Sustainable Campus Town Development in Suburban Area of Bangkok, Thailand

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Abstract

    The importance of university establishment is not aimed only increasing the educational level to young generation by providing specific knowledge, professional skills, or enhancing high-level of training facilities in order to raise skills of people for serving national job market, but also indirectly improving local economy and job opportunities for local people who are living nearby area of university. Therefore, it must be planned to meet the goal of urban development and sustaining the quality of life of the people, especially the suburban area of Bangkok, Thailand. Incorporating with the growth of mega city, the establishment of different university should not only consistent with regional planning and development in accordance to National Economic and Social Development Planning scheme, but should be complying with provincial and community development. However, university has been stimulating community development in all dimensions both positive and negative impacts. Urban problematics such as heavy traffic congestion, immigrations, safety and isolation between the "old-liver" and the "new-comer" had been induced in this area. Thus, campus master planning should be designed to create a node of urban intensification with pedestrian friendly environment which will not only encourage more compact development in the neighboring areas, but also provides health, environmental, and economic benefits.

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1. Introduction

Rapid urbanization has created both negative and positive impacts on urban residents, especially in relevance to uncontrolled urban expansion coupled with inefficient transportation planning. The negative effects of automobiles towards physical environment and quality of life become more concerns due to the current trend of global environmental issues of climate change. It occurs when the migration of population relocating from rural areas to urban areas.

It is obviously seen that Bangkok become greatly dispersed with the heavy migration and expansion, particularly the settlement outside of the urban core areas. This phenomena of growing of urban area are impacting towards population growth of Thailand. The present of institutions, employment areas and several activity centers are located in these areas which induced high intensification with a mixed of land use including public, commercial, employments and housing. The expansion of the metropolitan region could be viewed in several aspects as consequences. However, this intensity of urban function demonstrates the different degree of development to the peripheral or suburb area.

The wide range of intensity has directed its relationship to density of population and migration rates, which could be noticeably seen in the nodal development of the city. The varieties of population characteristic and density representing as a good indicator to characterize the level of attractiveness for human settlement. It could be referred that Bangkok Metropolitan Area (BMA) and its vicinities have their different competitive attractions for residential allocation and infrastructure development. This phenomena of urban development demonstrate situation of urban sprawl in Bangkok. Thus, tactical and integrative planning relates to land use and transportation plan are needed.
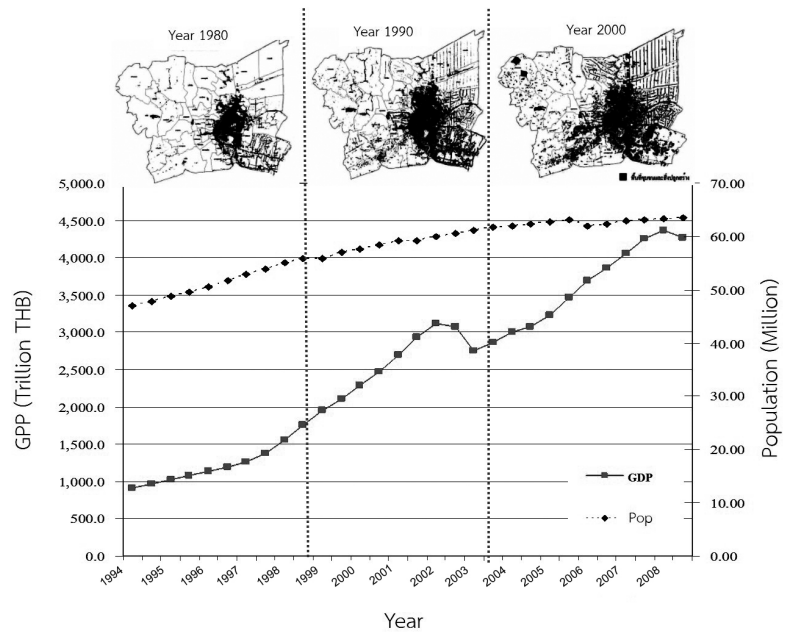
Figure 1. Urban expansion in Thailand during year 1980 – 2000.
(Source: National Statistical Office, 2015)

Several researches have been conducted to understand the mechanism of urban growth based on physical and functional changes from the transition of rural landscape to urban forms (Ewing, 1997; Thapa & Murayama, 2010). This study selected Pathumthani province which is belong to BMA vicinity as a case study. This area is potentially developing as a sprawl due to rapid transition and expansion: urban migration, socio-economic environment of human activities, sub-centers of employment places and economic activities had been founded. Furthermore, this area would be a well-meaning case study to explore the linkage of specific development pattern in the suburbanization area which impacts on shaping the travel pattern to link social activity and lifestyle of people.

To accommodate the huge attraction of urbanization in this area including population, commercial development and among others, it has been recognized that one of the most effective ways to

facilitate urban restructuring is to move towards a polycentric system from the current mono-centric system in Bangkok. Furthermore, this approach can also be successfully planned to deliberately utilize the urban rail transit systems. Additionally, to reduce the demands on automobile while most people are now highly dependent on car travel is presented as new challenges to the planner, the operators, the public, and other stakeholders (Beirão & Cabral, 2007). However, as previously mentioned, the limited massed transit service provided only in urban core could not accommodate the demand to provide maximum access and connectivity between the central core area and the surrounding area. It is crystal clear that urban sprawl has become the main influence to the settlement along the network expansion. The more use of private car which rises to the challenges of sustainable development. In case of investigate the campus planning and development, the usage patterns in the study area, the travel behavior approach plays an important role as powerful tool to reflect the interaction between land use and mobility pattern. This approach has been widely used by several researches through quantitative and qualitative interviews (Dieleman et al., 2002; Krizek, 2003; Næss, 2006). Several studies pointed out that impact of urban structure may alternate commuters' choices (Ewing & Cervero, 2001; Meyer & Miller, 2001). The opportunities offer flexibility of certain activities such as shopping, banking and other services and would affect destination choices. To graphically differentiate the activities in different sub-centers within the university and its nearby area, understanding towards the users; university students, staffs and the community who are living around university become important to distinguish their lifestyle towards functional usage in university area and the surrounding area of the university. Therefore, the aim of this research is to analyze the university students and staffs behaviors towards daily functional usage comparing between university areas and surrounding area of Thammasat University (Rangsit Campus) based on factor analysis. And to classify typos of space usage behaviors of university students and university staffs based on statistical cluster analysis.

2. Characteristic of Town-Gown Community

Campus town, college town, university town or town-gown community provides the keys to the successful implementation of high quality of facility and education environment. Focusing towards built environment characteristic, campus should intend to eliminate the need for a private automobile for many if not most daily trips. Campus, a unique place or a community, in the words of Checkoway (1997, p. 308), may be defined as a process of people acting collectively with others who shares some common concern, whether on the basis of a place where they live, interests groups that are similar, or relationships that coherent or continuity College campuses are very distinct communities. There are places where people from different backgrounds, various ncome classes, lifestyles and attitudes, are living together, studying, working, and doing recreational activities. College campuses built societies that are at once transitory and lasting, and have an ideal human scale (Ojeda & Yudell, 1997). Universities promotes themselves as elite bastions of information and knowledge. Professors and students attired in their academic gowns were as distinct from townsfolk as university campuses which were from their surrounding architectures (Martin, 2005). Roles of universities encouraging social and economic development, has become a catalyst for economic and social transformation in a particular geographical area, leading development in regional, urban and local level, and could be possibly being positive nor negative effects to communities and citizen (O' Mara, 2010).

The traditional campus adheres to the basic principles of the neo-traditional town, since it concentrates a variety of functions within reach radius for pedestrians. Campuses are usually self-contained neighborhoods where classrooms, offices, apartments, students' centers, child care facilities, performance halls, art galleries, gymnasiums, swimming pools, sports arenas and shopping places are all in close proximity. Having its own streets, squares and open spaces allows people to stroll together. College campus might be located in rural or urban areas which the layout is depended on locations. A rural campus tends to present horizontal connectivity, while an urban campus tends toward vertical connectivity. Towards the economic impact to surrounded communities, students could leverage local economy through using services or purchasing goods for daily consumption and other expenses (Humphreys, 2009). Rural campuses are normally more motorized-dependent than urban campus town. Although most of campuses are not totally excluded the automobile, walking become the expected way to approach a particular area even though other ways of transportation may also be possible. College campuses are a good example of a people's place (Engwicht, 1993). According to the concept of Campus town or college town, it came predominantly in 1970 and later continued to develop as a major international conference on "City of the education division" (Venezuela, 1990). The discussion of the campus town practices should consider the need for integrated planning

and the relationship of partners so as to develop educational and culture, and to remove the unequal access to education. There are four major types of town-gown community (1) *Harmonious type* – relationship between community and university in comfort level and highest effort which is desirable for all town-gown cities; (2) *Traditional type* – a combination of higher level of comfort but lower in efforts which is a typically generates modest amounts of relationship satisfaction, or each are pursuing their own goal; (3) *Conflicted type* – the relationship comprised of lower comfort levels and higher effort level which generates overall reduced satisfaction level while each participants trying to engage each other; and (4) *Devitalized type* – least amount of overall satisfaction between campus and community members (Gavazzi & Fox, 2014) as shown in Table 1.

Town – Gown efforts and comfort relationship		Efforts	
		High effort	**Low efforts**
Comfort	**High comfort**	**Harmonious type** - The most desirable of town-Gown development - Partners are dynamically involve in activities which beneficially to both community and university - Optimal town-gown relationship	**Traditional type** - Retains its desirable status in large part - Main objective becomes the maintenance of the status quo - Campus and community leaders often as not simply ignore each other as long as they are still able to pursue their goals
	Low comfort	**Conflicted type** - Conflict habituated (Cuber & Haroff, 1965) - Causing troubles towards town-gown relationship. Therefore, finding concordant way of maintaining their association with one another are important	**Devitalized type** - Representing the least amount of overall satisfaction between campus and community members. - "Love gone sour" situation (losing sense of connectedness) consequently lower sense of belonging

Table 1. A four type of town-gown relationship based on comfort and efforts of interaction. (Source: Gavazzi & Fox, 2014)

Important of town-gown community become important and should be considered in order to improve the relationship between university staff, students and other users incorporate with communities members, this issue become important, especially if the university become the leading factor of development in that region. However, some activities performed by university side may interfere the local activities and lifestyle, which consequently causing negative effect towards the relationship between university and communities. Thus, maintaining their relationship in terms of space usage control, environmental considerations, traffic safety and accessibility, and nuisance should be address as a major issues to maintain their relationship for achieving town-gown sustainable development in the future.

There are five kinds of relationship between "town" and "gown"; coordination, competition, coercion, conflicts or exchange. Both primary and secondary function of each land use (Town – communities and Gown – universities) are different. Those primary functions and secondary functions could be affected to relationship among both university and the surrounding communities such as events, purpose or goals (White, 1991) (Table 2). The five types of interaction between town and gown stated by White in 1991 could be shown in Table 3.

There are some differences between concerns (e.g., local government and research university) and it is difficult to measured (O'Mara, 2010). However, impacts of town-gown communities could be distinguish in accordance to concerns issues as shown in Table 4.

Table 2. Possible interactions between town-gown primary and secondary function. (Source: White, 1991)

Town – Gown primary and secondary function		Town side	
		Primary function - Protection - Water, sewer, garbage disposal & other public works - Education - Finance (Tax)	**Secondary function** - Culture - Library - Recreation - Entertainment
Gown side	**Primary function** - Teaching - Research - Service (by-product of teaching or research)	**PP – Type (Majority of interactions cross)** could possibly be cooperates, however in also could be conflicts or competition if the satisfaction of aims are did not meet to the another side	**PS – Type (Primary function of Gown, secondary function of Town)** representing exchanging situation between the two types and expecting something in return for the other side
	Secondary function - Service (Extended by university to meet community needs. - Maintain physical and plant	**SP – Type (Primary function of Town, secondary function of Gown)** representing exchanging situation between the two types and expecting something in return for the other side	**SS – Type (Propose relates to secondary function)** special incentives are needed to implement. Roles of special interest groups or participants become the key to increase interaction between "town" and "gown"

Table 3. Classification of interactions between town and gown community. (Source: White, 1991, p. 32)

Types of interaction	Description
Cooperation	Working together for mutual interests, benefits, or goals. Acting or banding together for pursuing a particular achievement that could not be done individually.
Conflict	Two or more engaged in a struggle against the other to achieve a common end or gain prized or valued objective. It may have positive aspects of integrating or bonding people into a group or leading to needed social change.
Exchange	The giving or acting toward one in order to receive something in return. The expectation is that the other will feel grateful and return in some kind occurred.
Competition	A struggle of two or more to achieve the same goal but not directed against another. It is a kind of cooperation/conflict, and goal-oriented
Coercion	Forcing another to do something against their will without concern. All forms rest on threat of the ultimate use of force or violence, usually subtle and negative.

Table 4. Some dimensions of university-locality interaction during 1950 – 2009. (Source: O' Mara, 2010)

Concerns of local government	Concerns of research university
University activities that maintain or increase local revenue streams - Private sector job growth - Increase an education workforce - Construction - Growth of high-productivity, high-revenue, knowledge-intensive sectors	*Local actions that support university revenue generation* - Political support for state and federal lobbying efforts (appropriations, technology transfer, tuition authority) - Private giving - Sponsored research
Uses of university-owned and university-controlled property	*Freedom to develop university-owned and university-controlled property*
Neighborhood viability - Increased traffic - Economic stabilization - Effects of student housing on residential housing market	*Neighborhood viability* - Public safety - Aesthetics of built environment - Availability of student/faculty/staff housing
Behavior of members of university community	*Behavior of non-university affiliates in the community*
University as urban amenity and attraction	*Community as an amenity and attraction for students, faculty, and staff*
University expertise and human capital applied to local problems and/or resource shortages	*Student educational experiences enhanced by service-learning*

university and communities collaboration could be seen in concept of town-gown development. Collaboration among university and communities such as service learning, service provision, faculty involvement, student volunteerism, community in the classroom, applied research and major institutional change, all could be refered to collaborative pattern that university and surrounded communities are possibly done (Martin et al., 2005) as shown in Table 5.

Towards physical features of town-gown communities. The two-types of users: students (requires housing, parking, student life and academic space), and non-students (requires public presence, faculty or staff retention, retail/college town/disposable income, and employment opportunities) are being considerate for improving their living condition. Moreover, transportation services such as general access, parking solutions, and deliveries should be commonly concerned (Bagnoli, 2012). There are three typos of town-gown relationship in defined by physical characteristic explained in Table 6.

The relationship of interaction between environment and social aspect could be comprised as basic level which embodies two dualities: the relationship between physical form and spatial form, and the relationship between bodily function and socio-cultural function. The elaboration of the physical form of the space can be seen as a plinth, a pedestal, a shaft, and a capital. Towards culturally and socially, space usage are complex depends on background and material existence. It is a key aspects of how societies and cultures are constituted in the real world. Moreover, space is more than a neutral framework for social and cultural forms. It had built into the vary forms. Therefore, human behavior does not simply happen in a single space. It is because the spatial organization through buildings and built environments becomes one of the principle ways which culture is made real. Buildings can carrying social

Typos of university – community collaborations	Description
Service learning	To motivate students in university engaging community learning and service activities in their regular coursework.
Service position	To coordinate faculty members and students do a long-term projects, coordinates, or sustained a specific community.
Faculty involvement	As an individual initiatives where faculty becomes the driving force behind community activities: supports community.
Student volunteerism	As an individual or groups that students engage in community activities separately from service learning initiatives.
Community in classroom' initiatives	Involves the design of university course that enhance community building and community capacity.
Applied research	Involving faculty members, students, and university in data collection, analysis, and reporting the community issues of the day.
Major Institutional change	To promote university-communities engagements in accordance to internal organizational culture change (e.g., mission, promotion and tenure criteria, awards, course offering, etc.)

Table 5. Classification of collaboration and partnership between university and surrounded communities. (Source: Martin et al., 2005)

Type	Benefits	Defining characteristic
Fully integrated	School presence contributes to retail and entertainment, student focused rental housing near campus. Recent initiatives include revitalization, neighborhood improvements, and lower demand for parking.	- Town often established before school, with pre-existing and defining pattern of growth - Mix of uses within block and/or building - School integrates existing pattern of street and structures. - Less auto-dependency
Partially engaged	Neighborhood serving retail, character defining presence for campus and city/neighborhood, shared parking but segregated services between town and gown.	- Founding dates of town and campus very simultaneous - Mix of use within/adjacent to campus - Small scale retail adjacent to campus caters to student, staff and visitor use - Walk-able distance between uses discourages private auto trips during academic day
Physically separated	Town retains separated identify, minimized impact on local parking and infrastructure service (Limits immediate economic benefit). Campus may create its own identity, separate from Town's existing patterns.	- Independent campus life not tied to surrounding community - Separate transportation network - Large requirement for parking (often surface) - Limited daily interaction between town and gown (Reduce economic benefit-retail accommodated on campus) - May encourage segregated uses - May encourage short distance auto trips between uses during academic day.

Table 6. Typology of town-gown in physical and function. (Source: Bagnoli, 2012)

ideas within their spatial forms. It could be implied that the determinism between spaces to society is always likely to be structured in the spatial image of a social process of some kind (Hillier, 1996).

Those changes had increased urban density, which would be increasing of its growth rate in several dimensions (Litman, 2010). When the consideration had taken for the developing countries, the rapid growth of urban area affecting to the number of private car usage, energy consumption and the deterioration of urban environment. Due to rapid development of the country, transportation sector by motorized vehicle plays as a significant role as the major function, and that become crucial to economy and urban development. The growing of the city with the scattering of density and settlement in peripheral zones would influence to travel pattern in longer distance which require more energy consumption (Newman & Kenworthy, 1989).

3. Methodology

This research is mainly based on an interview survey of 300 sets of data in relation to physical aspects, the efficiency of land development and its utilization. Based on literature review, the three main aspects are (1) The prior study towards town-gown community; (2) Urban planning concepts; and (3) The related development policies. According to the questionnaire survey, the sampling method was followed Yamane's population sampling table with the ±7% error in order to cover the area sampling. The samples or respondents from this sampling method were totally 300 among students, workers and visitors. Based on this data collection, the descriptive statistical analysis and factor analysis was adopted into the methodology to differentiate the travel behavior response to campus development. On-site observation was also done during the research project. The step of this study could be depicted as Figure 2.

This study aims to explore the particular dimensions of built environment in relevance to land use and transportation linkage surrounding the campus area (Thammasat University, Rangsit Campus). The attractiveness could be assessed based on the land used analysis. The form of activity centers should be reviewed from both secondary data and primary analysis of its spatial distribution. The physical characteristic could be geographically analyzed by using both Geographic Information System (GIS) and site observation. It was employed to graphically demonstrate the detail of spatial site distinctiveness and allow for more understandable manner about the compatibility of existing land use and its living environment. To assess the spatial configuration of the campus and the activity of users which influence on their mobility patterns, questionnaire survey towards resident behaviors in the proximity area of campus were asked. This study applied factor analysis and cluster analysis for categorizing types of residences who are living in the proximity area of Thammasat University (Rangsit Campus) in accordance to their trip behavior making and their facilities usage.

Figure 2. Steps of study.
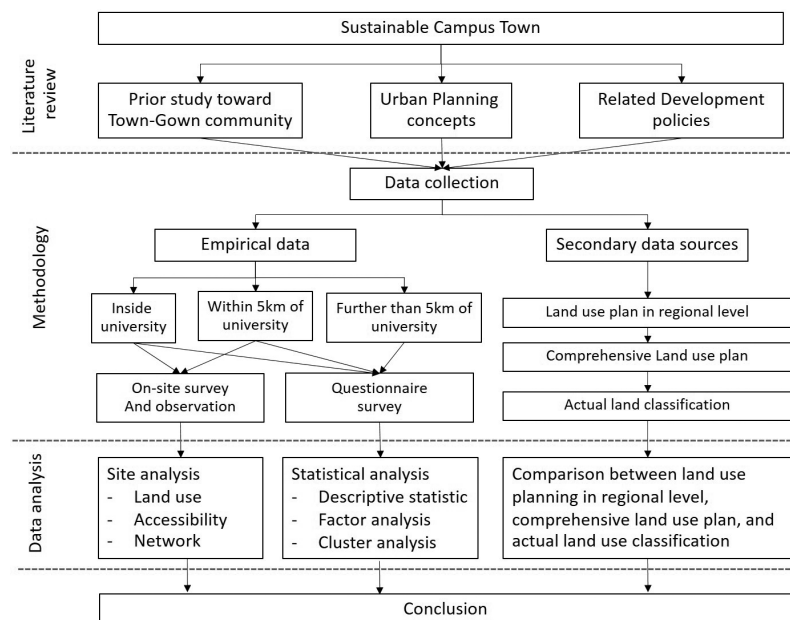
4. Study area

Thammasat University (Rangsit Campus) is located in Amphoe Khlong Luang, Pathumthani province as depicted in Figure 3. It comprises of seventeen faculties and two colleges: Law, Commerce and Accountancy, Political Science, Economics, Social Administration, Liberal Arts, Journalism and Mass Communication, Sociology and Anthropology, Science and Technology, Engineering, Sirindhorn International Institute of Technology, Medicine, Allied Health Sciences, Nursing, Dentistry, Architecture and Planning, Fine and Applied Arts, College of Innovative Education, and College of Interdisciplinary Studies. Therefore, those demonstrates visions of academic excellence and diversity, politically and socially active. According to the survey results, the intermodal connectivity had been founded in both inside university and outside university which is be connected by the various types of road network, and land use functions inside the university (mainly for education, dormitory or recreation space) become completely different from the space outside the university area (apartments, commercial districts, or socialize spaces). Toward the existing condition of Thammasat University, the land use classification inside the university are obviously separated among dormitory, educational area, hospital services area and recreation area. While the road network within the university area is grid system which the major road in the university could be causing severe traffic congestion in peak period (7 am. to 9 am., and 3 pm. to 6 pm.). Towards the connectivity between university and the surrounding area, there are six entrances which connecting between the university area and surrounding area. The result of site survey could be depicted as Figure 4.

Towards the number of students who are enrolled to study in Thammasat University (Rangsit Campus) are slightly increased. Most of the students are studying in Bachelor Degree which could be shown in Table 7.

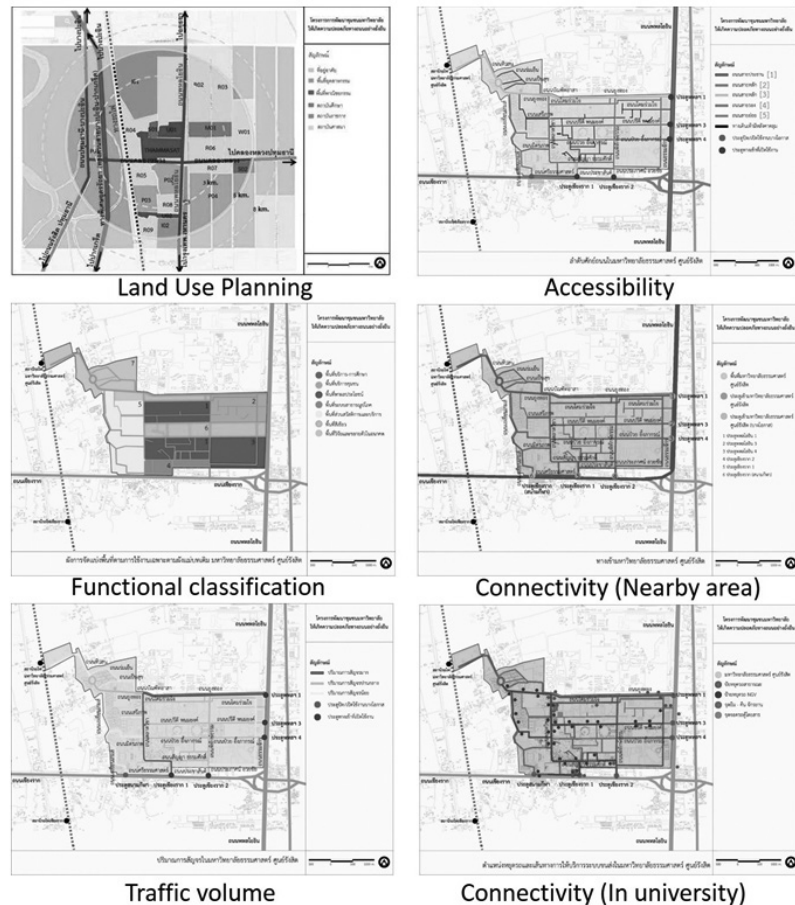**Figure 3.** Location of Thammasat University (Rangsit Campus).

Land Use Planning

Accessibility

Functional classification

Connectivity (Nearby area)

Traffic volume

Connectivity (In university)

Figure 4. Characteristic of the Study Area.

Year	Registered				Total	
	Bachelor		Graduated student			
	Quantity	Percentage	Quantity	Percentage	Quantity	Percentage
2011	22,477	94.83	1,226	5.17	23,703	100.00
2012	21,094	93.53	1,460	6.47	22,554	100.00
2013	22,959	93.83	1,509	6.17	24,468	100.00
2014	20,927	93.81	1,380	6.19	22,307	100.00
2015	22,828	94.53	1,321	5.47	24,149	100.00

Table 7. Quantity of students in the campus.
(Source: Office of the Registrar, Thammasat University, 2016)
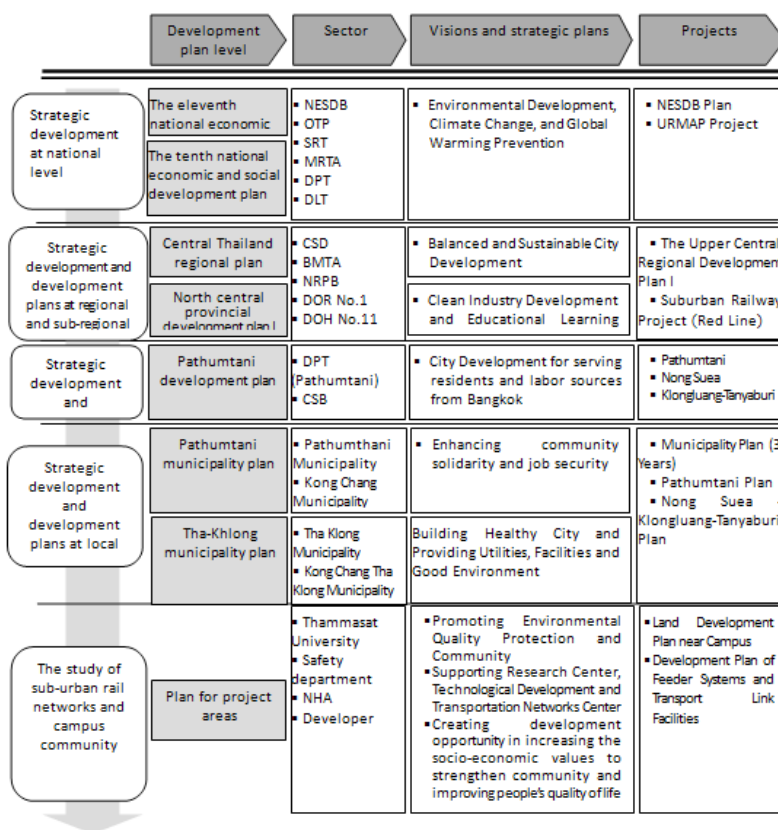
Figure 5. Different level of plans and policies review.

5. Results of analysis

5.1 Different level of plans and policies review

The development plan around the campus area was set in order to create the appropriate and efficiency in hub of education town plan within Pathumtani province. This step is necessary to study development plans at different levels including national level, city level and local level and their linkages as to associate with land development in campus area and nearby site. Additionally, it is also aimed to increase the development potential as well as to be used as guidelines for efficiency development. The focused development plans in each level can be illustrated as Figure 5. Operating conceptual plan and specific plan of the project area which is sub-center area of Bangkok metropolitan located in the Thammasat University (Rangsit Campus) community. It was designed based on education town development plan in order to enhance human resource and to support in development of country link with the strategic plans at different levels. Effects from the national development policies had been foster the university to increase students' competencies for serving and suiting to the demand jobs. Other affecting policies are relates to the university's motto "For the people". Therefore, the university's vision is to enlarge both direct and indirect supports to society, which particularly achieving towards developing strategies which initiated by local municipalities or the central government.

5.2 Urbanization of Bangkok and its Vicinities

Effects from urbanization of Bangkok and its vicinities has been affects to densities of people who are living the city and the future usage of suburban area. Large amount of people had decided to live and performed their services jobs around the university area as their new employment places or living in suburban area, which consequently causing severe of traffic congestion in suburban area. Considering

towards spatial pattern in the campus town, it is questioned about the urban structure formulation. This is due to the population and employment area settle away from the campus center which plays as a node of concentration. The scattering of housing, commercial and residential location are formed along the road alignment to facilitate their accessibility. This is consistent with the detonation of urban sprawl by Ewing (1997). The phenomenon of sprawl was demonstrated of its scattered development as a strip development along the road network. This is useful information to confirm that high potential of effective transit mode to provide the accessibility induced by population and employment demand in this area. However, due to the limited availability of transit network system to alleviate the circulation of people and balance their housing to work journey, along with the pattern of development along highway make corridor areas in the congestion of motorized vehicle. This combination of land use and transport network leads to the loss of quality of life, and unsolved sprawling urbanization still remains.

5.3 Behavior of the space usage

A total of 300 valid questionnaires survey were analyzed to investigate the interaction of land use and transport in the campus area. This relationship could be determined by assess the travel behavior of people to reflect their mobility pattern. Towards the consideration of physical structure of study area among different locations, the detail of area for data collection is illustrated in Figure 7. There are three types of area; (1) area within university; (2) area within 5 km. radius of the university; and (3) area that farer than 5 km. radius of the university. The analysis was analyzed by using factor analysis. The result is shown that samples are using space for their activities differently according to the urban pattern or land use planning. Sample who are living in university area are mainly use the area for studying, health care services, do some business and goes to shop or store to by daily goods.
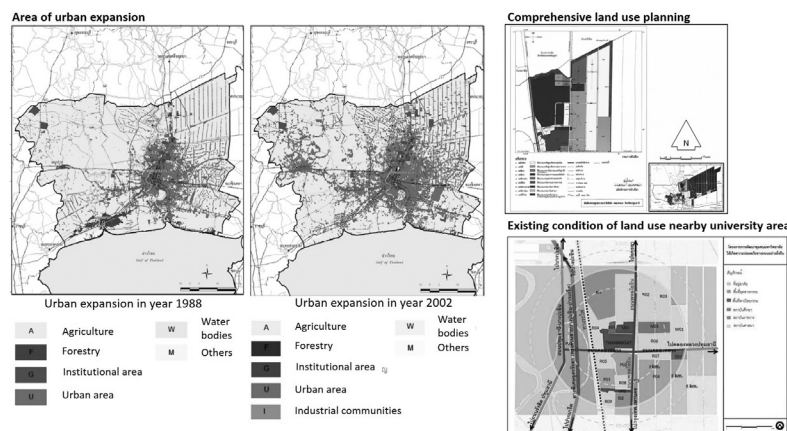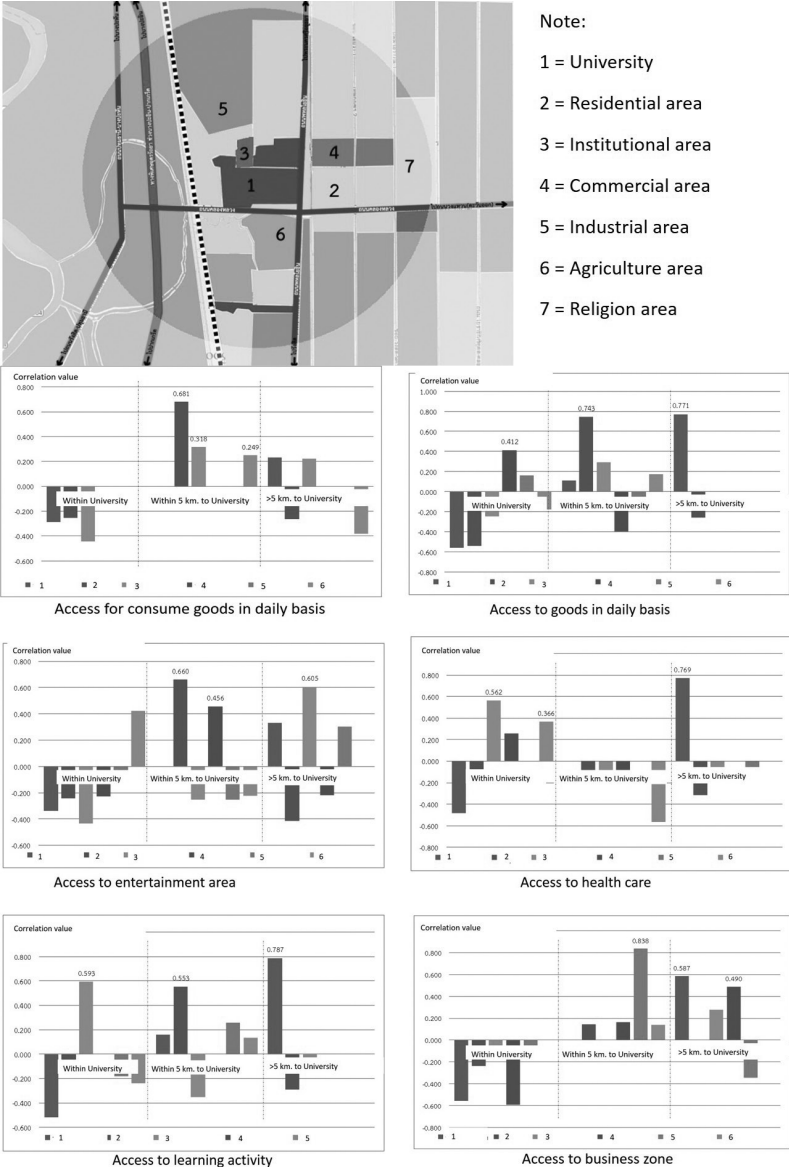

Area of urban expansion

Urban expansion in year 1988

A	Agriculture	W	Water bodies
F	Forestry	M	Others
G	Institutional area		
U	Urban area		

Urban expansion in year 2002

A	Agriculture	W	Water bodies
F	Forestry	M	Others
G	Institutional area		
U	Urban area		
I	Industrial communities		

Comprehensive land use planning

Existing condition of land use nearby university area

Figure 6. Effects from urban expansion though current land classification.

Samples used the area for buying and selling, relax or do entertainment activities and business jobs in the area nearby the university. While the area which farer than 5 km. of the university are used for entertainment, commercial and some health care activities. The result demonstrated that the existing function within university did not meet the students' demands and preferences, they are intended to use or access some facilities in the surrounding area of university. Most of the function that the sample had done are located in the area within 5 km. from university, which is representing that most of people are using some services outside the university. Activities such as medical services and basic consumptions become the primary function of the users to access and use within the university, while the area nearby the university are being used for commercial services and basic daily consumption. This finding could be used to support the weak functional integration of land use and transit. It was obviously seen that to sustain the linkage of poor campus town structure, the more interconnecting of streets and road infrastructure with efficient public transport should be provided to facilitate the daily commuters (students, workers and visitors) with the acceptable travel time and distance. The result of the factor analysis towards behavior of space usage of the university students and staffs could be depicted in Table 8 and Figure 7.

Activity	Zone																	
	Within University						Within 5 km. to University						>5 km. to University					
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
All activity>5 km. to University								X			X		X	X	X	X	X	X
Majority of activity are within 5 km. to University							X	X	X	X	X	X						
Health care and education within the university				X	X	X		X			X		X		X			X
Consumption good and health care within the university		X		X					X		X							X
Business within 5 km. to university		X									X	X	X		X			
Health care and entertainment within the university			X	X			X	X			X	X						

Note: 1= daily goods, 2=consumption goods, 3= entertainment, 4= health care, 5= education, 6= business.

Table 8. Summary of activity and zone in campus.

Note:

1 = University

2 = Residential area

3 = Institutional area

4 = Commercial area

5 = Industrial area

6 = Agriculture area

7 = Religion area

Figure 7. Result from factor analysis towards activities and land use.

6. Conclusions and recommendations

The main challenges of inappropriate campus planning and development has resulted to the negative effects of automobiles usage which recently has deteriorated quality of life of people. Especially, when it is happened in the area of large number of migration of the population caused changes. This group of land use and activities center induces the necessity of owning an automobile. Moreover, with the limited service of transit availability, the majority of commuters need to rely on the private vehicle with longer travel time and distance rather than transit usage. The results of analysis indicated the poor accessibility level and the connectivity of different activity in the proximity of campus area resulted to the high proportion of travel expenditure, urban expansion to the area nearby university, and demand for long-distance travel because function on the surrounded area of university did not meet demands of people who are living in those area. Additionally, some of them need to travel to outer areas not only weekend but also their daily work. This amount of the expenditure of transportation is also a burden for the medium to low income people in their daily time.

The availability of destinations together with an interconnected street network makes sufficiency mode of transport either public transport or non-motorization become more competitive and attractive mode of travel to other options in campus area. Accessibility is important to be taken

into consideration as if the nodes of activity within or near campus are located far from trip generation point, the number of commuters would be expected to decline in accordance with the longer distance. Finally, the result of this study demonstrates a number of factors other than land use environment which cause a profound impact on daily and occasion commuting behavior. Thus, considering the enhancing of connecting campus development area by improving housing units, commercial and employment area, and infrastructure might be considering as an initiative for achieving mobility policy challenge. Furthermore, more compact and mixed of an urban environment are more preferable to shorter the distances between destinations. Nodes of activities or destinations for work and leisure trip in campus, should not be located far from the community, otherwise the transport modes would be shifted from public transit to private vehicles and consequently causing traffic congestion. Thus, the provision of sustainable development should be raised to encourage the suitable development of campus development plan because at the beginning step of the plan, the amount of students and staffs are not much, meaning that some prior facilities still sufficient. However, there are numerous students and staff are living and accessing this area which facing with negative impact such as pollutions, nuisance, traffic congestion and demand for parking space had been arose. Thus, the improvement of campus plan in the future shall be needed.

When the consideration has been focused on the new and modern education town service, the infrastructure with supportive facilities should provide a powerful stimulus on human development. Enhancing human resource would result to the construction of new neighborhoods or new suburban centers in region. These new neighborhoods will enhance the identity of the region, capture value for human capital to stimulate social capital in the area as long as the proper planning are implementing onward. To achieve the full benefit from new campus town development which constructed in suburban areas, the campus must be planned as part of several factors such as a pattern of land use and vision of development that makes feasibility of the quality of education development. Some strategies such as provision of public transit, provision of specific commercial activities, road safety, or improving connectivity between university area and surrounding area are necessaries to stimulating attractive choices of use by maximizing of human resource with campus town development scheme at the areas.

7. Acknowledgements

References

Bagnoli. D. C. (2012). *Integration, revitalization and transportation: Smart growth opportunities for a small city campus: Benefits of a balanced town-gown relationship.* Retrieved from http://www.oregon.gov/lcd/tgm/docs/bagnolippt102312.pdf

Beirão, G. & Cabral, J. S. (2007) Understanding attitudes towards public transport and private car: A qualitative study. *Transport Policy, 14,* 478-489.

Checkoway, B. (1997). Reinventing the research university for public service. *Journal of Planning Literature, 11*(3), 307–319.

Dielemanf, M., Dijst, M. & Burghouwt, G. (2002). Urban form and travel behaviour: micro-level household attributes and residential context. *Urban Studies, 39* (3), 507-527.

Engwicht, D. (1993). Reclaiming our cities and towns. In O. Ojeda & M. Yudell (Eds.). *Campus and community*. Philadelphia: New Society Publishers.

Ewing, R. (1997). Is Los Angeles-style sprawl desirable?. *Journal of the American Planning Association, 63*(1), 107-126.

Ewing, R. & Cervero, R. (2001). Travel and the built environment. *Transportation Research Record, 1780*, 87-114.

Gavazzi, S. M. & Fox, M. (2014). A tale of three cities: Piloting a measure of effort and comfort levels within Town-gown relationships. *Innovative Higher Education, 40*(3), 189-199.

Hillier, B. (1996). *Space is the machine*. Cambridge: Cambridge University Press.

Humphreys, J. M. (2009). The town-and-gown economy. *Georgia Business and Economic Conditions. 69*(1), 1-14.

Iamtrakul, P. & Hokao, K. (2011). Urbanization patterns in Asian mega city, Bangkok, Thailand and their impacts on road safety. *Proceedings of the 9th Eastern Asia Society for Transportation Studies Conference*. Jeju, Republic of Korea, 368.

Krizek, K. J. (2003). Residential relocation and changes in urban travel. Does Neighborhood-scale urban form matter?. *Journal of the American Planning Association, 69*(3), 265-281.

Litman, T. (2010). *Land use impacts on transport: How land use factors affect travel behavior*. Victoria Transport Policy Institute with Rowan steele. Retrieved from http://www.vtpi.org.

Martin, L. L., Smith, H. & Phillips, W. (2005). Bridging "town & gown" through innovative university-community partnerships. *The Innovation Journal: The Public Sector Innovation Journal, 10*(2), 1.

Meyer, M. D. & Miller, E. J. (2001). *Urban transportation planning: a decision oriented approach.* Boston: McGraw-Hill.

Newman, P. W. G. & Kenworthoy, J. R. (1989). Gasoline consumption and cities: a comparison of U.S. cities with a global survey. *Journal of the American Planning Association, 55*(1), 24-37.

Newman, P. W. G., Kenworthoy, J. R. & Vintila, P. (1995). Can we overcome automobile dependence?. *Cities, 12* (1), 53-65.

Næss, (2006). Accessibility, activity participation and location of activities: Exploring the links between residential location and travel behavior. *Urban Studies, 43*(3), 627-652.

Office of the Registrar, Thammasat University. (2016). *Student statistic yearn 2011 – 2015*. Retrieved from http://web.reg.tu.ac.th/registrar/home.asp?pageid=5

O'Mara, M. P. (2012). Beyond town and gown: University economic engagement and the legacy of the urban crisis. *The Journal of Technology Transfer, 37*(2), 234-250.

Thapa, R. B. & Murayama, Y. (2010). Drivers of urban growth in the Kathmandu valley, Nepal: Examining the efficacy of the analytic hierarchy process. *Applied Geography, 30*, 70-83.

White, S. W. (1991). *Town and gown, analysis of relationships: Black Hills State University and Spearfish*. South Dakota: Iowa State University.