

Local Vitality in Depopulating Regions : Where and Why It Thrives*

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Abstract

This study aimed to explore the factors contributing to local vitality in depopulating regions. A mixed-methods approach was employed, using Gyeongsangbuk-do as a case study. First, a time-series cluster analysis was conducted on active population data from 2019 to 2022 to address the question, "Where is vitality observed?" The empirical results classified 330 towns into four clusters: Decreasing, Stabilizing, Growing, and Oscillating. To address the subsequent question, "What drives local vitality?", interviews were conducted with 24 local public officials. The study identified four key factors that enhance local vitality. First, a scale effect was observed, as the agglomeration of housing, jobs, commercial and cultural facilities attracts both residents and visitors. Second, an influx effect was seen in areas where urban development and large-scale housing projects were implemented. These areas experienced a residential population increase exceeding 10 percent over four years, contributing to the enhancement of local vitality. Third, a job-centered effect was noted in areas with relatively small residential populations, where commuters working in industrial complexes or agricultural centers help invigorate the local economy. Fourth, an amenity effect was evident in small towns with populations of around 2,000, where distinctive natural, cultural, historical, and commercial amenities attract tourists. These findings demonstrate that expanding the resident population or increasing job opportunities remains an effective approach to fostering local vitality. However, the study also confirms that strategies aimed at attracting tourists and visitors can effectively enhance local vitality, particularly in areas with small or declining resident populations.

Keywords Depopulated Areas, Gyeongsangbuk-do, Mobile-based Active Population, Mixed Research Methodology, Time-series Cluster Analysis

1. Introduction

The demographic challenges in South Korea stem from the convergence of two significant trends: natural population decline and the concentration of population in the Seoul Metropolitan Area (Ha and Kim, 2021; Jang, 2023). In 2020, South Korea experienced its first population decrease,

as the number of deaths surpassed births. Simultaneously, the overconcentration of population in the capital region continues to intensify, with more than half of the total population residing there (Koo, 2021). Consequently, the urban-rural disparity has contributed to a growing number of depopulated regions in non-metropolitan areas, with designated "extinction-risk areas." The number of these areas increased from 85 in 2017 to 108 by 2021 at the borough

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level (si, gun, gu), and from 1,483 to 1,791 at the town level (eup, myeon, dong) over the same period (Ha and Kim, 2021).

In response, the national government implemented an initiative titled “A New Era of Livable Places Anywhere in South Korea” to address urban-rural disparities and foster local revitalization. Subsequently, in 2022, the government enacted the *Special Act for Supporting Depopulated Areas* to prevent the decline of non-metropolitan regional areas. This act broadens the concept of population beyond the de jure population (registered residents) to include the de facto population—individuals who temporarily stay in a region for purposes such as tourism, recreation, or other routine activities. This novel approach highlights the potential of visiting populations to contribute to local vitality, shifting the focus away from the zero-sum competition for registered residents (Lee, 2024).

Gyeongsangbuk-do is one of the regions with a remarkably high extinction risk. According to the Ministry of the Interior and Safety, Gyeongsangbuk-do covers the largest area¹⁾ designated as a depopulated region, spanning approximately 9,065 km² across 15 boroughs, followed by Jeollanam-do with approximately 8,470 km² across 16 boroughs. Previous studies have identified the causes of population decline in Gyeongsangbuk-do as the economic impact of the declining manufacturing sector and the inadequacy of educational and cultural infrastructure (Koo, 2021; Choi et al., 2021). However, these studies have focused primarily on the registered residents. This raises critical questions: Can regions experiencing a decline in residential populations still exhibit growth in visiting populations? What factors contribute to local vitality in such regions?

This study aims to identify areas within Gyeongsangbuk-do that have shown an increase in de facto population over four years (2019–2022). In this study, local vitality is defined as the town-level growth trend of the active population, measured using KT mobility data. Two research questions guide this study: Where are the vital areas with an increasing de facto population? and Why the de facto population has increased in these areas?

To answer these questions, this study employed an explanatory design²⁾ within a mixed-methods approach. This research design is particularly well-suited for revealing the underlying mechanisms or reasons behind a phenome-

non, as it applies quantitative and qualitative research methods in sequence (Choi et al., 2021; Lee and Yang, 2021). Accordingly, this study first conducted a time-series cluster analysis of 330 town-level administrative units (eup, myeon, dong)³⁾ to identify towns exhibiting growth patterns of the de facto population. Subsequently, interviews were conducted with local government officials in areas showing signs of local vitality to explore the factors contributing to this growing pattern.

The remainder of this study proceeds as follows: First, Chapter 2 reviews previous studies on the drivers of population growth. Chapter 3 presents the methodology of the time-series cluster analysis, describes the data, and reports the empirical results to identify areas exhibiting signs of vitality. Chapter 4 explores the underlying reasons through interviews with local public officials. Finally, Chapter 5 presents the conclusions and policy implications regarding local vitality in depopulating areas.

II. Literature Reviews

Increases in the active population are generally influenced by two main factors. One is the growth of the residential population, driven by urban development and job creation. The other is the influx of visitors attracted by the region's various amenities, such as natural landscapes, cultural facilities, and commercial infrastructure. To better understand the factors contributing to local vitality, this chapter reviews previous studies on the drivers of both residential and visiting population growth.

Several studies have emphasized the role of job opportunities in attracting people. Oh and Seo (2019), analyzing 85 cities nationwide, found that the growth rates of employment, the number of business establishments, and the working-age population significantly influence population increases. Their study underscored the importance of employment opportunities in facilitating population inflow. Similarly, Kim and Seo (2014) demonstrated that the number of business establishments was the most significant factor affecting population growth in both metropolitan and non-metropolitan areas. Yim (2019), focusing on small cities with populations under 200,000, found that the economic indicators, such as employment rates and per capita GRDP, were most strongly associated with popula-

tion increases. These findings suggest that economic opportunities, particularly those related to job creation, are pivotal in attracting residential populations.

Next, areas where public institutions were relocated or new towns were developed experienced significant growth in the residential population, as these developments enhanced overall living conditions (Oh and Seo, 2019; Kim and Yang, 2013). Kim and Yang (2013), through a comparative analysis based on city size, found that while the number of business establishments was the most influential factor in population inflow in large cities, housing and residential environment played a more critical role in medium-sized and non-urban regions. In particular, accessibility to educational facilities significantly influenced population inflow in medium-sized cities, whereas housing prices were more influential in non-urban areas. These findings indicate that housing and living conditions are key variables driving inter-regional population movements.

Improved transportation accessibility has consistently been cited as a key factor in promoting population inflow. For example, You et al. (2021), focusing on population-declining regions in non-metropolitan areas, demonstrated that the number of railway stations accessible within a 30-minute drive had a positive impact on attracting new residents. Shin et al. (2023) empirically examined the factors influencing the local extinction index and found that lower levels of transportation infrastructure—such as high-speed rail accessibility and road density—had a significant positive effect on the risk of regional decline. These results suggest that areas with enhanced transport connectivity are less likely to face depopulation.

Studies based on de facto population data indicate that amenities significantly contribute to attracting visitors by enhancing regional attractiveness. Choi (2017) found that cultural amenities, such as the number of cultural facilities and locally designated cultural assets, strengthen regional identity and encourage repeat visits beyond initial ones. In addition, Lee and Kang (2019) used the number of educational and art-related service businesses as proxy variables for amenities, finding that an increase in these establishments positively affected the active population. Cao et al. (2021) emphasized that in areas with numerous sports, entertainment, accommodation, and medical facilities, people engage in activities throughout various times of the

day. Lee et al. (2023) revealed that traditional markets and facilities for hobbies and recreation significantly contributed to an increase in the de facto population, highlighting the importance of both the diversity and abundance of amenities in driving visitor inflow.

In summary, local vitality is associated with job opportunities, decent and affordable housing, inter-regional transportation accessibility, and cultural and environmental amenities. These factors attract people and help strengthen the economic and social dynamism of a region. Building on the findings of previous studies, this study explores areas within depopulating regions that exhibit increasing trends in the de facto population and seeks to analyze the underlying causes.

III. Where Is Vitality Observed?

1. Methodology: Time-series Clustering

Time series clustering is an analytical method used to classify groups of time-series data with similar patterns that change over time (Aghabozorgi et al., 2015; Kang and Lee, 2019; Yang, 2023). This technique is useful when there is no prior information about the serial pattern, as it categorizes heterogeneous objects into several meaningful clusters based on similarity, while minimizing within-cluster variance (Kang and Lee, 2019; Kim and Kim, 2021). Recent studies have employed time-series clustering to classify regions based on their unique characteristics. For instance, Kang and Lee (2019) analyzed alleyway business sales to identify regions with growth patterns, while Rizqiana (2023) used this method to classify regions in Central Java Province, Indonesia, based on trends in the poverty index.

In time-series clustering, distance measurement methods are used to evaluate the similarity between objects. A commonly used method is Euclidean Distance, which calculates the distance by comparing the values of time-series graphs at corresponding time points. In contrast, Dynamic Time Warping (DTW) analyzes similarity by considering the values of neighboring time steps. This technique offers a more flexible approach by identifying an optimal alignment path that minimizes the cumulative distance between two time series. For this reason, it is particularly effective for comparing irregular or non-linear time-series

data (Kang and Lee, 2019; Kim and Kim, 2021; Yang, 2023).

Given two time series $X = (X_1, X_2, \dots, X_T)$ and $Y = (Y_1, Y_2, \dots, Y_T)$, the DTW distance is defined as:

$$d_{DTW}(X, Y) = \min_{r \in M} \left(\sum_{i=1}^m |X_{a_i} - Y_{b_i}| \right) \quad (1)$$

Here, $r = ((a_1, b_1), (a_2, b_2), \dots, (a_m, b_m))$ denotes a warping path that aligns elements from X and Y , and M refers to the set of all valid warping paths defined over the $T \times T$ distance matrix derived from the two time series. According to Berndt and Clifford (1994), who originally proposed the DTW algorithm (Kim and Kim, 2021), each warping path must satisfy the following constraints: monotonicity, where $a_i \leq a_{i+1}$ and $b_i \leq b_{i+1}$; continuity, where $a_{i+1} - a_i \leq 1$ and $b_{i+1} - b_i \leq 1$; and boundary, where $(a_1, b_1) = (1, 1)$ and $(a_m, b_m) = (T, T)$.

After measuring similarity, K-means clustering was employed for cluster analysis, following the approaches of Yang (2023) and Hwang et al. (2021). The reliability of the analysis results can be assessed by measuring within-cluster cohesion and between-cluster separation (Marutho et al., 2018; Hwang et al., 2021; Yang, 2023). First, the Sum of Squared Errors (SSE) represents the sum of squared distances between each data point and the centroid of its cluster. A lower SSE value indicates that the data points within clusters are more tightly grouped and that the distances between clusters are larger. Second, the silhouette score quantitatively assesses the degree of separation between clusters. This score ranges from -1 to 1, with values closer to 1 indicating clearer separation between clusters (Rousseeuw, 1987; Kim and Kim, 2021). By utilizing these two indices, an appropriate number of clusters can be determined in non-hierarchical clustering analysis such as K-means clustering.

2. Data Description

This study utilized the hourly active population data on a weekly basis at the town level (eup, myeon, dong) in Gyeongsangbuk-do. The dataset includes a total of 209 weeks, spanning from January 1, 2019, to December 31, 2022. The original dataset provides active population data for 24 hours

each day for each town. To perform time-series clustering analysis, the active population data were aggregated into weekly units, and the weekly average active population per hour was calculated across 330 towns. This data preprocessing step enables the identification of active population change patterns through time-series clustering.

〈Table 1〉 presents descriptive statistics on the weekly average active population per hour across towns from 2019 to 2022. The average active population for the entire period was 7,836, with a standard deviation of 8,836, indicating significant variability. The minimum value was 210, and the maximum value was 61,658, highlighting a wide distribution across towns and weeks. Yearly data indicate that the average active population was highest in 2019 at 7,955, followed by an overall declining trend. The standard deviation decreased in 2022 compared to 2019, suggesting reduced variability in the active population.

3. Empirical Results

To determine the optimal number of clusters, this study examined the Sum of Squared Errors (SSE) and silhouette scores, with a focus on ensuring that the resulting clusters were both interpretable and meaningful. According to 〈Figure 1〉, the SSE exhibited a gradual decline beginning with five clusters, which aligns with the commonly referenced “elbow point” criterion (Marutho et al., 2018). In addition, as shown in 〈Figure 2〉, the silhouette score was highest at 0.706 for three clusters and showed a decreasing trend as the number of clusters increased: 0.686 for four clusters, 0.684 for five clusters, and 0.622 for six clusters. Based on a comprehensive consideration of both indices, the number of clusters was set to four to maintain interpretability.

Table 1. Weekly average active population per hour

Year	N	Mean	Std, Dev.	Min	Max
2019~2022	68,970	7,836	8,836	210	61,658
2019	17,160	7,955	8,973	210	56,535
2020	17,490	7,828	8,799	328	61,658
2021	17,160	7,855	8,876	349	61,378
2022	17,160	7,706	8,691	462	60,373

Note: The data cover 209 weeks across 330 towns — 53 weeks in 2020, and 52 weeks in 2019, 2021, and 2022.

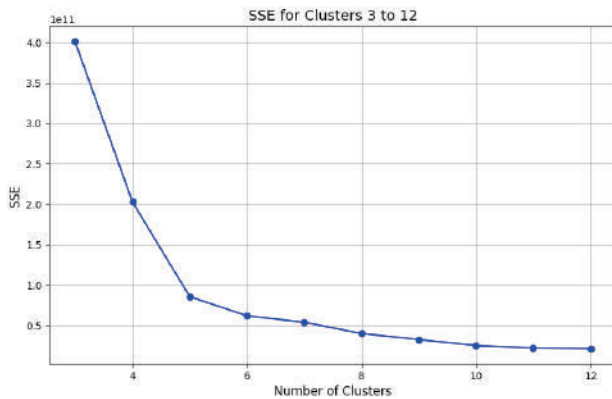


Figure 1. SSE results

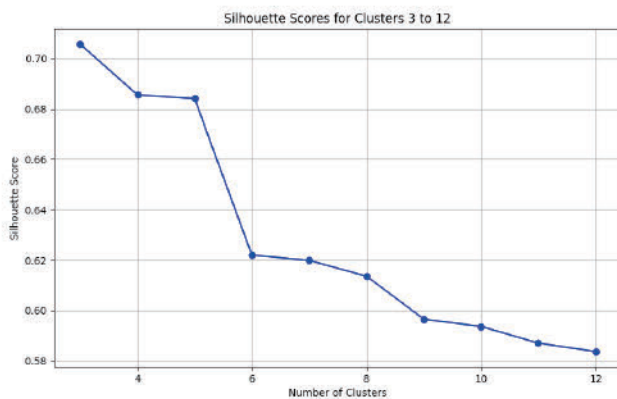


Figure 2. Silhouette score results

〈Figure 3〉 presents the results of the time-series clustering analysis with the number of clusters set to four. Cluster 1, named “Declining,” includes a total of 64 towns that exhibit a gradual decline in active population over the four years. Cluster 2, named “Stabilizing,” comprises a total of 138 towns characterized by low variability and a relatively stable trend in active population. Cluster 3, named “Growing,” contains a total of 46 towns, notable for a distinct upward trend in active population. Lastly, Cluster 4, named “Oscillating,” encompasses a total of 82 towns. While the overall pattern remains stable, these regions exhibit relatively large fluctuations in active population.

〈Figure 4〉 presents the spatial distribution of each cluster across Gyeongsangbuk-do, providing a visual representation of regional differences in active population trends. Among these, the increasing trend observed in Cluster 3 (“Growing”) is particularly noteworthy, as it suggests that the active population in these areas is growing due to certain factors. This cluster is primarily observed in the western and southern areas, including Sangju-si, Gimcheon-si, and Pohang-si, whereas it does not appear in the northeastern coastal

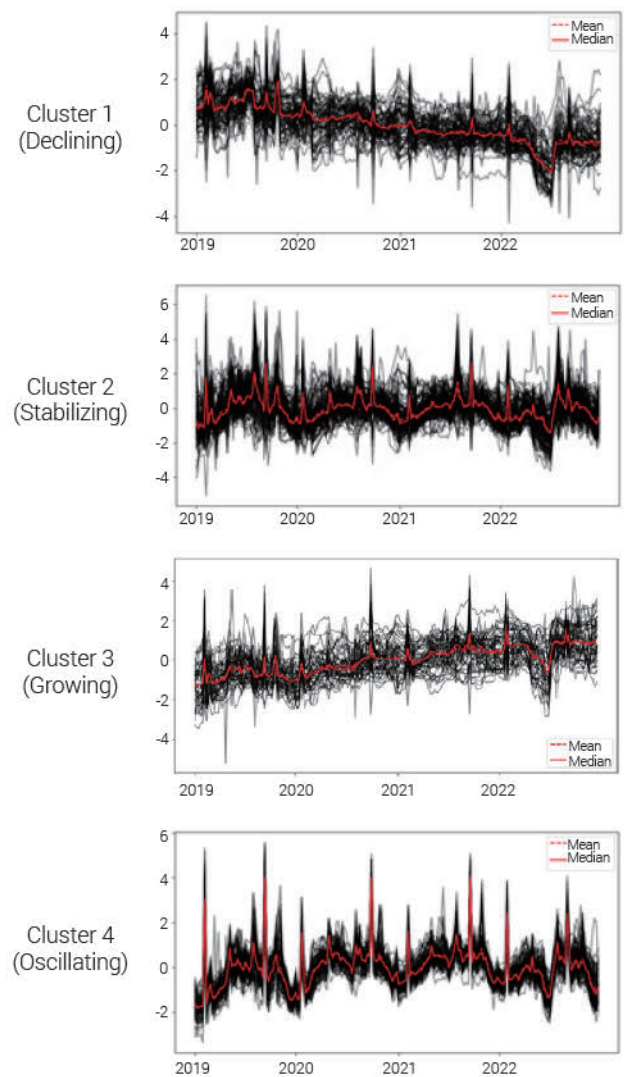


Figure 3. Results of time-series cluster analysis

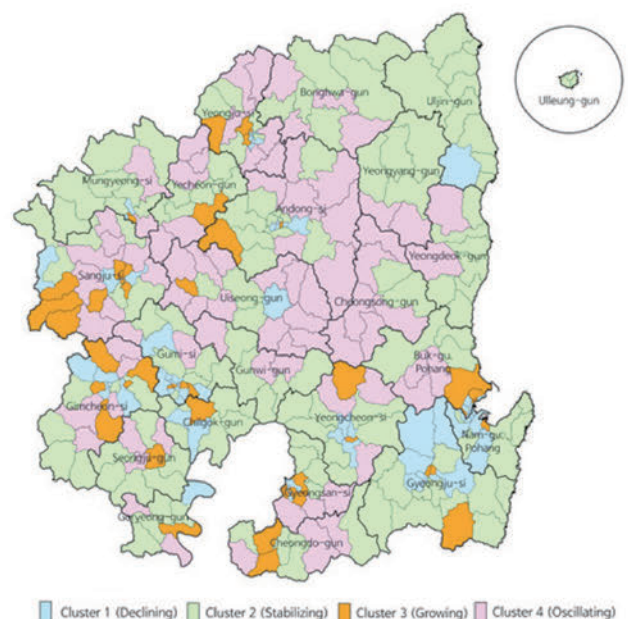


Figure 4. Spatial distributions of clusters

regions such as Yeongdeok-gun, Uljin-gun, and Yeongyang-gun.

〈Table 2〉 lists the 46 towns classified under the growing cluster and their population changes between 2019 and 2022. As of 2022, Jangryang-dong in Pohang-si recorded the highest population with 72,065 people, followed by Heunghae-eup in Pohang-si with 40,382 people and Dongbu-dong in Gyeongsan-si with 38,645 people. In terms of population growth rate, Apryang-eup showed the most significant increase of 235%. This dramatic growth is closely associated with its promotion from Apryang-myeon to eup status in January 2020, followed by the construction of a large-scale apartment complex. Songjeong-dong in Gumi-si also experienced a significant population increase of 43.25%, which resulted from administrative boundary adjustments. In July 2020, Gumi-si realigned its administrative boundaries to better reflect residents' actual living areas.

IV. What Drives Local Vitality?

1. Interview Overview

While the clustering analysis identified areas with an increasing trend in the active population over the past four years, the reasons behind this growth remain unclear. The explanatory design within a mixed-methods approach is particularly suited to uncovering how or why a particular phenomenon occurs (Choi et al., 2021; Lee and Yang, 2021). Building on this approach, this study seeks to investigate a range of factors contributing to the increasing trend in the active population by conducting purposive sampling-based interviews and applying inductive content analysis.

The study employed purposive sampling, a non-probability sampling method in which researchers select participants solely based on their relevance to the research objectives. This sampling method is widely recognized as an effective approach for achieving research goals (Yang et al., 2022). Interview participants were primarily selected as team leaders from urban planning or population policy departments within borough-level local governments. Additionally, deputy town leaders or general affairs team leaders were included at the town level. The interviews were conducted via telephone between November 18 and December 13, 2024. Boroughs and towns that declined to participate were

Table 2. Population changes in Cluster 3

Boroughs	Towns	2019	2022	Change (%)
<i>Si</i>				
Andong	Seogu-dong	9,457	8,647	-8.57
	Pungcheon-myeon	5,193	7,097	36.66
Gyeongsan	Seobu 1-dong	37,560	34,952	-6.94
	Seobu 2-dong	30,169	35,864	18.88
	Jungang-dong	6,752	6,269	-7.15
	Apnyang-eup	6,218	20,852	235.35
Gyeongju	Hwangseong-dong	29,665	27,940	-5.81
	Yonggang-dong	21,632	23,988	10.89
	Oedong-eup	18,649	22,179	18.93
Gumi	Songjeong-dong	16,406	23,502	43.25
	Jinmi-dong	16,343	16,857	3.15
	Hyeonggok 1-dong	15,385	13,721	-10.82
	Bisan-dong	13,058	12,946	-0.86
Gimcheon	Yulgok-dong	21,811	23,271	6.69
	Daegok-dong	20,528	19,987	-2.64
	Apo-eup	7,309	7,919	8.35
	Eomo-myeon	4,219	4,062	-3.72
	Joma-myeon	2,296	2,189	-4.66
Mungyeong	Jeomchon 1-dong	70,741	72,065	1.87
	Jeomchon 2-dong	4,929	4,630	-6.07
Pohang	Cheongnim-dong	4,929	4,630	-6.07
	Jangryang-dong	70,741	72,065	1.87
	Duho-dong	21,122	22,551	6.77
	Yanghak-dong	17,776	16,342	-8.07
	Heunghae-eup	40,222	40,382	0.40
Sangju	Bukmun-dong	9,698	9,345	-3.64
	Gyerim-dong	7,509	8,934	18.98
	Dongseong-dong	3,872	3,408	-11.98
	Modong-myeon	2,639	2,553	-3.26
	Hwadong-myeon	2,072	1,901	-8.25
	Moseo-myeon	1,815	1,682	-7.33
	Oenam-myeon	1,733	1,601	-7.62
Yeongju	Gaheung 1-dong	19,022	15,456	-18.75
	Gaheung 2-dong	8,073	10,186	26.17
	Yeongju 1-dong	4,227	3,770	-10.81
	Bonghyeon-myeon	2,871	2,624	-8.60
Yeongcheon	Wansan-dong	6,957	9,939	42.86
	Hwabuk-myeon	2,209	2,164	-2.04
<i>Gun</i>				
Cheongdo	Iseo-myeon	4,611	4,504	-2.32
	Gagnam-myeon	2,164	2,160	-0.18
Chilgok	Seokjeok-eup	31,820	31,327	-1.55
Goryeong	Gaejin-myeon	2,015	1,893	-6.05
Seongju	Seongju-eup	13,923	13,376	-3.93
Uiseong-gun	Danbuk-myeon	1,850	1,757	-5.03
Yecheon-gun	Homyeong-myeon	17,714	20,550	16.01

Source: https://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1B04005N&conn_path=I3

Table 3. Interviewees

Boroughs	Team (Towns)	Date
<i>Si</i>		
Andong	Urban planning	Nov. 29
	General affairs (Pungcheon-myeon)	Dec. 11
Gyeongsan	Urban planning	Nov. 18
	Population policy	Dec. 2
Gyeongju	General affairs (Seobu2-dong)	Dec. 11
	Civil affairs (Yonggang-dong)	Dec. 11
Gumi	Population policy	Dec. 2
	Civil affairs (Jinmi-dong)	Dec. 11
Gimcheon	Urban planning	Nov. 25
	General affairs (Yulgok-dong)	Dec. 13
	General affairs (Eomo-myeon)	Dec. 12
Mungyeong	Urban planning	Nov. 27
Pohang	General affairs (Heunghae-eup)	Dec. 12
Sangju	Urban planning	Dec. 2
	General affairs (Modong-myeon)	Dec. 11
	General affairs (Oenam-myeon)	Dec. 11
Yeongju	Urban planning	Nov. 27
	Office team (Yeongju1-dong)	Dec. 12
Yeongcheon	Urban planning	Nov. 25
<i>Gun</i>		
Cheongdo	Population policy	Nov. 29
Chilgok	Population policy statistics	Dec. 2
Goryeong	General affairs (Gaejin-myeon)	Dec. 11
Seongju	Population policy	Dec. 2
Uiseong	Planning team	Nov. 27

excluded from the analysis. Consequently, as shown in <Table 3>, interviews were completed with 24 representatives from 15 boroughs, which falls within the recommended sample size of 15 to 30 interviews typically suggested for inductive content analysis (Ahmed, 2025).

The interviews were conducted in an open-ended manner using a semi-structured questionnaire. The following questions were asked:

- What do you think are the reasons for the increase in the active population in the area during the 2019–2022 period?
- Were there any major developments, such as large-scale housing projects or industrial complexes?
- Are there any distinctive amenities in the area (e.g., national parks, cultural resources)?

- What is your assessment of the transportation accessibility of the area, particularly its connections to other regions via high-speed rail, expressways, or intercity buses?

2. Findings from Interviews

Inductive content analysis was applied to extract meanings directly from diverse interview responses. Based on the researcher's expertise and insights, the study took into account the population size and growth rate of each area. Regarding the question of what drives local vitality, the interview findings were classified into four categories: scale effects, influx effects, job-centered effects, and amenity effects.

1) Scale Effects

There is no doubt that the scale of cities brings positive externalities. These include the provision of decent housing, increased job opportunities, and access to a diverse range of commercial and cultural facilities. Such scale effects have been observed in certain depopulating areas. Three towns with a resident population exceeding 20,000 in 2022 were selected as case examples. Heunghae-eup in Buk-gu, Pohang-si recorded a population of 40,382; Seokjeok-eup in Chilgok-gun had a population of 31,327; and Yulgok-dong in Gimcheon-si recorded a population of 23,271.

Heunghae-eup in Pohang-si derives its name from the phrase "Always thriving with the sea" (Heunghae-eup homepage, 2025). KTX Pohang station is located in Heunghae-eup. Under the initiative of transit-oriented development, a new town development near the KTX station was undertaken, resulting in the construction of approximately 8,000 housing units in Chogok New Town (Shin, 2022). Additionally, the Blue Valley National Industrial Complex and the Yeongilman General Industrial Complex are located in the area. With the designation of a specialized cluster for cathode materials in the secondary battery industry, the area saw an influx of industrial workers (Kwon, 2023). Furthermore, Handong Global University, which has over 4,000 enrolled students, is located in the area along with Sunrin College and Pohang College, making it a hub for youth activity. Consider the following comments made by a public official:

“There was some population inflow with EcoPro and the Yeongilman Industrial Complex moving in. Additionally, as the apartments in Chogok New Town were completed, this led to a noticeable population increase.”

Seokjeok-eup in Chilgok-gun is adjacent to Gongdan-dong and Jinmi-dong in Gumi-si, where the Gumi National Industrial Complex is located. Since the 1990s, Chilgok-gun has undergone high-density residential development, establishing itself as an industrial hinterland for Gumi and Daegu (Maeil Newspaper, 1998). In addition, Chilgok-gun has positioned itself as a “Patriotic Peace City,” Seokjeok-eup is home to major historical and cultural landmarks, including the Patriotic Peace Memorial Hall and the Hyangsa Art Center. These facilities are connected to various cultural festivals, contributing to the attraction of tourists (Chilgok-gun homepage, 2025). The following comment was made by a public official:

“There are many apartment complexes, and Gumi-si is nearby. I understand that quite a lot of people commute to the Gumi Industrial Complex, as it is located close by. Also, in Seokjeok, there is the Patriotic Peace Memorial Hall, the Honeybee Theme Park located on the same site, and the Hyangsa Art Center, all situated together. Many tourists visit that area.”

Yulgok-dong in Gimcheon-si is the site of Gimcheon Innovation City, established through the relocation of public enterprises. Designed to accommodate a population of 26,000, the Innovation City was completed in March 2016. Twelve government institutions, including the Korea Electric Power Corporation Engineering and Construction (KEPCO E&C) and the Korea Expressway Corporation, have relocated to the area. Currently, the Korea Authority of Land & Infrastructure Safety (KALIS) is under construction. Among the 4,729 employees in public institutions, 4,090 (82.8%) are Gimcheon residents (Park, 2024). Furthermore, Yulgok-dong is adjacent to KTX Gimcheon Station and close to Gimcheon IC, offering convenient transportation accessibility. It is also recognized as a family-friendly city, with schools, supermarkets, hospitals, and parks within walking distance. The following remarks by a public official support this observation:

“Yulgok serves as the site of Innovation City, where public institutions have been relocating since 2015. The area attracts many visitors, with a total of 13 public institution headquarters. As expected, the presence of these headquarters brings in a sizable number of visitors.

Major public institutions, such as the Korea Expressway Corporation and KEPCO E&C, contribute to the high traffic of active population in the area.”

2) Influx Effects

Between 2019 and 2022, some areas experienced more than a 10% increase in resident population due to new town developments or large-scale housing projects. While these areas vary in population size, they have experienced a significant influx of residents driven by housing development. For example, Pungcheon-myeon in Andong-si recorded a substantial increase of 36.66% compared to 2019, reaching a population of 7,097 in 2022. Seobu 2-dong in Gyeongsan-si marked an 18.88% rise from 2019, with a population of 35,864 in 2022. Meanwhile, Yonggang-dong in Gyeongju-si showed a growth rate of 10.89% compared to 2019, resulting in a population of 23,988 in 2022. These three towns exemplify areas where a significant influx of residents has boosted local vitality.

Pungcheon-myeon in Andong-si is the newly designated site of the Gyeongsangbuk-do Provincial Government. The Gyeongbuk-do-chung New Town project aims to establish a self-sufficient city with a population of 100,000 by 2027, and the second phase of the project is currently underway (Son, 2023). In addition, Pungcheon-myeon is home to UNESCO World Heritage Sites such as Hahoe Village and Byeongsan Seowon, which attract many visitors. According to the Gyeongsangbuk-do Tourism Knowledge Information System, Pungcheon-myeon recorded an annual average of approximately 1.16 million domestic and international visitors between 2019 and 2022. The following comment was made by a public official:

“Pungcheon-myeon is where the new town is located. With the relocation of the Gyeongsangbuk-do Provincial Government, related institutions have also moved in, and there is an overall development plan consisting of three phases. Phase 1 has been completed, and Phase 2 is currently in its final stages. As a result, this area is expected to experience an increase in the active population, including residents.”

Seobu 2-dong in Gyeongsan-si has been the site of a large-scale urban planning project. Jung-san District 1 (known as Penta Hills) covers approximately 805,759m². The district features the large reservoir Jung-sanji, surrounded by neighborhood parks, creating an environment that harmonizes nature with urban living (Kim, 2023). Since 2005, approxi-

mately 6,980 housing units have been constructed, including 753 units completed in May 2019 and 657 units in May 2021. The area also boasts excellent transportation accessibility, being close to Sawol and Jeongpyeong Stations on Daegu Metro Line 2, as well as New Daegu-Busan Expressway and the Gyeongbu Railway (Kim, 2023). Consider the following comments made by a public official:

“Seobu 2-dong has many new apartments, resulting in a relatively large population. Significant residential construction in Jung-san District has contributed to this growth. Daegu Metro Line 2 passes by Seobu 2-dong, further enhancing accessibility.”

Yonggang-dong is located in the northern part of Gyeongju-si, where development restrictions are relatively limited. Gyeongju-si has long been subject to height restrictions, leading to active new apartment construction in the northern areas, while the southern areas have remained concentrated with aging housing (Choi, 2020). A large apartment complex with 1,204 units began occupancy in November 2020. This area is adjacent to Gyeongju City Hall, Gyeongju Civic Stadium, the Arts Center, and the Yonggang Industrial Complex, offering access not only to office facilities but also to various cultural and commercial amenities. The following statements from a public official corroborate these findings:

“As new apartments were built, the number of residents grew, leading to an increase in the active population as well. In the Yonghwang District, apartments have been continuously developed. Along with these developments, many commercial facilities have also been established. As more apartment residents moved in, the area naturally attracted many business owners and merchants.”

3) Job-centered Effects

Despite their relatively small population sizes, some areas have developed as industrial complexes or agricultural centers, serving as important employment hubs. Notable examples include Modong-myeon in Sangju-si, which had a population of 2,553 in 2022, reflecting a 3.26% decrease compared to 2019. Eomo-myeon in Gimcheon-si recorded a population of 4,062 in 2022, a decline of 3.72% from 2019, while Seongju-eup in Seongju-gun had a population of 13,376 in 2022, marking a 3.93% decrease over the same period. These areas illustrate that even amid declining residential populations, employment-driven inflows can lead to an increase in the active population.

Modong-myeon in Sangju-si is a major grape-producing area and has gained attention as a destination for those returning to farming or rural living (Pi, 2021). Located at an altitude of over 250 meters, Modong-myeon benefits from abundant sunlight and significant temperature variations between day and night, providing an optimal environment for grape cultivation (Kim, 2022). In recent years, Shine Muscat has shown remarkable growth in both domestic consumption and global markets, contributing to increased farm income (Kim, 2022). These observations are supported by the following comments from a public official:

“This area is well known as a major grape-producing region. The rise in people returning to farming might be one reason, but we also see many people coming from outside to work in grape-related jobs.”

Gimcheon General Industrial Complex 1, located in Eomo-myeon, Gimcheon-si, serves as a key hub for local industry. The industrial complex has completed its third phase of development and is currently preparing for its fourth phase of expansion. Conveniently situated near four highway interchanges and the KTX Gimcheon station, the area offers excellent accessibility. Travel times include one hour and twenty minutes to Seoul, one hour to Busan, and one hour to Daegu International Airport (Choi, 2021). These observations are reflected in the following remarks by a public official:

“In Eomo, industrial complexes are concentrated in this area. The fourth phase of the Gimcheon General Industrial Complex development project reflects this ongoing expansion.”

According to the Seongju-gun Cyber Business Support Center, the Seongju Agricultural Industrial Complex and the Seongju General Industrial Complex are located in Seongju-eup, Seongju-gun. These complexes host a variety of manufacturing industries, including textiles and fabrics, metals and machinery, as well as plastics and chemical products. Additionally, the local government organizes various events aimed at children and families. For example, every summer, the Seongju Summer Water Vacation takes place at the Seongju Byeol-go-eul Sports Park in Seongju-eup. Such events have helped establish Seongju-eup as an attractive travel destination for families (Choi, 2023). The following remarks from a public official reflect these observations:

“Our active population actually surpasses our residential population. This is largely due to the area’s proximity to Daegu. The presence of the two industrial complexes attracts many commuters from Daegu.”

Local festivals, such as the Seoungju Chamoe & Life Culture Festival in May, also help attract people.”

4) Amenity Effects

Interestingly, some areas with a population of around 2,000 have shown an increase in active population by utilizing their unique local amenities. These areas possess historical, cultural, and commercial resources capable of creating a strong sense of place. For instance, Oenam-myeon in Sangju-si recorded a population of 1,601 in 2022, marking a 7.62% decline compared to 2019. Similarly, Gagnam-myeon in Cheongdo-gun had a population of 2,160 in 2022, with a minimal decrease of 0.18% from 2019. Hwabuk-myeon in Yeongcheon-si reported a population of 2,164 in 2022, reflecting a 2.04% decline from 2019. These areas suggest that the active population can increase through the utilization of distinctive local amenities, despite a decline in the resident population.

Sangju-si is Korea's largest producer of dried persimmons, recording the highest production volume nationwide. Oenam-myeon, one of the main production areas, was designated as a Dried Persimmon Special Zone in September 2005. The Dried Persimmon Park features Korea's oldest 750-year-old persimmon tree and offers activities such as persimmon picking and peeling, attracting kindergarten groups and family tourists (Hwang, 2020). Since 2011, the annual Dried Persimmon Festival has been held, with the 2019 festival drawing approximately 138,000 visitors and generating 1.06 billion KRW in local agricultural product sales, contributing to the local economy (Im, 2019). The comment below comes from a public official:

“This area was designated as a Dried Persimmon Special Zone. There is also the Dried Persimmon Park in Soeun-ri, Oenam-myeon, where you can find Korea's oldest persimmon tree. It still bears fruit and attracts students on educational tours. In addition, there is a nearby cherry farm offering hands-on experiences for kindergarteners and young children. The Oenam Chinese restaurant, which is often featured in the media, has also been drawing visitors from other regions.”

Cheongdo-gun has become known as a ‘cafe city,’ popular among residents of nearby urban areas, including Daegu. The term ‘rice-field view’ originated from Cheongdo's cafe culture, which is characterized by diverse spaces ranging from cozy book cafes to large establishments offering panoramic views of farmland and nature (Oh, 2024). Its

proximity to major cities—particularly being just 20 minutes from Suseong-gu in Daegu—has contributed to its reputation as a favored tourist destination (Park, 2020). The following remarks from a public official reflect this perspective:

“There are a lot of cafes in this area, from what we've observed. It's located right next to Gachang-myeon, making it geographically very close to Daegu. You can get here in about 20 to 30 minutes by car, and there are many cafes and galleries as well.”

Yeongcheon-si is promoting tourism under the identity of the “Capital of Stars” by leveraging its astronomical and natural resources. Bohyeon Mountain in Hwabuk-myeon, known as one of the best stargazing locations in Korea, features Bohyeonsan Observatory, the largest in Asia, at an altitude of 1,124 meters (Yeongcheon-si homepage, 2025). Jeonggak-ri Star Village, located south of Bohyeon Mountain, offers both day-trip and overnight stargazing programs utilizing nearby facilities (Lee, 2009). The western area includes Bohyeonsan Dam, its suspension bridge, and additional facilities such as an observatory, zipline, and forest recreation area, establishing it as a destination for long-stay tourism. These observations are supported by the following comments from a public official:

“Hwabuk-myeon has several tourism resources. It is home to the Bohyeonsan Observatory, Bohyeonsan Dam, and the suspension bridge. There's also the Gohyeon Stream, which serves as an occasional attraction for visitors.”

V. Conclusions

This study explored areas exhibiting an increasing trend in the active population, referred to as local vitality, and identified the underlying causes contributing to it. A time-series cluster analysis was conducted on 330 towns in Gyeongsangbuk-do from 2019 to 2022, categorizing them into four clusters: Decreasing—towns with a continuous decline; Stabilizing—towns maintaining a consistent trend with low variability; Growing—towns showing an upward trend; and Oscillating—towns with a stable trend but high fluctuations. The focus of this study, the Growing cluster, comprised 46 towns and exhibited the following characteristics.

First, the scale effect was evident even in depopulating areas. The scale effect refers to positive externalities that arise in regions with a significant population size, driven by the

concentration of housing, jobs, commercial and cultural facilities. A representative example is the innovative city of Yulgok-dong in Gimcheon-si, where the relocation of public institutions, combined with a well-developed residential environment and transportation infrastructure, has attracted not only residents and workers but also visitors. These cases highlight that large-scale population agglomeration can positively impact local vitality.

Second, the influx effect was identified. This trend was observed in areas where the resident population increased by more than 10% after 2019, driven by new housing developments. For instance, Seobu 2-dong in Gyeongsan-si experienced significant population inflow due to the construction of large-scale residential complexes such as Penta Hills. Similarly, Yonggang-dong in Gyeongju-si showed an influx of new residents as a result of apartment developments in the relatively less-regulated northern areas. These examples illustrate how urban development projects and government-led housing supply initiatives can attract new residents, thereby enhancing local vitality.

Third, the job-centered effect was identified. These areas, while not characterized by large resident populations, provide significant employment opportunities through manufacturing-based industrial complexes or agricultural centers, resulting in a high volume of commuting from surrounding regions. A notable example is Modong-myeon in Sangju-si, a major grape production area, which has experienced an increase in agricultural workers and visitors with the expansion of domestic and international markets. These cases highlight the critical role of job creation in attracting workers and supporting the local economy.

Most intriguing is the fourth effect: the amenity effect. This was observed in exceedingly small villages with a resident population of around 2,000, which have successfully attracted tourists and visitors by leveraging their unique local amenities. For instance, Oenam-myeon in Sangju-si utilizes its agricultural specialty, dried persimmons, to offer experiential activities that draw tourists. Gaknam-myeon in Cheongdo-gun attracts visitors through its unique cafe culture, characterized by its "rice-field view" and abundant natural scenery. Meanwhile, Hwabuk-myeon in Yeongcheon-si has leveraged its geographical features and observatory facilities to focus on starlight as a tourism resource. These cases demonstrate that historical, cultural, and

commercial amenities can be utilized to enhance local vitality, even in depopulating areas.

This study is meaningful as it identifies numerous factors that enhance local vitality in depopulating regions through a mixed-methods research approach. Expanding the resident population or job opportunities remains an effective approach to fostering local vitality. However, the study also confirms that strategies to increase visitor numbers can effectively enhance local vitality, even without bringing in new residents. In particular, it is essential to leverage unique historical, cultural, and commercial amenities that cannot be experienced elsewhere. Such efforts to boost local vitality can be more effective when combined with improvements in transportation accessibility. These findings suggest that more proactive planning to attract visitors is necessary to address the crisis of depopulating areas, particularly in regions with small or declining resident populations.

This study focused on Gyeongsangbuk-do as the case region; however, the study period from 2019 to 2022 overlapped with the COVID-19 pandemic. Although the study was conducted under the assumption that all regions were equally affected by this social disruption, further research is needed in contexts unaffected by the pandemic. Also, while this study explored several factors influencing the increase in the active population through interviews with public officials, it did not quantitatively identify these factors. Future follow-up studies on local vitality are expected to employ a variety of quantitative and qualitative research methodologies, which will provide a deeper understanding of how to enhance local vitality.

Note 1. Depopulating areas were identified using data from the Ministry of the Interior and Safety (MOIS, 2024), and borough-level area sizes were calculated based on the Land Use Status by Land Category and Administrative Division dataset from KOSIS (2024).

Note 2. A mixed research methodology can be classified into two design approaches depending on the research objective. An explanatory design focuses on clarifying how or why a particular phenomenon occurs. It begins with quantitative analysis, followed by qualitative analysis. On the other hand, an exploratory design emphasizes discovering insights where existing knowledge on a specific subject is limited. It starts with qualitative analysis, which is subsequently complemented by quantitative analysis (Steinmetz-Wood et al., 2019).

Note 3. During the study period from 2019 to 2022, any renamed or merged towns were adjusted to reflect the administrative boundaries as of 2022.

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