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# A strategic approach to policy tasks for the development of Korea's island areas

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**Abstract**   This study discussed the creation of a strategic approach to the policy tasks associated with the development of Korean island areas based on DEMATEL. To this end, after having derived the problematic elements hindering the development of Korean island areas, an attempt was made to structuralize residents' perceptions via the implementation of a DEMATEL survey with the leaders of island areas. The problematic elements hindering the development of Korean island areas were identified as serious aging society, shortage of resident welfare facilities, fragmented industrial structure, limited labor forces, decreasing income sources, underdeveloped public transportation to the mainland, underdeveloped public transportation within islands, shortage of educational services, low sense of solidarity in villages, shortage of accommodation and leisure facilities, poor residential environments, and the serious debts accumulated by fishing households. The residents of island areas perceived underdeveloped public transportation to the mainland as the most fundamental and central element hindering the development of island areas. Impacting the regional economy and overall resident welfare, these problematic elements can be regarded as exhibiting the structural characteristics of underdeveloped areas. As such, the prerequisite for endogenous development of island areas is the improvement of the underdeveloped nature of accessibility to the mainland.

## Introduction

A prolonged period of historical inertia has resulted in Koreans' perceptions of spaces revolving around land-centered lifestyles and thought. On the other hand, Koreans' perceptions of islands and oceans remain passive at best. More to the point, the policies regarding uninhabited islands and the prohibition of fishing in place during the early Joseon period had the effect of creating an incorrect cognizance of the values of islands and oceans. Even after liberation in 1945, island areas continued to be perceived as being on the outskirts of development and even as problematic areas under mainland, and in particular, metropolitan and hub city-centered territorial development policies (Shin and Park, 2014). However, increased interest at the international level in ocean sovereignty and marine resources has resulted in islands becoming the subject of policy management measures associated with issues such as territorial integrity, securing of marine

resources, balanced national development, and the development of various regional cultures.

By the end of 2010, there were a total of 3339 islands in Korea, a total that can be broken down into 463 inhabited islands and 2876 uninhabited islands (Ministry of Public Administration and Security, 2011). Independent and comprehensive island development measures began in earnest with the implementation of the 'Island Development Plan' that followed the Island Development Promotion Act of 1986. The Island Development Plan has been implemented in full since 1988, with two stages having been carried over the last 20 years. The third stage of the plan (2008–2017) is now being implemented. The ultimate goal of this plan is to build up the residential environment in which the residents of island areas can maintain their lifestyle through the advent of improvements to residential conditions.

The establishment of appropriate development policy and the effective implementation thereof constitute a necessary precondition to the development of island areas. The establishment of appropriate development policy should be based on a precise analysis of the current state of local areas, and the rational opinions of local residents. Although the focus of regional development has been physical elements, the ultimate goal remains the continuous development of local communities (Shin and Park, 2014). As such, much attention should be paid to the analysis of local residents' perception of development, and the values engrained therein. However, there have been few studies that have dealt with the awareness structure of the residents on islands in Korea. Recent studies on the topic have generally consisted of specific regional cases (Shin and Park, 2014; Kang and Doh, 2011; Kim et al., 2005, 2013; Kang, 2005).

In addition, differences in opinions have emerged in conjunction with existing studies on the development of island areas during the analysis of problems associated with regional development measures. This has been in large part due to the general subjectivity exhibited during the establishment of hierarchies and the ignoring of the need to conduct reviews of the relationship between problematic elements, a denouement which can in turn be attributed to the subjective standards set by researchers. Furthermore, the subjectivity in deriving and defining the problematic elements has influenced the composition and assessment of alternatives, leading to differences in opinions between the researchers regarding the alternatives and eventually lowering the effectiveness and implementation of such alternatives.

It is against this backdrop that the answers to the following questions are sought: First, what are the characteristics of the conditions surrounding the development of Korean island areas? Second, what are the elements hindering the development of island areas? Third, what are the relationships and hierarchal structure between these elements? Fourth, what direction should island development policy head in? To resolve these research questions and analyze the perception structure of residents, a DEMATEL (DEcision MAking Trial and Evaluation Laboratory) analysis was carried out based on residents of underdeveloped island areas. Based on the results of this survey, a strategic approach to policy tasks for the development of island areas will be presented.

## Material and methods

### Development of island areas

Islands are generally narrow geographical spaces when viewed from the standpoint of human residence. This is because areas where residence can be taken up tend to be limited. These areas also have limited spatial contact with outside areas because they are surrounded by water (Shin, 1993). What are the characteristics of the development conditions surrounding Korean island areas? First, island areas exhibit characteristics such as limited available space and small-scale populations, which causes problems in terms of economies of scale and facility layout. The average population of inhabited islands in Korea in 2010 was 168 people, and the average area of such islands was 3.67 km$^2$. Second, island areas have faced the dual challenge of population decrease and an aging society. The worsening of the industrial base and living environment and the steady flow of people to urban areas has meant that the overall settlement rate has remained low. There has in particular been a lack of innovative young leaders capable of reviving villages suffering from an aging population. Third, island areas have been plagued by weak industrial bases. Island areas have mainly featured primary industries rooted in small-scale managerial structures. The problems associated with the distribution process and seasonal instability has placed limits on the creation of income. Fourth, island areas also face issues related to accessibility due to the uncertainty surrounding marine transportation. Obstacles to accessing the mainland include deteriorating weather conditions, the limited availability of transportation occasioned by issues relating to economic feasibility, and the excessive time required to reach such areas using low-speed transportation. Fifth, island areas are negatively impacted by poor living environments. Inherent limitations in terms of factors such as economies of scale, the critical threshold of facilities, accessibility, as well as shortages of drinking water and energy (electricity and gas) have translated into a weak living base as far as distribution, education, culture, medical and healthcare services are concerned.

What efforts have the Korean government made to resolve these problems? The government has in fact implemented various island-related projects, starting with the Comprehensive Island Development Project (Kim, 2013). However, despite these efforts, the phenomenon of population decrease has continued unabated. Rather than focusing on problems associated with a socioeconomic paradigm represented by urbanization and industrialization, the current study focuses on this phenomenon of population decrease and the government's lack of a strategic approach at the policy level. In addition, special attention was also paid to the results of policy alternatives based on a temporary band aid approach under which priorities are not assigned to the various policy tasks.

### Derivation of problem elements in the development of island areas

What are the problematic elements hindering the development of island areas in Korea? To answer this question, problem elements suggested by existing studies were gathered in see Table 1. More specifically, the initial problematic elements

**Table 1** Derivation of problem elements in the development of island areas.

| Problems | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Serious aging society | ● | | | ● | | | | | | ● | | ● | ● | ● |
| Shortage of residential welfare facilities | | ● | ● | ● | ● | | | | ● | | | | | |
| Fragmented industrial structure | ● | | | ● | | | ● | | | ● | ● | | ● | |
| Limited labor force | ● | | | | | | | | | | ● | | ● | |
| Decreasing income sources | | | | | | | | | | ● | ● | ● | | |
| Underdeveloped public transportation to the mainland | ● | ● | | ● | ● | ● | ● | ● | | ● | | | | ● |
| Underdeveloped public transportation in island | | ● | | | | ● | ● | ● | | | | | | |
| Expensive boat fare | ● | ● | | | | | | | | ● | | | | |
| Shortage of education services | ● | | ● | ● | ● | | | | ● | ● | | | | |
| Low solidarity within the community | | | ● | | ● | | | | | | | | | |
| Alienated area of the budget allocation | | | | ● | | | | ● | | | | | | |
| Lack of accommodation and leisure facilities | ● | | | | | | | | | | | ● | | ● |
| Poor residential environment | ● | ● | | ● | | | | | ● | ● | ● | | | |
| Serious debt among fishery households | ● | | | | | | | | | | | ● | | |

Number of existing studies

1. Shin, S.-H., Park, S.-H., 2014, A study of the change in consciousness among island residents in Korea related to policy: Using the Survey of Resident consciousness in 1995 and 2011, ISLAND CULTURES. 44.

2. Sim, S.-H, 2013, The Changes of Islands Regions Driven by Island Policies in Korea Since Modern Times, The Journal of Korean Cultural and Historical Geographers, 25(1).

3. Oh, S.-H., 2009, A Study Determinants on the Sense of Community in Island Area, Journal of Community Welfare Vol 28.

4. Lee, K.-Y., Kim, Y.-S., 2008, A Study on the Direction of Development on Islands Region: Centered on the Case of Eocheongdo, The Journal of Korean Island, 20(2).

5. Kim, J., 2012, The reflection on the Islands Development Policies and Alternatives for Sustainable Islands Making, ISLAND CULTURES. 40.

6. Kim, N.-O., Lee, D.-S., Rim, D.-O, 2005, A Direction on the Development of Marine Tourism for the Development of Chonnam's Island, The Journal of Korean Island 17(1).

7. Park, J.-S, 2002, The Policy Strategy and States for Islands Development of Jeonnam Province, The Journal of Korean Island, 14(1).

8. Yon, S.-H., 2000, The Development planning on the island: in case of Deok Jeok island, Journal of the Korean Regional Development Association 12(2).

9. Kim, J.-M., 2005, The Study on the Modeling Development of Dwelling House of Islands in the Future Based on the Insularity and the Factor of Traditional Culture, Journal of The Korean Housing Association 16(5).

10. Shin, S.-H., 1995, Development Strategies for Depressed Island area", Urban Information Service, 14(7).

11. Uhm, G.-C., 1997, "Strategy and Direction of Development on Islands Region, National Territory 184.

12. Son, H.-S, 2007, A Study of Survey on the Farm Liabilities in Jeonnam Region, Journal of Korean Regional Development, 6(2).

13. Go, D.-K., 2008, A Study on Possibilities of the Eco-Tourism Development by using of the Salterns: The Case of Shinan gun, Business Education Research 21.

14. Kim, H.-S., 2006, A Study on the Activation of the Marine Tourism in Shin an gun, Korea, The Tourism Sciences Society of Korea Conference.

were derived by first extracting the problematic elements found in the existing literature. Fourteen elements were derived following a summary of problematic elements that while having different names denoted the same problem. Second, in order to minimize and verify the derived elements interviews (July 12–20, 2015) were implemented with two government officials in charge of island area development and two professors who had studied island policy for over 20 years. In the end, twelve problematic elements (serious aging society, shortage of residential welfare facilities, fragmented industrial structure, limited labor force, decreasing income sources, underdeveloped public transportation to the mainland, underdeveloped public transportation in island, shortage of education services, low solidarity within the community, lack of accommodation and leisure facilities, poor residential environment, and serious debt among fishery households) were retained.

### Research design

DEMATEL is a system analysis method used to clearly reveal the general structure of complex problems boasting many components and relationships. It was developed by the Battelle Memorial Institute in Switzerland (1971) as part of efforts search for a solution to difficult and complicated problems which all countries in the world face (Gabus and Fontela, 1973; Park et al., 2011). Based on the use of the experiences and intuitions of people closely related to the problems, this analysis method can be used to explain and quantify the structure of complex problems, and in particular the casual structure, in a graphic manner. The basic contents of this analytical method are similar to those found in the input–output model used to heighten the performance of alternative by integrating and adjusting the opinions of those involved with the problems.

A data matrix for the DEMATEL was prepared to analyze the relationship between the various problematic elements associated with the development of island areas. While the parent population was identified as the residents of island areas nationwide, fifteen less developed islands were selected among the 463 inhabited islands (Fig. 1) in Korea to serve as the sample group. This was based on a consideration of indicators such as population (static population, dynamic population, and economically active population), infrastructure (medical,
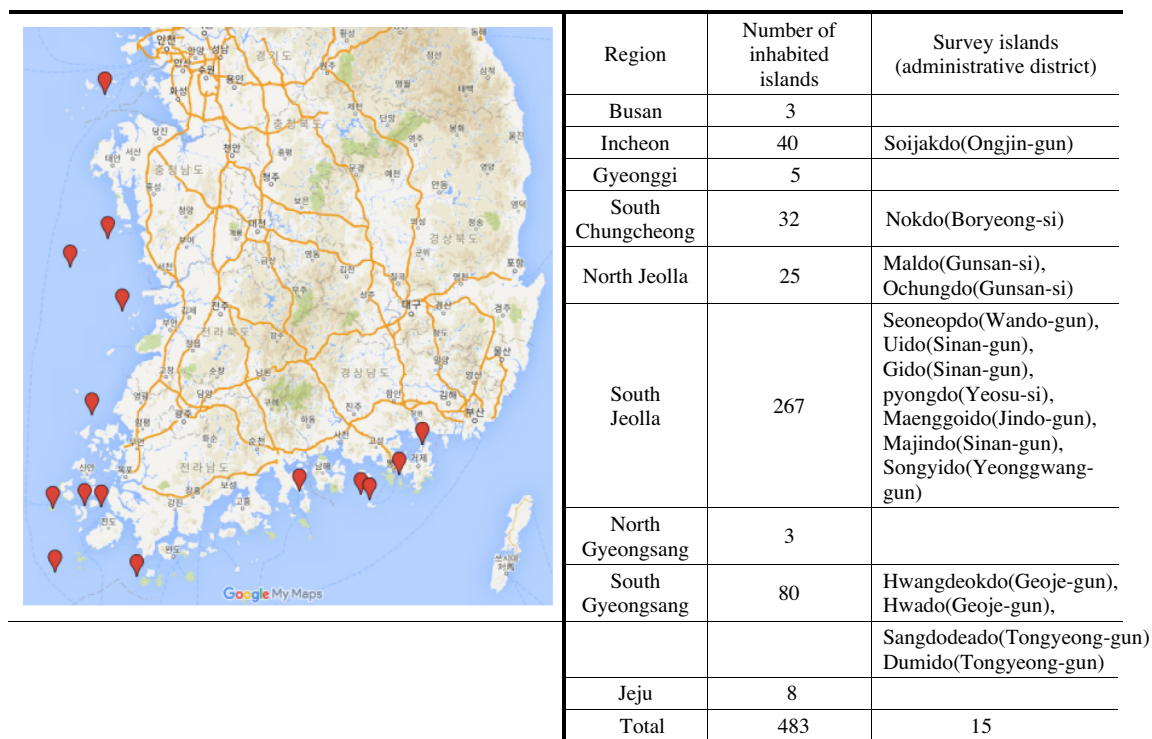
| Region | Number of inhabited islands | Survey islands (administrative district) |
|---|---|---|
| Busan | 3 | |
| Incheon | 40 | Soijakdo(Ongjin-gun) |
| Gyeonggi | 5 | |
| South Chungcheong | 32 | Nokdo(Boryeong-si) |
| North Jeolla | 25 | Maldo(Gunsan-si), Ochungdo(Gunsan-si) |
| South Jeolla | 267 | Seoneopdo(Wando-gun), Uido(Sinan-gun), Gido(Sinan-gun), pyongdo(Yeosu-si), Maenggoido(Jindo-gun), Majindo(Sinan-gun), Songyido(Yeonggwang-gun) |
| North Gyeongsang | 3 | |
| South Gyeongsang | 80 | Hwangdeokdo(Geoje-gun), Hwado(Geoje-gun), |
| | | Sangdodeado(Tongyeong-gun) Dumido(Tongyeong-gun) |
| Jeju | 8 | |
| Total | 483 | 15 |

**Fig. 1** Survey islands.

educational and administrative facilities), accessibility (physical and temporal distance, and transportation availability). As can be seen in Table 2, the sample group was revealed to lag behind the overall islands in terms of population, industrial structure, and accessibility.

The DEMATEL was implemented on July 27 and October 10, 2015. The questionnaire for the survey consisted of questions designed to assess whether a particular item directly influenced other item(s) and the extent of such influence. Based on the use of casual relationships, the rows represented cause while the columns represented effect. A 4 point-scale comparison matrix was prepared to assess the degree of influence between the evaluation factors that consisted of the following options: 0 point (none), 1 point (a little influential), 2 points (influential), and 3 points (very influential). For example, 3 points were given if a strong relationship was identified between the serious aging society (axis of cause) and shortage of residential welfare facilities (axis of effect) and 0 points if no relationship between them was uncovered. The values of the replies collected from the questionnaires are called the Direct Relation Matrix.

Unlike what is the case with general surveys, the DEMATEL is implemented based on the intuitive judgment of repliers as part of a 1:1 comparative research type. As such it is important to select survey subjects who are closely related to the problems and possess inherent knowledge about these problems. As such, 53 leaders of 15 villages from the selected islands took the DEMATEL survey. The general current state of the participants is summarized in Table 3.

## Results and discussion

### Analytical procedure

Different analytical procedures can be employed in conjunction with DEMATEL based on the research field involved and researchers' viewpoints (Lee et al., 2011; Bae, 2010; Tseng, 2009; Sato, 2008). However, the basic procedure generally unfolds as follows.

The first step in the generalization procedure is the preparation of a Direct Relation Matrix based on the survey. Once the data is collected based on an N × N matrix-type survey, the

**Table 2** The status of the sample islands (average).

| | Population | Person per household | Aging population rate | Rate of primary industry workers | Number of health services | Busiest shipping lanes (km) |
|---|---|---|---|---|---|---|
| Overall islands | 317 | 2.06 | 27.9 | 75.0 | 0.40 | 26.9 |
| Sample islands | 137 | 1.96 | 24.5 | 88.2 | 0.47 | 34.3 |

**Table 3** Respondent characteristics.

| Category | | Respondents (percent) | Category | | Respondents (percent) |
|---|---|---|---|---|---|
| Gender | Male | 49(94%) | Age | 41–49 years | 3(6%) |
| | Female | 4(6%) | | 50–59 years | 10(18%) |
| Achievement | Elementary school graduate | 17(33%) | | 60–69 years | 2(55%) |
| | | | | Above 70 years | 11(21%) |
| | Middle school graduate | 15(29%) | Occupation | Fishery | 23(43%) |
| | High school graduate | 13(24%) | | Agriculture & Fishery | 17(33%) |
| | Above graduating college | 7(14%) | | Commerce & Fishery | 9(18%) |
| | | | | Side job | 3(6%) |

Direct Relation Matrix is generalized based on a calculation of the average for each item.

Second, the normalization of the Direct Relation Matrix is also carried out. Normalization is brought about via the calculation of the sum of the matrix followed by its division by the largest value. Here it is important to note that the largest value should not exceed 1. The normalized Direct Relation Matrix X is calculated in Eq. (2), with the results seen in Table 4.

$$k = \frac{1}{\max \sum_{i=1}^{n} a_{ij}} \quad i,j = 1,2,\ldots,n \tag{1}$$

$$X = k \times A \tag{2}$$

Third, a procedure is also employed to calculate the Total-relation Matrix (T). The Total-relation Matrix (T) is a notion similar to the inducement coefficient found in input–output models, and denotes overall influence based on consideration of cycles. Here, I indicates the Identity Matrix.

$$T = X + X^2 + X^3 + \ldots X^m = X(I - X)^{-1} \tag{3}$$

The Total-relation Matrix (T) is of the type found in Eq. (4), and the calculated results can be seen in Table 5.

$$T = [t_{ij}]_{n \times n}, \quad i,j = 1,2,\ldots,n \tag{4}$$

The last step is the calculation and analysis of the evaluation indicators. The sum of rows (D) in the Total-relation Matrix (T) indicates influence, or the extent of causation on the overall problems accounted for by each problem. The sum of columns (R), which indicates absence of influence, refers to the degree of causation on the relevant problem assessed by amassing the overall problems. Here,

D + R (centrality) denotes the importance of a relevant problem within the overall problems regardless of cause and effect. On the other hand, D − R (causation) becomes the indicator used to exhibit whether a problem constitutes the cause or effect when measured against the overall problems. In other words, D − R > 0 denotes a strong character as a dispatcher while D − R < 0 indicates a strong character as a receiver (Table 6). The structure of complex causal relationships based on influence and cause is best visualized using a directed graph (Fig. 2).

$$D = \left[ \sum_{i=1}^{n} t_{ij} \right]_{n \times 1} = [t_i]_{n \times 1} \tag{5}$$

$$R = \left[ \sum_{i=1}^{n} t_{ij} \right]_{1 \times n} = [t_j]_{n \times 1} \tag{6}$$

**Analytical results**

First, a look at the sum of row (D) exhibiting the degree of causation clearly identifies underdeveloped public transportation to the mainland (F6) (3.9789) as the most important problematic elements in terms of the development of Korean island areas. This was followed by decreasing income sources (F5) (3.7531), and poor residential environments (F11) (2.5623). Meanwhile, a look at the sum of columns (R) denoting the degree of effect revealed decreasing income sources (F5) (3.9987) as having the most important receiver character. This was followed by fragmented industrial structure (F3) (3.5663)

**Table 4** Normalized initial direct-relation matrix X.

| | F1 | F2 | F3 | F4 | F5 | F6 | F7 | F8 | F9 | F10 | F11 | F12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F1 | 0.0000 | 0.0614 | 0.0922 | 0.1263 | 0.1331 | 0.0683 | 0.0478 | 0.0512 | 0.0614 | 0.0648 | 0.0922 | 0.0512 |
| F2 | 0.0444 | 0.0000 | 0.0205 | 0.0102 | 0.0307 | 0.0546 | 0.0375 | 0.0205 | 0.0410 | 0.0410 | 0.0717 | 0.0239 |
| F3 | 0.0785 | 0.0273 | 0.0000 | 0.0751 | 0.1092 | 0.0648 | 0.0512 | 0.0341 | 0.0648 | 0.0956 | 0.0785 | 0.0478 |
| F4 | 0.1092 | 0.0580 | 0.1092 | 0.0000 | 0.1331 | 0.0819 | 0.0717 | 0.0273 | 0.0273 | 0.0580 | 0.0717 | 0.0341 |
| F5 | 0.1195 | 0.0375 | 0.1092 | 0.1160 | 0.0000 | 0.0956 | 0.0785 | 0.0341 | 0.0785 | 0.0887 | 0.0990 | 0.0614 |
| F6 | 0.1024 | 0.0887 | 0.1126 | 0.0683 | 0.1195 | 0.0000 | 0.1195 | 0.0853 | 0.0683 | 0.0819 | 0.1092 | 0.0444 |
| F7 | 0.0546 | 0.0683 | 0.0717 | 0.0546 | 0.0648 | 0.0922 | 0.0000 | 0.0853 | 0.0785 | 0.0922 | 0.0751 | 0.0205 |
| F8 | 0.0512 | 0.0307 | 0.0648 | 0.0273 | 0.0546 | 0.0990 | 0.0478 | 0.0000 | 0.0478 | 0.0137 | 0.0683 | 0.0171 |
| F9 | 0.0546 | 0.0819 | 0.0614 | 0.0683 | 0.0614 | 0.0307 | 0.0410 | 0.0137 | 0.0000 | 0.0648 | 0.0614 | 0.0171 |
| F10 | 0.0751 | 0.0546 | 0.0922 | 0.0717 | 0.1024 | 0.1229 | 0.0887 | 0.0273 | 0.0171 | 0.0000 | 0.0922 | 0.0273 |
| F11 | 0.1160 | 0.0853 | 0.0853 | 0.0990 | 0.1024 | 0.1092 | 0.0785 | 0.0341 | 0.0614 | 0.0751 | 0.0000 | 0.0444 |
| F12 | 0.0375 | 0.0205 | 0.0512 | 0.0751 | 0.0751 | 0.0580 | 0.0375 | 0.0239 | 0.0171 | 0.0375 | 0.0410 | 0.0000 |

**Table 5** The total relation Matrix T.

|     | F1 | F2 | F3 | F4 | F5 | F6 | F7 | F8 | F9 | F10 | F11 | F12 |
|-----|------|------|------|------|------|------|------|------|------|------|------|------|
| F1  | 0.2668 | 0.2448 | 0.3542 | 0.3635 | 0.4215 | 0.3256 | 0.2634 | 0.1835 | 0.2346 | 0.2857 | 0.3457 | 0.1760 |
| F2  | 0.1692 | 0.0932 | 0.1492 | 0.1307 | 0.1739 | 0.1779 | 0.1417 | 0.0873 | 0.1253 | 0.1476 | 0.1930 | 0.0841 |
| F3  | 0.3056 | 0.1921 | 0.2367 | 0.2896 | 0.3640 | 0.2911 | 0.2403 | 0.1522 | 0.2154 | 0.2856 | 0.3020 | 0.1569 |
| F4  | 0.3514 | 0.2315 | 0.3547 | 0.2375 | 0.4060 | 0.3233 | 0.2730 | 0.1579 | 0.1974 | 0.2701 | 0.3157 | 0.1550 |
| F5  | 0.3950 | 0.2415 | 0.3914 | 0.3761 | 0.3295 | 0.3701 | 0.3086 | 0.1820 | 0.2642 | 0.3264 | 0.3733 | 0.1950 |
| F6  | 0.3946 | 0.2975 | 0.4077 | 0.3462 | 0.4493 | 0.3010 | 0.3567 | 0.2373 | 0.2691 | 0.3338 | 0.3990 | 0.1867 |
| F7  | 0.2823 | 0.2309 | 0.3011 | 0.2653 | 0.3221 | 0.3155 | 0.1919 | 0.2005 | 0.2290 | 0.2812 | 0.3000 | 0.1299 |
| F8  | 0.2181 | 0.1524 | 0.2325 | 0.1851 | 0.2435 | 0.2574 | 0.1859 | 0.0902 | 0.1618 | 0.1596 | 0.2318 | 0.0984 |
| F9  | 0.2243 | 0.2002 | 0.2315 | 0.2247 | 0.2533 | 0.2012 | 0.1808 | 0.1020 | 0.1151 | 0.2081 | 0.2287 | 0.0998 |
| F10 | 0.3219 | 0.2308 | 0.3401 | 0.3015 | 0.3791 | 0.3603 | 0.2908 | 0.1602 | 0.1881 | 0.2153 | 0.3338 | 0.1477 |
| F11 | 0.3819 | 0.2769 | 0.3596 | 0.3500 | 0.4088 | 0.3720 | 0.3009 | 0.1778 | 0.2438 | 0.3058 | 0.2745 | 0.1752 |
| F12 | 0.1930 | 0.1299 | 0.2076 | 0.2163 | 0.2476 | 0.2085 | 0.1650 | 0.1044 | 0.1212 | 0.1686 | 0.1927 | 0.0751 |

**Table 6** Causal influence level summarized table of criteria.

|     | D | R | D + R | D − R |
|-----|------|------|------|------|
| F1. Serious aging society | 3.4654 | 3.5040 | 6.9694 | −0.0387 |
| F2. Shortage of residential welfare facilities | 1.6730 | 2.5220 | 4.1951 | −0.8490 |
| F3. Fragmented industrial structure | 3.0315 | 3.5663 | 6.5979 | −0.5348 |
| F4. Limited labor force | 3.2737 | 3.2866 | 6.5604 | −0.0129 |
| F5. Decreasing income sources | 3.7531 | 3.9987 | 7.7518 | −0.2455 |
| F6. Underdeveloped public transportation to the mainland | 3.9789 | 3.5038 | 7.4827 | 0.4751 |
| F7. Underdeveloped public transportation in island | 3.0497 | 2.8991 | 5.9488 | 0.1507 |
| F8. Shortage of education services | 2.2168 | 1.8353 | 4.0520 | 0.3815 |
| F9. Low solidarity within the community | 2.2697 | 2.3651 | 4.6348 | −0.0953 |
| F10. Lack of accommodation and leisure facilities | 3.2696 | 2.9879 | 6.2575 | 0.2817 |
| F11. Poor residential environment | 3.6272 | 3.4901 | 7.1173 | 0.1372 |
| F12. Serious debt among fishery households | 2.0299 | 1.6799 | 3.7098 | 0.3500 |

and underdeveloped public transportation to the mainland (F6) (3.5038).

Fig. 2 indicates the location of element items, and the directedness between the items based on an X–Y coordinates system, with centrality (D + R) and cause (D − R) depicted respectively as the X-axis and Y-axis. In terms of analysis results, a look at centrality (D + R) exhibiting the sum of influence and absence of influence revealed that the most central problematic elements were decreasing income sources (F5) (7.7518), underdeveloped public transportation to the mainland (F6) (7.4827), and poor residential environment (F11) (7.1173). These elements are considered to be comprehensive problems when generalizing the causes and effects.

Next, a look at cause (D − R) to determine the difference between influence and absence of influence showed that the problematic element with the strongest dispatcher character was underdeveloped public transportation to the mainland (F6) (0.4751). The element with the strongest receiver character was revealed to be the shortage of residential welfare facilities (F2) (−0.8490).

The integration of centrality (D + R) and cause (D − R) revealed that the central problem structure hindering the development of island areas consists of the poor residential environment occasioned by underdeveloped public transportation to the mainland, which in turn leads to the emergence of a serious aging society. Moreover, the combination of these elements occasioned a further decrease in income sources and the eventual formation of the fragmented industrial structure.

*Strategic approach to the policy tasks to develop island areas*

What should the Korean government do from a strategic standpoint approach to foster the development of island areas? The basic premise is to establish a strategy that is based on the goal of eliminating the fundamental causes hindering the development of island areas, and to suggest measures to actively resolve problematic elements deemed to have comprehensive importance. The strategic approach prepared based on the analysis results above can be seen in Fig. 3.

At the first stage, the government should establish measures to improve accessibility to the mainland. Rather than simply connecting the mainland and islands based on island-mainland connection projects, the emphasis should be on a long-term public management system for coastal passenger boats that allows not only the residents of islands but also tourists to use passenger boats in a safer and easier manner. At the second stage, the government should establish a tourism base to attract tourists. This should be achieved via the establishment of measures to improve the accommodation and leisure facilities as well as the transportation system on islands. At the third stage, the government should implement an education program designed to strengthen the capability of island residents and manage conflicts between the residents and those who return to these villages. At the fourth stage, the government should suggest realistic measures to improve the residential environment and the welfare of senior residents in island areas. At the fifth stage, the government should establish the
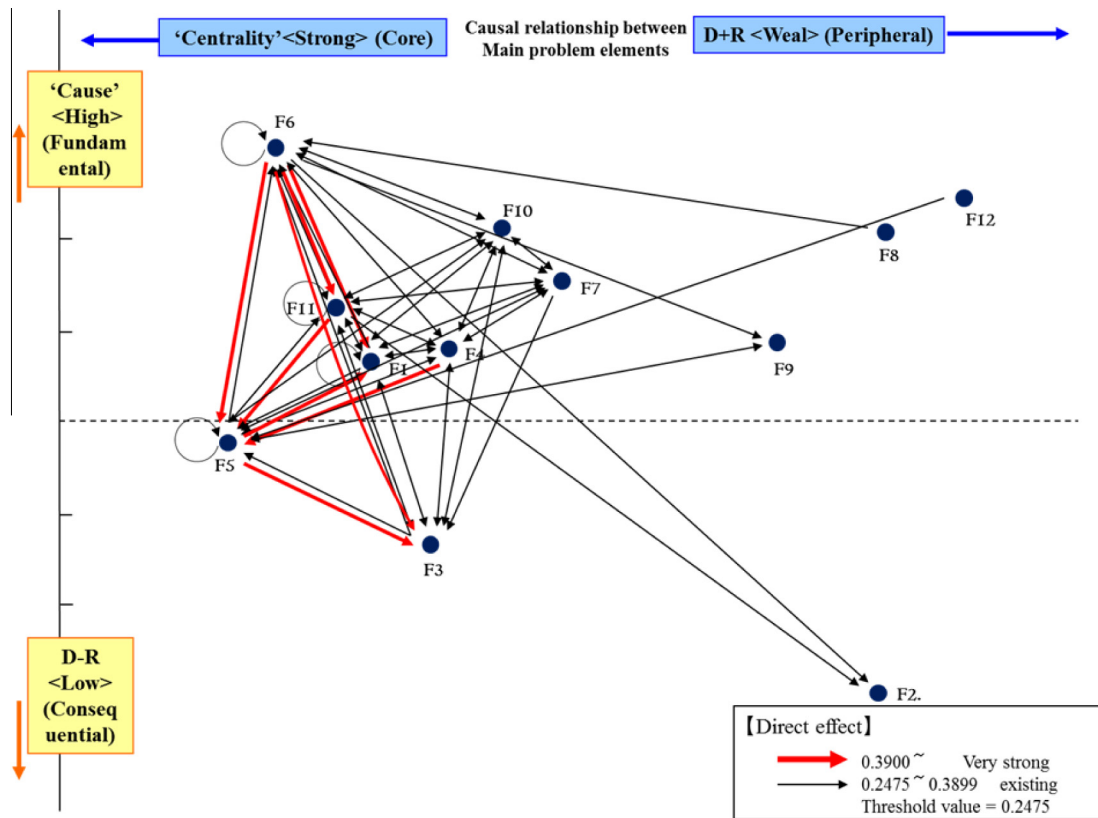
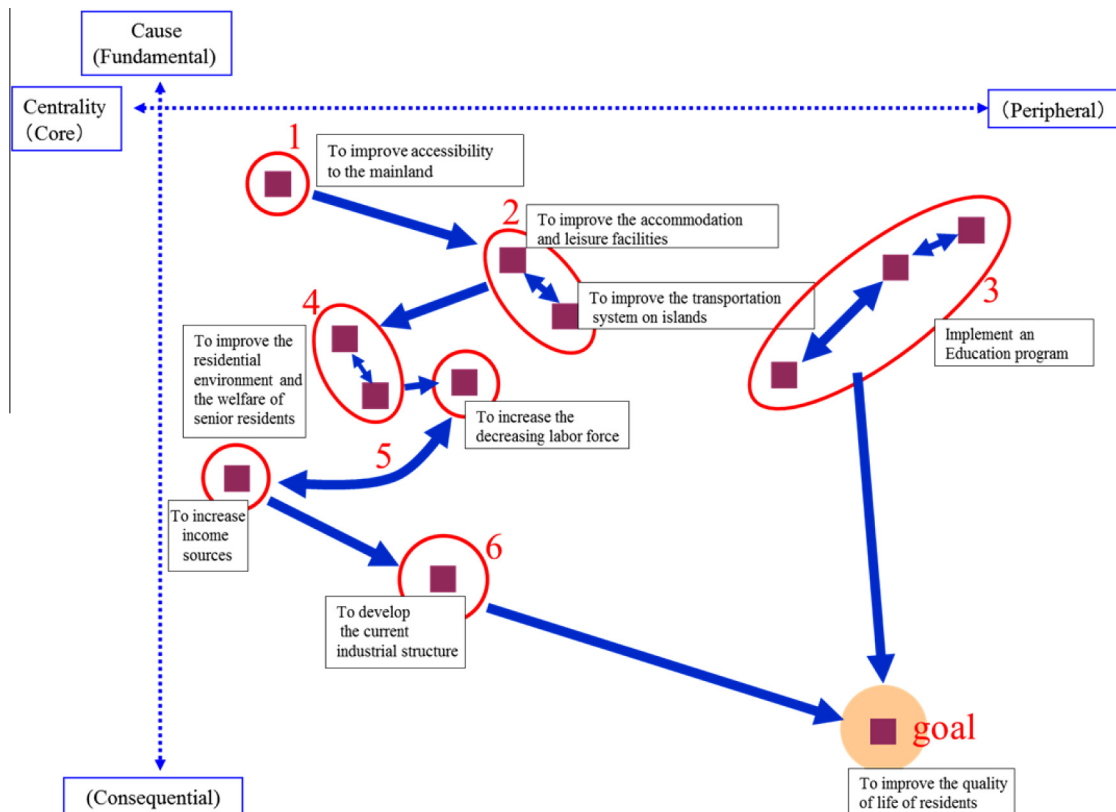**Fig. 2**    Causality diagram of criteria.



**Fig. 3**    The strategic approach prepared based on the analysis results.

framework for senary industries via the adoption of measures designed to increase the decreasing labor force in fishing areas and income sources. At the sixth stage, the government should establish a roadmap to develop the current industrial structure, which has heretofore been focused on primary industries, into senary industries. This is expected to improve the quality of life of residents in underdeveloped island areas.

## Conclusion

This study discussed the creation of a strategic approach to the policy tasks associated with the development of Korean island areas based on DEMATEL. To this end, after having derived the problematic elements hindering the development of Korean island areas, an attempt was made to structuralize residents' perceptions via the implementation of a DEMATEL survey with the leaders of island areas.

The problematic elements hindering the development of Korean island areas were identified as serious aging society, shortage of resident welfare facilities, fragmented industrial structure, limited labor forces, decreasing income sources, underdeveloped public transportation to the mainland, underdeveloped public transportation within islands, shortage of educational services, low sense of solidarity in villages, shortage of accommodation and leisure facilities, poor residential environments, and the serious debts accumulated by fishing households.

The residents of island areas perceived underdeveloped public transportation to the mainland as the most fundamental and central element hindering the development of island areas. Impacting the regional economy and overall resident welfare, these problematic elements can be regarded as exhibiting the structural characteristics of underdeveloped areas. As such, the prerequisite for endogenous development of island areas is the improvement of the underdeveloped nature of accessibility to the mainland. This study identified the need to establish a public management system for coastal passenger boats as a key means to the resolution of this problem. Coastal passenger boats can be envisioned as 'coastal sea buses' connecting coastal areas and islands, as well as islands to other islands. Much like transportation on the mainland, it is the duty of the state to ensure that its citizens have access to safe and economical coastal passenger boats.

The current policy for the development of Korean island areas consists of a resolution structure that is based on a temporary band aid approach whenever a problem emerges in island areas. Although this method may prove effective over the short term, its long term applications are limited. In this regard, a more desirable approach would be to use the method suggested in this study to address the most fundamental and central problem identified by residents.

## References

Bae, S.-J., 2010. Quantitative analysis for problems and improvement directions of the comprehensive rural village development projects using DEMATEL and contents analysis. J. Korean Soc. Rural Plan. 16 (3), 173–184 (in Korean with English abstract).

Gabus, A., Fontela, E., 1973. Perceptions of the World Problematique: Communication Procedure, Communication with Those Bearing Collective Responsibility. DEMATEL Report, No. 1. Battle Geneva Research Center, Geneva, Switzerland.

Kang, P.-Y., 2005. A survey on directions of the tourist development and the tourist-attitude of the inhabitants in Jeung-do. J. Korean I. 17 (1), 49–74 (in Korean with English abstract).

Kang, S.-K., Doh, K.-R., 2011. An evaluation of slow city tourism development: a focus on the case of Jeungdo. J. Tourism Sci. 35 (3), 287–306 (in Korean with English abstract).

Kim, J,-E., 2013. Land use management and cultural value of ecosystem services in Southwestern Korean islands. J. Mar. I. Cult. 2, 49–55.

Kim, J.-E., Hong, S.-K., Lee, K.-A., 2013. The analysis of public perception associated with island policies in Korean Government. J. Korean I. 25 (1), 41–59 (in Korean with English abstract).

Kim, N.-O., Lee, D.-S., Rim, D.-O., 2005. A direction on the development of marine tourism for the development of Chonnam's island. J. Korean I. 17 (1), 159–185 (in Korean with English abstract).

Lee, W.-S., Huang, A.-Y., Chang, Y.-Y., Cheng, C.-M., 2011. Analysis of decision making factors for equity investment by dematel and analytic network process. Expert. Syst. Appl. 38, 8375–8383.

Ministry of Public Administration and Security, 2011. Korea Island White Paper (in Korean).

Park, S.-H., Soda, O., Choi, S.-Y., 2011. A structured analysis of urban decay problems by DEMATEL: focused on Nisikawaguchi area of Saitama Prefecture, Japan. Korea Real Estate Acad. Rev. 46, 321–337 (in Korean with English abstract).

Sato, T., 2008. Analyzing the structure of management problems in the local government: using the DEMATEL method. Gov. Audit. Rev. 37, 87–97 (in Japanese).

Shin, S.-H., 1993. The improvement of public service delivery system in island regions. In: KAPA Conference (in Korean).

Shin, S.-H., Park, S.-H., 2014. A study of the change in consciousness among island residents in Korea related to policy: using the survey of resident consciousness in 1995 and 2011. I. Cult. 44, 203–235 (in Korean with English abstract).

Tseng, M.-L., 2009. A causal and effect decision making model of service quality expectation using grey-fuzzy DEMATLE approach. Expert Syst. Appl. 36 (4), 7738–7748.