

## Spatial Structure of Socio-economic Functions: A Case Study of Ywatharyar Village, Minbu Township

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### Abstract

Many geographical studies emphasize on the structural development of settlement area by means of land use with particular attention given to the urban areas. However, we would like to argue that socio-economic conditions of peoples living in the settlement area will revealed in terms of symbols. The structural development of a settlement area could be depicted by means of analyzing these socio-economic symbols. In this paper, spatial socio-economic structure of Ywatharyar Village located in Minbu Township is analyzed as a sample. Base map is created by using GPS. Socio-economic data are collected by field survey. Then, locational pattern of each socio-economic function in the village is found out by using distribution method, mean center, standard deviational ellipse, and Kernel probability analysis. Results show two points: (1) all economic functions are located near the center of settlement area along the major road. In addition, grocery shops are located at the newly extended portion of the settlement while services and manufacturing are still remain in the old village center; (2) different kinds of social function have varied location characteristics. Some like monastery, pagoda and underground water supply system are located at the periphery of settlement. *Dhamayon* needs dispersed location in the village. On the other hand, electricity supply and telecommunications system are concentrated in the old village center. Education facilities and hospital are located in the periphery of village where it has good accessibility and large space.

**Key Words:** Socio-economic functions, mean center, standard deviational ellipse, Kernel probability

### Introduction

Human being lives on the earth surface in various forms. Rural people from North America, parts of northern and western Europe, and in Australia and New Zealand live apart, with houses and farm buildings located on land that individual work. In other parts of the world, however, people lives in nucleated settlement named as village or hamlets. Actually, village and

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hamlets were settlement norm, although with size and form that varied by region and culture (Rubenstein, 2003).

Whatever the settlement size is it has a good deal of trading, buying and selling of farm goods and family crafts for other needed commodities, and at least some part of village area is used for non-residential purpose. With development of trade between two or more rural settlement areas, new physical characteristic is occurred in its structure as their inhabitants engage in additional types of occupations. Settlement becomes difficult to self-sustain. Selling and buying places will be developed along the main street and road leading to the other settlements. The location of villages relative to one another becomes importance as the once self-contained rural settlement become towns and cities engaged in urban activities (Fellmann, et al., 1990). With the increasing population the economic activities become more numerous and complicated. Social affairs could be performed together in the village. To sustain and facilitate the local residents, social-spaces like, school, clinic, churches, and monastery are being constructed. Socio-economic facilities, on the other hand, attract people to live around those facilities. Socio-economic conditions and settlement structure are gradually developed in such an interdependence manner.

Most of the geographical studies emphasize on the above structural development of the settlement area by means of land use. In addition many studies are focus on urban areas. Of them, concentric zone theory, sector theory, and multiple-nuclei theory are three classic models (Norris, et. al, 1982). However, we would like to argue that socio-economic conditions of peoples living in the settlement area will revealed in terms of symbols. Churches will be located where Christians are living. Services activities which need wider market area will be located at the most accessible area of the settlement. Thus, these symbols are closely related to the structure of a settlement area. The structure of a settlement area could be depicted by means of analyzing these socio-economic symbols. Therefore, this paper tried to analyze of socio-economic functions (symbols) found in Ywatharyar Village to solve the following problem.

### **Problem**

How is Ywatharyar Village structured in terms of socio-economic functions?

### Data and Methods

To understand the socio-economic structure of Ywatharyar Village, it is necessary to have a precise base map, and correct locations of each economic and social facility. Base map was derived based on GPS survey. By using *CE Trimble*, location of each road segment of the study area is digitized and changed into *ArcView GIS* software format (.shp). Based on this based map, socio-economic field surveys are conducted. Derived socio-economic data are digitized by taking references to road blocks.

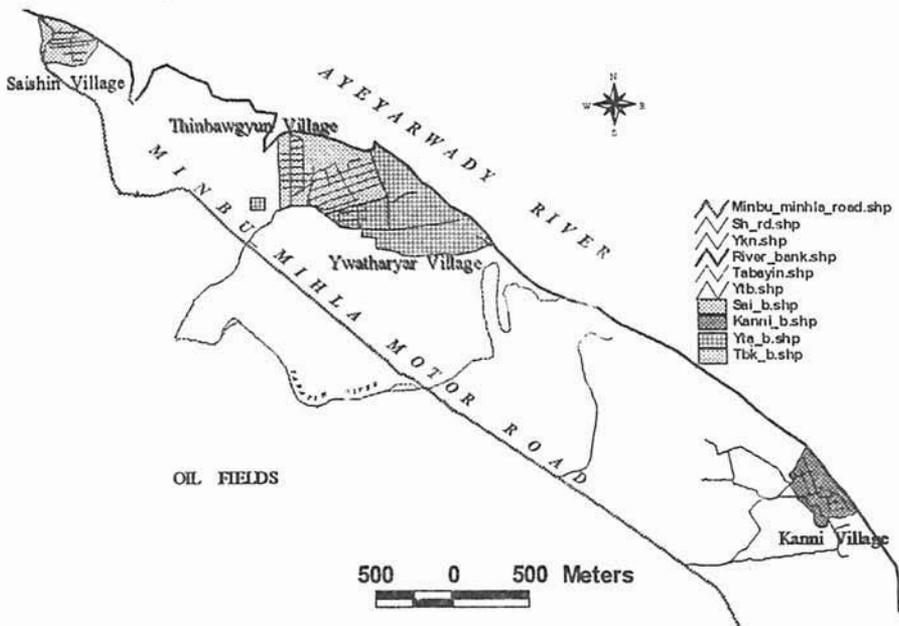
Among socio-economic functions, only visible symbols are use in this study. Economic functions are gathered to include grocery shops, services, and manufacturing. On the other hand, social functions include religious facilities (monastery, *Dhamayone*, and pagoda), electricity supply, water supply system, and telecommunications, education and administration.

The structure of a settlement area is reflection of both that settlement unit's location and its relationship with other units in the larger system of which all are apart. Moreover, the functional structure of that settlement area influences its current size and growth prospect (Fellman, et al., 1990). Therefore, second part of the paper deals with the spatial structure of Ywatharyar Village in the Ywatharyar Village Tract. Relationship between socio-economic functions and spatial structure of Ywatharyar Village is examined in third section. Then conclusions are drawn in last section.

### Spatial Structure of Ywatharyar Village Tract

Ywatharyar Village Tract is located in the southeastern part of Minbu Township, Magway Division. Although village tract's area is distributed in both side of Minbu\_Minhla Motor Road, settlement areas are located between Minbu\_Minhla Motor Road and Ayeyarwady River. Ywatharyar Village Tract consists of three villages namely, Ywatharyar, Saishin, and Kanni Villages. Thinbawgyun Village located on an island of Ayeyarwady River was destroyed by changing deep-channel course of Ayeyarwady. Some peoples from former Thinbawgyun Village were relocated in the place adjacent to Ywatharyar Village. Relocation project was started since the 1990s, and completed in 2002. Ywatharyar Village and Thinbawgyun Village are located at the center of the Ywatharyar Village Tract. Saishin Village is located in the Northern part while Kanni Village is located at the Southern part of study area (Figure 1). Village Tract Peace and Development Council (VPDC) is located

at Ywatharyar Village and Chairman is also living in the same village. Members of the VPDC are living in the rest three villages and manage their respective village.



Source: Based on GPS survey and topographic map (quarter inch).

Figure(1) Location of study area

In addition to its central location, Ywatharyar Village was a thriving Ayeyarwady River Port until the late 1990s. Many villages locate in the southeastern parts of Minbu District used Ywatharyar Port to go Magway and other large towns located along the Ayeyarwady River. In the last decade, however, changes are occurred in the transportation of Ywatharyar Village. Deep-channel of Ayeyarwady River was changed and sand bar are appears near the bank of Ywatharyar Village in the late 1990s. As a result, ship and boat could not directly enter to Ywatharyar Port.

Moreover, Magway Bridge was completed in 2002. As a result, people formerly depending on the Ywatharyar Port are changed their course from waterway to motor road which can reduce travel time and could safely

travel through out the year. Therefore, Minbu-Minhla Motor Road becomes important in transportation. Differ from ship bus could stop any place on the road. Therefore, passengers from the villages do not need to gather at Ywatharyar Village which is located about a one Kilometer away from the Minbu-Minhla Road (Figure 1).

Based on the above changes the economic and social role of Ywatharyar is greatly changed in the last decade. However, as a political and economic center of Minbu's southeastern villages it has many social and economic functions.

Before analyzing the spatial structure of a village, it is necessary to understand the relative positions and functions of Ywatharyar Village compare to adjacent town and villages. Figure (2) shows the numbers of household and populations of Ywatharyar and its adjacent villages. Since Ywatharyar is administrative center of village tract, it has largest number of population and household. Thinbawgyun Village is the second largest village while other two are relatively small. Three economic activities found in those villages are varied related to its population size and functions.

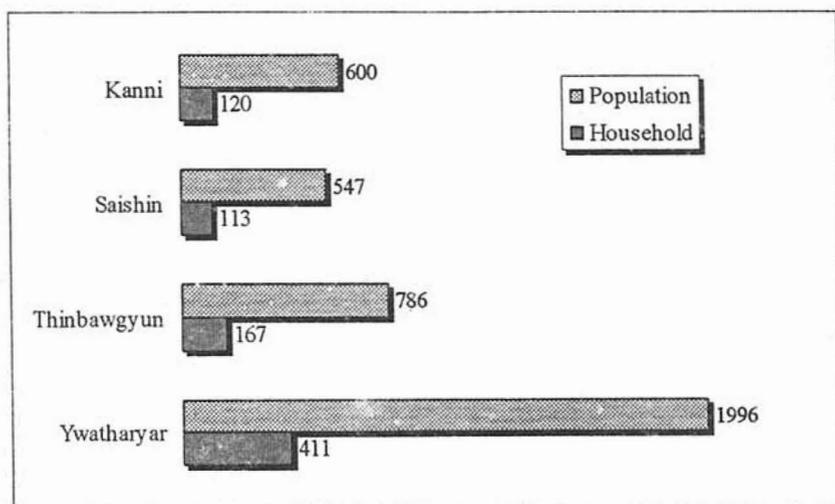


Figure ( 2 ) Numbers of household and populations in the Ywatharyar and its adjacent villages

Source: Village Peace and Development Council of each village (2004).

Figure (3) shows the variation of economic activities between Ywatharyar and its adjacent villages. As mentioned before, economic function includes grocery shop, manufacturing and services. Grocery shops which sell consumer goods are found in large number in all villages. Manufacturing activities like, bean husking, fodder cutting, and rice mill are found in the study area. The third category is services like, bicycle repair shop, electricity generators, restaurants are found in varied number and types. However, number and type of economic activities varied among villages related to its location and function. All three economic activities are found in large number in Ywatharyar Village which is not only the largest village but also administrative center. Thinbawgyun Village, however, has very small numbers of grocery shops and services related to its population. It is related to the points that its nearness location to Ywatharyar Village and recent development of the village. Thinbawgyun Village relies most of the services on Ywatharyar Village. For consumer goods it is also depend on the grocery shop located at the edge of Ywatharyar Village (Figure 7).

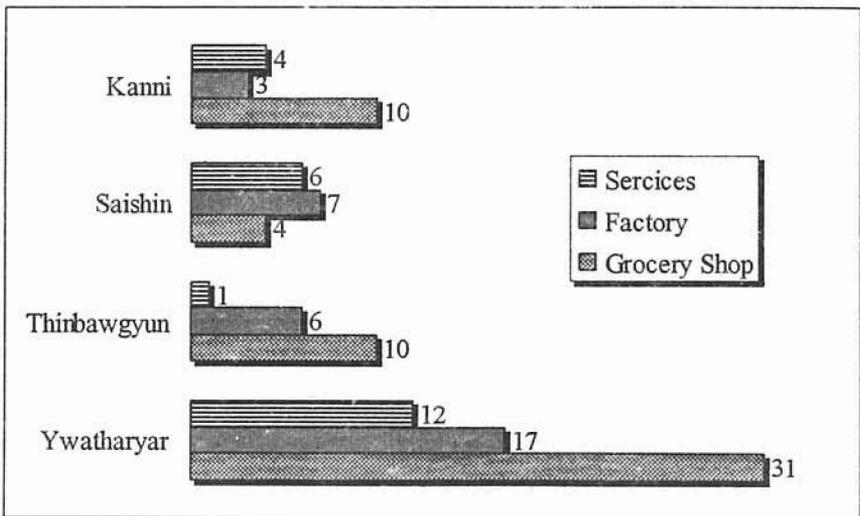


Figure (3) Variation of economic activities in Ywatharyar Village Tract

Source: Village Peace and Development Council of each village (2004).

From above figures (2 &3), it can be said that in term of physical, political and economic, Ywatharyar is the center of four villages.

### **Spatial Variation of Socio-Economic Functions in the Study Area**

General relationship of political and economic functions between Ywatharyar and its adjacent villages are stated in the previous section and this section will examine the spatial distribution of socio-economic activities in Ywatharyar Village. Spatial and temporal variations of economic activities are related to sequential development of village and structure of settlement. For example, small grocery shops which sell daily consumer goods, have small market area and capital investment. Thus, it will be developed in newly expanded areas. On the other hand, services which need large market area will not easily relocate in the new area. In addition, manufacturing activities with large capital investment will difficult to relocate in the new place. Demands of all economic and social activities are peoples and all peoples live in the houses. Therefore, spatial distribution of houses in the Ywatharyar Village is used as a reference to analyze the spatial socio-economic structure of the village.

### **Sequential Development and Residential Structure of Ywatharyar Village**

Figure (4) depicts sequential development of Ywatharyar Village. Ywatharyar Village is established since last 200 year ago at the western bank of the Ayeyarwady River. Although it is difficult to trace back the old spatial pattern of village, expansion was occurs along the Ayeyarwady River. In 1975, the village was expanded to the western part. Although, present situations of house are complex, the roads are constructed with plan. In 1978, Southwestern part was expanded for increasing population. Majority of the people living in the extended wards are newly married couples from the village. Newly immigrated people are very rare in the expanded area. In 1984, the western part of village adjacent to the Thinbawgyun Village was extended. Since the area is included in the Myanmar Oil Field, permanent settlements are only allowed to live in village. Beyond the settlement area is *Kaing* (in the river bed) and *Ya* (undulated land for dry cultivation) land owned by villagers.

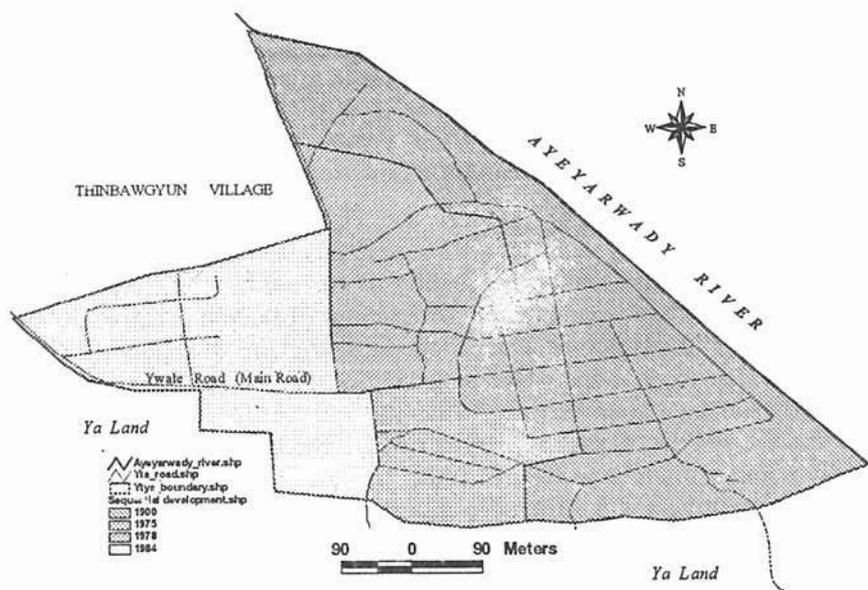


Figure (4) Sequential development of Ywatharyar Village

Source: Field observation, January, 2004.

Figure (5) shows the spatial distribution of houses in Ywatharyar Village. Residential houses are located as two groups: central part and western part of the village. Northern, southern, and southwestern peripheries are occupied by monasteries and pagodas. Land plots located between two houses groups are occupied by district hospital, State Middle School and State High School, and telecommunication office.

Since all socio-economic activities are related to human being and human being are living in the house, the spatial mean center and standard deviational ellipse of houses are used as a reference point to analyzed the spatial structure of socio-economic conditions in Ywatharyar Village. The center of village is located near the Ywale Road and its alignment is east and west. Result of Kernel Probability shows that the residential center of the village is located in the eastern part of the village centering the Ywale Road.

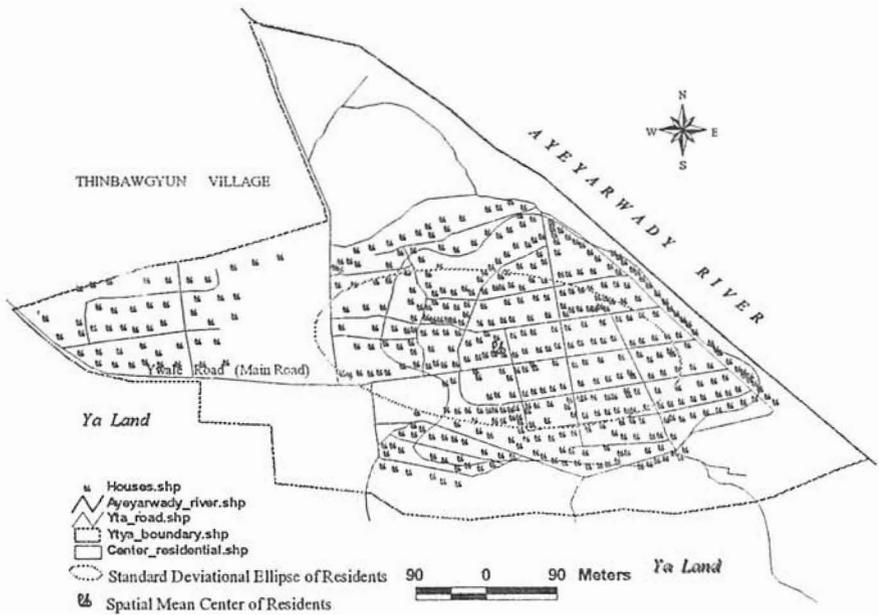


Figure (5) Location of residents, and its spatial mean and standard deviational ellipse

Source: Field observation, January, 2004.

### Spatial Structure of Economic Functions

Main Road connecting between Minbu\_Minhla Motor Road and former Ayeyarwady River ferry port is the most thriving place in Ywatharyar Village. Many villages located around the Ywatharyar have been used this road to take the ferry passing the Ayeyarwady River. As a results many services, restaurants and grocery shops were used to develop along this road. Due to deep-channel changing of Ayeyarwady River and construction of Magway Bridge, Ywatharyar Village lost its role of ferry port. In addition, the village itself is sequentially extending to the west where Minbu\_Minhla Motor Road is located.

Economic activities found in the village are divided into grocery shops, services and manufacturing. Since lands around the village are used as a *Kai* and *Ya* lands, agriculture is not included in the analysis and considers that this activity is located at the outermost ring of settlement area. To understand and analyze the spatial pattern of socio-economic activities, distribution map is depicted together with spatial mean centers and standard deviational ellipse for each socio-economic activity. In addition, Kernel Probability (50%) for each socio-economic activity is calculated and depicted to define the areal extends that occupied by each activity. In this analysis, residential mean center which is calculated based on location of all houses in the village are use as the center of village.

Figure (6) shows the results of Kernel Probability (50%) for grocery shops. It is centered on the western part of residential mean center. From standard deviational ellipse, it can be said that it has an east-west alignment. This orientation and location of mean center of grocery store is greatly contributed by the presence of some grocery shops in the western part of the village adjacent to the Thinbawgyun Village. In terms of size, large grocery stores are located in the east and south eastern part of village which is former core area of the village, and in the newly extended western part of the village. Large grocery shops located in the western part are targeting to the customers living both in Ywatharyar and Thinbawgyun Villages. Some small grocery shops bought goods from the large shops and resell at their neighborhood. Regarding sequential development process and above analysis results, it can be said that grocery shops are generally located in the central area of the village and small grocery shops are oriented to the newly developed areas.

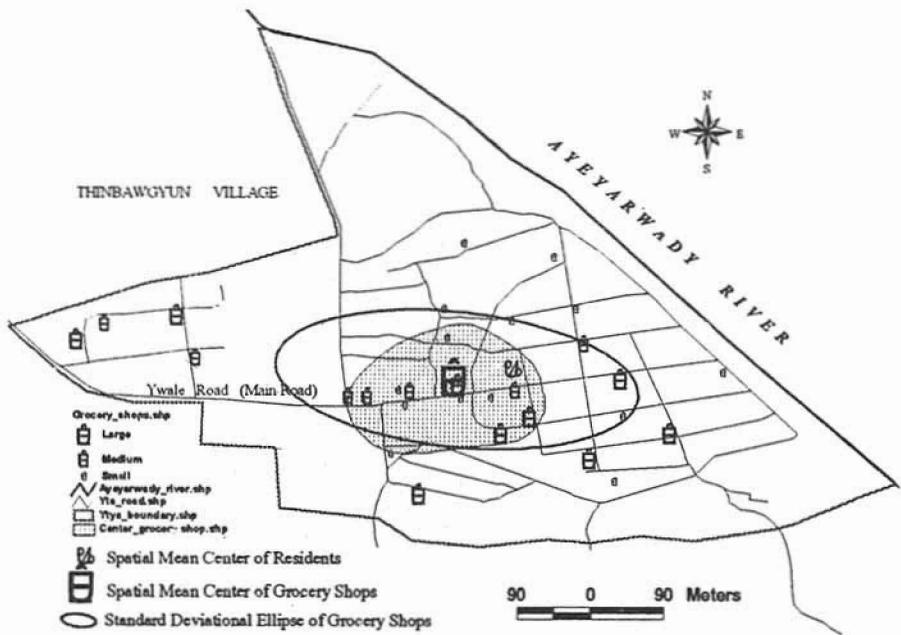


Figure (7) Distribution of grocery stores, and its Kernel probability results, spatial mean, standard deviational ellipse

Source: Field observation, January, 2004.

Services activities are mainly located along the Ywale Road for having good accessibility (Figure 8). Services found in Ywatharyar include, restaurants, bar, book rental, electricity supply, and video-house, etc. Service mean center is located in the eastern side of residential mean center on the Ywale Road. Standard deviational ellipse is indicating its orientation to the east-west. From the Kernel probability analysis service mean center is separated into two parts. One part is located in the former core area (eastern one) and another is near the center of resident. Presence of services in the former core area weighted the service mean center to locate at the eastern side of residential mean center. A bar is located at the western part of the village along the Ywale Road. One book rental shops and video house are located

each in two services areas. Of the three electricity supply sources, two are located near the center of services while other is located at the northeastern edge of village. From the above analysis, it can be said that services activities are located at the center of village and its spatial change is relatively slower than grocery store mentioned before.

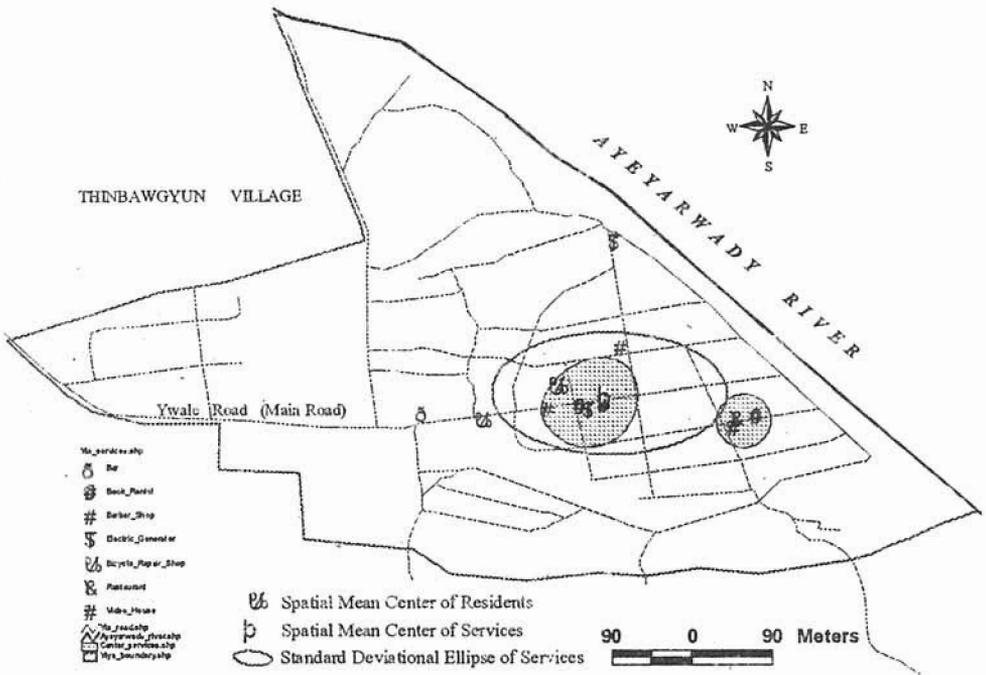


Figure (8) Distribution of services, and its Kernel probability results, spatial mean, standard deviational ellipse

Source: Field observation, January, 2004.

Manufacturing activities includes fodder cutting, oil mill, bean husking, pot-baking. Its mean center is located at the southeastern side of residential mean center and its orientation is rather rounded than former two

economic activities (Figure 9). It is revealing that manufacturing activities do not need the Ywale Road location like the service and grocery shops. Majority of manufacturing activities are located at the eastern side of the spatial mean of resident. Presence of two pot-baking grounds which are located at the southeastern and southwestern peripheries weighted the shape of ellipse. Results of Kernel analysis also reveals that most of the economic activities are locate at the southeastern side of residential mean center. From above analysis, it can be said, manufacturing activities are located near the center of residents. However, it is not demand the most accessible area. Their location has less mobility than grocery store.

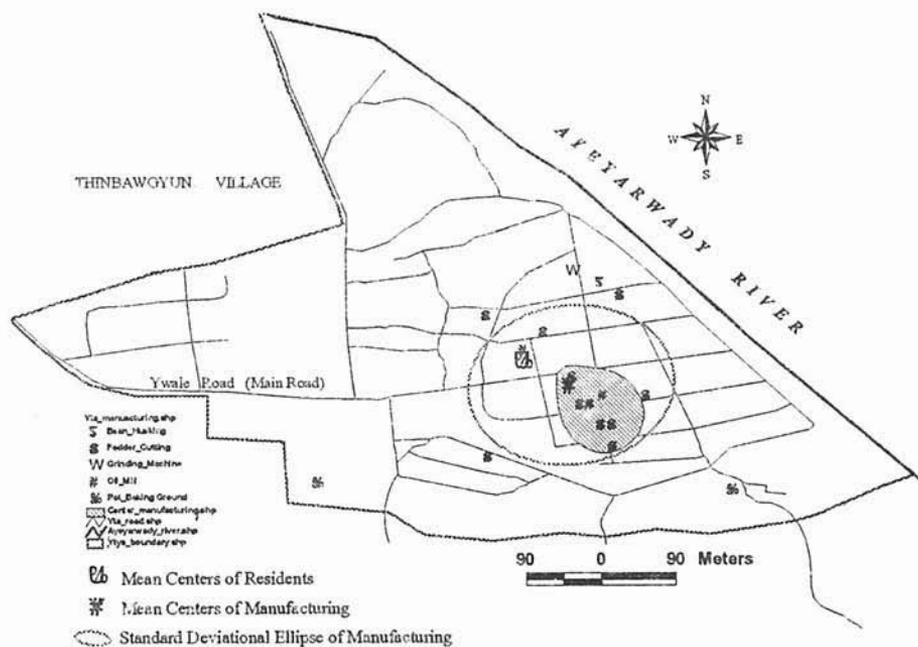


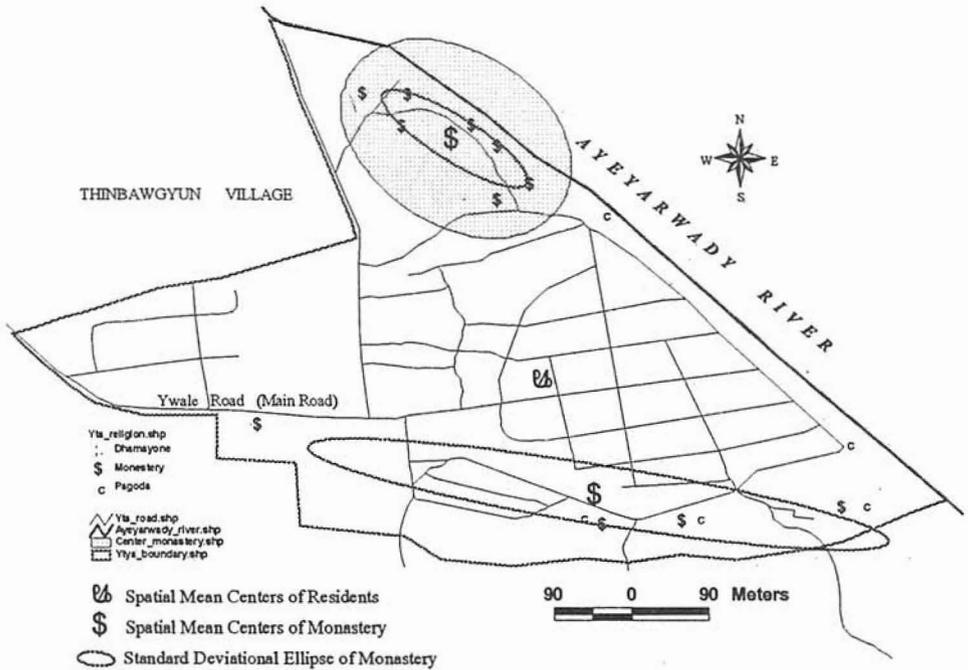
Figure (9) Distribution of manufacturing and its Kernel probability results, spatial mean, and standard deviational ellipse

Source: Field observation, January, 2004.

### Spatial Structure of Social Functions

Social functions in this paper are considered to include religious facilities, electricity supply, telecommunication system, water supply system, education, administration and health facilities.

Religious facilities could be divided into monastery, pagoda, and *Dhamayon*. Monastery and pagoda are place of learning and practicing the ways of Buddha's teaching. Thus, it is necessary to have silence and availability of *Sawn* (daily food supply). Therefore, they are seemed to locate at the periphery of a settlement area. On the other hand, *Dhamayon* that is used to held religious and social welfares should locate at the most accessible area. As expected, Monasteries are located at the northern and southern edges of the village. Pagodas are located close to the monasteries and also in the southern edge of village. On the other hand, three *Dhamayons* are located dispersedly in the village. Contradict to location of economic activities, religious facilities are located at the periphery of village. Spatial mean centers of monastery are located at the northeastern and southeastern parts of residential mean center respectively. Standard deviational ellipses also depicted as the very narrow band along the northern and southern periphery of village. Results of Kernel Probability, 50% of the monasteries are located in the northern and southern part of village. Therefore, form Figure (10) it could be said that in religious activities, monasteries and pagodas are located in the periphery of village while *Dhamayones* are constructed disperse location to serve small local communities.



Figure(10) Distribution of monastery, *Dhamayone* and pagodas, and monastery's Kernel probability results, spatial mean, and standard deviational ellipse

Source: Field observation, January, 2004.

Figure (11) shows the location of telecommunication (telephone users). Telephone exchange office is located in the western part of village along the Ywale Road. From this office 38 telephones are connected to the houses of villager. Telephones is one of the symbol that showing the wealth and central location of an urban area (Short, 1984). In addition to it, telephone is used in this study as a communication facility. Spatial mean of telephone users is located near the residential mean center along the Ywale Road. Location of this mean center is greatly influence by the existence of five telephone users in the recently developed residential area. Standard

deviational ellipse also revealed the east-west trend. However, result of Kernel probability analysis shows that most of the telephones users are located in the southern and eastern parts of residential mean center. It means that it is concentrated in the former core area of the village. One distinguished thing is that although spatial mean of telephone users is located along the Ywale Road, relatively few users are located on the Ywale Road.

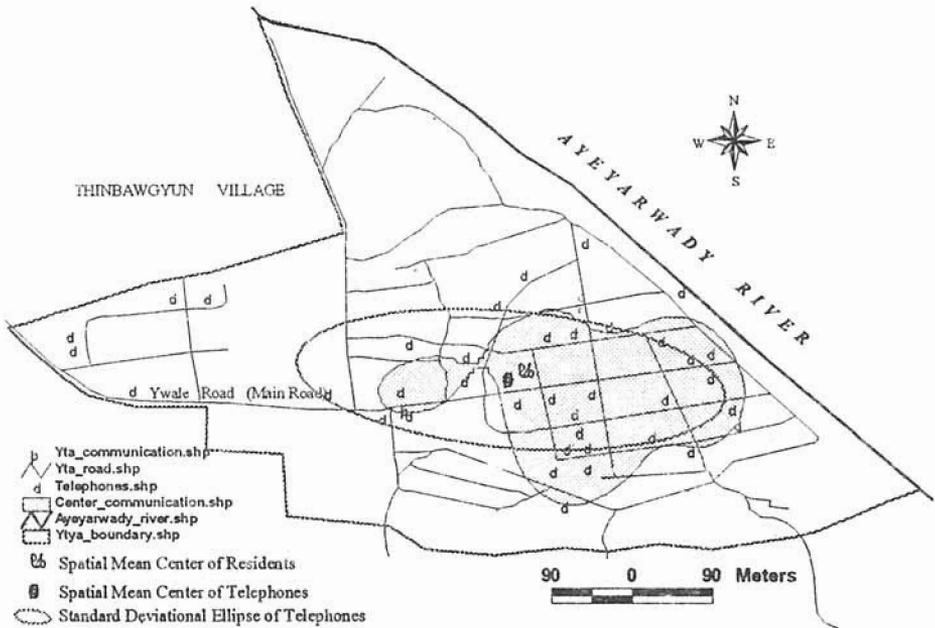


Figure (11) Distribution of telephones user and their Kernel probability results, spatial mean, standard deviational ellipse

Source: Field observation, January, 2004.

Locational pattern of electricity supply is shown in figure (12). Mean center of electricity supply is located in the eastern part of residential mean center. The standard deviational ellipse also reveals east-west alignment along the Ywale Road. There are four major sources of electricity supply: MOGE (Myanma Oil and Gas Enterprise), U Bo, U Zaw Min and U Win. MOGE

supplied electricity from the transformer located beside the Minbu-Minhla Motor Road. Their customers are workers of MOGE and dispersedly located in the village. As mentioned in the analysis of service activities, two electricity suppliers of U Min Zaw and U Bo are located near the village center while U Win is located in the northern edge of village. Kernel probability analysis result shows that U Bo occupied the central and eastern part of electricity supply while U Min Zaw supplies western and southeastern part of the village. Last supplier U Win shares the Northern part and southeastern part of the village along the Ayeyarwady River.

In general, it can be said that the old village center is systematically supplied with the electricity.

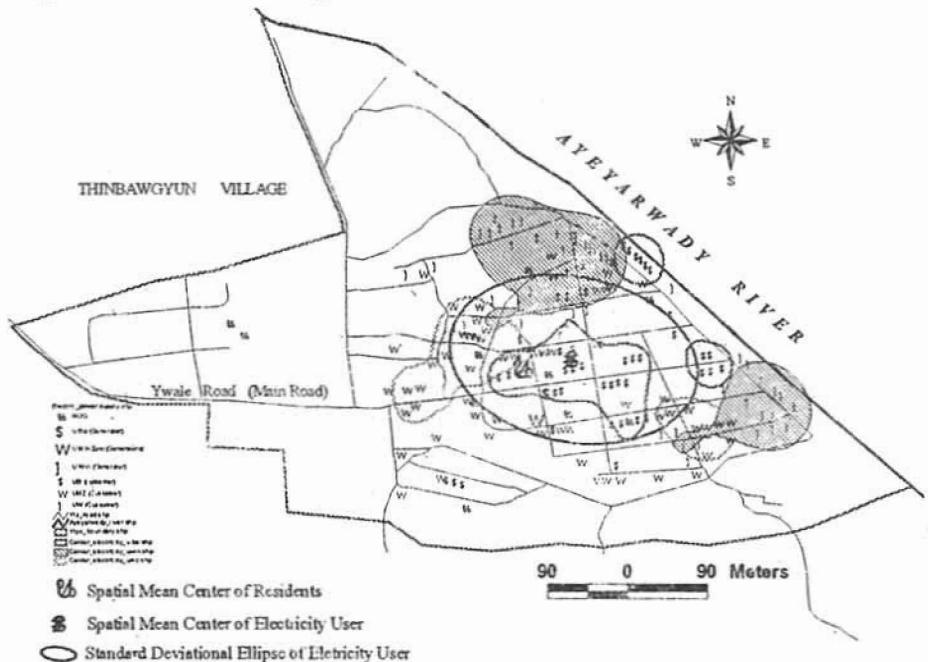


Figure (12) Distribution of electricity user and their Kernel probability results, spatial mean, and standard deviational ellipse

Source: Field observation, January, 2004

Water supply system of Ywatharyar village could be divided into river-water supply system and underground water supply system. River-water supply system is carried out by MOGE located in the Thinbawgyun Village and underground water supply is running by self-support system. Their distribution pattern is shown in Figure (13). From the MOGE's water pipe line running along the Ywale Road residents tap the water by their owned pipe to their house. Thus, MOGE river water supply system generally covers for the houses located near the Ywale Road. However, from the field survey, it is found the due to over tapping of water from the houses located near the supply source water shortage problem are occurring. Houses that do not cover the river water supply system have to rely on underground water supply. It can be divided into hand pump, tube well and surface-well. Surface wells are very old and sparsely distributed in the village. Hand pumps are found in the place of shallow underground water table and relatively poor areas. Since village center is covered with the river-water supply system the mean center of underground water supply is located in the western part of residential mean center. Kernel probability analysis shows that there are two underground water supply sources in the southern and western part of the village. Both of these include in the newly extended area.

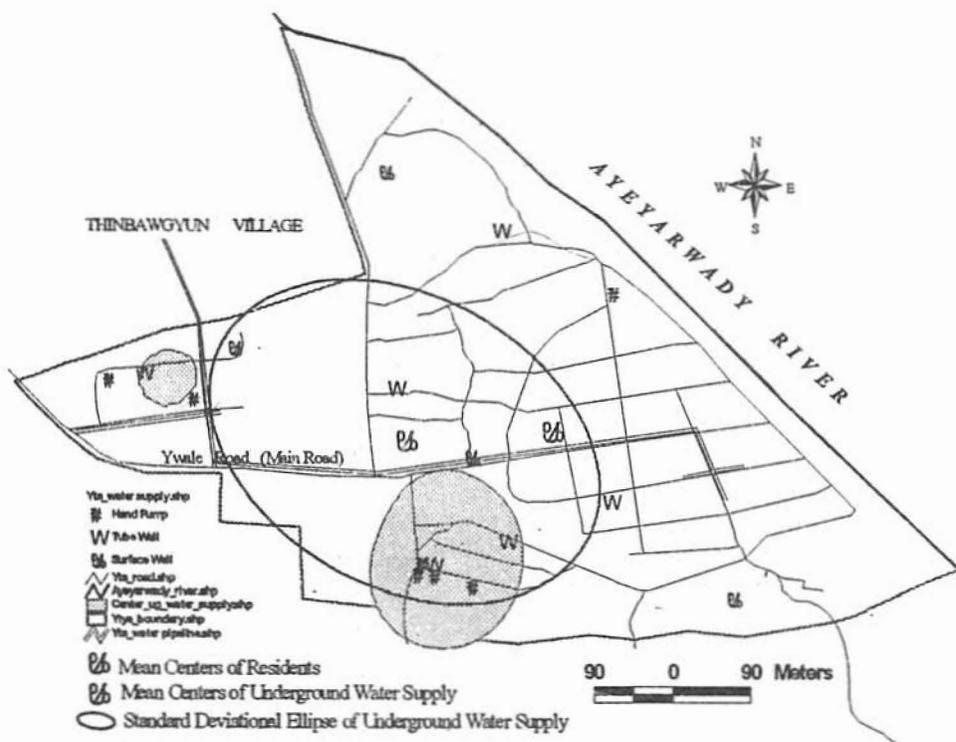


Figure (13) Distribution of water supply system, and their Kernel probability results, spatial mean, and standard deviational ellipse  
 Source: Field observation, January, 2004.

Location of administrative, education, and water supply facilities are shown in figure (14).

Administrative facilities include Village Peace and Development Council Office, and house of chairman. Location of the house of village-head is important since small villages have no administrative office. In case of crisis and welfare, village-head hit the drum in front of his house to gather all villagers. In Ywatharyar Village, both administrative office and house of village-head are located at the southern part of residential center. There is one

Basic Education State Middle School and one State High School located along the Ywale Road in the western part of village. Ywatharyar District Hospital and Communication Office (Telephone exchange) are located at the western part of the village. Facilities like hospital, schools, and telecommunication are located at the edge of village (before recent extension) for availability of land and nearness to other villages included in the district.

Although social activities like schools and hospital are located in the western part of village for good accessibility having in their construction age, present situations do not match too much. In the day of their construction all people from nearest villages have to come to Ywatharyar not only as an administrative center but also as a transportation center. But nowadays, the transportation pattern was changed and the distance that has existed between Ywatharyar Village and Minbu-Minhla Motor Road become a problem. As a result in the near future those facilities will be function only if Ywatharyar create it thriving economy again or relocation of those facilities near the Minbu-Minhla Motor Road.

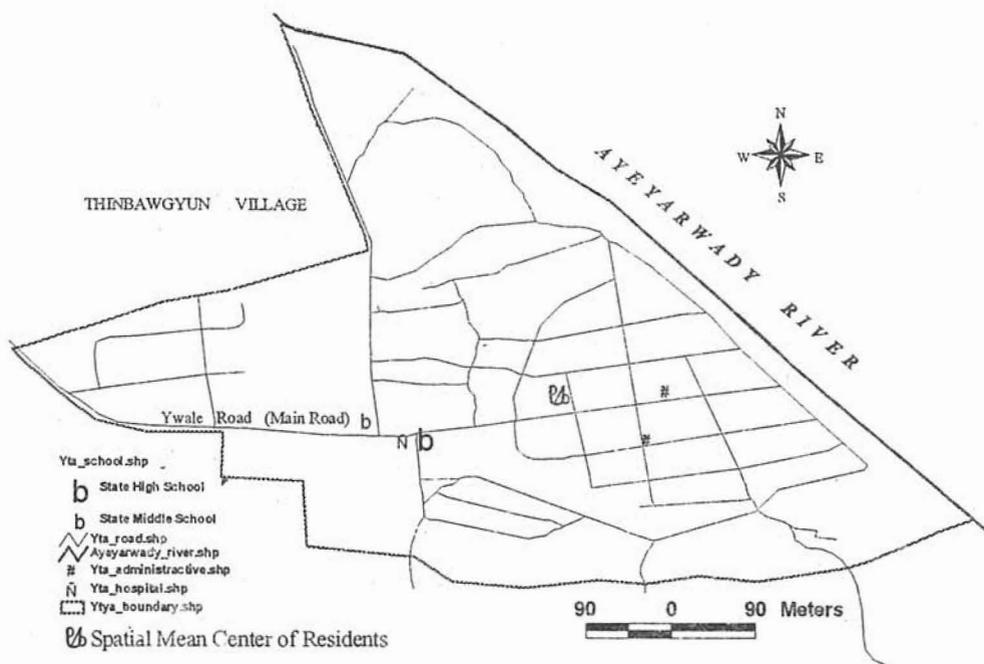


Figure (14) Distribution of education, administration, and health functions in Ywatharyar Village

Source: Field observation; January, 2004.

### Conclusion

To be able to conclude the spatial structure of socio-economic functions in Ywatharyar Village more clearly, results of mean center are collectively depicted in Figure (15). Spatial mean of residents and its standard deviational ellipse is used as a reference. From Figure (15) we could conclude following points.

- (1) All economic functions are located near the center of settlement area along the major road. In addition, grocery shops are located at the newly extended portion of the settlement while services and manufacturing are still remain in the old village center's location.

- (2) Different kinds of social function have varied locational characteristics. Some like monastery, pagoda and underground water supply system are located at the periphery of settlement. *Dhamayon* needs dispersed location in the village. On the other hand, electricity supply and telecommunication system are concentrated in the old village center. Education and hospitals are located in the periphery of village where it has good accessibility and large land space.

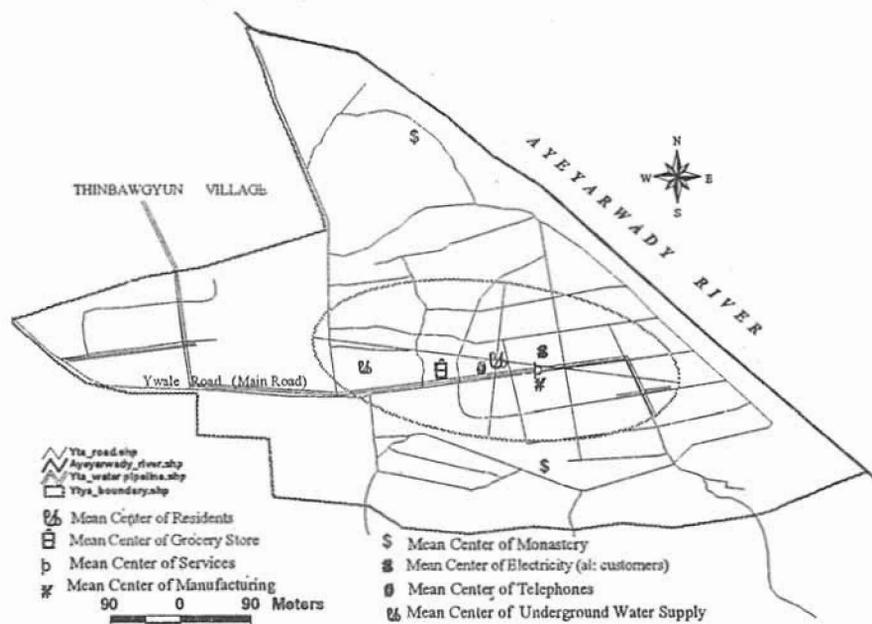


Figure (14) Mean center and standard deviational ellipse of resident and relative location socio-economic functions in Ywatharyar Village

Source: Based on calculation results mentioned before.

Above two conclusions are further verified by summary of Kernel probability analysis. Figure (15) shows the Kernel probability analysis results of economic functions. Result of resident also reveals that it has a tendency

for the old village center. By referring this result and mean center it can confirm above conclusion number (1).

Figure (16) shows the Kernel probability analysis results of social functions. Both electricity supply and distribution of telephone user are concentrated in the old village center and underground water supply system and monasteries are located at the periphery of the settlement area. Thus, it can be confirm the above conclusion number (2).

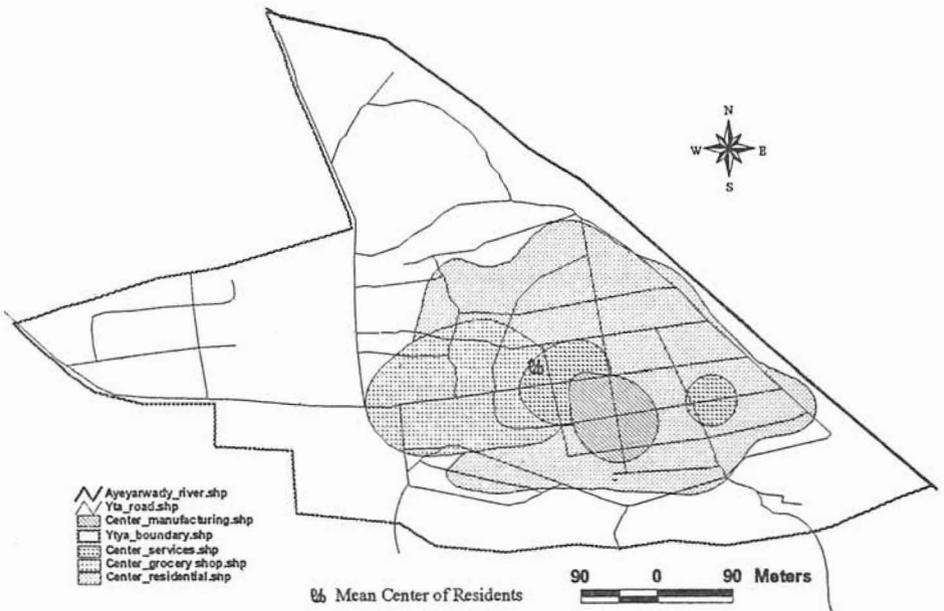


Figure (15) Comparison of Kernel probability analysis results for economic functions

Source: Based on calculation results mentioned before.

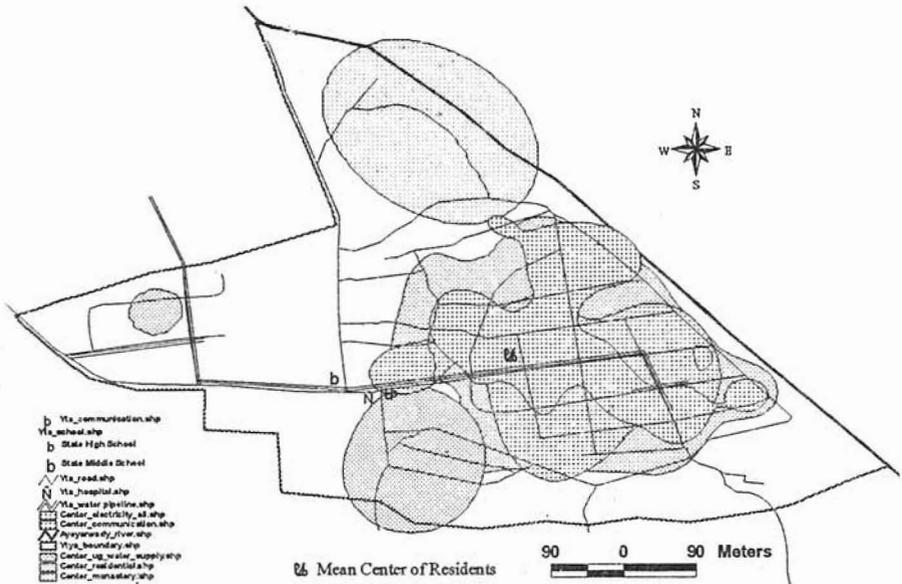


Figure (16) Comparison of Kernel probability analysis results for social functions

Source: Based on calculation results mentioned before.

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