2015 HAWAII UNIVERSITY INTERNATIONAL CONFERENCES
ARTS, HUMANITIES, SOCIAL SCIENCES & EDUCATION
JANUARY 03 - 06, 2015
ALA MOANA HOTEL, HONOLULU, HAWAII

SOCIAL NETWORK ANALYSIS FOR LEISURE ORIENTED MOBILITY CHARACTERISTICS: A CASE STUDY OF THE SEOUL METROPOLITAN AREA

CHOI, SEUNG-DAM & ET AL
HANKUK UNIVERSITY
DEPARTMENT OF TOURISM
KOREA CULTURE & TOURISM INSTITUTE
REPUBLIC OF KOREA

Dr. Choi Seung-Dam
Mr. Park Hong-Jun
Department of Tourism
Hanyang University, Republic of Korea.

Dr. Choi Ja-Eun
Korea Culture & Tourism Institute
Republic of Korea.

Social Network Analysis for Leisure Oriented Mobility Characteristics: A Case Study of the Seoul Metropolitan Area

This paper identifies the characteristics of the leisure mobility patterns of citizens in the Seoul Metropolitan Area. Leisure oriented O-D data from Household Mobility Surveys from 1996 to 2010 is analyzed to determine the leisure mobility characteristics of these Seoul citizens utilizing Social Network analysis. This paper concludes with a discussion on the implications of these leisure characteristics and trends based on the findings.

Social Network Analysis for Leisure Oriented Mobility Characteristics: A Case Study of the Seoul Metropolitan Area

Hong-Jun Park, Ja-Eun Choi, Seung-Dam Choi

1. Introduction

The understanding of the leisure oriented mobility in the Seoul Metropolitan area could provide the valuable basic data for establishment of strategies for the leisure as it explains the change of leisure demand and supply in the area. However, the studies on the leisure mobility in the Seoul Metropolitan area were limited. It is because leisure mobility researches were complicated process requiring a lot of time and efforts besides the close cooperation between local authorities.

On the other hand, for the analysis of these characteristics, O-D data is required. "Study on the traffic of households located in Seoul Metropolitan Area" regularly conducted by the local governments of Seoul, Incheon and Gyeonggi shows the time series data for the leisure oriented traffic volume in the area. Although the main purpose of that data is for the analysis of traffic volume in the metropolitan area, it offers the basic data for the analysis of characteristics of the leisure oriented mobility. Committee for the Economic Development of Seoul Metropolitan Area (2011) confirmed the validity of the data through its analysis of the leisure oriented mobility in the area conducted in 1996, 2002 and 2006 and suggested the necessity of continual data analysis.

This study has been done as a part of the studies made by Committee for the Economic Development of Seoul Metropolitan Area (2011). It aims at the in-depth understanding of the patterns of leisure oriented mobility of people in Seoul Metropolitan area through the further analysis following the prior studies made by the Committee. In this study, the social network theory and analysis methods which are the frame of the analysis were reviewed and then the analysis of social network using the results from previous 4 studies was conducted. In addition, the implications of the results of this study for the future studies and policy making were suggested.

2. Theoretical Background

The social network theory explains the relation the members of a community through the network (Knoke & Yang, 2008; Kim, 2003). It makes possible the diagram showing the relation between members using the analysis indicators such as degree centrality (Kim, 2003; Song et al., 2004; Kim, 2011). According to the social network theory, the network which is formed by the interactivity among the members is kept and maintained through the continuous networking process and the characteristics of the existing network affect the new network activities (Park, 2009). The social network theory not only simply explains the relation between the actors but also enables the description of the social structure embedded in the community by describing the relationship phenomena. It enables the explanation of the macro social structure through the analysis of the micro behaviors of members (Kim, 2003).

The social network theory also enables the analysis and explanation of not only the social structure but also the spatial structure in the community because the spatial structure in the community is also affected by the mechanism forming the social structure (Kim, 1996; Lee, 1999). It means that the social structure affects the activities of the member of the social structure and thus the spatial formation, thus resulting in the change in main parameters which decide the physical space formation, such as the pattern of land use, population density, and price of the land (Lee, 1999). As described, the studies on the social network are expanding its scope to explain the spatial formation relation in urban and local areas utilizing the data regarding the relation between members in the community and their mobility patterns (Koo, 2008a; Koo, 2008b; Lee & Kim, 2006).

The study of mobility and space formation have analyzed the relation between international air traffic flow (Smith & Timberlake, 2002) and the urban space formation and the relation between mobility of people between cities and the formation of urban space (Irwin & Hughes, 1992; Koo, 2008b). However, as far as the leisure is concerned, the studies using the social network theory and analysis were limited in the spatial perspective (Choi & Choi, 2014; Lee & Kim, 2012).

In the analysis of the social network, the structured linking patterns among

components of the space can be systematically explained by connecting the points and lines hidden in the spatial composition factors. In the social network analysis related to the mobility for the purpose of leisure in cities, the relation between origin point and destination of the visitors can be explained using the nodes and links (Lee & Kim, 2006; Park, 2009). The nodes represent the origin and destination while the links represent the volume of exchanges.

The result of degree centrality derived from the analysis of social network using the data on mobility between origin and destination is helpful in finding out the main nodes (the main place in the total network). It is because the number of main nodes analyzed through the study on the mobility patterns between destinations varies over time and that the analysis of the specific mobility patterns is possible depending on the relation characteristics (density and scope of mobility). The nodes derived like this mean the place where the visitors gather. If the time series analysis is conducted, the mobility flow and the change in the nodes can be identified (Committee for the Economic Development of Seoul Metropolitan Area (2011).

3. Method of study

This study targets the leisure and business oriented traffic volume in Seoul, Incheon and Gyeonggi as published in the "Study on the traffic of households located in Seoul Metropolitan Area" conducted by the local governments of Seoul, Incheon and Gyeonggi in 1996, 2002, 2006 and 2010. The purpose of traffic as classified in the study above is also used in this study as the purpose of traffic and the origin and destination traffic data was constructed based on the origin and destination of individual traffic.

The administrative unit as the analysis unit adopted the same administrative unit used in the prior studies made by the Committee for the Economic Development of Seoul Metropolitan Area (2011). In case of Seoul, the classification made by the Committee was partially amended for consistency. The number of administrative units in Seoul changed from 522 to 424 during 2008 and 2009. In this study, 522 administrative units were used for consistency for comparison with the study performed

before 2010.

The origin and destination traffic volume data for the purpose of leisure and business was analyzed for each degree centrality using the social network analysis method and the top 30 destinations were found out.

4. Analysis results

The result of the analysis of the destinations for purpose of leisure in the Seoul Metropolitan area in 1996, 2002, 2006 and 2010 showed that the leisure oriented destinations are mainly formed around the Seoul. Most of the top 30 destinations for 4 years specified above were located in Seoul, and only 4, 2 and 4 of top 30 destinations were located in Incheon and Gyeonggi area for the years of 2002, 2006 and 2010 respectively.

The destinations having high leisure centrality were found to be located in Gangnam, a new urban area rather than Gangbuk, an old urban area. The numbers of top 30 destinations which are located in Gangnam were 18, 9, 16 and 18 in 1996, 2002, 2006 and 2010 respectively while those in Gangbuk were 12, 17, 12, and 8 respectively. However, it is noteworthy that there are more destinations located in Gangbuk in terms of high centrality degree as 4, 6, 4 and 4 destinations in top 10 destinations are located in Gangbuk area in 1996, 2002, 2006 and 2010. Especially, two locations located in Gangbuk were chosen as top 3 destinations in every year surveyed. Most of these destinations show the increasing degree centrality and the top 5 locations in Gangbuk area including Jongno 1, 2, 3 and 4-ga showed the big increase in their degree centrality (Table 1 and Table 4).

The numbers of top 10 destinations located in Gangnam were less than those in Gangbuk with 6, 4, 6, and 6 in 1996, 2002, 2006 and 2010, respectively. The top 30 destinations in terms of leisure centrality usually showed the increasing centrality values. The destinations having the centrality value in 2010 higher than that in 1996 include Yeongdeunpo 1 for Gangnam area and Jongno 1, 2, 3 and 4-Ga, Myeong, Hoehyeon and Sajik (Table 1). These areas are the central and semi-central areas in Seoul, thus playing

a lot of urban functions and keeping a lot of floating and settled populations.

On the other hand, there are also many destinations whose degree centralities are gradually weakening. 25 of top 30 destinations in 1996 were pushed away from the top 30 in 2010. It is attributable to the fact that many of those destinations were changed in their main purpose from mixed purpose zone to residential zone.

Table 1. Top 30 destinations in Seoul Metropolitan Area in terms of leisure oriented centrality degree during 1996 to 2010 (O: Seoul Metropolitan Area, D: Seoul Metropolitan Area)

Rank	1996			2002			2006			2010		
	Destination		Degree cantrality	Destination		Degree cantrality	Destination		Degree cantrality	Destination		Degree cantrality
1	Seoul	Jongno1,2,3,4ga	0.2063	Seoul	Jongno1,2,3,4ga	0.2004	Seoul	Jongno1,2,3,4ga	0.2274	Seoul	Jongno1,2,3,4ga	0.3653
2		Myeong	0.1937		Myeong	0.1152		Yeoksam1	0.1831		Yeouido	0.2893
3		Jamsil1	0.1175		Seocho4	0.1117		Myeong	0.1440		Myeong	0.2758
4		Yeongdeungpo3	0.1049		Yeouido	0.0949		Daesin	0.1312		Yeoksam1	0.2477
5		Daechi4	0.1022		Sinsu	0.0904		Hoehyeon	0.1278		Sinchon	0.2441
6		Hyehwa	0.1022		Sogong	0.0762		Yeouido	0.1014		Seocho3	0.2269
7		Seocho2	0.0942		Hyehwa	0.0718		Seocho3	0.0920		Yeongdeungpo1	0.2242
8		Jamsil4	0.0861		Jamsil6	0.0709		Yeongdeungpo1	0.0920		Seogyo	0.2233
9		Siheungbon	0.0816		Samseong1	0.0683		Samseong1	0.0911		Hoehyeon	0.2061
10		Bugahyeon3	0.0798		Ihwa	0.0647		Sinrimbon	0.0894		Seocho2	0.1971
11		Daesin	0.0753		Yeongdeungpo1	0.0621		Samseong2	0.0886		Seocho4	0.1962
12		Sogong	0.0682		Sanggeye2	0.0576		Sogong	0.0869		Samseong2	0.1872
13		Cheongdam	0.0682	In-cheon	Bupyeong1	0.0567		Hyehwa	0.0843		Yangjae2	0.1736
14		Naegok	0.0673	Seoul	Hoehyeon	0.0559		Sajik	0.0826		Sinrim	0.1709
15		Hoehyeon	0.0601		Sajik	0.0559	In-cheon	Bupyeong1	0.0818	Gyeong-gi	Maesan	0.1655
16		Yeomni	0.0538		Daesin	0.0550	Seoul	Sadang1	0.0801	Seoul	Yeoksam2	0.1637
17		Guro4	0.0574	In-cheon	Juan1	0.0532		Jamsil2	0.0767		Jamsil3	0.1618
18		Deungchon	0.0565	Seoul	Bugahyeon3	0.0532	Gyeong-gi	Maesan	0.0639		Gasan	0.1600
19		Sinrim4	0.0556		Jeonnong2	0.0523	Seoul	Donggyo	0.0630	Gyeong-gi	Anyang1	0.1591
20		Sajik	0.0529	Gyeong-gi	Munwon	0.0496		Sanggeye1	0.0630	Seoul	Sogong	0.1537
21		Gwanghui	0.0520	Seoul	Jongno5,6ga	0.0488		Dobong2	0.0613		Yangjae1	0.1519
22		Samseong1	0.0511		Sinsa	0.0470		Yangjae1	0.0605	Gyeong-gi	Juanang	0.1510
23		Bangbae	0.0502		Sadang1	0.0461		Guui3	0.0605	Seoul	Sajik	0.1483
24		Munjeong	0.0475	Gyeong-gi	Seohyeon1	0.0452		Hwayang	0.0596		Nonhyeon1	0.1474
25		Sinsa	0.0466	Seoul	Apgujeong	0.0452		Yeongdeungpo2	0.0588		Apgujeong	0.1456
26		Sanggeye1	0.0466		Suyu3	0.0452		Mok1	0.0588		Sangam	0.1410
27		Namhyeon	0.0439		Yeoksam1	0.0443		Apgujeong	0.0579		Hwayang	0.1401
28		Yeongdeungpo1	0.0422		Yangjae1	0.0434		Gwanghui	0.0571		Hangangno	0.1383
29		Daechi3	0.0404		Guui3	0.0434		Banpobon	0.0554	Gyeong-gi	Gwacheon	0.1365
30		Sangam	0.0404		Hwayang	0.0434		Jamsil6	0.0545	Seoul	Mok1	0.1347

For the analysis of relation between traffics for purpose of leisure and business, the additional analysis was conducted on the traffic for business purposes as suggested on the "Study on the traffic of households located in Seoul Metropolitan Area". The result

of the analysis showed that there is the relationship between traffic for purpose of leisure and traffic for purpose of business. In case of the traffic for business purposes, most of the main top 30 destinations were also located in Seoul. The numbers of them were 25, 24, 27 and 30 in 1996, 2002, 2006 and 2010 respectively. Among them, the number of the destinations in the top 30 designations showed the gradually increases as in case of the leisure oriented destinations with the increase from 8 in 1996 to 20 in 2010 (Table 2 and Table 3).

Table 2. Top 30 destinations in Seoul Metropolitan Area in terms of business oriented centrality degree during 1996 to 2010 (O: Seoul Metropolitan Area, D: Seoul Metropolitan Area)

Rank	1996			2002			2006			2010		
	Destination		Degree Centrality	Destination		Degree Centrality	Destination		Degree Centrality	Destination		Degree Centrality
1		Yeouido	0.2759		Jongno1,2,3,4ga	0.2891		Jongno1,2,3,4ga	0.2256		Jongno1,2,3,4ga	0.2839
2		Yeoksam1	0.2306		Yeouido	0.2529		Yeoksam1	0.2223		Yeouido	0.2767
3		Yeongdeungpo1	0.2158		Hoehyeon	0.2202		Yeouido	0.2032		Yeoksam1	0.2568
4		Jongno1,2,3,4ga	0.2115		Yeoksam1	0.2157		Myeong	0.1702		Myeong	0.2315
5		Myeong	0.2019		Sogong	0.1928		Hoehyeon	0.1675		Samseong2	0.2188
6		Hoehyeon	0.1845		Samseong1	0.1848		Samseong2	0.1438		Seocho3	0.1971
7		Euljiro3,4,5ga	0.1819		Jongno5,6ga	0.1760	Seoul	Seocho3	0.1418		Yeoksam2	0.1908
8	Seoul	Sogong	0.1802		Yeongdeungpo1	0.1760		Sogong	0.1319		Hoehyeon	0.1881
9		Seocho3	0.1741	Seoul	Euljiro3,4,5ga	0.1742		Samseong1	0.1306		Yeongdeungpo	0.1817
10		Samseong1	0.1601		Seocho4	0.1733		Jongno5,6ga	0.1273		Nonhyeon1	0.1682
11		Gwanghui	0.1488		Yangjae1	0.1662		Garakbon	0.1247		Jongno5,6ga	0.1582
12		Jongno5,6ga	0.1419		Gwanghui	0.1618		Gwanghui	0.1240		Yangjae2	0.1573
13		Changsin	0.1323		Myeong	0.1600	In-cheon	Nonhyeongojan	0.1194		Samseong1	0.1546
14		Garakbon	0.1314		Garak1	0.1565		Sajik	0.1102		Hangangno	0.1510
15		Garak1	0.1262		Nonhyeon1	0.1441		Gasan	0.1082		Apgujeong	0.1492
16	Gyeong-gi	Ilsan1	0.1227		Seocho1	0.1406		Yangjae2	0.1062	Seoul	Yangjae1	0.1483
17		Jamsil4	0.1227		Sinsa	0.1379		Yangjae1	0.1022		Seocho4	0.1474
18		Hwagokbon	0.1192	In-cheon	Nonhyeongojan	0.1300		Nonhyeon1	0.1016		Sinsa	0.1410
19	Seoul	Sinseol	0.1184	Seoul	Sajik	0.1202	Seoul	Jamsil1	0.0989		Sinrim	0.1383
20		Samseong2	0.1175	In-cheon	Bupyeong1	0.1202		Euljiro	0.0963		Sogong	0.1356
21		Sinsa	0.1175	Seoul	Hangangno3	0.1176		Yeongdeungpo1	0.0910		guro3	0.1329
22		Giheung	0.1131	In-cheon	Guwol1	0.1167		Nonhyeon2	0.0897		Cheongdam	0.1320
23	Gyeong-gi	Maesan	0.1097	Gyeong-gi	Jeongwang1	0.1088		Yeongdeungpo2	0.0884		Nonhyeon2	0.1302
24		Tongjin	0.1071		Guro3	0.1088	Gyeong-gi	Choji	0.0844		Seocho2	0.1302
25	Seoul	Nonhyeon1	0.1062	Seoul	Jamsil6	0.1070	Seoul	Sinseol	0.0844		Guro2	0.1302
26	Gyeong-gi	Bundang	0.1053		Seocho3	0.1061		Yeoksam2	0.0844		Gonghang	0.1284
27		Yangjae1	0.1027	Gyeong-gi	Anyang1	0.1052	In-cheon	Guwol1	0.0818		Sinchon	0.1284
28	Seoul	Jamsil1	0.1018	Seoul	Mok1	0.1034		Daesin	0.0818		Jamsil3	0.1257
29		Seocho2	0.0992		Sinseol	0.0999	Seoul	Seocho1	0.0798		Seocho1	0.1248
30		Gonghang	0.0975	Gyeong-gi	Giheung	0.0990		Mok1	0.0792		Gasan	0.1248

Table 3. Top 30 destinations in centrality degree for purposes of both leisure and business

Year (number of destination)	Destination
1996 (8)	Myeong, Samseong1, Seocho2, Sogong, Sinsa, Yeongdeungpo1, Jongno1,2,3,4ga, Hoehyeon
2002 (14)	Myeong, Bupyeong1, Sajik, Samseong1, Seocho4, Sogong, Sinsa, Yangjae1, Yeouido, Yeongdeungpo1, Jamsil6, Jongno1,2,3,4ga, Jongno5,6ga, Hoehyeon
2006 (14)	Daesin, Myeong, Mok1, Sajik, Samseong, Seocho3, Sogong, Yangjae1, Yeouido, Yeoksam1, Yeongdeungpo1, Yeongdeungpo2, Jongno1,2,3,4ga, Hoehyeon
2010 (20)	Gasan, Nonhyeon1, Myeong, Samseong, Seocho2, Seocho3, Seocho4, Sogong, Sinrim, Apgujeong, Yangjae1, Yangjae2, Yeouido, Yeoksam1, Yeoksam2, Yeongdeungpo1, Jamsil3, Jongno1,2,3,4ga, Hangangno, Hoehyeon

There was only one destination having the centrality value for top 30 destinations for 4 surveys at the place other than Seoul. It was Maesan-dong in Gyeonggi, which is the main node for traffic volumes. On the other hand, there was almost no destination falling on the top 30 destination in Incheon. There were only 2, and 1 in 2002, and 2006 but none in 1996 and 2010 (Table 4).

Unlike Seoul, the relation between traffic for business and traffic for leisure was not found in Incheon and Gyeonggi. In case of Maesan-dong which showed the high degree centrality, the value of leisure oriented centrality in 2010 (0.1655) was lower than the business centrality value (0.0868, 61th rank). In case of Nonhyeongojan-dong, Incheon, the leisure centrality in 2006 (0.0452) was lower than the business centrality (0.1194) (Table 5).

Table 4. Destinations showing the increase in the leisure oriented centrality degree in Seoul Metropolitan area during 1996 to 2010

Destination			Year: 1996	2002	2006	2010
			Degree Centrality			
Seoul	Jongno-gu	Jongno1,2,3,4ga	0.2063	0.2004	0.2274	0.3653
	Yeongdeungpo-gu	Yeouido	0.0108	0.0949	0.1014	0.2893
	Jung-gu	Myeong	0.1937	0.1152	0.1440	0.2758
	Gangnam-gu	Yeoksam1	0.0045	0.0443	0.1831	0.2477
	Seocho-gu	Seocho3	0.0027	0.0310	0.092	0.2269
	Yeongdeungpo-gu	Yeongdeungpo1	0.0422	0.0621	0.092	0.2242
	Jung-gu	Hoehyeon	0.0601	0.0559	0.1278	0.2061

	Gangnam-gu	Samseong2	0.0018	0.0231	0.0886	0.1872
	Jung-gu	Sogong	0.0682	0.0762	0.0869	0.1537
	Seocho-gu	Yangjae1	0.0036	0.0434	0.0605	0.1519
	Jongno-gu	Sajik	0.0529	0.0559	0.0826	0.1483
	Gwangjin-gu	Hwayang	0.0729	0.0434	0.0596	0.1401
	Yangcheon-gu	Mok1	0.0090	0.0426	0.0588	0.1347
Gyeonggi	Suwon-si	Maesan	0.0000	0.0293	0.0639	0.1655

Table 5. Destinations showing the increase in the business oriented centrality degree in Seoul Metropolitan area during 1996 to 2010

Year / Destination			1996	2002	2006	2010
			Degree Centrality			
Seoul	Gangnam-gu	Yeoksam1	0.2331	0.2157	0.2223	0.2568
	Jung-gu	Myeong	0.2040	0.1600	0.1702	0.2315
	Gangnam-gu	Samseong2	0.1187	0.0957	0.1438	0.2188
	Seocho-gu	Seocho3	0.2269	0.1061	0.1418	0.1971
	Gangnam-gu	Yeoksam2	0.1637	0.0496	0.0844	0.1908
	Jung-gu	Jongno5,6ga	0.1434	0.176418	0.1273	0.1582
	Seocho-gu	Yangjae2	0.1736	0.0771	0.1062	0.1573
	Geumcheon-gu	Gasan	0.1600	0.0674	0.1082	0.1248

5. Conclusion and implications

This study was conducted to closely understand the patterns of mobility for the purpose of leisure in Seoul Metropolitan Area on weekdays. This study has been conducted as a part of the studies made by Committee for the Economic Development of Seoul Metropolitan Area (2011). In addition to the study above, the additional analysis was conducted on the top 30 destinations in terms of centrality in 2010 with the adoption of social network analysis method.

In case of Seoul Metropolitan Area, the mobility for leisure on weekdays was found to focus on Seoul, the capital city of Korea. The number of top 30 destinations in Gangnam, or the new urban area in Seoul, was more than that located in Gangbuk, the

old urban city of Seoul. But there were more destinations in Gangbuk in terms of the high ranking centralities and the number showed the gradual increase. In case of Seoul, the pattern for leisure oriented mobility showed some relation with the pattern for business oriented mobility. But in case of Incheon, it was hard to find any relation between two. On the other hand, there were also the destinations having the big increases in centralities. The common point for this destinations is that they are the area where there are a lot of floating and settled populations and they are the mixed zone for business and residence and function as the main traffic nodes. There were also the destinations showing the gradual down in the centrality. Many of these destinations were changed in their land use from mixed zone to residential zone.

The results of this study show the rapid change in the leisure centrality on weekdays. There are the destinations which have the increasing centrality as the leisure oriented destination but there are also destinations have the lowering centralities. This means that the continuous monitoring of the mobility is necessary. The analysis of the cause of changes in the centrality of the mobility and the proper selection of policies would play a critical role in the developmental growth of cities. In case of Seoul, it is found that the business oriented mobility and the leisure oriented mobility are influencing each other. This means that the approach for integration of business and leisure purposes is required for urban planning and policy making.

Reference

Choi, J. E. & Choi, S. D. (2014). Investigation of leisure mobility patterns across social classes within a city: application of social network analysis. *Journal of Tourism Sciences*, 38(1), 117-136.

Committee for the Economic Development of Seoul Metropolitan Area (2011). Analysis of Characteristics for Tourism Mobility and Main Tourism Destination In Seoul Metropolitan Area Economic Region-Leisure Oriented Mobility on weekday.

Irwin, M. & Hughes, L. (1992). Centrality and the structure of urban interaction: Measure, concepts and applications, *Social Forces*, 71(1), 17-51.

Kim, K. S. (1996). A Theoretical Study on the Urban Spatial Structure. *Journal of Jeonbuk Association for Public Administration*, 10, 199-213.

Kim, Y. H. (2003). *Social Structure and Behavior*. Seoul: Nanam Books.

_____(2011). *Social Network Theory*. Seoul: Parkyoungsa.

Knoke, D. & Yang, S. (2008). *Social Network Analysis*. Los Angeles, London, New Dehli, Singa-pore: Sage.

Koo, Y. M. (2008a). A review of researches on networks in economic geography: SNA and ANT. *Space and Society*, 30, 36-66.

_____(2008b). The structural and spatial characteristics of the actor networks of the industries for the elderly: based on the social network Analysis. *Journal of the Korean Geographical Society*, 43(4), 526-543.

Lee, H. Y. (1999). The concept of spatial structure and dynamic mechanisms of changes in spatial structure. *The Journal of the Korean Association of Geographic and Environmental Education*, 7(2), 583-609.

Lee, H. Y. & Kim, H. J. (2006). The analysis of the structure of commuting network in Seoul Metropolitan Area. *Journal of the Korean Urban Geographical Society*, 9(1), 91-111.

Lee, J. S. & Kim, Y. R. (2012). Analysis of the spatial characteristics and effect that determine leisure movement: an application of spatial autocorrelation and spatial regression. *Journal of Tourism Sciences*, 36(9), 221-240.

Park, K. C. (2009). *A Study on the Spatial Structure of the Seoul Metropolitan Area Using O/D Trips*. Gyeonggi Research Institution.

Smith, D. & Timberlake, M. (2002). Hierarchies of dominance among world cities: a network approach, in Sassen, S. (Ed), *Global Networks Linked Cities*, Routledge, New York, 117-143.

Song, H. G., Kim, W. S. & Lee, J. Y. (2004). *A Research on Korean Social Network*. Seoul: Seoul National University.