeconomic reform of community ICT center as research tools and using percentage, means ± standard deviation in statistical analysis. The results showed that the performance of all community ICT centers was at mediocre level. The location was evaluated as great; however other aspects of community ICT centers were evaluated as mediocre. As for the evaluation form in support of the socioeconomic reform of community ICT center, the overall result was great. The main process relating to administrating community ICT center was found to be mediocre, however other aspects were great. These findings were in accordance with the research concept of the researcher which leads to development of database regarding knowledge, personnel, financial budget and also involvement from citizen and community leaders.

After the completion of building community ICT centers, Siribut (2013) studied the integration of research on community ICT centers with the objectives to synthesize research on community ICT centers by using 7 reports (2008-2013) regarding evaluation and activity organization of community ICT centers supported by Ministry of Information and Communication Technology and also National Research Council of Thailand. They found that community ICT centers led to reduced gap in digital use among citizen, administration with citizen involvement, decentralization of power and financial management by community ICT centers themselves. Most community ICT centers provide internet services and training courses for ICT usage to local people, mostly are children and youngsters. From their research, the main problem was the staff at ICT centers and insufficient financial budget. They suggested the Ministry promoted administration with more involvement from local people, networking of ICT centers, personnel development and giving education to users to be able to follow digital technology. Obviously, there was a lack of services at ICT centers that were previously laid out in the policy to develop digital technology for socioeconomics, a lack of data collection and systematic data archiving. In this work, it was hoped that the research would bring about good practice in building database for each ICT center.

General Information of Mae Tao River Basin

Origin of research problem in this study was stemmed from the survey of soil and rice contamination with high cadmium in the area by Baan Pa The and Baan Tao Mai, Phra That Pha Daeng subdistrict, Mae Sot district in Tak province. This was discovered by International Water Management Institute (IWMI) and Department of

Agriculture between 2541-2546 (Simmons, Sukreeyapongse, Noble, & Chinabut, 2005). When local people were informed about the soil and rice contamination, they were in panic. There was some confusion among local farmers in the early phase that the governmental sector used the method of burning rice to tackle this issue and adversely affected the local people emotionally and culturally in great magnitude. In addition, some local people were found to accumulate cadmium in their bodies at the critical level which is able to cause Itai-itai disease and osteoporosis. In the past, several controversial and conflicting events and tensions had occurred between local people and governmental sectors. To date, the court judgment was released from Phitsanulok Central Court stating that all the working officials in the area must follow the appropriate procedures and follow the measures to protect the environment bear Mae Tao river basin, Phra That Pha Daeng subdistrict, Mae Sot district in Tak province, however this conflict has not been resolved and true understanding of the problem among local people and governmental sectors has never come to light.

1. General information

The studied areas included Mae Ku subdistrict and Phra That Pha Deang subdistrict, located in Mae Sot district, Tak province. The generalities of each subdistrict are described as follow;

1.1 Mae Ku subdistrict

According to the Four-years Regional Improvement plan 2018 - 2021 of Mae Ku Municipal (Mae Ku Subdistrict Municipality, 2015), Mae Ku is one of the subdistricts of Mae Sot district, Tak province, located in the southern part of Mae Sot, and approximately 14 kilometers away from Mae Sot District Office to the south-eastern. It is located to the west of Tak civic along the route 1, route 105, and route

1090 in total of 98 kilometers. The area has approximately 163.7 square kilometers of lands. The north border of the area is closed to Mae Tao subdistrict and Phra That Pha Daeng subdistrict of Mae Sot district. The south border is closed to Mahawan subdistrict and Pawor subdistrict of Mae Sot district. In the southern part of the area consists of Mei River and Republic of Myanmar. The eastern and southern areas are high mountain ranges. The location of Mae Ku community is a basin area, consisted of numbers of creeks and public streams, including 7 creeks, 1 swamp, 3 weirs and 2 mines, which makes the area suitable for agriculture. However, the area of 50 square kilometers (30.54% of the total land area) is a national forest reserve. Most of the remaining areas are habitats and agricultural areas.

In 1866, a group of people, approximately 12 households, had migrated from Theon district of Lam Pang province due to lack of lands to live. The migrants had settled in an area where there is a stream flowing through throughout the season, consisting of a small creek and a large creek; the immigrants have named the great creek "Huay Mae Ku Luang", and the small creek "Huay Mae Ku Noi" . The origin of both names came from the name of native Karen hill tribes leader who had settled down before Theon migrants group, "Mr.Pa Ku Po"; the names of the creeks were named after the leader as "Huay Mae Ku". Later on, the population from other places had increasingly migrated to the current location of Mae Ku subdistrict and had built a village, and then a subdistrict respectively. The name of the subdistrict is also named after the mentioned creek names.

At present, Mae Ku subdistrict contains 10 villages, including: 1) Mae Ku Luang village, 2) Pha Laad village, 3) Huay Pak Lah village, 4) Pooter village, 5) Nong Nam Keaw village, 6) Mae Ku Tai village, 7) Mae Ku Noi village, 8) Mae Ku

Nua village, 9) Mae Ku Mai Tha Soong village, and 10) Ko Chuay village. The administration of the area has been divided into two parts, which are Mae Ku Municipality administrative area, and Mae Ku subdistrict administration organization area (non-municipal area). The studied area in this research is in Mae Ku municipal area, as the community digital center is located in the area. In addition, the administrative area of Mae Ku municipality covers approximately 8.32 square kilometers (5.08 percent of Mae Ku subdistrict), and has total of 6 communities in responsible, including: Si La Laad community (located in village number 2: Huay Pha Laad), Rak Tin community (located in village number 6: Mae Ku Tai), Kade Keaw community (located in village number 7: Mae Ku Noi), Srivichai community (located in village number 8: Mae Ku Nua), Burapha community (located in village number 11: Mae Ku Burapha), and Don Chum Phu community (located in village number 12: Baan Mai Don Chum Phu).

Table 2.1 Population and household numbers in Mae Ku Municipal area

Village No.	Name of the village	Name of the community	Population (person)		Total population (person)	Number of households
			Male	Female		
1	Pha Laad village no.2	Si La Laad community	532	562	1,094	470
2	Mae Ku Tai village no.6	Rak Tin community	366	401	767	339
3	Mae Ku Noi village no.7	Kade Keaw community	684	696	1,380	538
4	Mae Ku Nua village no.8	Srivichai community	493	556	1,049	432
5	Mae Ku Burapa village no.11	Burapha community	667	667	1,334	525

Table 2.1 Population and household numbers in Mae Ku Municipal area (continued)

Village No.	Name of the village	Name of the community	Population (person)		Total population (person)	Number of households
			Male	Female		
6	Baan Mai Don Chum Phu village no. 12	Don Chum Phu community	343	337	680	220
Total			**3,085**	**3,219**	**6,304**	**2,524**

Source: Mae Ku Subdistrict Municipality (2015)

According to Table 4.1, it is illustrated that there are total of 2,524 households in Mae Ku municipal area, consists of 6,304 people which could be divided into 3,085 males and 3,219 females. The majority of the population are farmers; the primary crops grown in the area are corn, rice, soybean, green bean, sugar cane, garlic, onion. The major secondary occupations are handicrafts, basket weaving, cloth weaving and industrial work.

1.2 Phra That Pha Daeng subdistrict

Phra That Pha Daeng subdistrict is the tenth established subdistrict in Mae Sot district of Tak province (Phra That Pha Daeng subdistrict administrative organization, Mae Sot district, Tak province, 2016). Originally, the subdistrict was a village, and was a part of Mae Tao subdistrict. Later, due to increased number of population and households, the village had been established as a subdistrict in 1986, under the name "Phra That Pha Daeng subdistrict".

Phra That Pha Daeng subdistrict is located approximately 5 kilometers away from Mae Sot district office to the east, and approximately 95 kilometers away

from Tak civic. The total area covers approximately 68 square kilometers. The northern border of Phra That Pha Daeng subdistrict is close to Mae Pa subdistrict of Mae Sot district, the southern border is closed to Mae Ku subdistrict of Mae Sot district. The eastern area is closed to Pawor subdistrict of Mae Sot district, and the western part is closed to Mae Tao subdistrict and Mae Sot subdistrict of Mae Sot district. There are two types of geographies in Phra That Pha Daeng subdistrict, including mountainous upstream forest region, which is a habitat of Karen hill tribes, covering the area of Padae village, Tham Sua village, and Khun Huay Mae Sot village. Another geography is flatlands, which is a habitat of northern Thai hill tribes who had migrated long time ago, covering the area of Khang Phibal village, Hua Fai village, Mae Tao Mai village, and Auang Doi village.

Table 2.2 Population and household numbers in Phra That Pha Daeng subdistrict

Village No.	Name of the village	Population (person)		Total population (person)	Number of households
		Male	Female		
1	Khang Phibal	1,269	1,085	2,354	1,045
2	Hua Fai	883	899	1782	896
3	Mae Tao Mai	422	408	830	582
4	Padae	431	427	858	250
5	Tham Sua	284	254	538	138
6	Khun Huay	203	188	391	108
7	Auang Doi	253	258	511	236
Total		**3,745**	**3,519**	**7,264**	**3,255**

Source: Phra That Pha Daeng Subdistrict Administrative Organization (2016)

According to Table 2.2, there are total of 7 villages in Phra That Pha Daeng subdistrict, Mae Sot district, Tak province, including; Khang Phibal village, Hua Fai village Mae Tao Mai village, Padae village, Tham Sua village, Khun Huay village, and Auang Doi village. The total population is 7,264 people, divided into 3,745 males and 3,519 females, and there are 3,255 households in the area. The majority of the population are agriculturalists, followed by general contractors, merchants, public servants/officers, and other businesses.

The social trait of Phra That Pha Daeng subdistrict is an agricultural society with traditional lifestyle in most parts, which is to live sufficiently. The majority of the population, up to 70 percent, do farms for living; the rest are merchants, contractors, livestock farmers, and public officers. Hence, agriculturalist is the main occupation of the population in Phra That Pha Daeng subdistrict. Agriculture is available whole year long as the area is a basin, and that there is adequate water to do so. The crops grown in the area are rotated, started from rice; the most popular rice is jasmine rice. Other genres of rice of rice are grown, yet not very popular (rice is grown once a year, known as in season rice field). After rice is harvested, the agriculturalists would grow economic crops, such as corns, soybeans, and green beans, as these crops have short cropping cycle and provide great yields. In addition, the people in the area also have secondary jobs, in spare times and after harvest, by establishing career groups, such as livestock feeders group, broom weaving group, basket weaving group, cloth weaving group, wood flower crafting group, beauty salon group, etc. The budget and materials used in the career groups are supported by the local organizations.

2. Collection of conditions and development movement of study area

In this part of research reported the general conditions of the study area, development and the background story of zinc mining business in the area, situations and phenomena that occurred and their consequences, problems, obstacles, opportunities and possibility in the future.

2.1 General conditions of the Mae Tao river basin

Pollution Control Department of Thailand (2011) reported the overall geography of Tak province occupying the West border of Thailand with area of 16,407 kilometer square accounting for 3.19% of Thailand which is the second largest area in Thailand. In Tak province, there is a mountainous road dividing Tak areas into 2 parts; the East of Tak consisting of 4 districts, Muang Tak, Baan Tak, Sam-Ngao, Wang Jao, the West consisting of 5 districts, Mae Sot, Mae Ramad, Tasongyang, Pobphra and Aum-Pang. Since Tak has one of the most complex geology in Thailand and has several mineral mines stretching to Myanmar. Zinc resources were found on Pha Daeng mountain (in Mae Tao-Mae Ku river basins) and neighboring ones occupying 10 km area. Cadmium has been also found in Pha Daeng mine, Mae Tao subdistrict, Mae Sot district. In addition, researchers also reported on geography of the area of interest – Mae Tao-Mae Ku river basin that has been contaminated with cadmium, situated in Mae Sot district in Tak province. In the area of interest, there is Mae Tao river originating from Ray Pah Do mountain, Mae Tao mountain and Mon Dok Eang Mountain and occupying 53,584 rai. Mae Ku river is originated from Pha Daeng mountain and Mon Hin Lek Phai mountain occupying 85,215 rai. Mae Tao river passes through the mining areas belonging to Pha Daeng Industry Co. Ltd and Tak Mining Co.Ltd and passing through Baan Pah Dae, Baan

Mae Tao Mai, Baan Mae Tao Pa, Baan Mae Tao Klang and Baan Mae Tao Tai and Ta Sai Luod subdistrict, Mae Sot district to Moei river which borders Thailand and Myanmar with a total area of 25 km long for Mae Tao river. Mae Ku river passes through Baan Mae Ku and ends at Moei river in Baan Mae Ku Luang. Thus the area affected by cadmium contamination is stretched across 13,237 rai along the way these rivers passing through or approximately 21.18 kilometers square.

In Mae Tao-Mae Ku river basin, people in the 3 following areas in Mae Sot subdistrict are affected: Pha Daeng subdistrict (all 6 villages are contaminated with cadmium), Mae Tao subdistrict (3 out of 7 villages are contaminated with cadmium, Baan Kang Phi Ban, Baan Mae Tao Mai, and Baan Pah Tae) and Mae Ku subdistrict (3 out of 10 villages are contaminated with cadmium, Baan Ku Tai, Baan Mae Ku Noi, and Baan Mae Ku Nua). The population affected by cadmium contamination from these areas is added up to 15,439 persons (4,095 households) accounting for 67.16% of the total population in the 3 subdistricts.

Most areas in the 3 subdistricts near Mae Tao-Mae Ku river basin are mostly used as agricultural cultivation lands such as paddy field, corn growing, soy bean and onion. The affected cadmium-contaminated areas of 13,237 rai (21.18 km square) are accounted for 56.69% of the total areas of 23,350 rai (37.36 km square) in the 3 subdistricts in Mae Tao-Mae Ku river basin. The affected population includes the land owners, land renters and employees to paddy fields. From sample data of proprietary right of land ownership for cultivation purpose between land owners, land renters and employees in the 6 villages in Mae Tao subdistrict, there are more land renters than land owners followed by employees, respectively. The researchers have

found that this data is invaluable for administrative management, monetary compensation, or any kinds of help at present and in the future.

Culturally, Mae Sot district has a 100 years-old history and Karens were found to be the first group of people living there. After that, more people Thai Yai, Chinese people from Yunnan, Burmese people, Muslims from Bungaladesh and Thai Nua, Sikhs, Hindus. As a result of mass influx of new inhabitants, Karens had moved to a higher area nearby. These mixed populations have brought about multicultural atmosphere however they can live in harmony.

2.2 Evolution of community and zinc mine business in the area

In 1897-1947 people started to migrate from Lamphun and Lumpang provinces to live with Karens in the same area with Pha Daeng mountain as the sacred place, Mae Ku and Mae Tao rivers as water resources for cultivation stretching from Pha Daeng mountain to Moei river passing through 3 subdistricts of Mae Sot district. There is an irrigation system to manage water from the water source to the downstream water with rigorous administration by the community and local wisdom. Later, in 1947, Department of Mineral Resources (as named at the present day) found the zinc source at Pha Daeng mountain, Mae Tao district, Mae Sot district in Tak province. Between 1957-1967, both foreign and Thai companies came to survey the area of mineral resources and Thai zinc company was the first to start mining in 1968-1975. After that time, zinc resource was abandoned and the forest was invaded. Six years later after that, in 1990, concession area was expanded further and Pha Daeng pagoda was moved to the newly born village Moo 7 Pha Daeng Pagoda subdistrict.

2.3 Situations and phenomena that occurred and consequences

The situations were divided into 4 periods (Lerdlukanavong, 2007):

2.3.1 January 1974 – February 2005: It was chaotic and confusing and started with International Water Management Institute and Department of Agriculture jointly announced that Mae Tao river basin was contaminated with cadmium. This was not a thought through process at all and not prepared for the aftermaths after the announcement. It caused confusion among local people. Although many governmental sectors came later to the area to collect data and research for the truth, no data was sent back to the local for better understanding at all. In addition, the measures taken had destroyed agricultural products from the local area in Mae Tao river basin and also ruined the beliefs of the local in agricultural value. The Vietnamese news station broadcasted this conflict to the wider world. During this time, local people did not receive any explanation or data of what happened at all. There was only the gathering of communities to ask for the help from the government however the matter of help was not specified.

2.3.2 March 2005 – September 2006: The situation had calmed down and saw the light at the end of the tunnel. Both governmental and private sectors worked together to propose the resolutions and introduce the positive attitude in creative working under the project of development of Mae Tao river basin. This action helped create the understanding and develop working mechanism in terms of education from the local community more, conducted experiment Participatory Rural Appraisal using Mae Tao area as a pilot area. Community sector took part in social management, releasing referendum from 3 subdistricts, 12 villages to ban rice cultivation in 2005 and asked for monetary compensation for a lack of rice cultivation. There was an encouragement scheme to pursue and develop the career already established in the area such as natural rubber cultivation, oil palm and

sugarcane by industries. They came to support production factors for those who were interested. They offered contracts in the production of all plant cultivars. However, all organizations which came to the area did not work in synchrony at all. The official sector invented the process without any citizen involvement, people only received the order of what to do. In this period, there was lack of a central stage in the meeting for debate, exchange of opinions, and data presentation to the community in the affected area.

2.3.3 October 2006-Cultivation time 2007: The researchers called it 'Stepping to the new border' with the use of knowledge and management. During this time, sugarcane cultivation supporting center and also Tao river development project center were established in the area. There were 5 full-time staffs, 3 Deputy District Chiefs and 2 staffs appointed from the meeting of Participatory Rural Appraisal. Expansion of sugarcane cultivation area, reform of irrigation system and dredging the city canal, repairing things, monetary compensation were all continually conducted during this period alongside beef cattle breeding supporting project. However, there was a rebel to the referendum of not doing rice cultivation. The researchers found that the support, the change in community leaders, career leaders, community leaders were the keys to manage everything equally important as the financial support.

2.3.4 Since April 2007: The researchers called this period as 'Transition time' proving what had been done and going to the new production season in 2007 without monetary compensation and extension of sugarcane cultivation did not cover all the areas. Other products that had been pushed by the government as income-generating source for local people did not come through. The researchers

found several limitations in financial budget, water management, inconsistency of official system and no follow up of changing data in policy.

From the 4 periods mentioned above, researchers have gathered activities that moved the projects forward which can be categorized into different types as follows: 1) Health care – Monitoring the level of cadmium and evaluating health status of local citizen with age of more than 15 years old in 13 villages of cadmium highly contaminated areas in zone 3 in Tao river basin subdistrict from B.C. 2004-2005 in the total of 7,730 persons. 89.1% of population had a normal level of cadmium in their bodies and 10.9% had cadmium above the normal level. Health risks of local people were derived from long contact of cadmium. It takes a long time for cadmium to degrade in human bodies, possibly take 10-30 years. Moreover, cadmium has an adverse effect on nervous system, kidneys and immune system. People who have touched cadmium must undergo health check, evaluation of cadmium toxicity and obtain appropriate treatment continually. 2) Environment –Soil sample was taken for determining the basic cadmium value of water sludge at 3 mg/kg. The areas of study were divided into 4 parts; (1) Non-contaminated area (less than 3 mg Cadmium/kg), low contaminated area (3-20 mg Cadmium/kg), medium contaminated area (21-60 mg Cadmium/kg) and high contaminated area (more than 60 mg Cadmium/kg). The results showed that 42.0% of the total studied area was not contaminated, 48.8% was low contaminated area, 7.4% was medium contaminated area and 1.9% was the high contaminated area. The medium to high contaminated areas required the recovery from cadmium contamination. In addition, the researchers had compared the cadmium level data obtained from each area to the regulations of soil quality according to the announcement from the national environment committee

volume 25 (2004) under the Proposed Act of Supporting and Maintenance of Environment Quality in 1992. This Act designated that contaminated area must have cadmium at 37 mg/kg and less than 37 mg/kg for non-contaminated area, respectively. This measurement was different from the designation set by the researchers stating that contaminated area must have at least 5.7 mg cadmium/kg. According to the Act, the area of 5.7 mg cadmium/kg was ruled out as the contaminated area however it resulted in contaminated rice grains. On the other hand, the contaminated area of 12.3 mg cadmium/kg did not lead to contaminated rice grains at all. This difference may be due to different pH and Eh in soils that affect absorptive ability in the areas. 3) Occupation – Occupations of local people tend to change from farming to gardening without developing the previous career further except for cow domesticating. 4) Sociocultural system – The culture of the local people was mostly and tightly bonded to rice and the goddess of rice (Phra Mae Phosop). When changes in occupation occurred, it affected the local people mentally and their way of life. The problems of inefficiency in new occupation, changing irrigation systems, abandoned irrigation systems and changing water management system need to be improved. This was done not without difficulties because the outsiders came to the community without basic knowledge of the local people. The local people did not believe in their leaders and that led to conflict in the community. They, on the other hand, believed other people could lend them a better hand than their own leaders. The generosity and relationship between the land owners and the land renters have been also changed. 5) Innovative development for administrative management – It did not found any academic reports and organizations discontinued the work after the news announcement in 2004. The disclosure of data to the public

should continuously lead to the verification and follow up process and also distribution of data in terms of health status of the local people. In addition, the researchers have found that the database system of the people affected by cadmium contamination was not clear enough and needed the redesign of archiving, following up and updating data covering all affected areas and affected people. 6) Research and development, database setting, information technology and knowledge management and public communication – The data from the central sector were categorized into 4 groups without continuation or synchronization. Basic information is derived from research studies and review articles from national and international educational institutes, official institutes, news from newspapers, data from Mae Tao river basin area and data from personal communication. Knowledge from Research and development and related database is very limited and administrative mechanism and management was not designed to be educational. There was a lack of data and case studies from in the country and outside the country. GIS system has not been used enough. Official sectors involved in the project have not established clear-cut and sufficient database. 7) Human resource development and teamwork – The researchers have found that the problem regarding cadmium contamination was not resolved because of lack of effective human resources and up-to-date teamwork. Mostly they worked in a passive manner. 8) Use of financial budget during the previous work – between 2006-2011 there were 6 projects with the total budget of 124 million Baht excluding monetary compensation.

2.4 Problems and obstacles

Lerdlukanavong (2007) had categorized problems and obstacles into different groups as follows :

1) Local people did not develop themselves. They were attached to the old idea of blaming the culprit and asking for compensation.

2) Insufficient water resource in Mae Ku river

3) Regional official sector focused on material development without stressing on irrigational system and water system planning

4) Inconsistency of the official system and thus discontinuation of the work

5) Changing relationship between the land owners and the land rentors

6) Lack of innovative mechanism, work ethics based on understanding of the local people

7) In transparency of administrative system

8) Lack of unity in coordinating centers

9) Lack of support from policy-level organizations

10) Conflicts of interests

11) No success in data transfer from the government to the community

2.5 Opportunities and possibility in the future

Lerdlukanavong (2007) proposed 2 ways of opportunities and possibility in the future. Firstly, the positive change consists of career development and stable revenue, improvement of soil quality in the area, means for development to support economic expansion by community involvement. These will bring about up-to-date working mechanisms in the area, understanding in teamwork from every sector. Secondly, the negative change consists of disagreement in teamwork, lack of

understanding in any situations and the arising need in the area, deforestation of the water source to expand corn cultivation area and weakening of irrigational system.

2.6 Justice process

In terms of fights by the people, there was a court order from administrative court from Pitsanulok, Black case no. 245/2556 dated 14 August 2556 stating that National Environment Committee used the law section no. 43 of the health supporting and national environment act 2535 designated the Tao river basin area in Mae Sot district in Tak province as the environmentally protected area. Working committee at subdistrict, district and provincial levels, had been set up to make a decision upon the Tao river basin area. One of the measures had presented the draft for consideration in this research, which was development of database to support the need of database in decision making. In this measure, it was proposed to set up the data center as the central co-ordinating center, mineral data resource networking and other data.

Many research reports were involved in the problem of cadmium contamination in Tao river basin area regarding environmental, health issues and resolution guideline including citizen involvement (Simmons *et al.*, 2005; Songprasert *et al.*, 2015; Sriprachote *et al.*, 2014; Weeraprapan *et al.*, 2015; Swaddiwudhipong *et al.*, 2007). Content relating to this research is database systems. Resolutions were proposed and area development using database in the project studying on cadmium distribution and cadmium contamination in Tao river basin area, Mae Sot district in Tak province. Pollution Control Department of Thailand (2011) had suggested that there should have been development of database regarding cadmium contamination to be used for surveillance, resolution of the problem and area development.

This must be done in accordance with the need of local people to receive the up-to-date and accurate news that brings about mutual understanding in the community. Moreover, it needs to have surveillance in the present time and also in the future which in turn needs reliable database in comparison with other contaminations in humans and environments. Preliminary data collection from researchers in the subject of using data in early phase of problem occurrence was in agreement with the research result of Kumsopa (2010). Research on data management system of Tao River basin area planning in Tak province covered the area of 3 subdistrict and 12 villages. Five areas of database of primary and secondary information were highlighted including (1) soil resources, geology and use of soil (2) water resource and soil residue (3) socioeconomics, product yield and well-being. This was done by PAR system and related staff in database development. From this research, they have found the problems in data integrity between organizations. When the data were in disagreement, confusion occurred. Until now, there were no clear conclusions about the cause, violence, and trends of cadmium contamination situations. In addition, this research mentioned about the significance of citizen involvement and this could lead to the acceptance of research by the community. This will reduce the conflict occurring in the area caused by confusion. Different levels in database setting should be established for community, officials and academics to open the doors for knowledge development regarding resolving the issue of cadmium contamination in Tao river basin area and other areas with similar problems. Thus, this research on database management in community with citizen involvement from community digital center and citizen was really based on people's need and people engagement.

Data and data management

1. Data manipulation

In this research, the scope was focused upon the study of data management process and thus one had to define the word 'data' clearly although different definitions were found. However, the core meaning of data was fact of the event that was recorded (Gordon, 2007). Data can be in the forms of picture, sound or symbol or mixture of two, but cannot be used instantly. These are prepared for data integration and used in information technology (Iamsiriwong, 2012) although data cannot be used instantly. It is the first and important step to use information technology in other areas in the future. Gordon (2007) summarized the significance of data and relations between information technology and data that quality of the data was important to integration that brings about information. If data is inaccurate or it is of poor quality, information used to make a decision will be inaccurate too. Similarly, Tetiwat and Esichaikul (2010) stated that data/information was a key indicator for success or failure of the system since data collection coming from data sources must be corrected, screened and verified. In addition, archiving for database establishment must be systemic for quick and effective search and thus must have good data management as well.

Data management involves vital processes including capturing, verifying, classifying data, arranging, summarizing, storing, retrieving, disseminating and reproducing. Gordon (2007) had defined 'data management' as the service and processes working together that lead to controlled information or linking the definition and use of useful and relevant information or the process in administration, data archiving and making use of data conveniently. Malaiwong (1998) stated that

change in information technology services in the modern days lied in 3 subjects; (1) a change in archiving data from one place to different places and types of information become various (2) Behaviors of service users affect the use of service at data center. If they do not have data of interest, the users will not visit there again. In addition, ways of accessing data through internet via electronic devices are very important and convenient for all the users. Thus designing ways of accessing data by users is something to be considered for the data center (3) Executors in information technology should be capable of using this technology and internet effectively as well as having knowledge of data management.

2. Database

Database is one way to manage data in the systematic manner with an advantage in reducing repetition of data, conflict in data, time and steps in data management. Standard of data was set up. Users can use the data altogether and can secure the data. Jongpattanakorn (2007) stated that database was stemmed from collection of relevant or related data in the same place which users can make use of instantly. Models and relations of data stored in database are using simulated models in many forms divided in 4 main forms (1) Hierarchical database model (2) Network database model (3) Relational database model (4) Object-oriented database model. When using computers for data management, database management system was established as an important tool for systematic data arrangement.

Information system and community information system

Data importance is the start of production of information that people can make use of in many aspects. In this section, information system and community information system will be defined.

1. Information system

Development of information system needs educational, analytical and designing techniques to run the work process effectively since system developers must study and analyze the process of information flow and relations of factor inputs, resources, and outcomes for building the new information system. However, in reality, system development does not end at model design, developers must search for and install, perform, and evaluate the system whether or not it meets the demand. Moreover, it needs planning of system development in the future. However, this will use both system development and system analysis and system design with interchangeable meanings. Information system development is a subtle process involving personnel and different aspects of components of the data center. It needs guidelines and systematic planning to make a developing system complete according to the demand and satisfaction of the users. Tetiwat and Esichaikul (2010) studies concept on community information system and found that there were many definitions however they summarized that information system was the designing system for data collection, data integration using personnel and information technology to optimize information system for applications. This definition is composed of 2 parts including system and information. System is collection of components relating to each other and interacting with each other. Information is news from raw data leading to data integration which can be used in many areas.

Since information system works with other components altogether to accomplish the objectives of interest and thus information system consists of

1.1 Hardware means instrument, device used together in information system

1.2 Software means computer program, demand set and other processes with the demand and control over hardware to work accordingly

1.3 Data/information is the input into the system for integration to result in the outcome of interest. Data are important for information system and act as a key indicator for success or failure. Data must be of high quality, have systematic archive for quick and effective search Tetiwat and Esichaikul (2010)

1.4 User/People means personnel involved in the system both in the development phases and access to the use the system

1.5 Network & Communication is an important factor in the transfer and linking data from different data sources in different regions. At present, network and communication is important in working process of ever system

1.6 Procedure is part of performing steps of the developed system

2. Community Information System (CI)

Information system is a supporting tool for working process in every organization. Not only this can be sued in organizations, but also used in communities to solve the problems and develop the community as well.

Jinda (2010) presented the meaning and principles of information system. Community information system is the information system and knowledge focused on building community, strengthening community to be able to administrate and manage the center themselves, solve daily problems to improve quality of life using

information technology and communication as tools. In information system, community is a multidisciplinary arts used to search for other factors in sociocultural aspects leading to community development. Information and knowledge from community information system of the service is categorized into 2 types (1) Basic information used in daily life of community citizen and (2) information regarding community activities for building citizen involvement. Furthermore, Jinda (2010) presented results from information system development from oversees. It was shown that designing and development was divided into 3 phases (1) Vision designation in the community phase and search for the need in community information system development (2) community information system development phase and (3) The search for or develop community organization phase.

System development

Iamsiriwong (2012) defined 'system' as a group of components with whole or partly relations. Each part has to work together to achieve the same objective. Each system could also have sub-systems. Visioning the system comprising of many sub-systems has advantages in narrowing the scope of the system and easily control it, reducing system complexity as well. Therefore, working system being newly built or the old working system being changed can solve problems to meet the needs of users. This is called 'system development' (Tetiwat & Esichaikul, 2010). From the definition of system consisting of many components with relations to each other for the same objective, if there is no planning or designating the steps to develop the system, the system would not work to meet the demands of the users. Thus, they

set up the guidelines in the form of life cycle to make the system meet the demands of people always.

1. System development life cycle (SDLC)

System development life cycle is logical process in information system development to solve business problems and respond to the demands of the users. In the life cycle, processes are categorized into 3 phases including planning phase, analysis phase, design phase, implementation phase and maintenance phase.

1.1 Planning phase

This is the start of system development with important content regarding the problems to be solved, possibility in resolving it and objectives of the process. The main activities involve problem indication, study the possibility, designation of duration of working process, designation of working committee. If all these activities in this phase do not meet the demands of the people, then the work in later phase will be a waste of time (Kendall & Kendall, 2014).

1.2 Analysis phase

This is the phase where demands of users and expectations of users must be determined. This phase may need interaction activities with users in many forms such as interview, data survey, questionnaires, observing behaviors and environment of the users. Results obtained from this phase will be used as the frame and the rules of the system to be newly developed or built.

1.3 Designing phase

This is the phase where demands of users and expectations of users must be determined. This phase may need interaction activities with users in many forms such as interview, data survey, questionnaires, observing behaviors and

environment of the users. Results obtained from this phase will be used as the frame and the rules of the system to be newly developed or built and build simulated process using man different tools such as data flow diagram (DFD), sequence diagram or entity relationship diagram (E-R diagram).

1.4 Implementation Phrase

This phase is focusing on developing the system according to the design, testing the system before use to determine the flaws at preliminary level, reducing the flaws as much as one can. After that the system will be implemented for practical use and manual will be produced, the training for users will be held and evaluation of the system will be carried out.

1.5 Maintenance phase

This phase is focusing on monitoring the users which may have problems in accessing the system, understanding of the system. Thus they need help to fix the system correctly. When users discover that the system is still lacking what the users need, this may bring about the restart of life cycle of the system to obtain the system that really meets the demands of the users.

2. System developing patterns

System development can be used in many forms by considering the steps of working process in each phase of system development.

2.1 Waterfall model has a linear characteristic in working process. Each step must be completed before taking the next step. It starts with planning phase, analysis phase, system development phase, implementation phase, and maintenance phase, respectively. If there is a problem in any phase till the maintenance phase, one must restart the life cycle.

2.2 Evolution model has the focus on building the model that users can use and improve the model according to the demands of the users in evolutionarily manner till the perfect system that meets the demands of users is achieved. This model is suitable to small and medium system. It is a developing process of the sub-system as part of the whole system and needs to respond to users quickly and users can see through the system they are using.

2.3 Rapid application development (RAD model) is developing the system with flow-through of process characteristics which dividing the work into parts and different working committees and gathering the outcomes from all the parts to speed up the system. However, when the system with the scope is enlarging, there is a need to have more working committees (Assawamekin, 2015)

2.4 Agile system development is the new concept in system development with repeated life cycle of working process and focus greatly on communication between system developers and users. Use of manuals makes users as if they were part of working committee developing the system. This Agile system development was invented in mid-1990 with the need to solve the problems that users were changing their minds often. There was the Act of software development by Agile system with 4 important points (1) Importance given to the workers with emphasis on interaction between workers (2) Focus on software development for practical use more than the manuals (3) Participation from users and developers more than the importance of working contract and (4) Focus on solving the system according to the need of users than importance of planning (Assawamekin, 2015). Agile system development can be divided into many forms such as extreme programming, scrum.

From the above mentioned system developments, the researchers have chosen RAD for system development in this research study to make sure the system matches the demand of users and allow users to get involved in the system development process.

3. Concept on coding pattern

This can be divided into 2 main concepts (1) Structured programming (2) Object-oriented programming (OOP) with following characters:

3.1 Structured programming is the management of commands into easily writing forms and standards, easy to verify, convenient to edit programs in the future. There are 3 controlled models. 1) Sequence structure - It consists of unconditional command or command set, without decision, one-way access and one-way exit, sequence process with every single step being performed once only. 2) Condition structure - For making a decision in the program that needs condition whether it is the true value or not. After that, follow the order that is conditioned before with the planning pattern. 3) Iteration structure - It is the repeated process and away from condition if only that condition matches what was designated before.

3.2 Object-oriented programming (OOP), when the program becomes more complex, software developers must find the way to manage the program model for more effectiveness and be able to manage and maintain it easily. That has led to the use of object oriented programming. This was programmed with different languages. In the past, it depended upon the work of command set gathered to form a program while material language collected good properties of processing program can enhance capacity in algorithm management and new data model with the focus on

working and new data collection into one unit in the material form. However the processing program clearly separates 2 parts.

3.3 Model-View-Controller (MVC)

MVC is a kind of architecture software and at present is the architecture platform used in software engineering. The MVC platform is used to divide the software in logical parts including users' understanding of using the software. Data input and result illustration help separate the development, verification and maintenance of software from each other.

Model means a part of software used in translation of the system work leading to what the software system was designed for in the first place, logical content used to give the meaning to raw data (such as figuring out the birthday of the user, total tax value and cost of delivery). When a model changes, a warning will be sent to related view for editing many system software to keep the data permanently such as database. MVC does not designate the level of access to data since this is known to be under or controlled by a model. A model is not just an object to gain access to the data, but in small software with little complexity there is little difference.

View shows the value of model in a form suitable to interacting with users. In one model, there can be many forms of views for different purposes.

Controller receives data from users and continues to respond to the data calling out logics from materials in a model and sending data outcomes back to the result section in order to respond appropriately to users.

Information technology service management

Information technology is of importance as a tool to drive the work of the organizations. If the organizations are using information technology for practical use, worthy and responsive to the aims of the organizations well, this will increase competitiveness. However, the organizations must invest well on bringing information technology for applications in their workplaces, without good planning this may be a waste of money. Thus, the organizations must follow the rules in managing information technology. Malaiwong (2002) gave the following guidelines (1) Organizations should clearly designate the aims of the use of information technology (2) Analysis of total cost of ownership regarding the work systems and also costs in administration and maintenance of the system (3) Organizations should designate the persons in charge of the information technology and data system to follow up the work to meet the aims of the organizations (4) Organizations should archive and administrate data in electronic forms (5) Organizations should have basic frameworks regarding information technology in accordance with the workflow of the organizations (6) Organizations should designate the standards in information technology compatible with open standard and have evaluation of technology, standard and emerging products to reduce the costs or enhance capacity of the organizations (7) Organizations should design systems easy to adjust to the changes in organizations or in technology (8) Organizations must perform in such a way that information technology used in the organizations continues to work continually without a pause and (9) Organizations should measure and evaluate the results regarding IT works periodically.

From the above, one can clearly see that information technology sector of the organization serves a role to provide tools in information technology for other sectors of the organizations to call upon service continuously and conveniently for making sure that all sectors can work continually without stopping. Thus, information technology sector of the organizations provides good support to other sectors to drive the whole organization to achieve its goals.

1. Management of information technology service

From the importance of driving the organization to accomplish its aims using information technology as supporting sector, at present there is information technology service management (ITSM) standard that uses the principles of service management for information technology. The primary aims of this management are to assure the organization that information technology services are in accordance with demands in business of the organization and can provide continuous service (Lloyd *et al.*, 2007). This is to make the organization capable of administrating information technology to meet the aims of the organization.

2. Information Technology Infrastructure Library (ITIL)

At present, the concept of ITSM has been commonly used in several organizations. There is a framework development of ITSM in many ways. ITIL is an administrative framework of information technology services invented by working committee of British government in 1980. The Central Computer and Telecommunication Agency (CCTA) was the pioneer in developing administrative management of information technology with the initial name as Government Information Technology Infrastructure Management Method (GITIMM). After that, content has been improved and changed the name to IT infrastructure Management

Forum. The development that emerged was not the method, but rather the guidance. Thereafter, it was developed and changed the name to IT service Management Forum (itSMF). The first published report was Service Level Management and the last one was Availability Management which distribution led to development and building standards and guideline in other work processes. Book series were gathered and distributed collectively called IT infrastructure Library (ITIL). ITIL v1 was distributed in 1990 upto now this has been improved to ITIL v3 in 2011. ITIL v3 consists of 5 book modes: Service strategy, service design, service transition, service operation and continual service improvement. The relations of these 5 books are shown in Figure 2.1.

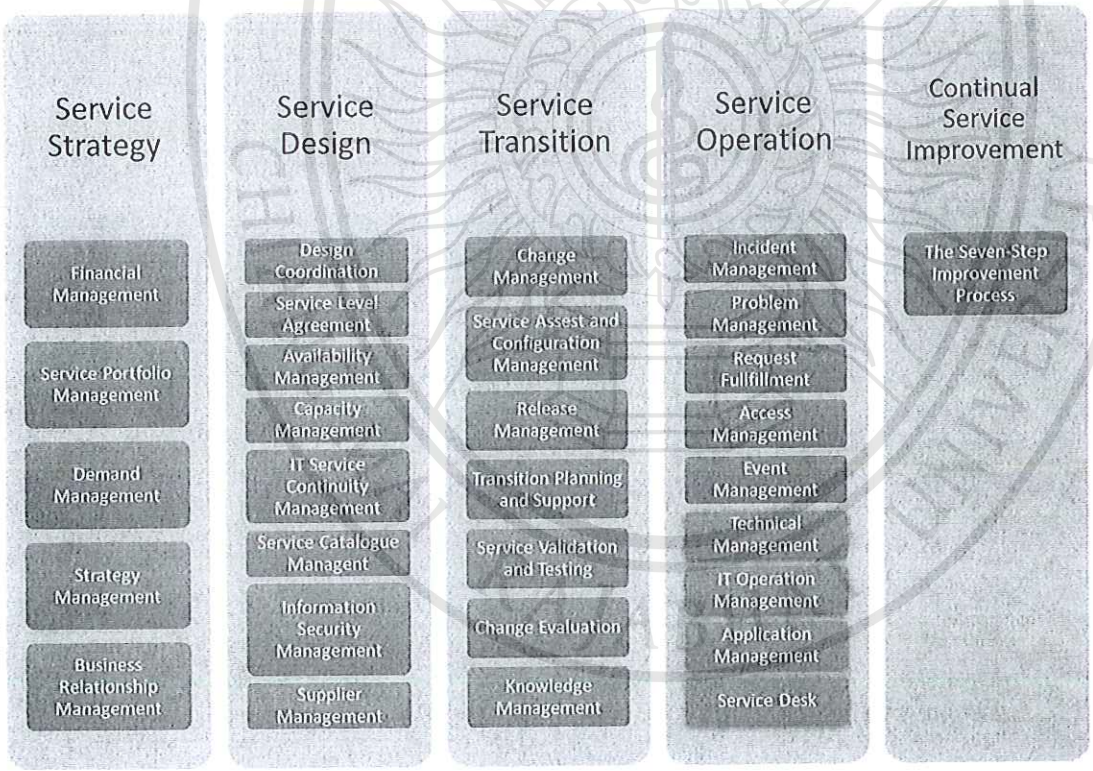

Figure 2.2 ITIL Process

Source: Fry (2010)

2.1 Service strategy

Documents in this process cover the methods that change service management to strategic asset. The outcome showed relations of services, systems or processes that organizations are running and business model (Office of Government Commerce, 2007). The aims of service strategy are to prove the opportunity in developing the service system to business market to meet the demands of users and customers. Service strategy has 3 sub-components: 1) Financial management 2) Service portfolio management 3) Demand management.

2.2 Service design

Documents in this process focus on designing activities in the process of services consisting of designing working system, service method, strategy development and administrative management of service system, preparation in services, capacity limit in services, service continuity management and security management. Documents in this mode have process and function as follows: 1) Service Catalogue Management 2) Service Level Management 3) Capacity Management 4) Available Management 5) IT service Continuity Management 6) Information Security Management and 7) Supplier Management.

2.3 Service Transition

Documents in this process focus on working process to obtain the outcome of the best service including creation of new service methods and improving the previous service method. Service Transition consists of process and function as follows: 1) Transition Planning and Support 2) Change Management 3) Service Asset and Configuration Management 4) Release and Development Management 5) Service Validation and Testing 6) Evaluation and 7) Knowledge Management.

2.4 Service Operation

Documents in this process focus on important activities for working process to achieve the aims and follow the agreements to users and customers. Service Operation consists of process and function as follows: 1) Event Managementn2) Incident Management 3) Request Fulfillment 4) Problem Management 5) Access Management 6) Monitoring and Control 7) IT Operation and 8) Service Desk.

Service desk is the main function that organizations must have in order to use ITIL fully to co-ordinate the service users as the co-ordinating center.

2.5 Continual Service Improvement

Documents in this process focus on increasing the capacity in improving the ongoing service to continuity, having good quality and responding to changes in service needs and in technology. Continual Service Improvement consists of 7 steps of improvement process describing measurement methods and report on service improvement.

From Figure 2.1, service strategy and service design are parts leading to meet the demands or accord with the need of information technology use that drive the working process. Fry (2010) had compared different modes of ITIL and a boat as a simile. Service Strategy and Service Design were the director of a boat that leads the boat to its destination. Service Transition and Service Operation were the boat engine that drives the boat to its destination. Without these two, a boat cannot reach its destination. Continual Service Improvement is the evaluation of the process and increasing the effectiveness for continual function using life cycle work process as shown in Figure 2.2.

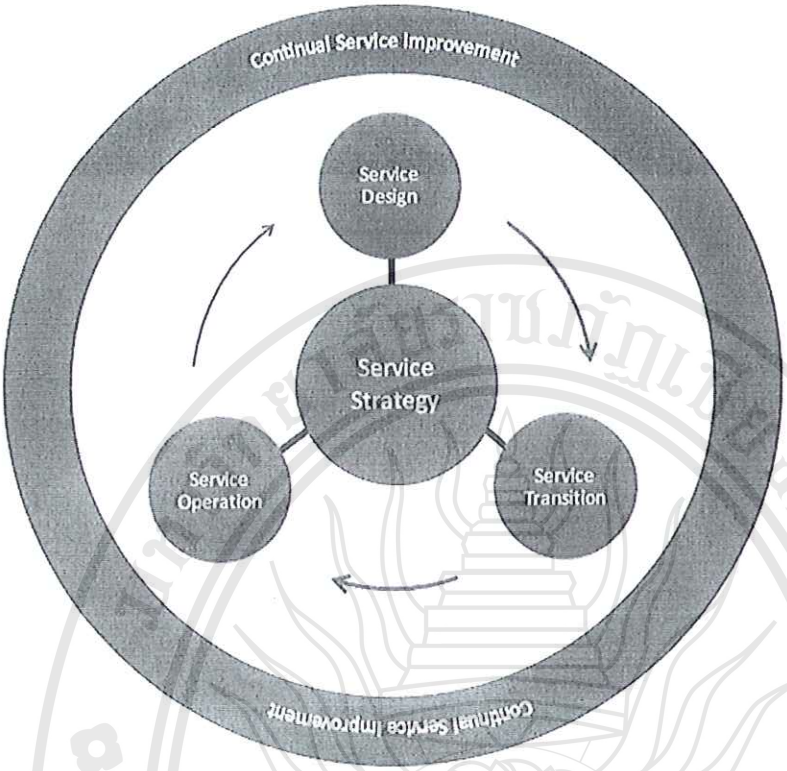

Figure 2.3 ITIL Life Cycle

Source: Fry (2010)

However, since ITIL is not the standard that one must follow, organizations can choose the guideline in ITIL framework dependent upon the readiness of the organizations. Application of ITIL in parts is called ITIL Lite or itil Small-Scale Implementation. Fry (2010) presented the ready-to-use application of ITIL in many forms. The principles of how to choose which part of ITIL for implementation are outlined in Figure 2.3.

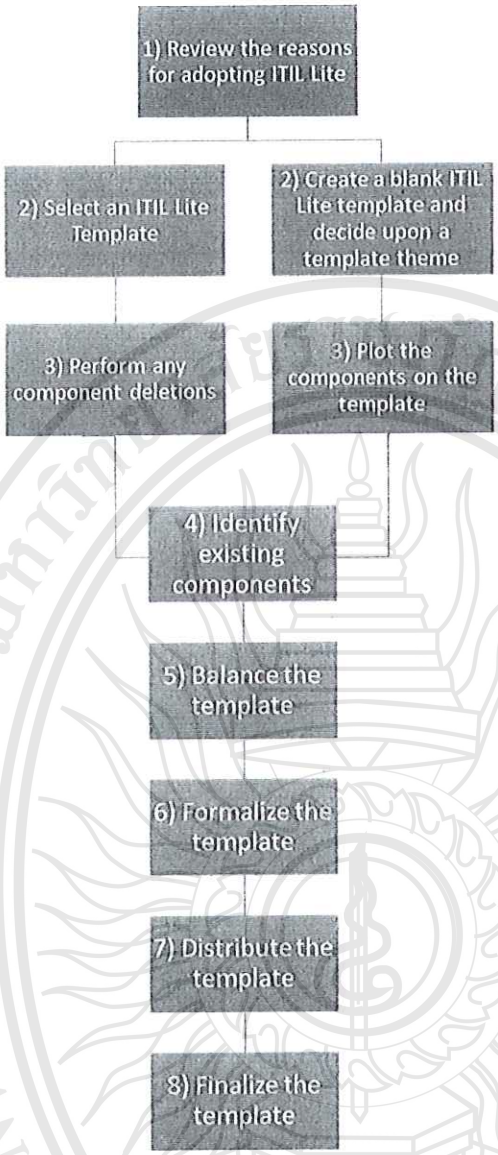

Figure 2.4 ITIL Lite

Source: Fry (2010)

Benefits of ITIL implementation are manifolds such as increase the use of resources to the fullest, increase competitiveness, reduce the repeated work and unnecessary work, improve quality in IT service to users, meet the demands of users.

3. Maturity Model

Maturity Model is the system used to measure the maturity level of the working process of organizations consisting of indicators reflecting upon capacity of the process. Mostly, Maturity Model has divided the measurement values into 5 levels (1) Initial (2) Repeatable (3) Defined (4) Managed (5) Optimized (The highest level of capacity of the process). This Maturity Model has been continuously developed in various forms such as Capability Maturity Model (CMM) Governance Maturity Model (GMM). In ITIL framework, there is Maturity Model which is Process Maturity Model (PMF). This has divided the capacity into 5 levels as mentioned before. Marquis (2006) stated that Maturity Model of ITIL covered factors of the process consisting of visions and strategy of the organization, pushing the organization forward using information technology, process to achieve the objectives, personnel, implemented technology and culture in the organization.

Implementation of ITIL Maturity Model in the measurement of ITIL processes can be used to evaluate the process of interest, part of process in total processes and total processes. Pereira *et al.* (2011) studied the use of Maturity Model in measurement of maturity level of incident management, configuration management and service desk function. This research used questionnaires to measure maturity level of 5 organizations. The questionnaires included questions with 4 choices to choose from i.e. Yes, No, Not know and In progress.

Citizen involvement

In this research, not only data management system has been developed, but also include citizen and governmental sector involvement i.e. community data center

as the information technology service provide to the local community as mentioned in Section 2.1. Bureekul (2008) stated that the definitions of participation are various, but going to the same direction. In summary, citizen involvement is the process which people or stakeholders have a chance to show their visions and take part in activities affecting the well-being of the community. This uses two-way communication between citizen and related sectors in both informal and formal manners, data sharing and building unity in society. This is in agreement with Somsamai (2010) that gathered the definitions of participation from many sources. According to WHO and Unicef (1978), it was stated that participation brings about process and framework that allow people to express what they need, to get involved in development process and benefit from the development. People have the rights to make their decisions. Oakley and Marsden (1984) defined participation as the process that gives rights and roles to people in order to solve the problem. Citizens will initiate ideas, make attempts and use resources to solve these problems and co-operate at the fullest. In addition, Cohen and Uphoff (1977) stated that it was the process which participants must get involved in decision making process, working process, sharing benefits and project evaluation process. Community citizen, community leaders, officials and outsiders are key players in this participation. For this research, the purpose is to create participation from governmental sector, people, community leaders and outsiders for building community data management system process. For the governmental sector, it is the working committee at community. For people and community leaders, it is the leading group of citizen that pays attention to community data system. For outsiders, it is supporting organizations that drive the development of community data system.

Citizen involvements can be grouped into 3 forms (1) Induced involvement (2) Compulsory involvement and (3) Volunteer or group involvement. These 3 forms of involvements are carried out in this research. The people sector took part in volunteer or group involvement in response to the need to set up the community data management system leading to resolving the problems and develop community further.

Walaisathean *et al.* (2543 cited in Somsamai, 2553) summarized the involvement process regarding citizen involvement and building up the community data management system that this was related to community education process which stimulates people to learn the community conditions, way of life, funding for the use in working process, indicating problems, causes of problems, and basis for resolution. Community Forest Management Bureau, Royal Forest Department partners with Sustainable Development Foundation. Walai Rukhavej Botanical Research Institute (2008) gave a suggestion of how to make data with citizen involvement as follows : (1) Making data is not a sole responsibility of either organization, but a joint mission between governmental sector, people and private sector based on the agreement, designated standards, mechanisms and methods to work together. (2) Data framework should cover socioeconomic, cultural, geological contents. These are not made based on roles and duties of each organization. (3) Working in integral manner. (4) Emphasis on involvements from all sectors. From the outcomes from this research, part of them was data management system process designed and executed by involvements from all sectors: People are the ones who designate the scope of data that they need in data management system and also designate the process in data management system and take part in evaluation and suggestion to the process and data

management system through the representative from the people sector whom volunteered to be in the working committee. The citizen involvement presented here in this research is deemed as Delegated Power that is the level where a small participation can have a positive benefit. Personnel related to this matter can also follow up the working process.

Data privacy and personal data protection

From the importance of data sharing via information technology at present, it creates benefits from data sharing in many kinds of work. One thing following the convenience of exchanging data or sharing data between each other is the problem in privacy and data security especially personal data. If a bad person takes the data and distribute them without consent, it will be a breach of personal rights and cause a great deal of disaster. Thus, this research will take on planning the process in privacy and personal data protection.

Privacy means the right to be left alone and right free from disturbance without valid reasons (Rojratanavanich, 2013). Regarding privacy issue, one emphasized on importance of personal data protection at the national and international level (Chanse. 2010). In Thailand in the past, Thai Constitution 2007 and several law acts such as Act of national health 2007 section 7 stated in a summary that data regarding personal health, those who did not own the data cannot disclose it to anybody and cannot ask for documents on personal health that do not belong to them. In addition, Act of Official Information 1997 Mode 3 Personal Information stated that disclosure of personal data by the official sector to the organization or a third party and personal rights in receiving personal data and forms of data at present days

especially the personal data of users in the digital era gave birth to definition of personal data in digital form as Digital Privacy (Gülsoy, 2015). Details of privacy relating to personal data are mainly included in the laws.

Chanse (2010) stated that personal data protection appeared in several laws. In foreign countries, personal data protection appeared in their laws differently from ours. In Europe, there are the rules in personal data protection and agreements by European Parliament and OECD called Directive 95/46/EC with objectives to determine the guidelines in Act of personal data protection for EU members to meet each other's accordance. In England, there is Data Protection Act 1998 that follows the rules set by EU. In Korea, there is law under Personal Information Protection Act (PIPA). In Thailand, a policy and guideline in personal data protection by governmental sector 2010 was announced in Government Gazette 2010 in 3 main principles : (1) Governmental sector responsible for collection, use, distribution or any activity on personal data of users via electronic forms must formally set out a policy in personal data protection in hard copy. (2) Governmental sector must set out the guidelines in personal data protection for users and designate what to do with data reports and (3) Governmental sector must set out a policy and guideline in personal data protection in (1) and (2) for governmental sectors receiving Trust Mark issued by a sector or organization confirmed by law. These organizations must also declare the policy and guideline in personal data protection to electronic relations committee.

Declaration of policy and guidelines in personal data protection by governmental sectors as mentioned above covered the designated objectives of data collection, power to disclose personal data of the users, personal data protection and security in terms of both technological and practical forms. For this research, ITIL

was chosen due to framework of ITIL having process in policy setting in personal data protection as appeared in Service Design and Information Security Management.

Literature review

The researcher in this study studied and search for literature reviews regarding process formats in administrative management of community data service with involvement from citizen and community digital center as follows:

1. Reports on community ICT learning center project in Thailand

The results showed that Ministry of Information and Communication Technology had carried out the task in the same way as other research reports. Status of working process of community ICT center in Thailand was studied (Wunsuk, 2010; Nilsook *et al.*, 2012; Kittivaraporn, 2011). Siribut (2013) had synthesized the research regarding community ICT center in Thailand during 2008-2014 in total of 7 reports. These can be grouped into 2 activity reports and 5 reports of working process outcomes. From the study, it was found that community ICT centers have the roles in reducing gap in digital access, extending opportunity to access information technology and communication and supporting the society full of wisdom and adjusting the national social framework. In terms of administrating the ITC centers, Ministry of Information and Communication Technology had assigned the power to the community to designate administrative method and verify themselves. The personnel responsible for this duty consist of (1) Committee at ICT center whose responsibility is designating the policy and the rules for members such as local leaders, occupational group, academic staff (2) Centre administrators responsible for administration and facilitating the center to run smoothly and accordingly to the

policy set up by the community. Centre administrators are mainly the community leaders or head of organizations that established the ICT center (3) Centre administrators responsible for taking care of ICT centers and activities organized by Ministry of Information and Communication Technology (4) Volunteers responsible for assisting the administrators in any activities, mainly are children and teenagers. In terms of financial budget, the center committee is in charge of searching for the sources of incomes received at ICT centers. Receiving funding from the organization that helped set up the ICT center, the ICT center found that most users were children and teenagers and the main services were accessing to internet for searching engine, following up news, receiving e-mails and also computer training service to do their homework. The main problems and obstacles regarding administration the ICT centers were facing were no planning in making administrative management to be tangible, no manual on administrative management and practical manual, no continual understanding. The latter made the working committee lack of knowledge or clear roles and personal communication between the committee. There were fewer meetings which were not enough to govern the work flow to meet the objectives and most ICT centers did not co-operate well or collaborate with other sectors. Only exchange of data, knowledge transfer of good practice at ICT center was conducted. Lack of systematic database, planning for data archive, interrelations and communication among community members about services was observed. Furthermore, lack of personnel and financial budget also adversely affected the work.

Suggestions from the previous reports were emphasis on the importance of participatory administration, idea sharing among community, solving problems together, creating a sense of ownership, mechanism to follow up the working process

and guideline to solve the problems of community in a systematic manner. The researchers are interested in using the framework of information technology service to mainly focus on the aims of the organizations as mentioned before. Moreover, researchers have designed the research process for community to get involved more in designating the service and guideline in working process at community ICT center as well. In addition, it was proposed to create networking between community and academics and between community and organizations with the same philosophy and aims for driving the work forward.

2. Research related to community information system

Jinda (2015) studied the research on information system development for administration in Thai community with the aims to analyze information necessary for community administrative management by Department of Local Administration in the context of Thailand, study the current status of information technology implementation and community administrative management by Department of Local Administration in the context of Thailand and development of information system for community administrative management in the context of Thailand. This was carried out with the target group; Department of Local Administration composed of Provincial Administrative Organization, Municipality Administrative Organization and Subdistrict Administrative Organization in Khon Kaen, Nongkhai and Mahasarakham with the total number of 16 places. Interviews were conducted with service users and administrators of information technology at Local Administration Organization. The results showed that there was a lack of systematic administrative management although the information system was already developed by other organizations. This information system still did not really meet the demands of Local

Administration Organization. In fact, the results led to the revelation that Local Administration Organization needed 1,390 information units to use information system for managing the community with 6 missions, 50 aspects. This led to categorization of information and confirmation to administrative committee and experts. It was found that 290 information units were used for administration and the most wanted one was information in basic infrastructure unit and quality of life unit. From this categorization, researchers have created the system called Community Management Information System composed of 5 main systems, 42 sub-systems. The main systems consist of population database, socioeconomic database, community problems, basic infrastructure and local data and local projects. This system was applied to a municipality at one subdistrict in the area of interest and found that users were greatly satisfactory with the service. It was suggested there should be a system development in making portable devices in the near future and consider data protection in the system. From the study, researchers thought that main users were governmental organizations and thus still lack the viewpoints from users from citizen sector for developing data service at community digital centers. Moreover, community would have data that meets demands of the people.

Tantipalee (2008) studied the research on development of community information system management at Baan Kok subdistrict, Srang Com district in Udonthani province. The aims of the research were to study the problems and demands in community information system, develop community information system and evaluate it by studying the sample groups in areas of interest consisting of community leaders, head of village, village committee, village volunteers and village representatives and representatives from households. The results showed that to

achieve 3 good properties of the system including speed up to date, meeting the demands of users, and accuracy there are ways to manage the information system as follows: 1) Public relations on setting up information system for local people 2) Setting a referendum stage in ready-to-do villages with the need to manage community data system 3) Community information committee should have designated roles and responsibilities, setting the place for ICT center 4) Setting a referendum stage for verifying the data to accuracy 5) setting up community information 6) encouraging information to be used at the fullest and 7) Community information committee must verify and update the data to meet the demands and to become accurate.

Kanchong *et al.* (1999) studied the research on development of information system for public health organization in Trang province. Medical doctor mentioned that surveillance in epidemiology did not respond well enough to the epidemiological events, there was a lack of comparative data in administration, lack of improving mechanism to update data, lack of efficiency in using data as tools to serve the target groups, local people were not aware of roles of volunteers well enough. The aims of their research were to set up the information system for organizations and public health organizations at every level in Trang province to plan the administration, management, follow up, govern, and evaluate the results of people's health development according to limited resources in Trang province. The scope of their research focused on the urban area in one district namely Kantrang district, two sub-urban areas in two districts namely Pralean district and Wangwiset district. At subdistrict level, the study covered 3 districts. Variables in the study included personnel, registration system and reports of information technology. Study

on management of data system and use of public health data for decision making on planning administrative management, follow up, govern, and evaluate the results of people's health development had the researchers, personnel relating to public health information and administrators in a total of 413 persons as the sample groups. Interviews with related persons and evaluation of data development were conducted. The results led to more effective use of data. Officials at a district level can use data for analysis and prioritizing the problems to make a project in solving health problems for local people. However, in this study, there was still a lack of staff responsible for software development as tools. There was also a lack of co-operation between organizations in the study areas. Thus, research on formats of community information system management with involvement from community ICT center and citizen had designated the roles of community ICT centers as co-ordinators to other organizations.

Tetiwat and Esichaikul (2010) conducted research on development of community geological information system for supporting the development of community in the lower Northern part of Thailand. The aims of the research were to study the demands of formats of community information system to support the development of community in the lower Northern part of Thailand and to develop community geological information system to become data center for the area and descriptive community information. The study lied in the lower Northern part of Thailand and the areas used to develop the geological information system for development of communities namely Phitsanulok, Sukhothai, and Nakhon Sawan provinces. Samples groups in the research were divided into 3 groups 1) Group for study of demands of community information format, chosen by grouping method that

included administrators, staff and local people in the lower Northern region 2) Group for confirming data from the first group by insight interviewing with community gurus in the lower Northern region and 3) Group for evaluating satisfaction of community information service by specifically choosing the sample group in Phitsanulok Sukhothai, and Nakhon Sawan provinces. In addition, the scope of research covered 15 aspects and development of system to website program using PHP language plus MySQL and Google Maps API. Research methodology was divided into 2 parts (1) Qualitative research on the need of format of community information system by collecting and studying data from documents, books, relevant research papers, and comparing database from websites to use obtained data to make questionnaires (2) Survey research was conducted by collecting questionnaires about the need of format of community information system using a sample group of 40 persons and interview with 32 community gurus to confirm the data and summarize the results. The system was developed into application website using Agile system development technique and evaluation of satisfaction by users on developed community information system was conducted using a sample group of 400 persons. Results showed that data from 15 aspects were important and necessary for archiving database in the same place and can make use ot it. Research on format of community information system with involvement from community digital center and people sector will use the framework of 15 aspects for survey to confirm the need of community information use in the area of Tao river basin and consider the problems for analyzing which data and where one can use data from when solving each problem.

In this research, not only community information management was developed, but also processes of administrative information technology and other related processes involved working with Out Source were developed. In addition, data management process that set data as service using ITIL framework application was also developed.

3. Research on community information system

In research using ITIL framework in the organization, software to use used for supporting the ITIL framework was studied. Suchaiboonsiri (2008) studied the use of Remedy program in accordance with ITIL principles of performing section and information technology service. In case of airline company, data was collected from interviewing with staff who used Remedy program and data from documents were also studied. The results showed that Remedy v7 software was developed to web application that was more compatible to ITILv3 guideline more than the previous version and it went on as administrator of the organization expected. Similarly, Theanhom and Srikhomkham (2009) studied on information system for solving information technology problems using ITIL. In case of Faculty of Social Studies from Naraesuan University, they studied the use of ITIL in solving information technology problems, development of information technology system to solve information technology problems there and evaluate satisfaction of the users by interviewing with staff and administrators about the problems found in information technology, resolution, and the need for reports for administrators. The total 65 persons were studied in this research. The outcomes from this research included development of information technology system to web application and using Agile system development technique for users to take part in developing process.

Furthermore, analytical method and system design employed material principles using UML as a tool. The information system was developed and gave service through Apache and command code was written in PHP language. From evaluation result, users were very satisfied with this system. In addition, staff who were using information system at Faculty of Social Studies were able to manage the problems and IT service in parts of ITIL framework only since they still lacked of knowledge in ITIL framework. The use of partial ITIL framework made researchers to focus on working framework in Service Desk, Incident Management and Problem Management since these matched the needs of users the most. The two previous studies were different from the study by Yamakawa, Noriega, Linares and Ramirez (2012) that studied on Improving ITIL compliance using change management practices : a finance sector case study. The aims of this research were to study effect of using Change Management framework on financial section. ITIL framework used in this work was ITIL v2 that collected data from insight interviewing with related managers including questionnaires in self-evaluation regarding overall capacity of the process. Four companies in Peruvian group in the same industry were chosen for the research to reduce gap between industries. The chosen companies had used other processes of ITIL with a total of 11 processes used in organizations. The results showed that every company gain benefits from using Change Management in their workplaces and Change Preparation process was the most frequently used.

Not only ITIL framework has been used in large organizations or those involved in information technology directly, but also can be used at any organization in many forms. Corvine (2008) studied on ITIL : a framework for managing digital library services with the aims to explain the use of ITIL and other parts of it in digital

library process. The result showed that there was a wide use of ITIL in many organizations especially in England and can apply this in development and services in IT organizations that are using digital library very well. Likewise, Carol E. Pollard *et al.* (2009) proposed the way to combine ITIL framework with Software Development Life Circle. This study presented the emphasis on the focus of ITIL and SDLC. SDLC's viewpoint focused on the product from the system development circuit including the software or developed system. However, ITIL had a broader viewpoint than SDLC in which ITIL covers from the start of business process to customer service and look at the outcomes from the system development circuit as a tool to serve the customers only.

From the study on ITIL, it was found that ITIL framework was used in organizations that wanted to add value to their business by making the best of information technology already present in their workplace to achieve the business goals. Information technology committee must build supporting service to other business sectors at the organization without having those realize about the cost in investment or accept the risks that may happen when using information technology. The mentioned duty belongs to information technology sector which designate details of information technology under the main business goals. This research has designated roles of related personnel in community information technology management process in accordance with ITIL framework. Since development of community information technology used computer for data arrangement only, that did not cover the process or guideline in community data management and also other basic framework management processes.