

Population Mobility and Urban Spatial Structure: Does the Use of Information and Communication Technology Matter?

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Abstract

Internal population mobility within an urban region was very much influenced by the accessibility factors and the location of urban service centers. Accessibility involves the ease of reaching service locations, which are concentrated mostly in the city centre, in search of spatial efficiency. Nowadays, the development and use of information and communication technology (ICT) in developing countries has brought some changes to population mobility patterns as well as service locations. Coinciding with this development, economic services such as banking and retailing have been oriented toward ICT based services. Consequently, there have been changes in the ease of access to economic services that is leading to changes in population mobility patterns as well as the reorientation of service location development in the Yogyakarta Urban Area (YUA).

This research aims at analyzing the spatial patterns of population mobility as ICT users in accessing economic services and its impacts on the development of new location of economic services. This research employs a case study method in which an in depth interview is used to collect the necessary information from the ICT users. The YUA is treated as a single case within which 40 individual cases of ICT users are selected purposively following a snowballing mechanism. The geographic coordinates of the residence of the individual cases as well as the service centers visited are plotted on a map.

The study reveals that the use of ICT has changed the population mobility patterns in the YUA as is shown by shorter distance of travel, less time spent, less financial cost and lower frequency of movement. With regards to the direction of movement, two significant findings are observed: 1) the population mobility patterns to seek for services have changed from the urban centre to the suburban areas, reflecting a decentralization process of the new location of economic services and 2) there is a strong tendency of change in the development of ICT based services away from the city centre toward the suburban areas.

Keywords: population mobility, ICT use, ICT based service location

I. Introduction

The conventional urban spatial structure shows that city centers as central business districts (CBD) tend to have the highest accessibility level and form centralization of service locations in the urban regions (Ley, 1983 in Hall, 1998; Bourne, 1971; Chapin & Kaiser, 1979; Yunus, 2000). The centralization and the variety of services available in the city cause a tendency of population mobility into the urban centre to fulfill the need for various socio-economic services and employment. Thus

population mobility toward the city centre are more predominant than that into the rest of the urban region (Short, 1984).

Retails and other services such as supermarkets, malls, insurance, banks, hotels and theaters occupy areas in the city center, whereas the residential zone is located beyond the city center, with lower land value and lower settlement density (Bourne, 1971; Yunus, 2000). Under the conventional urban structure, there is a need for geographical mobility from residential areas to service locations to access various socio-economic services and employment. Since there is a strong tendency of concentration

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of services in the city center, population movement toward the city center tends to increase over time. The phenomenon of population mobility from the sub-urban areas toward the city centers has been the main pattern of rural-urban mobility in both developed and developing countries.

Lately, there is a new phenomenon of suburbanization of business activities stimulated by the inexpensive land factor in the countryside (Stilwell, 1995). Retail relocation tends to take place in the residential locations (Sohn, 2005). On the other hand, the current development of ICT based economic services enables people to access the services without any mobility from the sub-urban area to the city centre or other nearby locations. Some economic services in the urban areas of developing countries have been reoriented toward the use of ICT based services. Most of them are provided in the form of banking and retail services, presently known as e-banking and e-shopping services. Decentralization of business activities toward the sub-urban regions and the increasing use of ICT in service provision would likely reduce the intensity and change the patterns of population mobility from the sub-urban areas to the city centers. At the same time, the utilization of ICT in economic service provision will most probably influence the geographic orientation of economic service development toward the sub-urban regions. Thus, the relationship between the decentralization of location of economic services and the increasing use of ICT in economic service provision is a very interesting phenomenon to explore in increasing our understanding of future urban spatial structure.

II. Objectives of the Research

This research aims to explore changes and the spatial pattern changes of the mobility of the urban population as users of ICT in accessing economic services and to understand its impact on the orientation of service location development as well as the future spatial patterns of the city of Yogyakarta, Indonesia. A case study method is used, as the phenomena of the use of ICT in accessing economic services in developing countries are relatively new and thus the number of ICT users is still very limited, which demands special methodological treatment. Case study method can be appropriately used to deal with such a situation.

III. Review of Literature

There are several theories and concepts dealing

with the distribution of economic service locations and population movement. Theories related to the location of economic services centralization in the city was suggested by Burgess (1923), Hoyt (1939) and Harris & Ullman (1945), known as the Traditional Models of Urban Structure (Ley, 1983 in Hall, 1998; Bourne, 1971; Chapin & Kaiser, 1979; Yunus, 2000). These theories describe the city centers as a Central Business District (CBD). According to this concept, CBD consists of the central part called RBD (Retail Business District) with predominant activities related to department stores, office buildings, banks, hotels, and theatres with the highest level of accessibility (Ley, 1983 in Hall, 1998; Bourne, 1971; Chapin & Kaiser, 1979; Yunus, 2000). This model commonly represents the spatial structure pattern of medium to large-sized cities in Indonesia as well, *i.e.* service centralization that forms an urban municipality.

Centralization of economic services is also confirmed by theories related to land value such as urban land economics, the patterns of land value, urban land value surfaces, urban land use patterns which are consecutively suggested by Retcliff, Knos, Berry, Alonso (Bourne, 1971; Yunus, 2000). These theories elaborate that city centers are characterized by very intensive land use and high accessibility (at the same time the presence of ring roads and radial roads are also influential), high land value, and high land rent. Retailing zone situated in this part of the city is related to the proximity to potential shoppers, accessibility to travel from or to other locations. Residential zones are, however, situated away from the city centre (*i.e.* in the sub-urban areas) and less densely populated and with more expensive transportation cost to the city centers.

Presently, the use of ICT in economic service provision is mainly developed by the banking and retail services. In banking services, ICT use is known as electronic banking or e-banking. Internet based banking began to be introduced by several banks in Singapore in 1997–1998 (Liao & Cheung, 2002). In Indonesia, e-banking and mobile banking have been implemented since 1998 by several banks (http://opensource.telkomspeedy.com/wiki/index.php/Sejarah_Internet_Indonesia:e-banking). Previous research by Rachmawati (2005) shows that 28 percent of 1,000 randomly selected respondents in the City of Yogyakarta in 2005 use the internet to access banking and retail services such as purchasing or ordering goods, money transfers, payment of electricity services and telephone bills. The same survey reveals that 37 percent of respondents use ATM as an ICT-based banking service, especially

for withdrawing cash, transfer payment, and payment of telephone bills and electricity services (Rachmawati, 2005).

In the Netherlands, virtual shopping mall and online bank began to develop in 1994 (Faraq, 2006). The development of internet use has increased online system sales through e-shopping by as much as 2.1 percent from 2003 to 2004 (Faraq, 2006). In 2004, more than 4.7 million internet users in the Netherlands made online purchases (thuiswinkel.org, 2005 in Weltreveden, 2006). Another set of data show that in 1999 as much as 17 percent of 30 million Americans performed online shopping (Choi & Geistfeld, 2004), while in Korea, in 2000, some 16 percent of the population performed online shopping (Forrester, 2000 in Choi & Geistfeld, 2004). E-shopping has reduced shopping time and effort as it does not demand physical travel. Besides, e-shopping can also be performed in a more flexible time (Ren & Kwan, 2005).

Related to mobility patterns of people, (Schwanen, 2003) analyzes how mono-centric and poly-centric spatial structures of the city influence travel distance for a number of travel destinations in the Netherlands cities. The study shows that the relocation of occupation and residence to the suburban areas led to declining movement to several areas within the city and lengthened the movement distance.

The time span of movement distance from suburban to city fades due to ICT use. Intensity of population movement from suburban areas to city centers also declines as was observed by Stilwell (1995). Graham and Marvin (1996) reported the declining intensity of population movement from city to suburban areas and vice versa due to the use of ICT. Meanwhile, Hanson (1995), Hall (1998), Plaut (2000), Gomes & Casadiego (2002), Graham (2004), Friedman (2006), and Graham (2006) emphasize the declining travel time and cost due to the use of information and communication technology. It is clear from this point that since the mid 1990s the use of ICT has increased in urban and sub-urban areas of both developed and developing countries. Thus, there is ample ground to study the use of ICT in economic service and its consequences on population mobility and locations of economic service centers in the YUA as a representative of an urban area in a developing country.

IV. Research Method

The research is conducted in the YUA (Yogyakarta Urban Area), considering that the

city is a centre for education, tourism and retail services that are closely related to the use of ICT. This research uses a case study method. An explanatory case study is carried out as a means to compare theories and concepts to the empirical condition (Yin, 2009), by using single case study namely YUA. Within the single case of the study area, there are 40 individual ICT users as individual case units from whom data on ICT use and their spatial mobility changes were collected through in-depth interviews. The geographic coordinates of the residence of the individual cases as well as the service centers visited are plotted on the map to measure the distance to the nearest service points, time spent and cost of mobility and to identify the spatial patterns of the mobility of the individual cases respectively. Individual cases are determined using a snowball technique, taking into account that the individual cases are users of ICT.

Qualitative and spatial analyses are performed to understand the importance of the use of ICT in accessing economic services and the emerging patterns of population mobility affected by the use of ICT. Qualitative analysis is conducted on the data obtained from the outcome of the in depth interview, while spatial analysis is performed by using GIS techniques. The later technique is used to draw the spatial patterns and changes in the patterns of geographical mobility of people before and after the use of ICT in accessing urban economic services.

V. Changes of Mobility Patterns as a Consequence of the Use of ICT

The research reveals that the use of ICT to fulfill the need of economic services has led to changes of population mobility patterns. Among the important changes are the distance, time and cost of mobility. Out of 40 individual cases, 24 unit cases reported a travel distance decrease, 21 individual cases reported travel time reduction, and 16 individual cases reported travel cost decrease. Changes of movement direction and frequency of obtaining economic services appear in all cases. Thus, at this level of observation one can see that the use of ICT in accessing urban economic services has changed very substantially.

The following statements of our individual cases are consistent with the information that the use of ICT has brought many changes in the reduction of travel distance, time and cost simultaneously.

...distance is getting narrower, traveling distance is reduced (Individual Case 17).

...travelling is not necessary, physical distance equals to zero, movement cost is saved (Individual Case 38).

...it is very efficient, one does not need to go around but still can do many activities (Individual Case 34).

...it is more practical and more efficient; ICT use is not limited by space and time; distance and time impediment can be overcome (Individual Case 27).

...it enabled multi-tasking, works in parallel, several activities/tasks can be accomplished in one place at the same time (Individual Case 19).

With regards to the access to banking services, the following are statements of the individual cases showing the declining frequency of visit, distance traveled, time spent and cost incurred as they used ICT based banking services such as ATMs and e-banking.

I rarely go to the bank now; I do not need any physical movement and save a lot of time (Individual Case 9).

It reduces distance traveled; transaction can be done anytime without having to go to the ATM or bank. Reduction in time means I do not need to go out (Individual Case 22).

ICT shrinks the globe and reduces distance with consumers. Consumers can make the payment via internet network; it saves transportation cost a lot (Individual Case 8).

The result of previous study covering 400 head of household respondents in the YUA shows that the distance reduction due to the use of ATM is mostly about 1–5 km, followed by 6–10 km and more than 10 km (Rachmawati, 2009). Change in population mobility as shown by the declining travelled distance and the declining volume of population mobility to access banking and economic services support the statement of Stilwell (1995), Graham & Marvin (1996) in association with the declining volume of population mobility from city center to sub-urban and vice versa due to the use of ICT. Thus, it can be stated that if the access to banks located in the city center is substituted by the use of ATM and e-banking services, the frequency of population mobility

and the demand for population mobility to the city center will also decline. It is important to note that this is especially relevant only for the population mobility for accessing economic services.

The declining travel time and cost due to the use of ICT substituting the access to economic services, which appear in this research, support the statement of Hanson (1995), Hall (1998), Plaut (2000), Gomes & Casadiego (2002), Graham (2004), Friedman (2006), and Graham (2006) that there would be a decline of movement time and cost due to ICT use. Thus, this is also consistent with what Wardiana (2002) asserts that in the information era, physical or geographical distance is no longer an obstacle in interpersonal or interagency relationships. From the results of our research, this includes the relationship between individuals and business entities and agencies of economic service providers.

Subsequently, the change of mobility patterns due to the use of ICT based banking economic services can be seen in Figure 1. It is obvious from the figure that in accessing economic services related to banks and ATMs, people tend to move from the sub-urban areas to the urban centre or from the sub-urban areas to another part of the sub-urban areas, moving either from the residential or working place. The same group of individual cases spatially behave very differently as ICT is used in accessing the same economic services. It is clear from the figure that there is no population mobility involved in accessing the same services as e-banking services are used.

Besides banking, another service which has implemented ICT is the payment service which includes electricity payment, water bill payment, telephone bill payment, post-paid mobile phone subscription, and cables TV subscription. In the past, these services could only be performed in the conventional payment points such as the office of state electricity company (PLN), local drinking water office (PDAM), and mobile phone service points. This also decreases the distance traveled and time spent in paying various kinds of bills after and before the use of ICT, as shown in Figure 2. The figure depicts that under the conventional way, population mobility flows from the sub-urban to the urban centre as is shown by some movements to banks, service centers and ATMs. Population mobility for bill payments disappears as e-banking services are practiced. This is also consistent with the opinion of the following individual cases:

Using ICT does not require queuing, saves time and reduces the distance (Individual Case 8).

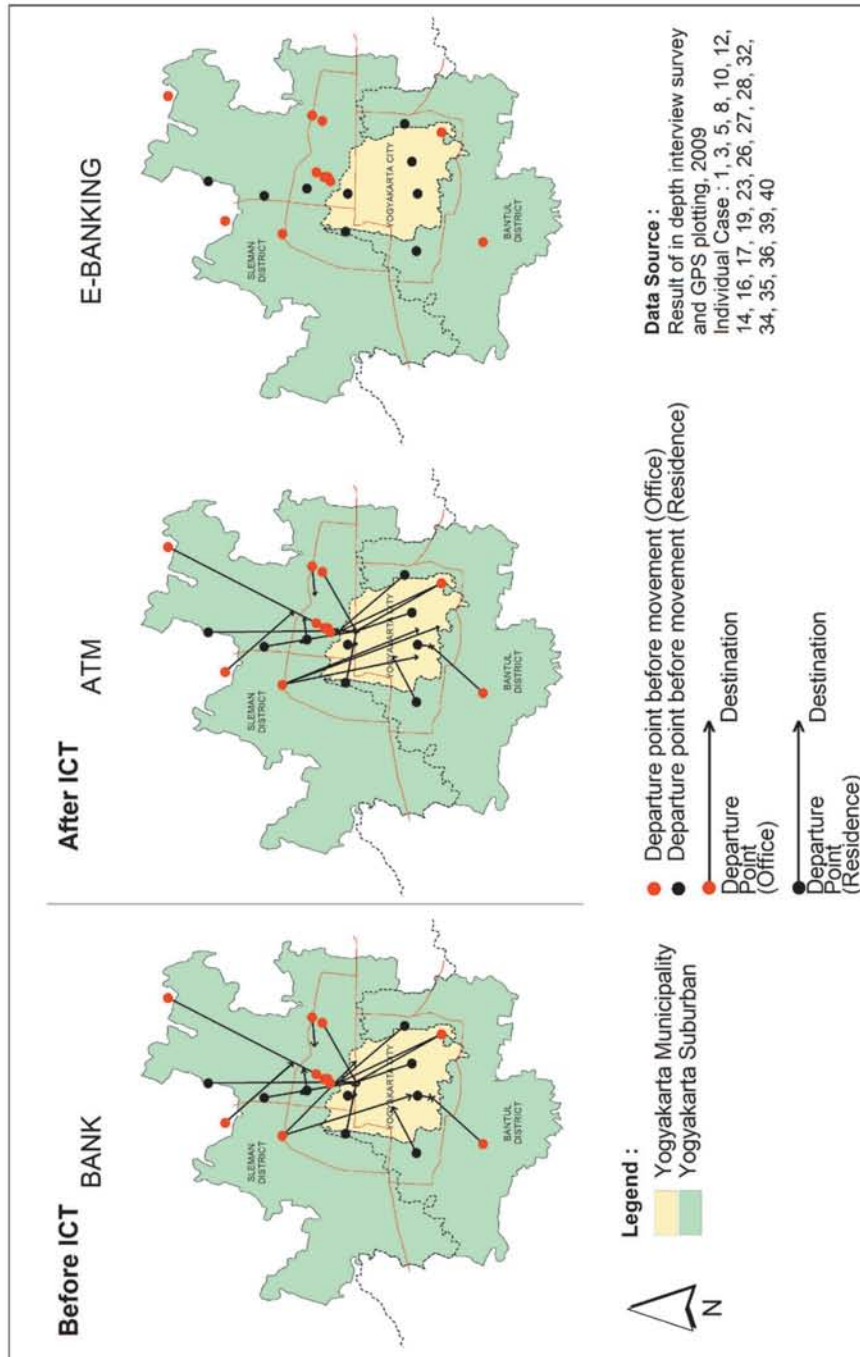


Fig. 1. Change of movement pattern in banking transaction before and after the use of ICT

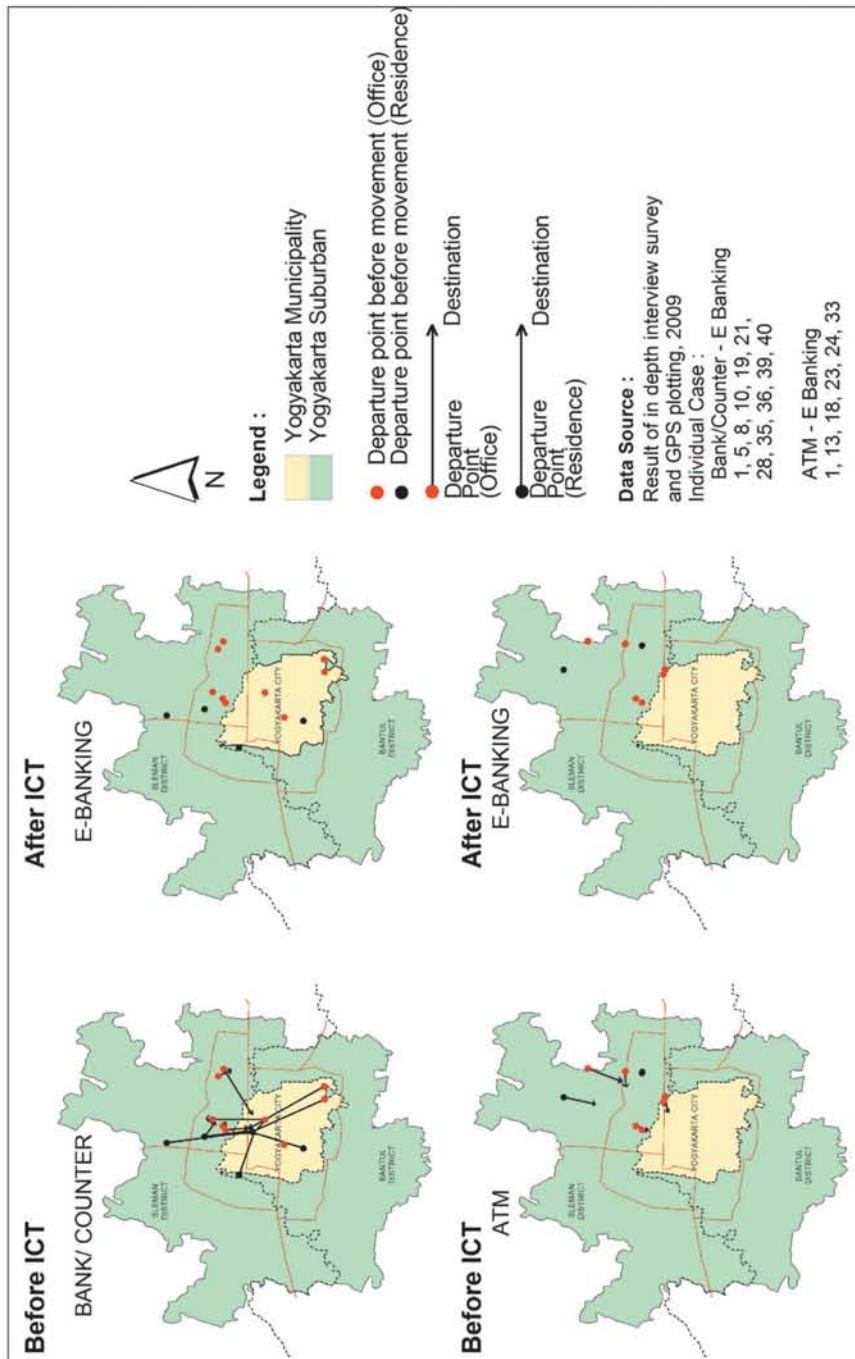


Fig. 2. Reduction and spatial patterns of movement in bill payment before and after the use of ICT

On the other side, retail services (supermarkets, malls and department stores) have also provided ICT based service known as online-shopping. Ordering or purchasing items using ICT also has consequences on the declining distance of movement as shown in Figure 3. This phenomenon supports Ren and Kwan's (2005) statements that e-shopping does not require physical travel. In this regard, Ren and Kwan do not emphasize the declining physical distance, but rather the declining time spent for shopping as well as greater flexibility of shopping time.

The use of ICT based retail service is still very limited to some commodities such as books, electronics, computers and their peripherals (including batteries, tablet PCs, CDs, PDAs, laptops, 3D model/animation, soft wares), durables, food, medicine and souvenirs. As suggested by Alba & Linch (1997) quoted in Farag (2006) e-shopping is not easy to perform for all types of products. For books and music, for instance, quality can be easily valued without having to examine or handle the items physically. However, in the purchase of clothes or vulnerable stuff, it is hard to value goods that direct examination and contact are essential. Thus, there is another barrier of transactions using ICT emanating from the local culture and tradition, *i.e.* the traditional buyers usually need to examine and select the items physically.

In ordering and purchasing items, the use of telephone has narrowed the distance range in the span between the locations of service providers and the individual case locations (both residential or offices), *i.e.* around the YUA. The use of hand phones for the same purposes, however, has broadened the range of shopping locations. This covers other cities in Java, namely Surabaya and Jakarta. Moreover, the use of internet in shopping has the broadest range covering other countries such as the USA, Taiwan, Australia and Singapore.

Before the use of ICT, especially e-shopping, population mobility toward the urban centre was a very common way of shopping. But population mobility declines substantially as the conventional and mobile telephones become involved in shopping transaction (tele-shopping). Further declines can be observed as e-shopping through the internet is used, and no physical movement is needed even for various types of items obtained abroad. Under the new way of shopping, buyers can access a great variation of items offered through the internet, and at the same time can purchase them online as well.

VI. New Locations of the Economic Services

Regarding the ICT based economic services most individual cases reported that they need the services for frequent transactions. The use of ATMs is one of the services considered to be convenient, as its usage is not attached to time and space. This also enables some economic transactions to be performed anywhere and anytime. Moreover, it does not need physical movement to the bank, as stated by the following individual cases:

With ATMs, I do not need to go to the bank. Banks are used only to withdraw cash (Individual Case 9).

ATMs have been substituted by internet banking (Individual Case 8).

There is a strong tendency that individual cases who have utilized e-banking service expect that all economic transaction can be accessed via e-banking. Therefore individual cases who have made use of e-banking service, consider direct contact with bank officers unnecessary or to be limited in number. Face to face contact and visit to the banks are very limited, for administrative purposes only such as saving, book renewal, credit proposal negotiations, complaints, dealing with safe deposit boxes or other services that require a direct contact between the consumers and the bank personnel.

With regard to cash drawing, however, ATM services have not been substituted by electronic banking. Besides, ATM as debit card is also needed as a means of payment, especially in shopping malls and supermarkets. For individual cases who have not been able to access e-banking and for payment which cannot be performed via e-banking transaction, the presence of ATM is certainly required. ATM services are also needed to anticipate the limited or absent internet access to e-banking services. The following statements of our individual cases support the above explanation:

ATM is still needed, not all people can perform e-banking transaction (Individual Case 12) and not everybody has good internet access (Individual Case 17).

Internet banking cannot be used for cash drawing and item payment device. as we cannot only rely on a single access, other means are then need to be achieved, particularly when we

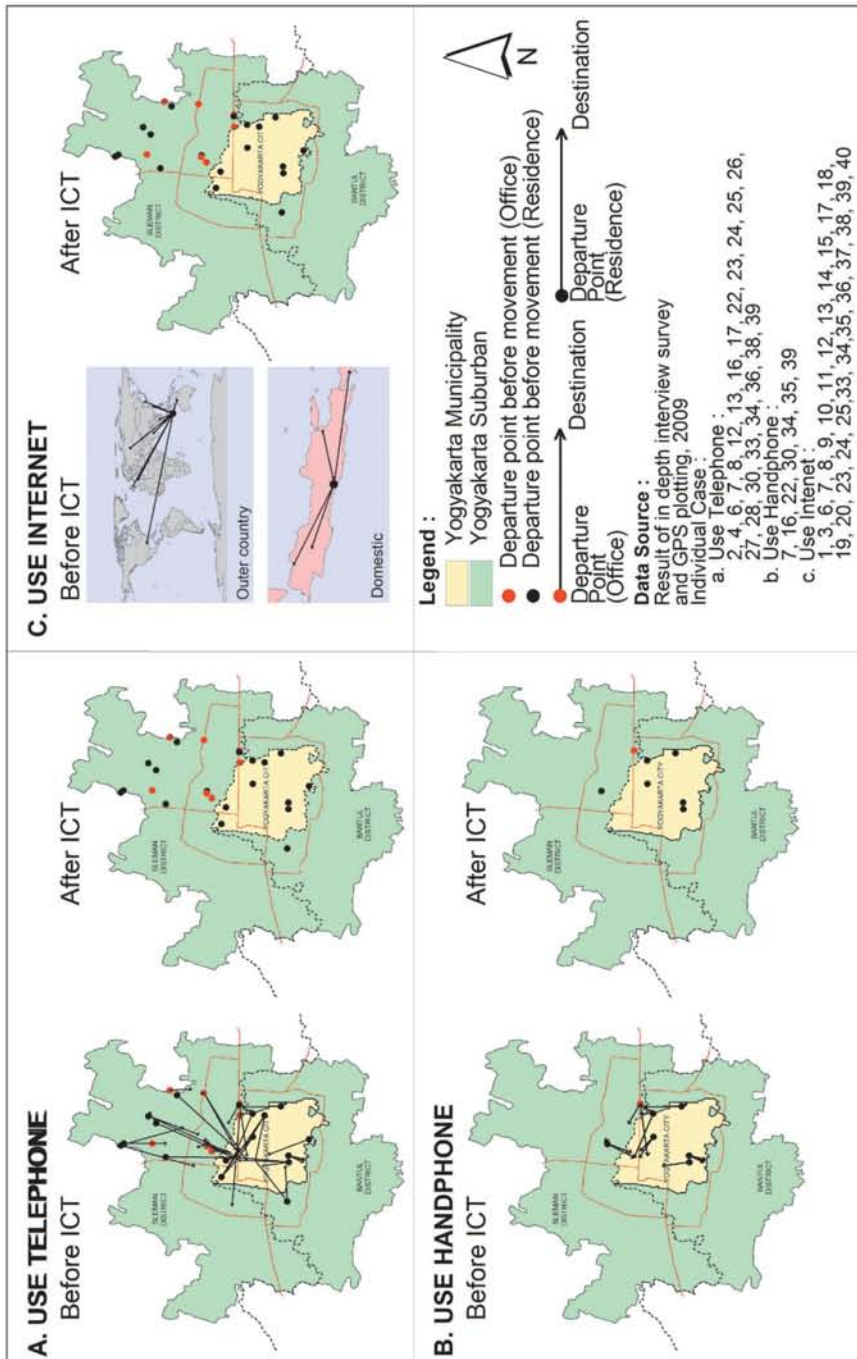


Fig. 3. Change of movement pattern in purchasing and ordering items before and after ICT use

are not online (Individual Case 34).

Regarding the payment of various services such as electricity bills, drinking water services, and telephone bills, conventional direct payment or payment through agencies or service points is considered unnecessary since these kinds of services can be accessed via ATM and e-banking, as suggested by the following individual cases:

I do not need them (payment agencies/payment points) anymore since I can use the internet (Individual Case 14). I do not need them (payment agencies/payment points); I can do it via ATM or e-banking (Individual Case 27).

Payment service is not needed any more (Individual Case 8).

Related to the preference of ATM location, most individual cases choose the location close to their residence (48 percent) or their workplace (30 percent). This indicates an important difference of services location from conventional banking services which are mostly located in the city centers. ATM service tends to be located in the residential areas as well. More recently developed residential areas in the YUA tend to be located in the sub-urban areas. Locations of ATM services seem to follow the residential location, and at the same time there is also an early indication that development of the sub-urban area is also followed by the use of ICT. The ICT providers tend to put higher priority on the new residential areas of the YUA. However, in many strategic places in the commercial areas and office buildings, many ATMs can be observed as a part of the financial services designated for the people in the city centre. This is consistent with the outcome of our research in the vicinity of Jakarta (Bekasi City), that ATMs which are located on the residential areas are more regularly visited by local residents rather than those located in the trade centers or the industrial areas (Rachmawati *et al.*, 2009). The survey further shows that most respondents prefer to use the ATMs around their residential areas. Thus, the consideration of distance to residential locations is an important factor for the placement of new ATMs.

For bank location, individual cases recommend that banking service location be in the business centres or other strategic locations. However, individual cases who have utilized e-banking services do not consider service location as a crucial matter since ICT makes everything more flexible, as proposed by

the following individual case:

It becomes less sensitive due to infrequent access, which means that any place will do since accessing is rare (Individual Case 39)

Some individual cases who have used e-banking service believe that bank location should be located in sub-urban areas or outside city or even remote areas to serve the remote society. Some of the people living in the city centre have tended to access services through ATM and e-banking. Here are some opinions of individual cases on the orientation of economic service development after the use of ICT based services:

Suburban or anyplace will do (Individual Case 18). Not always in city centre but it can be in accessible locations outside city (Individual Case 32).

It should reach remote areas for the people who are not acquainted with bank (Individual Case 34).

In every sub district there should be a similar authority to the central one." (Individual Case 21).

The location for electricity, telephone and drinking water services is expected to be close to the residential areas, shopping centers and business centers. It is interesting that there are some opinions suggesting that the payment location must be directed to sub-urban areas or villages since many people living in the city center have begun to shift from conventional payment to ATM and e-banking, as suggested by the following individual cases:

Its existence in city should be minimized, yet needed in villages (Individual Case 24). The city does not need too many but villages need more because there are still many people who do not have access to ATMs, as for sub urban areas its number should be in between (Individual Case 28).

It should be close to the users, rural/ modest housing residents in sub-urban areas (Individual Case 29).

Most individual cases suggest that the location of supermarkets, malls and department stores should be closer to the residential areas, city centre and

locations intended as shopping areas. Some suggest that there should be location development in sub urban areas and outside the city as stated below:

A mall is ideally located in sub urban area, sub district level. In some countries, suburban areas do have mall so people do not need to go to the city (Individual Case 19).

Outside the city (Individual Cases 32, 33, 36).

It should not be in the city because it is too crowded (Individual Case 38).

A similar opinion related to the orientation of retail location in sub-urban areas is also suggested by Evers (2002) in Schwanen (2003), that retail facility planning is directed to neighborhood locations to maintain the distance to be accessible by bicycle or on foot by local residents. However, Evers' emphasis is on the transportation mode, while the emphasis of this research is more on ICT use for item purchase/order which has been initiated by the people living in the city, so that orientation of location is suggested more in the suburban areas. Nonetheless, orientation of retail location near the residential areas in sub-urban is also proposed by some individual cases due to the new tendency of residential location to be more decentralized toward the sub-urban area.

With regard to shopping activity, individual cases who have performed shopping activity using ICT either by telephone, hand phone or internet reported that it can be predicted that in the future the existence of supermarkets, malls and department stores are no longer needed due to online shopping, as suggested by the following individual cases:

In the future, malls, supermarkets and department stores are no longer needed; European countries have applied online shopping (Individual Case 30)

Someday, they will not be needed anymore, but now, they are still needed since there are still few online retailers (Individual Case 15)

They are not needed for we can get information of items to be bought through the internet (Individual Case 36)

VII. Conclusion and Generalization

Some initial conclusion from this case study can

be drawn as follow. There is a substantial change of spatial pattern in population movement of the individual cases in accessing the economic services due to ICT use. This is shown by the declining distance, time, cost, frequency of movement. At the same time, individual cases also demonstrated a substantial change in the direction of movement. The reduction of travel distance and travel time are more important than the reduction of travel cost. The frequency of movement toward the city centre in accessing services has decreased, as some movements have been substantially replaced by ICT based service access. The direction of population mobility is no longer centralized toward the city centre, but rather from and to the sub-urban areas.

The orientation of service location development tending to be decentralized to sub-urban coincides with the growing use of ICT based economic services and the new phenomenon of residential decentralization. Thus, from dynamic of population mobility and the location of economic services, one can predict that the future urban spatial structure of the YUA would be partly determined by the use of ICT in various types of activities that reduce travel time and distance.

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