Peri-urbanization: a study from ICT perspective

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Abstract. With the vast expansion of ICT infrastructures, information are being openly shared and exchanged among individuals, companies, and governments. This study delves to define how ICT might have opened up new possibilities for urban practices into peri-urban area and affected the peri-urban areas. It is suggested that ICT have allowed paradigm shift into information economy and modern agglomeration; ICT have aspired and enabled people to migrate to peri-urban area; ICT affected the identity and perception of peri-urban places by the way it is represented in online world; and ICT brings the influence of urban to people outside urban areas and allows sociocultural transformation.

Keywords: peri-urbanization, ICT infrastructure, peri-urban dynamics, information economy

1. Introduction
In 2006, in its report, “The State of the World’s Cities” the United Nations HABITAT office made a formal pronouncement that, for the first time, more than half of the world’s population, nearly 3.3 billion, lived in urban agglomerations rather than in rural areas [1], which also reinstated by UN Department of Social Economic Affairs in 2007 [2]. More and more megacities were emerged since 2005 [3], in which, not only signified by the major increase of population number, but also the expansion of urban areas outwards the major central city, shaping an extended metropolitan region in juxtaposition with formerly rural areas. This spatial configuration created a transition zone between urban and rural areas, and later formed few terms –’urban fringe’, ‘urban shadow’, ‘exurban zones’ just to names a few– which experts agreed to name the particular zones as peri-urban area [4].

The trend of large scale development promoted the dispersion of former “central functions” into new nodes located outside former urban areas [4]. This kind of development provides not only the expansion of infrastructure, including transportation and lifelines, but also the information and communication technology (ICT) infrastructure. As a matter of fact, in the same year of 2008, the number of worldwide Internet users who used mobile cellular broadband surpassed those who used fixed broadband [2]; helped by the ubiquity of cheap mobile devices and smartphones, people started to get used to being connected everywhere. The networked era change the way of knowledge sharing: expands the building blocks of knowledge; balloons the places where knowledge originates; change the processes and the velocity of creating knowledge; capacity to gain knowledge; ability to dispense knowledge; and the value of knowledge of itself. It is also shaped the harmony in organizations, where there are networked individuals, information, workplaces, and enterprises [5]. These transformations might allowed a radical shift in the way that space is organized and also opened up radically new possibilities for urban practices, much like other previous new technologies in other eras [6]. Through
literature review and indicative evidences from Jakarta Metropolitan Area (Jabodetabek), this paper will explain the peri-urbanization, from the approach of ICT perspective.

2. The Dynamics of Peri-urban Area and The Emergence of Mega-urban Regions

Rural, peri-urban, and urban areas created a system, connected with each other and formed a multidimensional chain. Peri-urban areas often identically defined with the process of rural areas which transformed into urban-character, physically, economically, socially, and in other aspects. In exploring the dynamics of peri-urban and peri-urbanization, one should look at more than one aspect, but also in understanding the complexity of the system [4]. PLUREL, an integrated project in 2007-2011 about Peri-urban Land Use Relationship coordinated by the University of Copenhagen, has defined 5-dimensional framework to identify the main processes which are visible at different levels, and also represent a kind of generic ‘story’ of how peri-urbanization takes place. These dimensions themselves are not distinctive, but rather, overlap or connect with each other. The first aspect is where urban expansion occurs as a direct result of growth in population, economics and space demands. Next, as cities expand further, they form regional agglomerations, with step-changes in economies of scale taking place, and a new type of peri-urban territory developing. Thirdly, underlying these developments are the effects of various deeper political and cultural forces which shape the peri-urban territory. The fourth factor is where the whole urban system can go through rapid transitions, with radical change and restructuring. The final aspect concerns policy responses to these changes and transitions which often feed back into the mix, and become ‘dynamics’ themselves [7].

The first two aspect of the framework explains the direct factors of urban expansion and regional agglomeration which can be simplified as a term of regional urbanization. In Asian context itself, distinctive areas of agricultural and non-agricultural activity are emerging adjacent to and between urban cores, which are a direct response to pre-existing conditions, time-space collapse, economic change, technological developments, and labor force [8]. These factors behaves in a different manner with Western industrialized countries in the 19th and early 20th; the existence of high-density agricultural regions adjacent to large urban cores offers a opportunity for a particular form of mega-urban region to emerge. McGee’s model of the spatial configuration of a hypothetical Asian country consists of 5 main regions of the spatial economy [8], which are:

- **The major cities of the urban hierarchy**, which are often dominated in the Asian context by one or two extremely large cities. In this paper, Jakarta is the observed major city.
- **The peri-urban regions**, which are those areas surrounding the cities within a daily commuting reach of the city core. In some parts of Asia, these regions can stretch for up to thirty kilometres away from the city core. In this paper, these region consists of Bodetabek (Bogor, Depok, Tangerang, Tangerang Selatan, Bekasi area).
- **The regions labeled desakota**, which are regions of an intense mixture of agricultural and non-agricultural activities that often stretch along corridors between large city cores. These regions were previously characterized by dense populations engaged in agriculture, generally but not exclusively dominated by wet rice.
- **Densely populated rural regions**, which occur in many Asian countries, particularly those practicing wet-rice agriculture.
- **The sparsely populated frontier regions**, found in many Asian countries that offer opportunities for land-colonization schemes and various forms of agricultural development.
This mega-urban regions formation is seen to be strongly linked to industrialization and globalization since the Industrial Revolution. The clustering of producers and consumers in urban space gives rise to a variety of agglomeration economies, which can lead to greater productivity and technological innovation, thus creating a potential snowball effect that stimulates urban industrial expansion [1]. Soja in 2014 further explained that there are 3 major forces that have been driving the regional urbanization process and shaping the formation of city regions: 1) the globalization of capital, labor, and culture; 2) economic restructuring and the formation of a new economy; and 3) the facilitative effects of the revolution in information and communications technologies [9].

3. Stay Locally, Connected Globally: Role of ICT in Peri-Urban Dynamics

3.1. ICT and Transformation of Economy

Castells explained that the existence of technology and information economy concept creates a new dimension of space called space of flows [10]. Space of Flows is the material organization of time-sharing social practices that work through flows, enabled by circuit of electronic exchange, nodes and hubs of activities, and elites that exercise the directional functions to articulated space. While the space of flows do not have specific locations, the layers explained above shifts the paradigm of agglomeration of urban population, with addition of some criteria cited by Audirac [11]: access to the city and places that connected with global economy; technological infrastructures (Internet, airport, highway) which creates fast and digital communication between cities; and good location based on values of the elites in the era of information (for example, location with educated workers). This location will have a greater pull factor to the actor of information economy, enabling the modern agglomeration with such factors.

This agglomeration can then open more new opportunity and create further technology acceleration, known as knowledge spillover. Jacobs in 1969 suggests that information is codified and can be formalized, written down, by contrast, knowledge or what is sometimes referred to as tacit knowledge, is vague, difficult to codify and often only serendipitously recognized. This tacit knowledge is what encouraged the agglomeration, as geographic proximity matters in its transmission, because tacit knowledge is inherently non-rival in nature, and knowledge developed for any particular application can easily spill over and have economic value in very different applications [11].
3.2. Migration to the Peri-Urban Area: Pull and Push Factors

As the urban expands outwards the city core physically, it creates a new functional relationship between the city core and the urban region, cited by Friedmann and Miller in 1965, as the countryside close to towns became a potential place for living, recreation, and working, and creating an area of urban influence around cities through the expansion of infrastructure [7]. Studies showed that migrations to peri-urban region happened because of varying reasons; two examples of pull factors highlighted in Bryant et al. are the demand for labor and difference of living standard between rural and urban. These two factors, along with demand for products from countryside and demand for land, were observed by Bryant as the forces of ‘urbanization’ of the countryside [14]. Soja also explained that some activities and household once densely clustered in the urban core began to move out to the periphery as an early decentralizing trends, which accompanied by other forces such as formation of expansive corporate monopolies, and policies that led to new clusters of corporate headquarters and government bureaucracies in growing central business districts and civic centers [9].

While economic and cultural reasons of these migrations are somehow entwined, sociocultural reasons rather than economic ones seem to be the dominating ones. This is best described by five general reasons given by people, which also reflect ‘pull’ factors of countryside [13]: desires for greater privacy and personal space; values inherent in both the man-modified and the natural environment amenities of the countryside; freedom to carry on activities usually not permitted in the built-up area, e.g. keeping animals, attraction as a place to raise children; and the hope that economic advantages will result. Along with the pull factors, the ‘push’ factors exist which represent essentially a negative image of the urban environment by exurbanites. First, there is the reverse side of the coin of the five pull factors listed above; second, there are added problems of congestion, of air pollution and of the psychological ‘rat race’ syndrome of intense urban life, i.e. perceived disadvantages in the physical and psychological environment of the built-up city as a place to live. A French study carried out in the Plaine de Versailles, noted a set of positive features of the rural environment (e.g. having open space easily accessible; the good air; being close to nature) as well as a set of negative features of the urban environment (e.g. the ‘threatening nature’ of the urban environment, the lack of sense of personal freedom) [13].
This social, economic, and political force behind the physical processes of expansion/agglomeration in peri-urban area is also explained in the third dimension of PLUREL framework: dimension of global-local and structural dynamics. The first aspect of this dimension is globalization, which can perhaps best be defined as the “widening, deepening and speeding up of worldwide interconnectedness in all aspects of contemporary social life”, as cited by Held et al. In 1999 [13]. A key dimension of globalization is a rapid increase in cross-border flows of all sorts, starting with finance and trade, but also ideas, ideologies, and knowledge about democratic and economic governance, cultural and media products, and people [15]. The common assumption that technological change has facilitated migration along increasingly diverse geographical pathways is indicated by the change brought by technology, which has lowered resource constraints on mobility by bringing down costs of travel and communication, strengthened migrant networks by making it easier to stay in touch with relatives, and increased people’s aspirations and awareness of opportunities in previously unknown places through improved access to global information [15]. Paul Saffo mentioned particularly about the ICT technological breakthrough in 1996, that the Internet won’t mean the death of urban centers, as it will mean the reinvention of them. However, it could also eventually mean an explosion in some exurban areas [16].

In the context of migration to the peri-urban area, both from the urban area outwards or rural area inwards, it should be stressed that the major advantage of living in the city’s countryside is the ability to be close to nature, open space and all that they stand for and to be able to have access to the facilities of the city (Bauer and Roux 1976) [13]. While the commuting distance seems to be increased over the years in almost every country [17][18], the peri-urban area seems to sit right in the constellation of important factors of agglomeration in the era of information economy based on Audirac explained before: good access to the city and places that connected with global economy, which enabled by the further expansion of physical transport infrastructure; technological infrastructures which creates fast and digital communication between cities; and good location based on values of the elites in the era of information, exemplified by the existence of educated workers with the migration of exurbanites into the peri-urban area [11]. Related to the increasing population in the peri-urban areas, telco providers are now catching up by the construction of base transceiver station (BTS) tower, providing the first layer of Space of Flows and enabling larger flows of information on communication network.

![Figure 3](image_url)

**Figure 3.** A year-to-year comparison of number of Telkomsel BTS towers with 4G network in Jabodetabek area from 2015 to 2017. According to Protelindo, the growth of BTS towers in Indonesia reached 12% annually. In the image above, orange circle shows a higher density of BTS towers. Source: [27]

3.3. Technology and Production of Space
If we look into the movement of people in more detail, into the dimensions production of space, we would find that the ICT affects our perception of space. Schmid observed that, “With the Internet and
mobile phones, we can continue our work or the conflicts in our relationships even at the beach, dragging our entire everyday existence along with us wherever we go. This kind of overlapping of detached realities has since become an everyday experience. Space shrinks, distances no longer have the same meaning they had 20 years ago, and different life worlds begin to merge”[19]. In his essay “Cities or Urbanizations?” geographer David Harvey observes that, “The way we see our cities affects the policies and actions we undertake” [6]. Perhaps this statement works not only with cities, but also with other spaces. The Internet and social media, in addition with the ease of multimedia-sharing (photo, audio, and video), allow people to see and explore the spaces differently. Andrea Baldini discussed this in Post-Internet Cities International Conference in 2017, that social media has helped people to reach the unexplored sites of urban space where graffiti art usually take places as a radical form of art, and influence people’s perception of graffiti and their sites, and how it reshapes the understanding of urban space [20].

The way spaces ‘represented’ in social media nowadays, affect the response of people and designers of space. Instagram, as the most popular social media platform widely used to share photos and visual arts, has known for its influence on shaping a space. There is a newly term popularly known as ‘Instagram phenomenon’, to describe a place or spot that was once isolated and hard to find, but a picture on Instagram made it viral and turned it into a picnic spot [21]. As mass-photography is becoming a trend, Lombardi added that tourist sites are now laid out and staged for taking photos, which has become the main attraction, as they have transformed them into a sort of fun social-media playground for photography [22]. This should be anticipated in non-urban area, as it is holding the positive aspects of rural, which create the demand of land based on recreational purpose, for its scenery and other aspects such as land availability [13]. The consumption culture itself, explained in the third dimension of PLURAL framework, affects the identity and perceptions of peri-urban places through leisure, tourism, and other location decisions [7].

3.4. Technology and Socio-cultural Change
The complex configuration and connectivity among the city core and urban regions creates a ‘metropolitan mainstream’: under the conditions of global urbanization, cities have become strategic nodes of global economy and social life. Soja and Kanai observed that cities in themselves, as socially constructed human habitats, generate positive forces of creativity, innovation and economic development [1]. Walker (1976, 1977) in Bryant et al. [13] stated that while the social networks of the exurbanites are more closely linked to the city than to the rural community, links to the rural community increase with length of residence. Meanwhile, city core has the pull factor for people outside them to keep connected to the city, as becoming disconnected itself, nowadays, is seen as an existential threat [23]. With the transformation of knowledge sharing and society as a network society—that is, a society constructed around personal and organizational networks powered by digital networks and communicated by the Internet—perhaps the links between cities and the rural should be revisited.

Urbanism as a way of life, as explained by Louis Wirth has four characteristics: 1) transitory: an urban inhabitant’s relation with others last only for a short time, tends to forget old acquaintances and develop relations with new people; 2) superficiality: an urban person has limited number of persons with whom he interacts and his relations with them are impersonal and formal; 3) anonymity: urbanites do not know each other intimately; and 4) individualism: people give more importance to their own vested interests [24]. With the interconnectivity of people enabled by ICT infrastructures, the Internet and social media are very powerful tools that can influence and shape human behavior [24]. These characteristics are, somehow, mirrored in the way people interact in digital era. Digital era has transformed the social networking protocols of engagement, from set of rules which needs to be agreed on by both parties, into a narrowed down protocol of the Internet: TCP/IP.

Felix Stalder stated that by having TCP/IP and being visible on the Internet, people can access any social networks and therefore, gained trust to start interacting within the network [23]. The online social media provides a medium for the kind of interaction that can throw up new ideas, new symbols, new rituals and new identities. In this way, people can interact with strangers—they might have some
things in common to a certain degree which represented by their ‘identity’ in the network or social media, but not intimately. But first, people needs to be visible on the Internet, which makes them needs to be focus on to be different than others. Castells further explained that there is a rise of ‘Me-centered society’, or the process of individuation, as the decline of community understood in terms of space, work, family, and ascription in general. It is based on the transformation of space (metropolitan life), work and economic activity (rise of the networked enterprise and networked work processes), culture and communication (shift from mass communication based on mass media to mass self-communication based on the Internet) [26].

The individuation, Castell explained, is not the end of community, and not the end of place-based interaction. Instead, there is a shift toward the reconstruction of social relationships, including strong cultural and personal ties that could be considered a form of community, on the basis of individual interests, values, and projects [26]. Shortly, there is a rise of prosumer function–people are producing together things they value for themselves [23]. Put together with the great glories of the Internet as it allows everyone to have an opinion and share it through various methods, including blogs, videoblogs, and social networking websites, then it makes sense that many observers have concluded that in a networked world the social media possesses the potential to promote public participation, engagement and the process of democratizing public life [25]. This way, information and knowledge shared across the Internet—including the ones shared informally by individuals in social media—could be a way to know the voices of the public as it reflects actual and on-the-ground observation and experience, and later, can be harnessed by the higher stakeholder of development for public policy and decision making, including in peri-urban areas.

Figure 4. Map of tweets from Twitter #DataGrant containing the word “flood” or “banjir” in Jabodetabek. Each tweet represented by blue dot, which reached 150,000 tweets in total during in 2013-2014. These tweets were used by the local government to monitor and respond monsoon floods. Source: [28]

4. Discussion and Conclusion
Through this paper, it is observed that ICT plays 4 role in the peri-urban dynamics. The interconnected era shifted the paradigm of spatial economy into information economy, thus creates modern agglomeration around urban areas. While peri-urban area sits right between the positive sides of rural and close access to the facilities of the city, the technological breakthrough has aspired and enabled
people to migrate easier. The way spaces represented in online world have affected peri-urban places, especially through leisure, tourism, and other location decisions. The influence of ICT in human behavior has somehow transformed the social and cultural aspects of people so that they resembles the urbanism as a way of life while not necessarily be in urban type of settlement, and peri-urban residents can be highly influenced by urban social networks as they can be connected everytime and everywhere. As this study reviewed general literature of ICT and peri-urbanization, more variable can affect the peri-urbanization in specific cases and locations, e.g. the Internet literacy, movement of job opportunities from cities outwards. Thus further studies can be conducted based on more detail variables and directing policies should be taken.

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