



Spatial Perspective on Location Factors of Telecenter as Determinant for the Sustainability: A Requirement of Geospatial Mapping

Abdul Manaf Bohari^{1*}, Cheng Wi Hin², Nurwahida Fuad³

¹ Universiti Utara Malaysia, 06010 UUM Sintok, Kedah, Sintok, Kedah, 06010, Malaysia

* Corresponding Author Email: manafdr@uum.edu.my - ORCID: 0000-0002-1079-2350

² Universiti Utara Malaysia, 06010 UUM Sintok, Kedah, Sintok, Kedah, 06010, Malaysia

Email: chen2g@gmail.com - ORCID: 0000-0002-1079-2000

³ University Technology MARA (UiTM), UiTM Kampus Arau, Perlis, 02600, Malaysia

Email: wahida.fuad@uitm.edu.my - ORCID: 0000-0002-1079-0100

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Abstract:

A spatial perspective is crucial for Telecenter sustainability, as location factors directly influence their sustainability as reflects directly on effectiveness, usage, and long-term viability by determining accessibility for the community and aligning with socio-economy contexts. Key factors for Telecenter sustainability include location related factors, supported by infrastructure and info structure, and the presence of supportive environments, such as commercial complexes, banks, services agencies and so on. This paper aims for develop a conceptual model of spatial location that integrates geographic information systems with survey data that can help identify location of Telecenter users. The visualization of location related factors, with infrastructure and info structure, and supportive environments, at location is important to further analysis, especially the sustainability issues as faced by Telecenter. Suggestion and recommendation will be made for lightening the future prospect of Telecenter.

1. Introduction

Telecentres have emerged as a widely adopted strategy to bridge this divide by offering public access to ICT infrastructure and skills training. Yet, despite numerous telecentre initiatives across South Asia, Southeast Asia, and Africa, questions persist about their effectiveness and long-term sustainability. A clear synthesis of evidence on how telecentres function within rural developing contexts remains underexplored [1]. The studies as conducted by many scholars such as [2], [3] and [4] are consistence mentioned that Telecentres are the platform to bridge the digital gaps especially in the rural and remote area by utilizing the sophisticated of the latest version of Geographical Information Systems.

Rural telecentres provide applications of Information and Communication Technology (ICT) to empower community processes and achieve community objectives including supporting the community and sustaining the telecentre [5]. Telecentre programs have been one such policy

response by developing countries in seeking to reduce poverty and improve quality of life. However, telecentre programs in rural communities have been problematic and difficult to maintain and sustain in the long term. This is due to sources of external funding and appropriate resources; such as financial and people [6] and [7]. Recently, a study of Telecenter sustainability is vital to academicians, government and non-profit organization where Telecenter has contribute to the nation development of rural community through the successful of ICT-based of non-profit based activity. With regard to the advancement of worldwide global information and communication technology (ICT), Telecenter today has participates actively in the rural community with location is a major consideration for it sustainability. [8] coined out that future sustainability of these interventions depends on two factors, named as sustainable knowledge networks and affordable business plans. Besides, the new plans will have to consider including related factor to it future sustainability, where location is important consideration of operating the

Telecenter. Nevertheless, there are challenges towards sustainability that need to be overcome for telecentres' effectiveness. The main challenge is the sustainability of the telecentre programs. Several factors, such as lack of inputs (physical environment), lack of availability of relevant digital content, low income, and high operating cost have been identified as challenges of sustaining telecentre program [9].

2. Spatial Perspective on Sustainability Issues of Telecenter

Historically, the Telecentre movement's origins can be traced to Europe's telecottage and Electronic Village Halls (originally in Denmark) and Community Technology Centers (CTCs) in the United States, both of which emerged in the 1980s as a result of advances in computing [10]. [11] categorized Telecentres into six types; commercial, franchise, Non-Government Organisation (NGO), educational related, municipal, and multipurpose. The categorization of Telecenters is made based on two main aspects: one is the way in which their management is organised (i.e. private, NGO, school or university, municipality, and administrative board); and the other one is the services offered in addition to a computer connected to the Internet. This classification is also used based on Telecenters' critical significance and sustainability. Telecenters is the focal point to help the government achieve its aim in transforming the country into a k-economy and a k-society country. Telecenters are equipped with facilities such as computers, access to the Internet, scanner, printer and other basic technological facilities to provide the community with access to technology in order that they become aware of the importance of technology as a tool to search for information and how it can add positive values (socially, politically and culturally) and change their lives [10]. Therefore, issues related to Telecenter sustainability is vital to research because it has impact on government initiative and policy, including the rural society as major users of it. Most telecentres have been found lacking in terms of the funding for operational expenses associated with telecentre, and most importantly capital investment in new ICT infrastructure to underpin the telecentre program. As discussed earlier, they needed to seek more financial resources. Therefore, the role of the telecentre management committee becomes very important to assist telecentre managers to gain more funding for operational expenses and capital investment in the telecentre program. In addition, other ways of raising money can be achieved through privatisation, for example of commercial services, business one-stop centres among others.

Yet there are problems with the injection of fund for telecentres due to the reason that they are controlled by the government. Hence, this restricts their ability to make any profit and become business centres. With sufficient funds, the telecentres would have a high potential to be sustained [12]. Telecenters sustainability means more than financial sustainability. Currently the Telecenters face the question of how they can generate income yet serve those in the community who cannot afford to pay for "public goods" kinds of services. [13] reported that some centers use the income from user fees and other income services to make public goods affordable or free. [14] argues that it is a mistake to write off Telecenter that are able to induce locally relevant development but do not generate sufficient revenue to cover their costs. With refers to these facts, in Malaysia, some of Telecenter has problem to survive because of cost constrain although they have support from some resources. By there, non-financial aspect especially location factor should be consider as new factor to look into depth of sustainability issues. Beside the sustainability issues, [15] have included (i) community partnerships and participation, and (ii) community relevance as other important dimensions in creating a successful Telecenter. There must be participating communities in the planning and managing activities related to Telecenter project. This is in a line with [16] study that stressed on the importance of community participation for Telecenters sustainability. In regards to community relevance, Telecenter need to be relevant to their clientele, especially in the contents provided to communities. Much of the information available via electronic networks, for example through websites, portals may not meet communities' needs for local information on agriculture, socio economy, and health and nearby markets. Irrelevant contents and materials would be useless to communities if most of them are not delivered in national or local language. Furthermore, [17] suggest that for Telecenter sustainability, the Telecenter communities must be empowered to ensure the communities benefit from the Telecenter establishment. In addition, [10] had exampled another essential role of Telecenters is to equip the community with the tools, skills and information they need in order to help them compete on an economic level with others in their own country and throughout the world. With regard to these findings as above, Telecenters sustainability is important to be modeled based its location where different location of Telecenters has different challenge and advantage.

3. Spatial Location Related Factors

In general, spatial factor refers to factor related to spatial information where it is exist in geographical environment. The use of spatial information as part of model development is important where it will complement the non-spatial side of information as well as survey data. This is supported by [18] that cited approximately 80 percent of all business data are related to location. Businesses manage a world of information about sales, customers, inventory, demographic profiles, mailing lists, and so much more. In fact, [19] had explained that a theory of values of spatial information can be assessed. He assumed that if geographic information is offered on a market it competes with other information and other goods; it has economic value, when it is used in a decision and leads to an improvement of the decision. Therefore, according to these scholars, the use of spatial data for developing spatial location model of Telecenter will make new approach in estimating Telecenter sustainability where it takes together spatial and non-spatial data differ from before, traditionally and conventionally. Location is one of the main factors that can be considered for estimating Telecenter sustainability in platform of geographical place. Fundamentally, [20] defined location as the physical site of a firm which may be a leased space, an existing building the retailer purchases or a new structure built to specifications. This support by [21] mentioned that store location is often the most important decision made by a firm. It is typically the prime consideration in a user's choice. Location represents site where a store is situated in a specific geographic area and served as a channel of distribution. The researchers [22] conceptualized that location is the must for all kind of organization because that is exactly used as a guideline to understand some issues related to sustainability, as well as the choice of what kind of user the enterprise wants, how to find them, and how to provide service to them. It also determines the choice of a preferred communication medium, how often to contact the customer, about what to contact the customer, and so on. Consequently, with regard to [23], [22] and [21] location is a critical aspect of any firm where it can attract large number of consumers, stimulate them to revisit the store, spend more money and increase frequency of purchasing. Also, location has significantly altered consumers' shopping behaviour, including recency and frequency of the customers. Definitely, location factor can measure the success or failure of a business including Telecenter. For instance, the Telecenter can have low prices, quality of product, and excellent service, but, it has a potential to fail because it is located in improper place. However, with regard to [24] those works do not mention about how location can be visualized geographically. In

fact, the studies by [25], [22] and [21] did not provide any solution on how to differentiate location of customer that can give impact on Telecenter sustainability, physically. Thus, this study highlighted how critical it is to use GIS as a platform to understand the location related issues, where Telecenter sustainability fail to view as spatial issues. Moreover, location is identified as a major factor that can potentially contribute to the Telecenter sustainability. [26] observed that location should also be selected in more affluent areas of the city where the location of convenience stores cannot be targeted precisely based on consumer characteristics. He proposed local market characteristics such as income level and household composition be considered. With regard to this scholar, in Malaysia, location of Telecenter is determined by some of authority bodies. As a result, sustainability of Telecenter can only determine if the Telecenter has collected some information regarding their users from surrounding the location. However, most of Telecenter always missed a segment of non-permanent users. Currently, location factor has become critical issues when Telecenter has no idea about location factor, resulting from the weakness of current practices on Telecenter evaluation. As increase of current need in the Telecenter, it is important to the Telecenter to model the locations which is possible to trace the location of their users and environment who do purchases with them include location factor related to them. According to [27] facility offered at location attract customers which are characterized by combining certain aspects such as size, parking areas, opening hours, accessibility, and so on. This is supported by [28] where by location is significantly affects the firm's long-term profitability. Besides being theoretically interesting, location of Telecenter is still mysterious for any Telecenter as implication on lacks of information of them. Based on the preceding assessment of the main concerns, this study provides the following research questions and research aims for reference:

Research Questions:

RQ1: What is Telecenter status in Malaysia?

RQ2: What is the spatial location information related to sustainability of Telecenter in Malaysia?

RQ3: What are the spatial data that used for mapping the sustainability of Telecenter in Malaysia?

RQ4: What is GIS method to be used in mapping the location related of Telecenter in Malaysia?

RQ5: How the location factor of Telecentre sustainability will be mapping with the GIS Method?

Research Objectives:

RO1: To develop spatial location model of Telecenter that determine the sustainability.

RO2: To mapping the spatial location model by category of infrastructure of Seberang Perai Tengah of Malaysia.

4. Methodology

Basically, the development of conceptual model of Telecenters location, involved spatial and non-spatial data. Basically, the common spatial data are boundary, road and street, mukim, residential area, and so on. It is important to develop the physical side of geographical place of the study. Meanwhile, specific spatial data were developed by the researcher. They are related to items or variables that were used in the questionnaires.

4.1 GIS

Geographical Information System (GIS) remains a unique tool use for location mapping for a clear understanding of the nature, planning, and distribution of spatial patterns and distribution as well as information related to Telecenter sustainability. GIS is an approach for developing a spatial location model of Telecenter sustainability. [18] defined GIS as a computer system that stores, manages, displays, analyses and reports on information. It explains a 'where' component, i.e. a location, because a number of decisions undertaken by staff in land-related organisations often refer to 'what', 'where', 'how much', 'what does this relate to' and 'how does this relate to other data'. The inclusion of the 'where' component into the decision-making process can be a powerful tool for providing a better understanding of the issues at hand and the implications of specific decision paths. With regard to this opinion, location of the Telecenter and user's is important where GIS can play a major role in tracing their location through the geographical marketplace model. This is then supported by [29] that described geo-referencing as a technique for showing the location of people by referring it to adding X-Y (longitude-latitude) fields to an existing data record. In fact, roughly 80 percent of business data has the potential to be geo-referenced, as mention by [30] and [31] where there is a spatial location attached to it. GIS is system designed to capture, store, manipulate, analyze, manage, and present all types of geographically referenced data. The acronym GIS, is sometimes

used to mean geographical information science or geospatial information studies; these latter terms refer to the academic discipline or career of working with geographic information systems [32]. With regard to this concept of GIS, [33] pointed out that the major function of GIS is to provide means to collect, store, retrieve, map, and analyze such spatial data. GIS allows storing a number of different themes of data across space and it is with this richness of data types and the ability to manipulate, model, and analyze spatial data in complex ways that the real value of GIS becomes apparent. In fact, collecting spatial data and capturing its geographical location is an important task for detecting the location of Telecenter and users in the geographical based information.

4.2 Survey

Survey (non-spatial data) will be used as non-spatial data that related to location Telecenter used. The spatial information of users will be generate from survey (questionnaires) which involved the 400 users of Telecenters. Based on the probability sampling framework, that is convenience sampling, was applied for selecting and distributing questionnaires to the Telecenters' users. Then, this non-spatial data are processed and converted into spatial and attributes data before they are combined with spatial data. In fact, spatialization process is applied to non-spatial data to transform it to a suitable format which is refers to spatial format. Meanwhile, some procedures are applied and or developed by the researcher to integrate the spatial and non-spatial data into a platform of GIS.

4.3 Location of Study

Location of Study is Seberang Perai of Penang, Malaysia. It is a narrow hinterland opposite Penang Island (Main Land) on the Northern of Malay Peninsula. Formally, Seberang Perai is divided into three administrative districts which are Seberang Perai Utara (Northern Seberang Perai), Seberang Perai Tengah (Central Seberang Perai) and Seberang Perai Selatan (Southern Seberang Perai). The main local authority for Seberang Perai is Seberang Perai Municipal Council (Majlis Perbandaran Seberang Perai) or locally called Majlis Perbandaran Seberang Perai (MPSP). Specifically, Seberang Perai Tengah (SPT) of Penang is the location chosen for applying the developing the Spatial Location of Telecenter.

5. Results and Discussion

5.1 Postal Address of Telecenter Users

Table 1 shows the input data (postal address) for each respondent in the study. Spatial data (attributes) include address, alternative for lane or sub-street, resident and district postal code. This input data becomes the basis for spatial postal data through the spatialization process. The formation of the database including the review and validation process takes around 4 to 5 months.

Table 1: Data Input for Spatial Postal Address of Telecenters User.

Idname	Address	Altaz	Postcode	Residence	Town
006-TNN	11 Tingkat Siakap 1	Tingkat Siakap 1	13700	Seberang Jaya	Perai
007-TNN	43 Pintasan Teubok 4	Pintasan Teubok 4	13700	Seberang Jaya	Perai
008-TNN	8 Lorong Kaku	Lorong Kaku	13700	Seberang Jaya	Perai
009-TNN	42 Lorong Sutea Prima 9	Lorong Sutea Prima 9	13700	Seberang Jaya	Perai
010-TNN	127 Lorong Tenggi 25	Lorong Tenggi 25	13700	Seberang Jaya	Perai
011-TNN	44 Lorong Kurau 22	Lorong Kurau 22	13700	Taman Chai Leng	Perai
012-TNN	14 Lorong Sembilang 2	Lorong Sembilang 2	13700	Seberang Jaya	Perai
013-TNN	11 Lorong Talang 1	Lorong Talang 1	13600	Taman Talang	Perai
014-TNN	22 Pintasan Teubok 1	Pintasan Teubok 1	13700	Seberang Jaya	Perai
015-TNN	14 Tingkat Tuna 2	Tingkat Tuna 2	13700	Seberang Jaya	Perai
016-TNN	47 Lorong Siakap 24	Lorong Siakap 24	13700	Seberang Jaya	Perai
017-TNN	59 Lorong Kurau 25	Lorong Kurau 25	13700	Taman Chai Leng	Perai
018-TNN	9 Lorong Kaku 1	Lorong Kaku 1	13600	Taman Inderawasih	Perai
019-TNN	38 Lorong Bawal 7	Lorong Bawal 7	13700	Taman Inderawasih	Perai
020-TNN	128 Lorong Bukit Minyak 19	Lorong Bukit Minyak 19	14000	Taman IKS Bukit Tenga	Bukit Mertajam
021-TNN	31 Lorong Tenggi 5	Lorong Tenggi 5	13700	Seberang Jaya	Perai
022-TNN	51 Lorong Sembilang 18	Lorong Sembilang 18	13700	Seberang Jaya	Perai

5.2 Spatial Postal Address of Telecenter Users

Table 1 shows the results of the transformation of input data for each respondent in the study into spatial postal address format. This spatial data is a combination of spatial attributes and non-spatial attributes, which is the spatial database for this study. The transformation process to spatial data involves the use of coordinate system data and spatial references. The formation of this coordinate database, including the review and validation process, took about 5-6 months, and there were also repeated processes due to the absence or weakness of the match between spatial data and attribute data.

5.3 Spatial Location of Telecenter

Figure 1 is the basis for the spatial location related to Telecenter. The representations used as spatial location are the main city, mukim, housing estates with formal boundaries, residential areas (formal and informal) and road systems (main roads, alternative roads, villages including lanes or roads that are not gazette). Figure 2 shows the facilities and infrastructure within the Telecenter. These facilities serve as spatial references and spatial boundaries for this study.

An example of selected infrastructures and facilities of SPT are shown in Figure 2. The SPT is located at the center of Seberang Perai t complete with various kinds of infrastructure and facilities, as well as roads and streets, residential Parks, banks and commercial

sectors, shopping malls, post office, schools, government Agencies, a taxi Station, bus stop, parking lots, a recreation park, children's Playground, and many more. These are compressed spatial data of Hospital, Healthclinic, Mosque, Building, Highways and Road System, and so on. These data are available in various types of points, polygon and line data which represent a concept of GIS spagethi model.

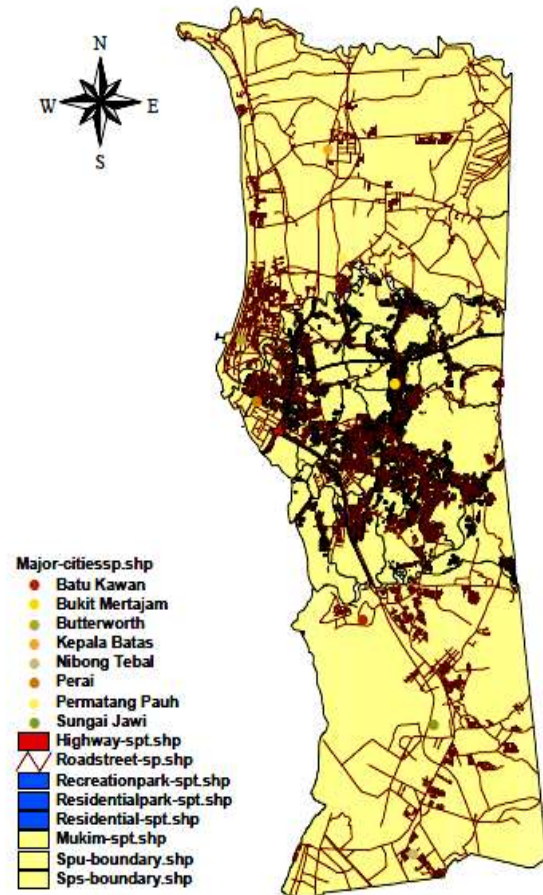


Figure 1: A Baseline of Spatial Location for Telecenter.

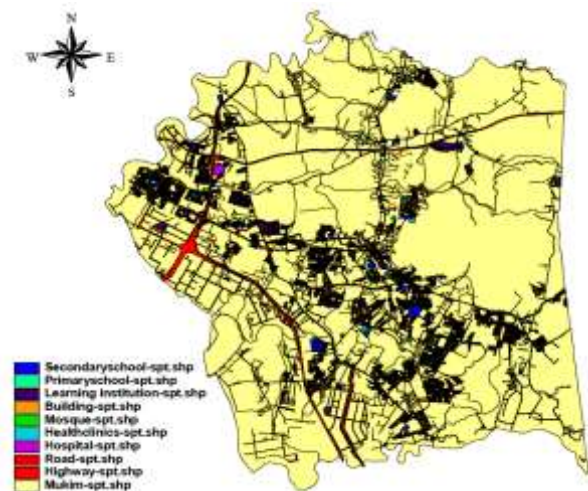


Figure 2: Facilities and Infrastructure around the Telecenter.

5.4 Facilities and infrastructure

In fact, SPT functions as the central location for business, socio and economic activities. This indicates that the geographical marketplace of SPT is of great priority to the government since upgrading of infrastructures and facilities, is done from time to time. Recently, until the year 2010, the study area has changed a lot whereby some additional and newer infrastructure and facilities, as well as residential and shopping areas, have been developed. Other development is still in-progress. Besides the dramatically change in population, other socio-economic aspects such as business complexes, petrol Stations, Hindu Temples, libraries and many more present the current society of SPT [34]. For example, the selected socio-economic indicator in Table 2 shows buildings, business complex, petrol Stations, a library, surau, a hospital, and healthy clinics.

In addition, the existence of religious place (place of worship) as well as Surau, a Hindu Temple, a Sikh Temple, and many more shows that a multi religious society live in the area of SPT. With regard to these facts, it is important to update the related spatial data to ensure they are always up-to-date and balanced with latest socio-economic data on the geographical marketplace.

Table 2: Selected Facilities at SPT.

Category of Facilities	Unit
<i>Education Facilities</i>	
Secondary School	25
Primary School	34
'Sekolah Rendah Jenis (C)'	18
'Sekolah Rendah Jenis (T)'	7
'Sekolah Agama Rakyat'	16
Technical School	1
Pre School	81
<i>Healthy Facilities</i>	
Hospital	2
Health Clinics	5
Health Clinics (Mother and Children)	1
Rural Clinics	14
<i>Housing Facilities</i>	
Village	28,814
Residential Park	47,677
<i>Recreation Facilities</i>	
Children's Playground	54
Football Field	28
'Takraw' Court	64
Badminton Hall	18
Basketball Courts	28
Swimming Pool	2
<i>Religion Facilities</i>	
Mosque	50
'Surau'	78
Buddha Temple	35

Hindu Temple	30
Church	14
Siam Temple	4
Others	7
<i>Other Facilities</i>	
Bus Stop	203
Public Assembly Hall	93

Sources: Adapted from Annual Report, PTD SPT (2010)

5.5 Location of Individual Users of Telecenter

Figure 3 is an individual mapping for each respondent (user) in the study, which totaled 400 respondents. This spatial postal address is the result of the study and is useful for predicting the sustainability of the Telecenters studied.

6. Discussion & Suggestion

Based on this study, the following spatial related factors that affect the sustainability of Telecentre is includes:

(a) Cost of Services: The service cost is crucial for sustainability. This is similar and supported by [35] and [36]. According to [36] the financial costs of using a telecentre are a major demand-side factor influencing the use of telecentre.

(b) Skillsets of Operator: An operator runs the operation of a telecentre is critical to ensure the Telecenter sustaibility, as similar with finding by [37]. According to Attwood et al. (2013), a telecentre manager (operator) is found to be an essential driver of telecentre development. According to [38] telecentre resources may remain underutilised because of operators' lack of ability to utilise them. In addition, the skillset of operators remains an important consideration for the smooth functioning of telecentres [39].

(c) Technical: Telecentres face significant technical challenges that impede their functionality, limit user adoption, and ultimately affect their sustainability. A primary issue is related to equipment, including the obsolescence or non-functioning nature of existing computers, printers, and other ICT tools.

(d) Operational: Telecentres face significant operational challenges related to their management and funding that threatens their sustainability. A major hurdle is funding shortages, often stemming from a dependence on subsidies.

(e) Socioeconomic and cultural: Furthermore, Telecentres face significant socioeconomic and cultural challenges that create barriers for potential users and limit their integration into community life, widespread poverty among target communities directly impacts telecentre usage. Even when

services are offered, the cost of access can be prohibitive for individuals with low incomes.

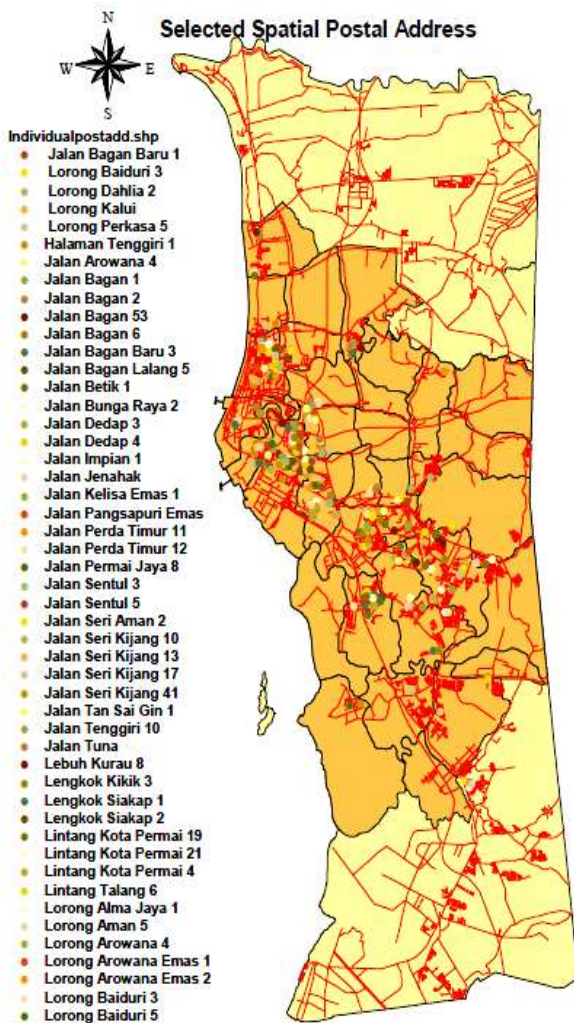


Figure 3: The Individual Mapping of Spatial Postal Address.

7. Conclusion

The successful organization use GIS tools purposely to integrate, view, and analyze data from geography view, as applicable for Telecenter research. These applications can be used across an entire level of Telecenter, in the physical environment field, and on the Internet. GIS enables Telecenter to understand and visualize these geographic relationships toward the end for improve productivity, effectiveness, and efficiency in these processes. At the same time, predictive investigators such as market and customer analytics are also enhanced by GIS capabilities. In addition, many different forms of real-world and modeled data can be used with it to understand the demographic, competitive, and psychographic interaction of consumers, suppliers, and the geographic space in which the data is distributed. In contact of Telecenter in Malaysia, the beauty and power of GIS is that it allows Telecenter to consider

many possibilities, understand potential, review the impact of different users, and analyze changing trends in the location and its environment landscape.

Author Statements

- **Ethical approval:** The conducted research is not related to either human or animal use.
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