A REVIEW OF LITERATURE ON URBAN SPRAWL USING BIBLIOMETRIC TECHNIQUE

[1]Nur Aulia Rosni, [2]Norzailawati Mohd Noor *and* [3]Zakiah Ponrahono

[1]Faculty of Built Environment, University of Malaya
[2]Kulliyyah of Architecture and Environmental Design, International Islamic University Malaysia.
[3]Faculty of Environmental Studies, Universiti Putra Malaysia

ABSTRACT

Urban sprawl is the broad research topic in urban studies. Thus far, the debate on the causes and consequences of urban sprawl has not led to a widely accepted interpretative framework. This paper attempts to review publications on urban sprawl factors and causes extracted from two largest scientific databases namely Scopus and ScienceDirect. The time of publication was set from 1996 to 2015 with 20 years' gap. The citation-based approach analysis was used to provide better vision regarding this topic where the journal articles are selected by using identified keywords from wide-ranging fields that cover built environment, geography, planning, architecture, engineering, economics, transportation, health, social and spatial technologies. Subsequently, the factor and causes of urban sprawl were extracted from each publication and reviewed. The findings is presented in different categories including (i) socio-demographic, (ii) economic, (iii) political, (iv) physical, (v) environment, and (vi) transportation, pertinent to the formation of urban sprawl. The findings from this paper contribute in defining urban sprawl based on its factor and causes which cover broader context of built environment. The future improvement includes developing land use geospatial indices based on the outcome of this paper.

Keywords: Urban Sprawl, Urban Development, Urban Growth, Urban Planning, Land Use, Urbanisation, and Bibliometric Analysis.

INTRODUCTION

Cities have evolved since the beginning of human civilization, and specific boundaries have defined each city. However, cities in many parts of the world are facing issues of excessive growth which leads to one of its notorious problem, namely urban sprawl. Generally, urban sprawl is known by many as unplanned, and uncontrolled growth of the inner city towards its periphery causing pressure on the development near the boundary and also mainly contribute to negative impacts (Chorianopoulos, Pagonis, Koukoulas, & Drymoniti, 2010; Ewing, Pendall, & Chen, 2002; Noor & Rosni, 2013; Sorensen, 2000; Sudhira & Ramachandra, 2007; Verbeek, Boussauw, & Pisman, 2014). Urban sprawl is also highly related to urban development. According to Bhatta et al., (2010), urban growth is one of the processes of urban development

besides urbanisation, where the characteristics of its occurrence are so general causing its implications to be so wide. Urban growth involves spatial and demographic process within a specific economy and society while urbanisation is a spatial and social process that occurred in communal dimensions of a city. Correspondingly, urban development can be regarded a complex physical and spatial changes that influence another aspect such as social, economy, demography, politics, and the environment. As highlighted by Barnes et al., (2001), regardless of how urban development, urban growth, and urbanisation being defined and evaluated, sprawl is a response to often bewildering sets of economic, social, political, and physical forces. These forces include municipal fragmentation, the patterns of infrastructure investments, subsidization of infrastructure from cities. Many professionals associated with urban sprawl found that it is necessary to examine its different aspects in the various contexts in order to control or prevent its adverse effects (Arribas-Bel, Nijkamp, & Scholten, 2011; Ewing, 2008; Habibi & Asadi, 2011; Hasse, 2004; Terzi & Kaya, 2008; Torrents & Alberti, 2000).

OBJECTIVES
This paper attempt to examine the theoretical literature related to factors and causes of urban sprawl. The theoretical literature was analysed through the comparative and deductive method by using bibliometric analysis techniques and content analysis techniques. Even though urban sprawl is one of the highly-discussed topics in the built environment fields, the debate on its factor and causes has not led to a widely accepted interpretative framework. Multi-perspective urban sprawl researchers recorded the complex interaction and process of urban development driving force like social, economic, political and cultural as the primary cause of sprawl. These driving forces include the population, traffic conditions, industrialization, rapid urbanization, agricultural, migration, economic development, income growth, and government policy as the primary influences (Fang, Gertner, Sun, & Anderson, 2005; Osman, Nawawi, & Abdullah, 2008; Xiao et al., 2006). Moreover, urban sprawl does not have a specific definition to determine what it is. Therefore, in this paper, urban sprawl is defined as "ineffective and dysfunctional urban growth that significantly interrupt the utilization of land use in the landscape context which affected the sustainability of built environment such as the degradation of environment, economic and social well-being of a community." Based on this definition, the factor and causes of urban

sprawl will be represented into categories pertinent to the elements of built environment.

RESEARCH METHODOLOGY

Recent studies proved that the Bibliometric Analysis Techniques provides sophisticated and multidimensional citations-based techniques to obtain sensitive measures of research quality and to trace the development of fields of science and networks (Borgman & Furner, 2002; Bornmann, 2014; Campbell et al., 2010; Mann, Mimno, & McCallum, 2006). While the content analysis techniques allow for valid inferences by interpreting and coding textual materials into quantitative data. These analysis techniques contribute to the improvement of literature review for scientific research through the combination of analytical qualitative and quantitative methods. In this paper, bibliometric analysis technique is used to attain most reliable data to be analysed using content analysis techniques to extract the factors and causes of urban sprawl. A detailed study of literature was carried out based on the publications in the established journals. Two scientific databases that are used include Scopus and Science Direct. The time of the publications was set as the principle search parameters from the year 1996 to 2015 (20 years) for all scientific databases. "Urban Sprawl" has been used as the main indicators to extract published journal articles from 1996 till 2015. In total, there are 9170 publications on urban sprawl topic found in all databases which Scopus has 3207 publications, and ScienceDirect has 5963 publications. After the results of publications had been narrowed down to focus only on urban sprawl factors and causes, the final number of journal articles were 4329 publications (Table 1).

Table.1: Publications on Urban Sprawl Topic for 20 Years from 1996 to 2015

Search Indicators		Urban Sprawl		Urban Sprawl Factor and Causes	
		Scopus	**Elsevier ScienceDirect**	**Scopus**	**Elsevier ScienceDirect**
	Year				
1.	**2015**	314	821	22	591
2.	**2014**	331	663	24	471
3.	**2013**	310	661	19	478
4.	**2012**	296	562	27	401
5.	**2011**	265	404	25	284
6.	**2010**	238	316	13	210
7.	**2009**	202	373	11	245

No.	Year				
8.	**2008**	217	339	16	221
9.	**2007**	170	261	7	189
10.	**2006**	143	259	16	182
11.	**2005**	147	186	13	125
12.	**2004**	118	212	9	138
13.	**2003**	108	158	6	107
14.	**2002**	81	135	2	88
15.	**2001**	86	173	9	104
16.	**2000**	57	107	0	60
17.	**1999**	37	63	2	48
18.	**1998**	37	72	1	32
19.	**1997**	25	106	1	68
20.	**1996**	25	92	2	61
TOTAL		**3207**	**5963**	**225**	**4103**
		9170		**4329**	

The total of 4329 publications related to factor and causes of urban sprawl found in 20 years' time consists of 225 publications recorded in Scopus and 4103 publication recorded in the ScienceDirect. All of the publish journal articles were reduced to 50 most cited paper for each database making the final selected journal articles to be 100 publications. The collected journal articles publications were then reviewed by using content analysis techniques with Mendeley Desktop Software applications.

RESULTS AND FINDINGS

The results and conclusions were presented in two main sections. The first section represents the results of Bibliometric Analysis Techniques focusing on the publications on factor and causes of urban sprawl topic from selected scientific databases. The results are explained according to several significant indicators such as subject areas, publication sources, and country. These indicators assist the author in looking further on the trend and pattern of urban sprawl studies from different aspects. The research gap was identified based on the result. Meanwhile, the second section represents the findings of literature review through content analysis technique on the subject matter. The extracted findings are categorised into six different categories namely socio-demographic, economic, political, physical, environment and transportation.

Bibliometric Analysis Techniques

The results and findings from bibliometric analysis techniques show that, over the years, the research trends on this topic have increased consistently from 1996 to 2015. By using the statistical tools in Scopus,

the extracted publications were tabulated into top 15 of subject areas, sources, and countries. As shown in Figure 1 above, studies of the factor and causes of urban sprawl mainly focused in the fields that closely related to Built Environment such as Social Science (25.2%) followed by Environmental Science (21.4%), Decision Science (9.9%), Earth and Planetary Science (8.8%) as well as Agriculture and Biological Science (8.3%). Conversely, other fields which have less correlation with Built Environment have low percentages of publication on this topic. Those fields of studies include Materials Science (0.5%), Physics and Astronomy (0.9%), Energy and Mathematics (1.2%) as well as Arts and Humanity (1.7%). Other fields such as Business, Accounting, Engineering, Medicine and Computer Science have an average percentage of publications on urban sprawl factor and causes topic (3.5% - 5.8%). By looking at the pattern of the publications, it can be understood that urban sprawl involves spatial factors of a land use that affect the elements of Built Environment, thus the subject areas that are very much involved in the spatial management and arrangement have more publications as compared to other sectors which have less interaction with spatial factors. This statement is supported by the findings shown in Figure 2 below, where the top publication's sources are related to the subject areas with a high percentage in Fig.1.
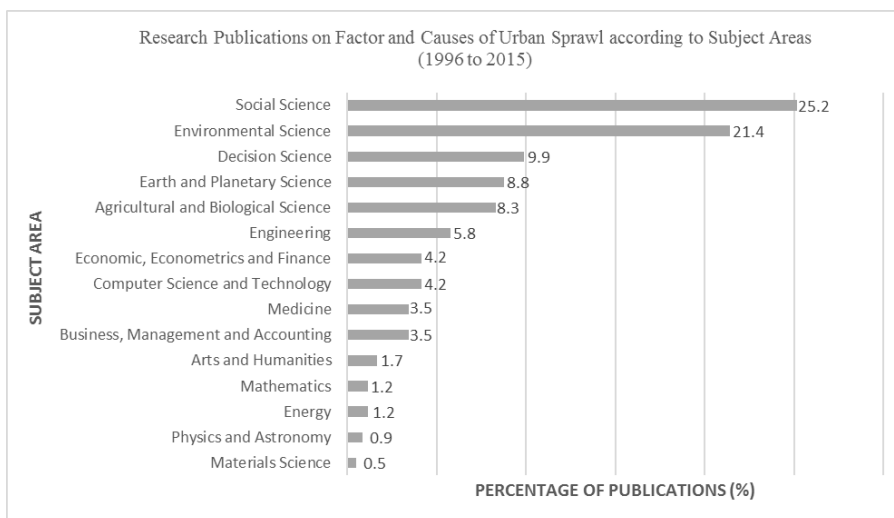

Fig.1: Research publications on factors and causes of urban sprawl according to subject areas (1996-2015)

Publication sources like Landscape and Urban Planning have the highest percentage which is 18.6%, followed by Land Use Policy (14%), and Ecological Indicators (11.6%). Environment and Planning, as well as Journal of Urban Health, have 8% of publications each. The trends from the publication sources indicate that the factor and causes of urban sprawl are closely related to urban planning and land use management. However, low publication on this topic under potential journal such as Cities, European Journal of Transport and Infrastructure Research, International Geoscience and Remote Sensing Symposium as well as Journal of Asian and African Studies illustrated that using the technological application in measuring urban sprawl is still lacking especially in the developing countries like Asia and Africa (Fig.2).
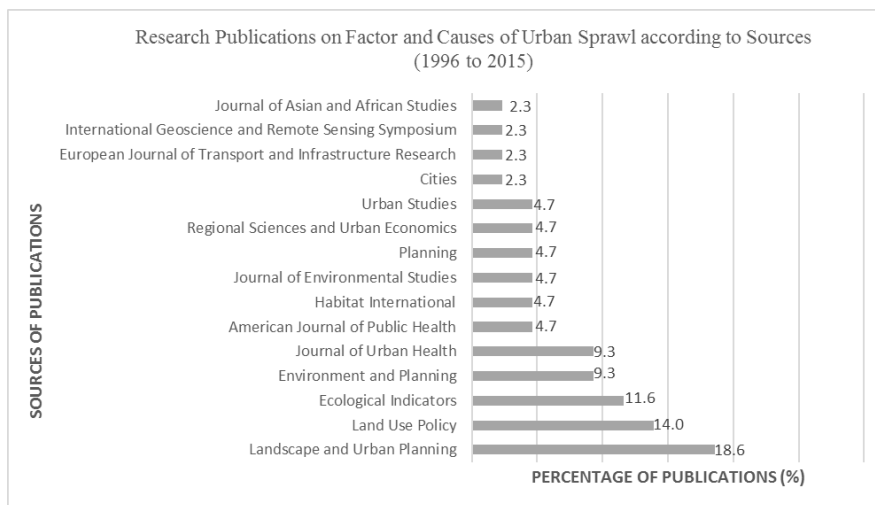

Fig. 2: Research publications on factors and causes of urban sprawl according to sources (1996 to 2015)

This statement is supported by the findings in Fig.3, showing the United States of America has produced the highest research publication on urban sprawl factor and causes (41.8%), followed by China (9.8%) as the second highest country after U.S.A. However, the extreme gap of publication percentage between U.S.A and China indicate that urban sprawl issues have only become the concerns of the American society until recently. Based on these results, the author saw the needs to properly determine what sprawl is through examining the factor and causes in a broader context, not only in urban and land use planning but

the different geographical context as well. Also, the factors and causes of sprawl cannot only be based on the American experience but other countries as well since each country has their unique background. Most of the countries in Asia has the low percentage of publication compared to European countries proving the Asian countries especially countries in the South East Asia need to have more awareness on the sprawl effect on their built environment.
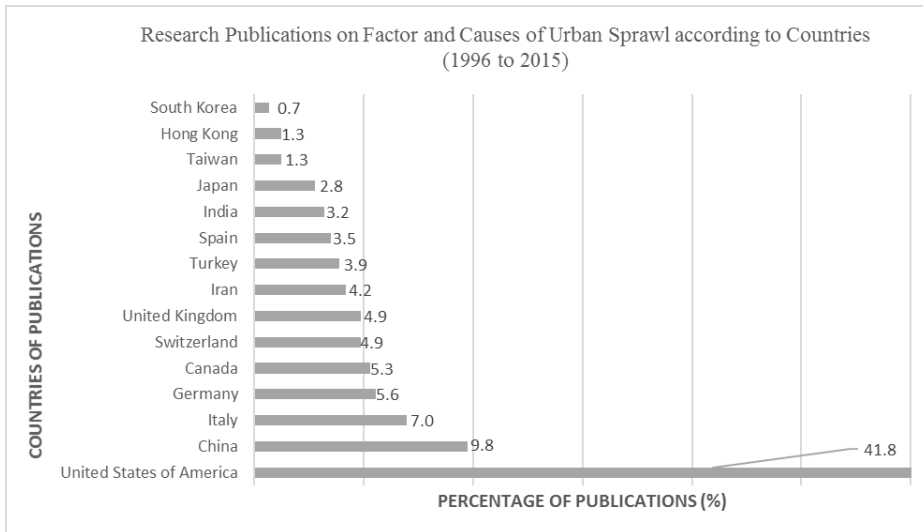

Fig. 3: Research publications on factor and causes of urban sprawl according to countries (1996 to 2015)

Content Analysis Techniques

Urban sprawl has some characteristic that differs from urban growth and urbanisation. Also, a researcher from different fields has various viewpoints on its factor and causes. By referring to the statement in the previous section, the factors and causes of urban sprawl need to be examined not only based on different viewpoints but also in different countries experience as well. In this section, all of the collected journals were analysed to see the most probable factor that instigating urban sprawl. The result from databases provides reliable information on studies of urban sprawl factor and causes. After reviewing each journal articles, the factor and causes of urban sprawl are represented into six categories by considering the definition of urban sprawl provided for this paper. The categories of factors and causes of urban sprawl include

socio-demography, economic, political, physical, environment, and transportation (Table 2).

Table 2: Collection of Studies on Urban Sprawl Factor and Causes

No	Factor	Causes	Authors
1.	Socio-Demographic	• Housing demand (affordable), low crime and quiet neighbourhood. • Connected-urbanisation process of rural population • Lifestyle and behaviour • Cultural value emphasizing on automobile use • Health • Age and household structure • Population growth • Population redistribution in urban fringe • Migration from rural to urban area • Income growth	• (Couch & Karecha, 2006) • (De Ridder et al., 2008) • ((EEA), 2006) • (Fang et al., 2005) • (Jaeger & Schwick, 2014) • (Lopez, 2004) • (Wu, 2006) • (Anas & Rhee, 2006) • (Amato, Pontrandolfi, & Murgante, 2015) • (Brueckner & Helsley, 2011) • (Chorianopoulos et al., 2010) • (Habibi & Asadi, 2011) • (Ibrahim & Sarvestani, 2009) • (Jain, 2008) • (Abdullah, 2012) • (Boori et al., 2016)
2.	Economic	• Socio-economic changes in developed society • Unpriced/ under-pricing traffic congestion • Subsidies and taxation • Economic growth • Disparity of urban and rural area	• (Couch & Karecha, 2006) • (Anas & Rhee, 2006) • (Bart, 2010) • (Anas & Pines, 2008) • (Abdullah, 2012) • (Brueckner & Largey, 2008) • (Eid, Overman, Puga, & Turner, 2007) • (Fang et al., 2005) • (Habibi & Asadi, 2011) • (Ibrahim & Sarvestani, 2009) • (Jain, 2008) • (Ji, Ma, Twibell, & Underhill, 2006)

3.	Political	• Government Spatial Planning Policies • Government Policies • Competition among cities	• (Couch & Karecha, 2006) • (Bart, 2010) • (Abdullah, 2012) • (Fang et al., 2005) • (Feng, Du, Zhu, Luo, & Adaku, 2015) • (Lopez, 2004) • (Poelmans & Van Rompaey, 2009)
4.	Physical	• Urban planning not well managed • Conversion of open space to build-up spaces • Urbanisation • Failure to account spaces for facilities, amenities and open space value in urban centre • Pattern of urban development • Sub-urbanisation	• (Altieri, Cocchi, Pezzi, Scott, & Ventrucci, 2014) • (Anas & Rhee, 2006) • (Brueckner & Largey, 2008) • (Chorianopoulos et al., 2010) • (Durieux, Lagabrielle, & Nelson, 2008) • (Eid et al., 2007) • (Fang et al., 2005) • (Feng et al., 2015) • (Ibrahim & Sarvestani, 2009) • (Jain, 2008)
5.	Environment	• The role of physical geography • Quality of inner city environment, landscape and townscape • Zoning and forest planting requirement	• (Coisnon, Oueslati, & Salani, 2014) • (Couch & Karecha, 2006) • (Lichtenberg, 2011)
6.	Transportation	• Adoption of automobile • Availability of roads and highways • Increased automobile ownership • Infrastructure investment-highways and roads • Increase transport demand	• (Anas & Rhee, 2006) • (Anas & Pines, 2008) • (Brueckner & Helsley, 2011) • (De Ridder et al., 2008) • ((EEA), 2006) • (Ji et al., 2006)

Socio-Demographic

Couch & Karecha, (2006) suggesting the causes of urban sprawl can be grouped into two categories: (i) the general drift of socio-economic change in developed societies and (ii) government spatial planning policies. In this section, the focus is on the social and demographic factor of urban sprawl. Their research proves the demand for housing and its external characteristic from socio-economic perspectives is what actually influencing the growth of urban sprawl. People living in the city will have a tendency to leave the centre and settle in the surrounding greener areas due to lower cost of living (De Ridder et al., 2008). This situation is the main reason for urban sprawl phenomena in the United States. It was fuelled by the rapid growth of private car ownership and the preference for detached houses with gardens (EEA, 2006). Jaeger & Schwick, (2014) and Lopez, (2004) added that sprawl is a result not just of population growth but also of new lifestyles that require more space. Socio-demographic context involved several component like population growth, economic development, proximity to resources and basic amenities (Almeida, 2005; Boori, Netzband, Voženílek, & Choudhary, 2016; Jain, 2008). Improvement in socio-demographic factor like growing population and income lead to high demand for housing and other facilities. This situation cause land and housing prices to increase greatly, causing the shifting of lower and middle income city population towards the suburban areas due to a reduced cost of residential properties (Abdullah, 2012; Amato et al., 2015; Brueckner & Helsley, 2011; Brueckner & Largey, 2008; Rahman, 2016). Anas & Rhee, (2006) and Chorianopoulos et al., (2010) mentioned urban sprawl is dominantly associated with urbanisation and increasing population growth rate towards the urban fringe causing an upturn in congestion level, scarcity of open space and initiate more instalment of the road network and usage of automobiles. Habibi & Asadi, (2011) also summarised the most important factors that encourage sprawl is socio-demographic like population and income growth, followed by other factors such as better accessibility, low price of land and transportation, better infrastructure and public services. According to Ibrahim & Sarvestani, (2009), a socio-demographic factor not only became the cause of urban sprawl but the continuation of great environmental and social problems as well.

Economic

Urban sprawl is a most association with poorly planned urban land use and economic activity. It is extensively evaluated and characterized based on the main socioeconomic indicators particularly commuting costs, employment shifts, city revenue change, and some commercial establishments (Ji et al., 2006). A large number of researcher also agreed that economic factors are one of the most significance cause of urban sprawl (Habibi & Asadi, 2011; Ibrahim & Sarvestani, 2009; Jain, 2008). Zhao, (2011) claims that planning control might not be successfully achieved when political, economic motivations are involved. Globalization and economic competitiveness among nations and cities have caused governments in Southeast Asia, including Malaysia, to focus on the economic development in the existing metropolitan areas to make cities economically more competitive. This situation, however, has caused many cities in the South East Asia to have high disparities between urban and rural as well as causing urban sprawl (Abdullah, 2012). The urban-rural disparities demonstrate that low-income residents have limited transportation mobility and inaccessibility to job opportunities which affecting their social mobility (Brueckner & Largey, 2008; Ewing, Hamidi, Grace, & Dennis, 2016).

Political

According to Couch & Karecha, (2006), political factors is one of the most important aspects of the process of urban development. The absence of strong planning intervention at the regional and local level further leads to urban sprawl. Bart, (2010) added that sprawl is not an inevitable consequence of economic growth, but rather a result of specific government policies. Government spatial planning policy is one of the main factors leading to urban sprawl (Lopez, 2004; Poelmans & Van Rompaey, 2009). Evidence suggests that where unplanned, decentralised development dominates, sprawl will occur in a mechanistic way. Conversely, where growth around the periphery of the city is coordinated by strong urban policy, more compact forms of urban development can be secured (EEA, 2006). However, in many Asian cities, socio-demographic, economic and physical factors are mostly regarded as the causes of urban sprawl neglecting the political factors (Feng, 2008). Feng et al., (2015) in their study has conclude that the implementation of land use planning policy in China played a major role in ensuring the lowest effective rate of change of sprawl. Also, Couch & Karecha, (2006) compares cities in Brazil, Switzerland, and Britain to see how the

political factors influencing the rate of urban development and urban sprawl. They found out that the rate of urban development for a given period is similar to Switzerland and Brazil. However, without proper government planning policy implementation, Brazil shows higher increase rate of urban sprawl and air pollution. For the similar period, Britain has the highest rate of urban development but has small sprawl growth due to the proper implementation of government policies. Based on a comparative case study, many city governments have elaborate regulatory systems composed of zoning ordinances, subdivision regulations, and building codes in controlling urban sprawl (Ewing, 2008; Tian & Ma, 2009).

Physical
Urban sprawl can be perceived physically, usually occurs when urban planning is not well managed, turns open spaces into built spaces, and degrading the environment. The development and expansion of urban patterns is the main driver of landscape sprawling (Altieri et al., 2014; Ewing et al., 2002; Ibrahim & Sarvestani, 2009). In developing countries, where urbanisation rates are high, urban sprawl is a significant contributor to the land use change (Sudhira & Ramachandra, 2007). Urbanisation process caused local traffic congestion levels to increase and urban open spaces to become scarcer. These trends, in turn, have fuelled increasingly popular sentiments against urban expansion, commonly referred to as urban sprawl, and the advocacy of more compact cities (Anas & Rhee, 2006; Chorianopoulos et al., 2010). Another researcher also concluded that urban sprawl is the by-product of urbanisation which is highly linked to the physical pattern of land use (Durieux et al., 2008; Ngoran & Xue, 2015). Also, Eid et al., (2007) suggesting that the good physical arrangement of land use not only can be used to prevent urban sprawl but can be used as planning control. They conclude their theories in term of compact development. Compact neighbourhoods may induce people to use their cars less often than those where buildings are scattered. Similarly, neighbourhoods where houses are mixed with a variety of local grocery stores and other shops may encourage people to walk more and eat healthier food than those where all land is devoted to housing.

Environment

The role of physical geography such as zoning and forest planting requirement are among the identified fundamental forces leads to urban sprawl (Coisnon et al., 2014). These types of activities increase the amount of land needed to accommodate a population of any given size in another area, which, contribute to sprawl and hence to the loss of open space at the urban fringe (Lichtenberg, 2011).

Transportation

The last recognised factor and causes of urban sprawl is transportation. Anas & Rhee, (2006) clearly stated that the adoption of automobiles and the availability of roads and highways are among the major drivers of urban sprawl. According to them, the automobile-related distortion causing too much highway-building promotes by transport planner and engineers triggering urban expansion into suburban areas where land was initially cheap (Anas & Rhee, 2006). Although there are many other causes for urban expansion such as an increase in incomes, economists and planners agree that the automobile is a major contributor but perceptions differ widely (Anas & Pines, 2008). Many researcher seems to agree with Anas & Pines, (2008) and Anas & Rhee, (2006) opinion on urban sprawl caused by transportation factors. Brueckner & Helsley, (2011) and Ji et al., (2006) viewing highway investment and growing automobile ownership as contributing to sprawl by reducing the cost of access to employment centres from suburban locations. In addition, the tendency for people to leave cities and settle in the urban fringe areas led to a significant loss of natural landscapes and induced an enhanced in transport demand (De Ridder et al., 2008; Theobald, 2003).

ANALYSIS & DISCUSSIONS

The analysis shows that the factors and causes of sprawl either contribute to sprawl independently, associated with each other or the combination of different factors and causes leads to the formation of another. In the category of social factors, housing cost and demand from the people cause the development of affordable housing towards the boundary of a city as housing cost in the inner city are higher. Moreover, due to cultural influences, some people tend to choose safer, quiet and larger space of housing which requires them to be automobile independent to commute from their house to their workplace. The economic growth also become as one of the major drivers of urban sprawl, lack of effective government

policies to control land use development and competitiveness among cities has cause centralisation of economic activities in the city centre causing urban and rural disparity. The disparity attracts people to commute in longer distance from the workplace due to the lower living cost at the rural area. This situation is worse for more infrastructure investment that not supporting public transportation, more roads and highways are constructed encouraging more people to drive and affecting the environment through pollution.

Also, it can be seen that people strive for having a better quality of life and safe environment. However, this case always leads to the occurrence of urban sprawl. A stronger integration between each category of urban sprawl factors and causes is required to lessen its adverse consequences to provide a better quality of life, preserving the environment at the same time excel in the physical and economic development of a city. After surveying the factor and causes of urban sprawl, the positive and negative result of this phenomenon can be acquired. Regardless of the positive aspects of urban sprawl, most of the viewpoints focused on negative results. Among the mention issues associated with the factor and causes of urban sprawl are a concentration of poverty, low quality of educational centres and shortage of financial resources. In transportation, sprawl cause to more commuting, long travels, and more congestion. Households can pass more distances to access to better housing, educational centres and job and it intensify by access to infrastructure. Sprawl increases the cost of infrastructures. Other examples are highways, parking, water, electricity costs. Also, it will cause to usage more energy, emergence of pollution and eliminate lands. Living in these regions also has many psychological and social costs.

CONCLUSIONS
This paper provides some solid findings on the trend of urban sprawl growth factors and causes. Urban sprawl has been studied mainly from the built environment context since urban sprawl involves the modification of spatial factors. Therefore, urban sprawl studies are main dominated by fields that involve in the spatial arrangement and management such as planning, architecture, engineering and geography. Nevertheless, other areas such as economic and medicine also have serious attention on urban sprawl studies due to its influence on the socio-economic aspect. Despite gaining the attention from significant fields, urban sprawl experiences are vastly based on single geographical context only. The great gaps of research publications between developing

and developed countries proving that urban sprawl remains a serious threat especially in the developing countries. As the economic and social development, have to stabilize in the North America and European countries, the issues of sprawl can be controlled with the implementation of planning concepts such as "New Urbanism," "Green Cities" or "Compact Cities." However, these planning concepts might not be suitable to be implemented in the context of developing countries especially in Asia where the countries are competing in term economic and physical development. So, by recognising urban sprawl through its factors and causes, the pattern of urban sprawl in the local context can be acknowledged, and suitable measures can be implemented to control its growth. Other than that, a clear distinction of urban sprawl can be seen by placing each factor and causes into categories. This effort contributes to defining urban sprawl in line with as previous work by Galster et al., (2001) method which is to identify urban sprawl by its factor and causes. This paper provides contributions towards the way to determine urban sprawl. Thus, for future improvement, the author aim to develop the land use geospatial indices to measure and determine this concept. Based on this paper, the geospatial indices not only focused on one perspective that causes urban sprawl only but included all factors so the sprawling growth can be control effectively.

ACKNOWLEDGEMENT

REFERENCES
(EEA), E. E. A. 2006. "Urban sprawl in Europe : The ignored challenge". Copenhagen.

Abdullah, J. 2012. "City Competitiveness and Urban Sprawl : Their Implications to Socio-economic and Cultural Life in Malaysian

Cities". *Procedia - Social and Behavioral Sciences*, *50*(July), 20–29. http://doi.org/10.1016/j.sbspro.2012.08.012

Almeida, B. 2005. "A GIS Assessment of Urban Sprawl in Richmond, Virginia″. Virginia Polytechnic Institute and State University.

Altieri, L., Cocchi, D., Pezzi, G., Scott, E. M., & Ventrucci, M. 2014. "Urban Sprawl Scatterplots for Urban Morphological Zones data". *Ecological Indicators*, *36*, 315–323. http://doi.org/10.1016/j.ecolind.2013.07.011

Amato, F., Pontrandolfi, P., & Murgante, B. 2015. "Using Spatio - Temporal Analysis". *Ecological Informatics*, (AUGUST). http://doi.org/10.13140/RG.2.1.2961.3925

Anas, A., & Pines, D. 2008. "Anti-sprawl Policies in a System of Congested Cities". *Regional Science and Urban Economics*, *38*(5), 408–423. http://doi.org/10.1016/j.regsciurbeco.2008.05.001

Anas, A., & Rhee, H. J. 2006. "Curbing Excess Sprawl with Congestion Tolls and Urban Boundaries". *Regional Science and Urban Economics*, *36*(4), 510–541. http://doi.org/10.1016/j.regsciurbeco.2006.03.003

Arribas-Bel, D., Nijkamp, P., & Scholten, H. 2011. "Multidimensional urban sprawl in Europe: A self-organizing map approach". *Computers, Environment and Urban Systems*, *35*(4), 263–275. http://doi.org/10.1016/j.compenvurbsys.2010.10.002

Barnes, K. B., Morgan, J. M., Roberge, M. C., & Lowe, S. 2001. "Sprawl Development: Its Patterns, Consequences, and Measurement". Baltimore, Maryland.

Bart, I. L. 2010. "Urban Sprawl and Climate Change: A Statistical Exploration of Cause and Effect, With Policy Options for the EU". *Land Use Policy*, *27*(2), 283–292. http://doi.org/10.1016/j.landusepol.2009.03.003

Bhatta, B., Saraswati, S., & Bandyopadhyay, D. 2010. "Quantifying the degree-of-freedom, degree-of-sprawl, and degree-of-goodness of urban growth from remote sensing data". *Applied Geography*, *30*(1), 96–111. http://doi.org/10.1016/j.apgeog.2009.08.001

Boori, M. S., Netzband, M., Voženílek, V. Í. T., & Choudhary, K. 2016. "Urbanization analysis through remote sensing and GIS in Kuala Lumpur , Manila and Singapore cities". In N. Mastorakis, C. A. Bulucea, K. Ntalianis, & G. Tsekouras (Eds.), *Recent Advances in Electrical Engineering* (pp. 99–110). Istanbul, Turkey: WSEAS Press.

Borgman, C. L., & Furner, J. 2002. "Scholarly Communication and Bibliometrics". *Annual Review of Information Science and Technology*, *36*, 2–72. http://doi.org/10.2307/2074817

Bornmann, L. 2014. "How are excellent (highly cited) papers defined in bibliometrics? A quantitative analysis of the literature". *Research Evaluation*, *23*(2), 166–173. http://doi.org/10.1093/reseval/rvu002

Brueckner, J. K., & Helsley, R. W. 2011. "Sprawl and Blight". *Journal of Urban Economics*, *69*(2), 205–213. http://doi.org/10.1016/j.jue.2010.09.003

Brueckner, J. K., & Largey, A. G. 2008. "Social interaction and urban sprawl". *Journal of Urban Economics*, *64*(1), 18–34. http://doi.org/10.1016/j.jue.2007.08.002

Campbell, D., Picard-Aitken, M., Cote, G., Caruso, J., Valentim, R., Edmonds, S., Archambault, E. 2010. "Bibliometrics as a Performance Measurement Tool for Research Evaluation: The Case of Research Funded by the National Cancer Institute of Canada". *American Journal of Evaluation*, *31*(1), 66–83. http://doi.org/10.1177/1098214009354774

Chorianopoulos, I., Pagonis, T., Koukoulas, S., & Drymoniti, S. 2010. "Planning, competitiveness and sprawl in the Mediterranean city:

The case of Athens". *Cities*, *27*(4), 249–259. http://doi.org/10.1016/j.cities.2009.12.011

Coisnon, T., Oueslati, W., & Salani, J. 2014. "Urban sprawl occurrence under spatially varying agricultural amenities". *Regional Science and Urban Economics*, *44*(1), 38–49. http://doi.org/10.1016/j.regsciurbeco.2013.11.001

Couch, C., & Karecha, J. 2006. "Controlling urban sprawl: Some experiences from Liverpool". *Cities*, *23*(5), 353–363. http://doi.org/10.1016/j.cities.2006.05.003

De Ridder, K., Lefebre, F., Adriaensen, S., Arnold, U., Beckroege, W., Bronner, C., Weber, C. 2008. "Simulating the impact of urban sprawl on air quality and population exposure in the German Ruhr area. Part I: Reproducing the base state". *Atmospheric Environment*, *42*(30), 7059–7069. http://doi.org/10.1016/j.atmosenv.2008.06.045

Durieux, L., Lagabrielle, E., & Nelson, A. 2008. "A method for monitoring building construction in urban sprawl areas using object-based analysis of Spot 5 images and existing GIS data". *ISPRS Journal of Photogrammetry and Remote Sensing*, *63*(4), 399–408. http://doi.org/10.1016/j.isprsjprs.2008.01.005

Eid, J., Overman, H. G., Puga, D., & Turner, M. A. 2007. "Fat City : Questioning the Relationship Between Urban Sprawl and Obesity". Toronto.

Ewing, R. 2008. "Characteristic, Causes, and Effects of Sprawl: A Literature Review". In J. M. Marzluff, W. Endlicher, G. Bradley, U. Simon, E. Shulenberger, M. Alberti, C. ZumBrunnen (Eds.), *Urban Ecology An International Perspective on the Interaction Between Humans and Nature* (1st ed., p. 829). New York: Springer.

Ewing, R., Hamidi, S., Grace, J. B., & Dennis, Y. W. 2016. "Does urban sprawl hold down upward mobility?" *Landscape and Urban Planning*, *148*, 80–88. http://doi.org/10.1016/j.landurbplan.2015.11.012

Ewing, R., Pendall, R., & Chen, D. 2002. "Measuring Sprawl and Its Impact. Smart Growth America". Retrieved from http://www.smartgrowthamerica.org/sprawlindex/sprawlindex.html

Fang, S., Gertner, G. Z., Sun, Z., & Anderson, A. a. 2005. "The impact of interactions in spatial simulation of the dynamics of urban sprawl". *Landscape and Urban Planning*, *73*(4), 294–306. http://doi.org/10.1016/j.landurbplan.2004.08.006

Feng, L. 2008. "Applying remote sensing and GIS on monitoring and measuring urban sprawl: A case study of China". *International Journal of Applied Earth Observation and Geoinformation*, *10*(1), 47–56.

Feng, L., Du, P., Zhu, L., Luo, J., & Adaku, E. 2015. "Investigating Sprawl Along China's Urban Fringe from a Spatio-Temporal Perspective". *Applied Spatial Analysis and Policy*, (September). http://doi.org/10.1007/s12061-015-9149-z

Galster, G., Hanson, R., Ratcliffe, M. R., Wolman, H., Coleman, S., & Freihage, J. 2001. "Wrestling Sprawl to the Ground: Defining and measuring an elusive concept". *Housing Policy Debate*, *12*(4), 681–717. http://doi.org/10.1080/10511482.2001.9521426

Habibi, S., & Asadi, N. 2011. "Causes, results and methods of controlling urban sprawl". *Procedia Engineering*, *21*, 133–141. http://doi.org/10.1016/j.proeng.2011.11.1996

Hasse, J. E. 2004. "A Geospatial Approach to Measuring New Developemnt Tracts for Characteristic of Sprawl". *Landscape Journal*, *23:1*, 1–4.

Ibrahim, A. L., & Sarvestani, M. S. 2009. "Sensing and GIS – Case Study Shiraz City , Iran". *Urban Remote Sensing Joint Event*.

Jaeger, J. A. G., & Schwick, C. 2014. "Improving the measurement of urban sprawl: Weighted Urban Proliferation (WUP) and its

application to Switzerland". *Ecological Indicators*, *38*, 294–308. http://doi.org/10.1016/j.ecolind.2013.11.022

Jain, M. 2008. "GIS and Remote Sensing Applications to Study Urban Sprawl of Udaipur, India".

Ji, W., Ma, J., Twibell, R. W., & Underhill, K. 2006. "Characterizing urban sprawl using multi-stage remote sensing images and landscape metrics". *Computers, Environment and Urban Systems*, *30*(6), 861–879. http://doi.org/10.1016/j.compenvurbsys.2005.09.002

Lichtenberg, E. 2011. "Open Space and Urban Sprawl: The Effects of Zoning and Forest Conservation Regulations in Maryland". *Agricultural and Resource Economics Review*, *40*(3), 393–404.

Lopez, R. 2004. "Urban sprawl and risk for being overweight or obese". *American Journal of Public Health*, *94*(9), 1574–1579.

Mann, G. S., Mimno, D., & McCallum, A. 2006. "Bibliometric impact measures leveraging topic analysis". *ACM/IEEE-CS Joint Conference on Digital Libraries*, 65–74. http://doi.org/10.1145/1141753.1141765

Ngoran, S. D., & Xue, X. 2015. "Addressing urban sprawl in Douala, Cameroon: Lessons from Xiamen integrated coastal management". *Journal of Urban Management*, *4*(0), 53–72. http://doi.org/http://dx.doi.org/10.1016/j.jum.2015.05.001

Noor, N. M., & Rosni, N. A. 2013. "Determination of Spatial Factors in Measuring Urban Sprawl in Kuantan Using Remote Sensing and GIS". *ASEAN Conference on Environment Behaviour Studies*, *85*, 502–512. http://doi.org/10.1016/j.sbspro.2013.08.379

Osman, S., Nawawi, A. H., & Abdullah, J. 2008. "Urban Sprawl and Its Financial Cost : - A Conceptual Framework". *Asian Social Science*, *4*, 39–50.

Poelmans, L., & Van Rompaey, A. 2009. "Detecting and modelling spatial patterns of urban sprawl in highly fragmented areas: A case study in the Flanders–Brussels region". *Landscape and Urban Planning*, *93*(1), 10–19. http://doi.org/10.1016/j.landurbplan.2009.05.018

Rahman, M. 2016. "Detection of Land Use/Land Cover Changes and Urban Sprawl in Al-Khobar, Saudi Arabia: An Analysis of Multi-Temporal Remote Sensing Data". *ISPRS International Journal of Geo-Information*, *5*(2), 15. http://doi.org/10.3390/ijgi5020015

Sorensen, A. 2000. "Land readjustment and metropolitan growth: An examination of suburban land development and urban sprawl in the Tokyo metropolitan area". *Progress in Planning*, *53*(4), 217–330.

Sudhira, H. S., & Ramachandra, T. V. 2007. "Characterising Urban Sprawl from Remote Sensing Data and Using Landscape Metrics". In *10th International Conference on Computers in Urban Planning and Urban Management* (p. 12). Iguassu Falls, Brazil.

Terzi, F., & Kaya, H. S. 2008. "Analyzing Urban Sprawl Patterns Through Fractal Geometry: The Case of Istanbul Metropolitan Area" (No. 144) (Vol. 44). London.

Theobald, D. M. 2003. "Defining And Mapping Rural Sprawl : E Xamples From The Northwest US: Measuring & mapping rural sprawl". Colorado.

Tian, L., & Ma, W. 2009. "Government intervention in city development of China: A tool of land supply". *Land Use Policy*, *26*, 599–609. http://doi.org/10.1016/j.landusepol.2008.08.012

Torrents, P. M., & Alberti, M. 2000). "Measuring Sprawl" (No. 27). *Association of Collegiate Schools in Planning Conference*. London.

Verbeek, T., Boussauw, K., & Pisman, A. 2014. "Presence and trends of linear sprawl: Explaining ribbon development in the north of

Belgium". *Landscape and Urban Planning*, *128*, 48–59. http://doi.org/10.1016/j.landurbplan.2014.04.022

Wu, J. 2006. "Environmental amenities, urban sprawl, and community characteristics". *Journal of Environmental Economics and Management*, *52*(2), 527–547. http://doi.org/10.1016/j.jeem.2006.03.003

Xiao, J., Shen, Y., Ge, J., Tateishi, R., Tang, C., Liang, Y., & Huang, Z. 2006. "Evaluating urban expansion and land use change in Shijiazhuang, China, by using GIS and remote sensing". *Landscape and Urban Planning*, *75*(1–2), 69–80. http://doi.org/10.1016/j.landurbplan.2004.12.005

Zhao, P. 2011. "Managing Urban Growth in a Transforming China: Evidence from Beijing". *Land Use Policy*, *28*(1), 96–109. http://doi.org/10.1016/j.landusepol.2010.05.004