

A Time-Series Evaluation on Economic and Livelihood Self-Sufficiency of the New Towns

수도권 신도시의 시계열적 자족성 평가

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국문초록

1. 내 용

(1) 연구목적

본 연구는 신도시 자족성에 대한 논의를 토대로 대표적인 자족성 평가지표를 설정하고, 이 지표를 활용하여 1기 신도시 중 지역적 특성이 상이한 분당과 일산을 중심으로 신도시 입주 이후 현재까지 자족성의 시계열적 변화를 동태적으로 비교분석하는 것을 목적으로 하였다.

(2) 연구방법

도입 가능한 다양한 신도시 자족성 평가지표들에 대하여 상관관계를 분석하여 대표적인 자족성 평가지표라 할 수 있는 직주균형지수와 자족통근지수를 도출하였고, 이를 분당과 일산 신도시의 입주 이후 시점부터 적용하여 자료를 구축함으로써 신도시 자족성의 동태적 변화를 시계열적으로 비교분석하였다.

(3) 연구결과

신도시 자족성 평가지표로는 경제적 자족성 측면에서 직주균형지수, 생활기반 자족성 측면에서 통근비율을 활용한 자족통근지수가 대표성을 갖는 것으로 나타났다. 이를 분당과 일산 신도시에 적용한 결과, 입주초기에는 직주균형지수가

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50 미만으로 일자리가 매우 부족한 것으로 나타났으나, 시간 경과에 따라 분당은 114, 일산은 81 수준으로 매우 개선된 것을 알 수 있었다. 또한 일정 시기에 분당의 경우 내부통행 비율이 늘어나 서울에 대한 의존도가 낮아졌으나, 일산의 경우 큰 변화가 나타나지 않은 것으로 분석되었다.

2. 결 과

수도권 1기 신도시 자족성에 대한 횡단면적 분석보다는 시계열적·동태적 변화를 고찰한 결과 시간 경과에 따라 자족성이 점진적으로 개선됨을 알 수 있었으며, 이에 현재 개발되는 사업지의 경우 입주 초기부터 자족성을 확보할 수 있는 전략의 마련이 필요한 것으로 판단된다.

3. 핵심어

- 자족성, 평가지표, 직주균형, 자족통근, 신도시

ABSTRACT

The purposes of this study are setting self-sufficiency evaluation indexes based on the discussion about self-sufficiency of new towns and dynamically comparing and analyzing time-series changes of self-sufficiency of first-stage new towns. As self-sufficiency evaluation indexes, the job-housing balance has representativeness in terms of economic self-sufficiency and job-housing match based on commute ratio has representativeness in terms of life style-based self-sufficiency. When we applied them to Bundang and Ilsan new towns, the result revealed that both cities experienced the lack of job openings in their begging stage of residence with 50 point of the job-housing balance indexes. With the course of time, Bundang got 114 point and Ilsan got 81 point. Bundang showed that internal trip ratio increased and reliance on Seoul decreased in certain time but Isan didn't show any notable change in trip ratio.

KEY WORDS : Self-Sufficiency, Evaluating Indexes, Job-Housing Balance, Job-Housing Match, New Town

I . Introduction

Responding to the needs at the time, new towns in Korea have been constructed for various policy goals such as industrial development, intra-city expansion, the provision of housing and to ease the overcrowding in Seoul. In particular, from 1980s to 1990s, the overcrowding of Seoul became a serious issue, creating problems such as a shortage of housing that led to

the soaring cost of housing in Seoul. To solve these problems, the first-stage new towns(Bundang, Ilsan, Pyeongchon, Sanbon, and Jungdong) were developed, placing approximately 300,000 housing units in the areas immediately around Seoul. The development of the first-stage new towns produced some positive effects within a short period because housing prices were stabilized and the housing supply was increased by over 5%. However, diverse

problems arose because these new towns degraded into bedroom communities with insufficient economic self-containment. Wasteful traffic due to the imbalance between jobs and housing was observed, and the inadequate infrastructure of the new towns caused a lack of economic self-sufficiency that became a major issue.

Various planning techniques and studies for advanced social, economic, and environmental sustainability according to the principles of sustainable development by the Korean government were undertaken with the goal of surmounting these issues. Standards for planning, i.e., the creation of sites for self-sufficient facilities and the establishment of development reservations, were established and applied to the subsequent new town development to cure the lack of economic sustainability, which was the central criticism of the first-stage new towns. Academia had also proposed a variety of alternatives for improving the self-sufficiency of new towns through diverse evaluation studies¹⁾ of the first-stage new towns.

However, the above-mentioned studies only evaluated the self-sufficiency of limited areas of the new towns with a short-term perspective. They thus failed to present comprehensive and feasible alternatives. First, in terms of time, the previous studies employed a cross-section method that evaluated the self-sufficiency of the new towns based on only short period. It is

difficult to accurately analyze a city that is constantly evolving and developing with this type of method. For a clearer understanding of the organic characteristics of a city, the evaluation should be conducted in a dynamic manner over a long period of time, unlike the conventional evaluation. Second, in terms of space, previous studies have limited the range of study to the areas of the new towns. However, considering the characteristics of a modern city in which development of communications and transportation are available and growth takes place through exchanges with the surrounding towns rather than independently, limiting the range of analysis to the new towns makes it difficult to conduct a comprehensive analysis that reflects reality. Therefore, it is necessary to expand the range of the study to include the expansive surrounding area, including the living and economic zone.

It is thus necessary to overcome the temporal and spatial limitations presented in the previous studies and bring lucidity to the evaluation of the self-sufficiency of the new towns. This study suggests an index and a method for evaluating the self-sufficiency of the new towns, considering the characteristics of a modern city.

This study analyzed the changes in economic and livelihood self-sufficiency from 1996 to 2012 especially in Bundang and Ilsan which are the most representative new towns.

1) Kim, H. S., "The study on securing self-containment of new towns in Seoul metropolitan areas", *Daejin Journal*, 2002, vol.10, pp.175~187.

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II. Theoretical Study

1. The Concept of Self-Sufficiency

The recognition of the self-sufficiency of a city began with Ebenezer Howard's concept of garden city. Howard saw that the housing complexes which were being built around the metropolises at the time lacked self-sufficiency, and he proposed a garden city as the solution to the problem. The garden city proposed by Howard contains the concept of self-sufficiency in that it requires a greenbelt in the fashion of a rural farming community, along with the planning of residential, business, and public services at a sufficiently large scale to meet the diverse demands of the urban population.

The concept of the self-sufficiency of a city has been discussed ardently and consistently ever since. Golany²⁾ described self-sufficiency as a concept that includes the meaning of self-sufficiency, self-sustainability, and independence. Clapp³⁾ said that a self-sufficient city signified a city where the various functions as a city are satisfied by the city itself with no reliance on external cities. He argued that a city could be evaluated to be self-sufficient when there are not only sufficient employment opportunities but also when the various services necessary for social lives are provided within the city so that the residents can maintain a satisfying lifestyle without

leaving the city. A self-sufficient city can be defined as a vibrant city with a potential for growth that offers economic activities and urban functions of a scale matching the population size and is equipped with an urban infrastructure. And the self-sufficiency of a city can largely be divided into the economic or employment aspect, the livelihood aspect, and the urban environment aspect.⁴⁾

To sum up the above views, self-sufficiency means that the diverse activities of the residents that take place inside of a city do not rely completely on the outside but can be taken care of internally, at least with a certain degree. Self-sufficiency is closely related to the level of employment inside a city, meaning that the city not only needs to be able to provide sufficient employment opportunities but also to have fundamental industries that make it possible to export the goods and services produced within the city to other cities or surrounding areas. Self-sufficiency also means that a variety of livelihood such as education, culture, healthcare, public facilities, and shopping facilities that are essential for social lives should be provided within the city. Therefore, the concept of a self-sufficient city includes not only economic self-sufficiency in terms of employment and industries but also livelihood self-sufficiency with respect to providing social services.

2) Golany, G., *New town planning : principles and practices*, John Wiley Sons Inc, New York, 1976, pp.48.

3) Clapp, J. A., *New town and urban policy : planning metropolitan growth*, Dunellen Publishing, 1971, pp.72~80.

4) Gye, K. S. and Jeon, Y. O., *The study of business participation for self-sufficiency of new town development*, Korea Research Institute for Human Settlements, 2004, pp.117~125.

2. An Evaluation of Self-Sufficiency

An objective evaluation index of self-sufficiency that concretely conveys the meaning of a self-sufficient city is necessary to evaluate the self-sufficiency of a city and analyze its attainment. Diverse studies on the methods for self-sufficiency evaluation and an index to support these evaluations have been undertaken ever since the concept of self-sufficiency was introduced.

The studies by Jeong & Kim⁵⁾, the self-sufficiency of the five new town was analyzed in respect employment and livelihood using seoul metropolitan area OD data on 2006.

According to the studies by Kye & Jeon, an evaluation of the self-sufficiency of a city can be segmented into employment, livelihood, and the urban environment. First, from the perspective of economic activities, self-sufficiency is evaluated in terms of jobs and the industrial activities of the city. Second, self-sufficiency in terms of livelihood evaluates the self-sufficiency of a city based on the livelihood that the city provides. Third, self-sufficiency from the perspective of the urban environment evaluates the self-sufficiency of a city based on the ability of the city to provide a pleasant environment.

The job-housing balance index, the employment balance index, and the local employment index are the most commonly used indexes for evaluating economic self-

sufficiency. The job-housing balance index indicates the degree of balance between the amount of housing and the number of jobs in a region, and the employment balance index indicates the degree of balance between the economically active population and the number of jobs in a region. The local employment index indicates the ratio of employment for the local population to the total economically active population.⁶⁾

Additionally, the study by Lee & Ahn discussed the necessity of introducing the non-working trip, which is an index of self-sufficiency in terms of the livelihood infrastructure, into the evaluation of the self-sufficiency of a new town in addition to the indexes of economic self-sufficiency. The evaluation indexes that involve a non-working trip include the non-working trip index.

3. The Attainment of Self-Sufficiency

Because new towns are generally developed as a means to resolve various problems arising in the mother city, the self-sufficiency of a new town has been discussed mainly from the perspective of its relationship with the mother city. In essence, the self-sufficiency of a new town has been discussed to explore the preconditions for a new town to be independent of its mother city. The representative discussions of this topic relate to the distance from the mother city or the central city, the population of the new town, and the

5) Jeong, D. W., Kim, H.S., "Analyzing the levels of self-containment and centrality of the five first-period new towns built in the seoul metropolitan area", *Journal of the Korean Urban Geographical Society*, 2010, vol.13 no.2, pp.103~116.

6) Kim, H. S., H. C., Kim, G. S., Kim, et al., "Improvement and mid-term evaluation of construction of the second stage new towns", Korea Planners Association : Urban Information Service, 2009, 332, pp.4~11.

timing for the expansion of the self-sufficiency functions of a new town.

However, in today's environment, where transportation and communications are so advanced and intercity dealings are so active, it is not only impossible but also not desirable to provide the diverse services needed by the residents without relying on other cities. There are fundamentally skeptical views about whether it is really necessary for a new town to have the production function. According to Min's study⁷⁾ on this subject, while it is necessary for a new town on the periphery of a metropolis to have production-based self-sufficiency, the town could also seek alternatives such reducing the commuting time between the mother town or the surrounding cities and the new town.

Thus, it should be noted that the spatial structure of the Seoul Metropolitan Area of Korea is growing increasingly complex and the functions of business, commerce, and leisure are necessarily becoming interconnected with the surrounding areas. It is not the self-sufficiency of one individual new town that is significant; the concept

needs to be expanded into the new town's self-sufficiency in relation to the surrounding areas.

III. Setting Self-Sufficiency Evaluating Indexes

Among the evaluation indexes for the self-sufficiency of a new town, the major indexes of economic self-sufficiency are the job-housing balance index, the employment balance index, and the job-housing match index. First, the job-housing balance index indicates the degree of balance between the amount of housing and the number of jobs in a region, and it is frequently used as a general self-sufficiency index. The employment balance index is the ratio between jobs and the economically active population, with demographic characteristics such as the aging of the population factored in. This index signals the degree of balance between the economically active population and the number of jobs in the region. The balance among jobs, housing, and the economically active population is

〈Table 1〉 Indexes to evaluate economic self-sufficiency

Index	Computation Formula
Job-Housing Balance	(Number of jobs / Amount of household) × 100
Employment Balance	(Number of jobs / Economically active population) × 100
Job-Housing Match	(Internal commute / Total trip (Outbound commute+ Inbound commute)) × 100

〈Table 2〉 Indexes to evaluate livelihood self-sufficiency

Index	Computation Formula
Shopping Self-Sufficiency	(Internal shopping traffic / (Outbound shopping traffic + Inbound shopping traffic)) × 100
Non-Working Trip	(Internal traffic for all purposes / (Outbound traffic for all purposes + Inbound traffic for all purposes)) × 100

7) Min, B. S., "Securing self-sufficient new towns and building eco-friendly sustainable plans", Korea Research Institute for Human Settlements, 2002, vol. 257, pp.29~37.

a necessary condition for determining the economic sufficiency of a city, but it is not a sufficient condition.

Occasionally, the spatial mismatch among jobs, housing, and the economically active population generates wasteful commuting. For this reason, the job-housing match index is devised as an independent index of the proximity of jobs and housing based on the characteristics of commuting trips.

The new town self-sufficiency evaluation indexes for livelihood self-sufficiency make indirect assessments through shopping trips and non-working trips. Generally, a commercial sphere evolves with the increase in the population of the new town and the surrounding areas; it can be projected that the livelihood self-sufficiency of a new town is dependent on the degree of economic self-sufficiency attained, such as the employment in the new town.

The livelihood self-sufficiency index can be indirectly measured based on the trip data. According to the statistics data from the survey on household trips in the SMA (Seoul Metropolitan Area), the purpose of a trip can be classified into the four categories of work, school, shopping, and other. Inbound and outbound traffic for

each municipality is examined according to this category. The shopping self-sufficiency index checks whether shopping activities take place inside or outside of the zone through traffic data; the non-working trip index indicates whether activities other than commuting to work take place inside or outside the zone.

For an efficient and effective evaluation of the self-sufficiency of a new town, considering the economic self-sufficiency indexes based on the household or economically active population and employment, commuting trip traffic, and livelihood self-sufficiency as indexed based on non-working trips or shopping trips, I analyzed self-sufficiency by using the abovementioned five indexes. Using the actual data for each town in the Seoul Metropolitan area, the five indexes were computed and the correlation among them was analyzed through a correlation analysis.

The analysis results show that the relationship between jobs and housing, the job-housing balance and the employment balance display a very strong positive relationship. In addition, the job-housing match index, which shows the job-housing match manifested in the trip characteristics, has strongly positive relationships with

〈Table 3〉 Pearson correlation coefficients between self-sufficiency indexes

	Job-Housing Balance Index	Employment Balance Index	Job-Housing Match Index	Shopping Trip	Non-Working Trip
Job-Housing Balance Index	1				
Employment Balance Index	.992**	1			
Job-Housing Match Index	.079	.065	1		
Shopping Trip	.103	.098	.884**	1	
Non-Working Trip	-.038	-.043	.966**	.890**	1

** : p<0.01

the indexes for shopping trips and non-working trips in terms of the livelihood self-sufficiency.

Thus, given the statistical analysis results that all of the indexes for livelihood self-sufficiency are correlated with the economic self-sufficiency indexes, it can be concluded that we can just use the economic self-sufficiency as the self-sufficiency evaluation index. In other words, the job-housing balance index, with the numbers of jobs and the amount of housing, and the job-housing match index, evaluating the proximity of work and home, can be taken to represent all five of the indexes for the self-sufficiency evaluation. So, this study set two indexes, the job-housing balance index and the job-housing match index, as the evaluation indexes for the self-sufficiency of a new town.

IV. Time-Series Evaluation on the Self-Sufficiency of the New Towns

The two most representative new towns, Bundang and Ilsan, which were developed

relatively independently and are thus less affected by the surrounding areas, were selected as the subjects for the evaluation of the self-sufficiency of the first-stage new towns. Whereas other new towns were planned and developed in conjunction with the surrounding cities, these two cities are situated in remote areas away from other cities and thus allow for a more accurate evaluation of the self-sufficiency of the new towns themselves.

1. The Job-Housing Balance

The time series data of the changes spanning the period from 1996, when the new towns of Bundang and Ilsan were settled, to 2012 were collected.

The analysis results show that, although the self-sufficiency of the new towns was questioned at the beginning of their settlement in 1996 with the job-housing balance index at 41.49 for Bundang and 46.41 for Ilsan, the self-sufficiency rapidly improved as time passed. By 2012, the job-housing balance index had increased to 113.86 for Bundang and 81.09 for Ilsan, with an average annual rate of improvement at 3.7~ 6.7%. In analysis, this improvement

<Table 4> The time series change of the job-housing balance of Bundang

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Population	370,637	380,999	386,599	390,085	393,429	401,477	407,540	426,930	442,891
Household	114,829	120,345	121,530	123,933	124,763	129,105	134,369	145,941	156,761
Jobs	47,644	58,406	66,009	71,279	69,426	78,956	95,229	107,207	110,581
JHB	41.49	48.53	54.31	57.51	55.65	61.16	70.87	73.46	70.54
	2005	2006	2007	2008	2009	2010	2011	2012	
Population	451,519	440,433	434,115	428,858	460,688	481,027	488,328	490,735	
Household	163,608	162,147	159,040	157,171	168,352	175,359	176,957	177,498	
Jobs	128,097	140,531	149,437	152,091	156,387	171,091	186,380	202,095	
JHB	78.30	86.67	93.96	96.77	92.89	97.57	105.33	113.86	

〈Table 5〉 The time series change of the job-housing balance of Ilsan

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Population	355,532	378,550	393,333	409,474	428,150	440,092	459,618	484,366	500,216
Household	111,613	121,066	125,450	131,148	137,006	141,975	151,229	163,586	172,467
Jobs	51,803	55,678	57,653	72,177	84,841	93,527	100,531	111,998	115,667
JHB	46.41	45.99	45.96	55.03	61.93	65.88	66.48	68.46	67.07
	2005	2006	2007	2008	2009	2010	2011	2012	
Population	514,776	529,101	546,579	552,014	550,007	555,740	569,407	573,357	
Household	181,396	190,849	199,340	202,374	201,722	205,442	209,377	210,943	
Jobs	119,125	126,292	141,003	148,025	151,015	158,275	165,530	171,047	
JHB	65.67	66.17	70.73	73.14	74.86	77.04	79.06	81.09	

〈Table 6〉 Average annual increase in job-housing balance by category

	Population		Household		Jobs		Job-Housing Balance	
	Increase (Yearly)	Annual Increase	Increase (Yearly)	Annual Increase	Increase (Yearly)	Annual Increase	Increase (Yearly)	Annual Increase
Bundang	7,506	1.80%	3,917	2.81%	9,653	9.64%	4.52	6.70%
Ilsan	13,614	3.05%	6,208	4.09%	7,453	7.91%	2.17	3.69%

is primarily attributed to the rapid increase in the number of jobs (annual average 7.9~9.6%) resulting from the job supply, rather than an increase in the amount of household (annual average 2.8~4.1%) resulting from the housing supply.

2. The Job-Housing Match

The job-housing match index use SMA Household Traffic Survey data in this paper. Through comparing the trip pattern between 2002 and 2006, the changes of internal trip and seoul dependency of new town can be analyzed. The traffic patterns of Seongnam and Goyang, the administrative divisions where the two cities are located, were examined to match the spatial unit of analysis.

The Household Trip Surveys from 2002 and 2006 shows the changes in trip pattern.

These data show a somewhat lessened reliance on Seoul and an increased percentage of internal trips for Seongnam (Bundang), but there were no notable changes in the case of Goyang (Ilsan) because similar trip levels were maintained.

3. Chapter Conclusion

When the new towns of Bundang and Ilsan were first developed, the job-housing balance indexes were below 50, and a considerably high proportion, 40%, of commuting trips were to Seoul, the mother city. However, by 2012, the job-housing balance index reached at 114 for Bundang and 81 for Ilsan. The job-housing match indexes (internal trip ratio) were also similar to those of Seoul and the Seoul metropolitan area, at 48% for Bundang and 43% for Ilsan at 2006.

〈Table 7〉 The change of trip features of Bundang and Ilsan

Bundang	Total Trips		Commuting Trips		Shopping Trips	
	Bundang ⇒ Seoul	Bundang ⇒ Bundang	Bundang ⇒ Seoul	Bundang ⇒ Bundang	Bundang ⇒ Seoul	Bundang ⇒ Bundang
2002	342,129 (18.8%)	1,255,438 (69.0%)	144,539 (40.1%)	163,289 (45.3%)	10,455 (12.6%)	68,881 (82.9%)
2006	325,159 (17.3%)	1,269,361 (67.4%)	132,176 (34.5%)	184,011 (48.1%)	10,472 (13.7%)	61,055 (79.7%)
Ilsan	Total Trips		Commuting Trips		Shopping Trips	
	Ilsan ⇒ Seoul	Ilsan ⇒ Ilsan	Ilsan ⇒ Seoul	Ilsan ⇒ Ilsan	Ilsan ⇒ Seoul	Ilsan ⇒ Ilsan
2002	275,787 (20.1%)	988,363 (72.0%)	117,119 (43.4%)	121,037 (44.8%)	4,860 (10.3%)	41,615 (88.4%)
2006	344,539 (19.06%)	1,296,497 (71.74%)	142,064 (44.36%)	138,837 (43.35%)	9,294 (12.75%)	61,324 (84.14%)

During the beginning stages of residence, the first-stage new towns were the subject of criticism for their bedroom community characteristics: they were not self-sufficient but rather depended on the mother city.

However, as they reached the tenth year of their settlement, employment and consumption were being generated within the new towns and dependency on the mother city had decreased, greatly improving their self-sufficiency.

These results are in line with research of Chang and Lee⁸⁾ that self-sufficiency of seoul metropolitan area 5 new town had been improved in comparing 1996 and 2002 using trip data.

In conclusion, when evaluating the self-sufficiency of a new town, a time series analysis conducted over a long period of time can reveal whether the new town is becoming self-sufficient or remaining a bedroom community that is reliant on the mother city.

Thus, when evaluating the self-sufficiency of a new town, rather than a cross-sectional analysis, an examination of the dynamic changes in the time series that considers the relationship with the surrounding areas can be used to develop an understanding the characteristics of the city and to establish goals. The analysis results reveal that self-sufficiency is necessary during the initial stage of development for a new town as a strategy for early vitalization, and strategic considerations with respect to the spatial structure must be made for a new town to develop into a center of employment and livelihood.

V. Summary and Conclusion

Many elements ranging from the physical environmental to the socio-economic must be considered when building a new city. The new towns constructed in Korea prior

8) Chang, J. S., Lee, C. M., "A Study on the change of self-containment level of the five new towns in the seoul metropolitan area", The Journal of Korea Planners Association, 2006, vol.41 no.2, pp.43~56.

to the year 2000 focused on building residential spaces for people to live in, and thus they were not designed to grow into economically independent and unique cities. As a result, problems arose, such as the towns' degeneration into a bed-town or congested traffic to the mother city. Therefore, in the future, it is necessary to accurately assess and support the attainment of economic self-sufficiency in advance at the planning stage of the new towns. For this reason, and with the goal of overcoming the limitations in the spatial and temporal scope of the conventional self-sufficiency evaluation studies, this study selected lucid self-sufficiency evaluation indexes and suggested a new perspective for evaluating and reflecting on the cases of the first-stage new towns.

The indexes of self-sufficiency evaluation that were used in the previous studies were classified and applied to actual cases in the Seoul metropolitan area. This application was then verified by a statistical technique that established two indexes for the accurate evaluation of the self-sufficiency of the new towns. One index is the job-housing balance index that assesses the ratio between employment and household and the other is the job-housing match

index that assesses the ratio based on the total trip and the internal trip.

Using these two indexes, the self-sufficiency of the first-stage new towns of Korea constructed in the 1990s were evaluated. The previous studies limited their evaluations of the new town self-sufficiency to a single point in time. However, this study conducted a dynamic comparison analysis of the changes in the self-sufficiency of a city over the 15 years since the settlement of the new town. The results show that the job-housing balance indexes of Bundang and Ilsan were in the low and mid of 40s but increased significantly to 113.86 and 81.09, respectively, by 2012, after 16 years.

But, the latest job housing match indexes after 2006 were not analyzed in this paper because the data of 'SMA Household Traffic Survey' was not opened to the public after 2016. Although there is a limitation of trip pattern data, job housing match indexes of 2006 were increased and seoul dependency of new town was decreased compared to 2002.

In short, the self-sufficiency of the new towns can be comprehensively evaluated when viewed from a dynamic point of view.

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