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# A Study on Classifications and Characteristics of Declined Rural Area in Chungcheong Region*

Jinhee Jo[1], Hyungkeun Park[2] and Sedeok Seo[3]

***Abstract:*** *The study aims to identify the degree and types of spatial decline in Eup/Myun units within Chungcheong region in South Korea to contribute to the efforts being made to diagnose the rural decline and the potentials. To this end, we analyzed 27 Sis and Guns to identify the degree of decline and potentials of rural areas in Chungcheong region. We also carried out the diagnosis and K-Means Clustering on 274 Eups and Myuns, the smallest administrative units, to figure out the types and characteristics of the rural recessions. According to the results of the clustering analysis carried out on the 166 Eups and Myuns, there were five outstanding clusters. They were; areas with housing deterioration (29), areas with poor economic foundation (16), areas with poor accessibility to central areas (42), areas with poor residential environment (51) and areas with aged population (28). The findings and results of the present study are likely to serve as a basis for the design and enforcement of forthcoming rural area activation policies. Also, it would be highly recommended that a more comprehensive diagnosis is taken from a community-level perspective and policy suggestions and strategies tailored for rural communities are further discussed.*

***Keywords:*** *Small city, Rural Area, Declination Indicator, K-Means Clustering, Characteristics of Decline*

## I. INTRODUCTION

### A. Background and Purpose

Since 1970, Korean government's rural policy has focused on activation projects such as housing rehabilitation, cultural/welfare facility development or improvement of agricultural production infrastructure. However, the locality has not been properly or fully taken into consider while there is an increasing demand on a rural policy to reflect the cultural, social and physical characteristics of rural areas. In this regard, the present study, as a framework study for rural-centric policies, aims to develop a set of indicators for rural decline and characterize the decline phenomena in Eup and Myeon areas, the smallest administrative units in Korea.

### B. Methods and Boundary

To this end, the present study 1) developed a set of indicators to assess the rural decline, and 2) perform a rural decline analysis for Eup and Myeon areas in Chungcheong Province (Chungcheongbuk-Do and Chungcheongnam-Do) with the indicators adopted or applied. 3) The characteristics of the areas which were proven as declined rural areas are classified. To do so, 83 diagnostic indicator pools were derived from 22 preceding studies regarding regional diagnostics, rural living environment, rural residential environment and rural quality of life. Through expert interviews and a factor analysis, 29 indicators are evaluated and selected based on their applicability to the Korean rural areas and settings. To characterize and classify the spatial decline cases in all targeted Eup and Myeon areas, 8 indicators were selected (as the relevant data is accessible and available) and applied to assess the decline status of 274 Eup and Myeon areas in Choongcheong province. 166 Eup or Myeon areas were confirmed to have been declined. A K-means clustering analysis were carried out on the 166 Myeon and Eup areas to classify and characterize the declines.

## II. DEVELOPMENT OF INDICATORS

### A. Process to develop indicators

The index to analyze the declining characteristics and the stereotyping of the rural area is segregated into the decline-related index, which is variously piled in the sectors of population, society, economy and etc., and the potential index such as side job, new project, touristic agriculture and etc., which can occur the new energy. The selection procedure for the decline index and the potential index of the rural area will be as follows. Firstly, it will construct the rural area diagnosis domain and the diagnosis index pool by looking into the academic research and the related research report as the rural area becomes spatial object. The rural area diagnosis domain is classified into 5 kinds, namely, population, economy, living convenience, infra and safety by considering the research of Kim (2014), Lee et al (2012), Nam (2011) and etc.

On the diagnosis index pool stage, the material procurement nature of the index for 81 diagnosis index pools, which have been constructed through the precedent research, is judged, and 29 indexes, which the procurement is difficult, are excluded. In sequence, the questionnaire was executed for 27 experts among the indexes, which it is possible to procure the material, for selection of the analysis index, and Delphi Analysis is executed for 21 experts who responded to the questionnaire. Delphi Analysis is executed for the experts who are above graduation of the Master's degree and also above 5 years in the relevant field, and by applying the e-mail survey and the face-to-face survey methods, the 1st survey was made for 8days (April 10, 2014 to April 17,2014) and the 2nd

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survey was made for 28 days (April 18, 2014 to May 7, 2014).The basic statistics of the expert respondents for the questionnaire is presented through <Table-1>.

TABLE I
STATISTICS OF DELPHI SURVEY RESPONDENT EXPERTS

| Category | Results |
|---|---|
| Gender | Male : 15 (71%) |
| | Female : 6 (29%) |
| Education | Master degree : 10 (48%) |
| | Doctor course : 5 (24%) |
| | Doctor degree : 6 (28%) |
| Occupation | Research Institute : 10 (48%) |
| | Public : 5 (24%) |
| | University : 5 (24%) |
| | Company : 1 (4%) |

## B. Selection of analysis index

Delphi Analysis to select the decline diagnosis index of the rural area was made through 2 times of questionnaires for the experts, and it was executed in the closed type questionnaire that 5-mark Likert Barometer is applied by selecting the index per evaluation sector on the basis of the literature analysis. By analyzing the fitness and the standard deviation as per the 1st questionnaire result, 43 indexes, which were selected with the fitness above medium value(3marks), were selected, and the 2nd questionnaire was executed by adding 9 indexes that reflect the opinions of the experts for the additional indexes. On the 2nd questionnaire, the fitness of the index was verified and the survey for judgment of the decline/potential domain per each index was executed. In the 2nd Delphi Analysis, 20 indexes above 3.25 marks, which the index selection standards is higher than the medium value, was selected as the following <Table-2> so as to increase the fitness of the diagnosis index.

TABLE II
DELPHI SURVEY RESULT OF DIAGNOSIS INDEX

| Category | Index | 1st Survey result | | Category | Index | 2nd Survey result | | |
|---|---|---|---|---|---|---|---|---|
| | | Goodness of fit | Standard deviation | | | Goodness of fit | Standard Deviation | Decline / Potential |
| Population | Population growth rate | 4.19 | 0.85 | Population | Population growth rate | 4.14 | 0.62 | Decline |
| | Population movement rate | 3.67 | 0.94 | | Population movement rate | 3.59 | 0.65 | Decline |
| | Average number of family members | 3.14 | 0.77 | | Average number of family members | 3.05 | 0.88 | Decline |
| | Growth of Average number of family members | 3.38 | 0.90 | | Growth of Average number of family members | 3.41 | 0.94 | Decline |
| | | | | | Aged population ratio | 4.67 | 0.56 | Decline |
| | Aged population ratio | 4.57 | 0.49 | | Proportion of Beneficiaries of the National Basic Livelihood Security System | 2.91 | 0.73 | Decline |
| | Proportion of Beneficiaries of the National Basic Livelihood Security System | 3.33 | 0.85 | | Population under 20 | 3.91 | 0.79 | Potential |
| | Population under 20 | 4.10 | 1.08 | | Birth rate | 4.10 | 0.75 | Potential |
| | Birth rate | 4.10 | 0.84 | | Economically-engaged population | 3.81 | 0.79 | Potential |
| | | | | | Single elderly households | 4.32 | 0.55 | Decline |
| Ec... | Number of | 3.05 | 0.95 | Econ... | Number of | 3.05 | 0.71 | Potential |

| Category | Index | Goodness of fit | Standard deviation | Category | Index | Goodness of fit | Standard Deviation | Decline / Potential |
|---|---|---|---|---|---|---|---|---|
| ...on...omy | businesses | | | ...omy | businesses | | | |
| | Growth of total number of businesses | 3.57 | 0.89 | | Growth of total number of businesses | 3.41 | 0.83 | Potential |
| | Number of workers (per business) | 3.00 | 0.91 | | Number of workers (per business) | 2.91 | 0.79 | Potential |
| | Growth of number of workers | 3.24 | 0.92 | | Growth of number of workers | 3.36 | 0.93 | Potential |
| | Growth of manufacturing businesses | 3.35 | 0.72 | | Growth of manufacturing businesses | 3.32 | 0.76 | Potential |
| | Land price fluctuation | 3.00 | 0.85 | | Land price fluctuation | 2.91 | 0.85 | Decline |
| | Number of rural machines | 3.33 | 0.85 | | Number of rural machines | 3.23 | 1.00 | Potential |
| | Rural use of grounded (per household) | 3.10 | 1.14 | | Rural use of grounded (per household) | 3.14 | 0.92 | Potential |
| | Employment rate | 3.86 | 0.94 | | Employment rate | 3.36 | 0.71 | Decline |
| | Financial independency | 3.62 | 0.92 | | Financial independency | 3.32 | 0.70 | Potential |
| | GRDP (per capita) | 3.71 | 0.77 | | GRDP (per capita) | 3.45 | 0.78 | Decline |
| | Side work farmers ratio | 3.67 | 0.99 | | Side work farmers ratio | 3.36 | 0.77 | Potential |
| | Proportion of Community-led tourism service | 3.80 | 0.93 | | Proportion of Community-led tourism service | 3.50 | 0.78 | Potential |
| | | | | | Full time farmers ratio | 3.48 | 0.73 | Potential |
| | | | | | Unemployment ratio | 3.41 | 0.83 | Decline |
| | | | | | Agricultural sales account | 3.90 | 0.68 | Potential |
| | | | | | Agricultural debt | 3.90 | 0.61 | Decline |
| Living Conditions | Hospital beds (per 1,000 persons) | 3.14 | 0.58 | Living Conditions | Hospital beds (per 1,000 persons) | 3.05 | 0.77 | Decline |
| | Number of doctors (per 1,000 persons) | 3.33 | 0.81 | | Number of doctors (per 1,000 persons) | 3.18 | 0.94 | Decline |
| | Accessibility to healthcare institutes | 3.71 | 0.72 | | Accessibility to healthcare institutes | 3.59 | 0.72 | Decline |
| | Vacant houses ratio | 4.43 | 0.63 | | Vacant houses ratio | 4.41 | 0.58 | Decline |
| | Aged houses ratio | 4.10 | 0.69 | | Aged houses ratio | 4.14 | 0.62 | Decline |
| | Number of child-care facilities (per 1,000 persons) | 3.38 | 0.83 | | Number of child-care facilities (per 1,000 persons) | 3.05 | 0.93 | Potential |
| | Number of kindergartens (per 1,000 persons) | 3.29 | 1.00 | | Number of library seats (per 1,000 persons) | 2.95 | 0.82 | Potential |
| | Number of library seats (per 1,000 persons) | 3.00 | 1.05 | | Number of library seats (per 1,000 persons) | 2.64 | 0.71 | Potential |
| | Number of welfare facilities (per 1,000 persons) | 3.25 | 0.73 | | Number of welfare facilities (per 1,000 persons) | 3.00 | 0.85 | Potential |
| | Number of universities (per 10,000 persons) | 3.00 | 0.85 | | Number of universities (per 10,000 persons) | 2.45 | 0.78 | Potential |
| | Number of sport facilities (per 1,000 persons) | 3.10 | 0.90 | | Number of sport facilities (per 1,000 persons) | 2.64 | 0.83 | Potential |
| | Number of cultural facilities (per 10,000 persons) | 3.20 | 0.61 | | Number of cultural facilities (per 10,000 persons) | 2.86 | 0.92 | Potential |
| | Cultural budget (per capita) | 3.50 | 0.72 | | Cultural budget (per capita) | 3.05 | 0.88 | Potential |
| | | | | | Accessibility to public organization institutes | 3.32 | 0.70 | Potential |
| | | | | | Accessibility to center place | 3.64 | 0.64 | Potential |
| Infra | Sewerage supply ratio | 3.38 | 0.79 | Infra | Sewerage supply ratio | 3.32 | 0.92 | Decline |
| | Water supply ratio | 3.43 | 0.84 | | Water supply ratio | 3.45 | 0.78 | Decline |
| | Irrigation facility | 3.52 | 0.75 | | Irrigation facility | 3.55 | 0.72 | Decline |
| | Water system | 3.48 | 0.77 | | Water system | 3.50 | 0.78 | Decline |
| | Agricultural groundwater | 3.38 | 0.87 | | Agricultural groundwater | 3.50 | 0.72 | Decline |
| | Paved road ratio | 3.76 | 0.68 | | Paved road ratio | 3.64 | 0.48 | Decline |
| | Road density | 3.40 | 0.99 | | Road density | 3.23 | 0.52 | Decline |
| | | | | | Water consumption | 3.09 | 0.79 | Decline |
| | | | | | Sewage treatment equipment | 3.14 | 0.62 | Decline |
| Security | Crime ratio | 3.10 | 0.84 | Security | Crime ratio | 3.05 | 0.77 | Decline |
| | Number of accidents by rural machines | 3.14 | 0.88 | | Number of accidents by rural machines | 3.00 | 0.80 | Decline |

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## C. Analysis execution system

The execution system of this research is segregated into the decline degree analysis stage and the stereotyping stage of the declining characteristics, and the analysis unit is applied by dividing the decline degree and the potential degree per city/county unit and the Eup/Myeon unit. At first, on the decline stage, the statistics annual report of National Statistical Office and the city/county and the status data of Eup/Myeon for the recent 10 years (2003 to 2012) are constructed, and the decline degree and the potential degree are deducted by standardizing the variation rate for the recent 10 years per index (Z-courv)[1]. The directional nature of the index was defined by considering this, and the value of the analysis data was adjusted as per the directional nature. As for the decline degree of the analysis area, the total of the standardization value of the decline index is interpreted as the decline degree of the relevant area. On the stereotyping stage of the decline characteristics, the group analysis, statistical analysis method, which the group is classified in some clusters based on the similar characteristics of the object belonging to the same group, is applied. The cluster analysis has to go through the process that binds the objects being near distance into one cluster by converting the value, which is owned by each object, into the distance. In this research, K-average cluster analysis is applied on the basis of the decline degree value of Eup/Myeon area.

### III. ANALYSIS FOR DECLINE CHARACTERISTICS OF CHUNGCHEONG RURAL AREA (EUP/MYEON AREA)

If the area, which the value of the decline degree is above 0, is presumed as the decline area in the relative meaning as per the decline level analysis result of 274 Eup/Myeon areas of Chungcheongnam/bukdo, it was confirmed that 166 areas among 274 Eup/Myeon areas of Chungcheongnam/bukdo are showing the decline tendency, and the decline characteristics and type in this relation are deducted as 166 decline rural areas (Eup/Myeon area) become the objects. For this, firstly, the non-hierarchic cluster analysis was executed by utilizing SPS statistics program. The maximum number of repetitive calculations was set up 10 times during the analysis process, and as the significance probability is below 0.05, the statistical reliability has been acquired.

TABLE III
RESULT OF CENTER OF CLUSTERS

| Index | Cluster | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Aged houses rate | 4.21 | 3.56 | 3.79 | 3.92 | 3.68 |
| Aged population rate | 4.31 | 3.50 | 3.57 | 3.67 | 4.04 |
| Economicallyengaged population | 3.21 | 4.25 | 3.88 | 3.84 | 3.43 |

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[1] 1) As it is judged that as for the population change rate, net migration rate, GRDP per person, sewage supply ratio and road paving rate among the decline index, the higher value shows the non-decline trend, the directional nature was taken in the opposite way.

| | | | | | |
|---|---|---|---|---|---|
| Population growth ratio | 4.14 | 4.06 | 3.93 | 3.86 | 3.61 |
| Growth of total number of businesses | 3.79 | 4.13 | 4.21 | 4.00 | 2.89 |
| Sewerage supply ratio | 2.69 | 4.00 | 4.31 | 4.20 | 4.14 |
| Accessibility to healthcare institutes | 3.97 | 2.38 | 3.93 | 3.84 | 3.79 |
| Accessibility to center place | 3.72 | 3.63 | 4.29 | 2.53 | 4.68 |

As for Cluster type (1) in the final cluster-centered analysis showing the central value per cluster after the repeated calculation, the aging index shows highest as 4.31, and the aged housing rate shows the secondly high as 4.21.

Namely, as Cluster type (1) shows the regional characteristics that the aging of the aged housing is deepened and also the aged population is largely increased, it can be classified as 'Population and housing aging area' type. As for Cluster type (2), the economically active population change rate shows highest as 4.13, and the company change rate shows secondly high as 4.13. This can be classified as 'Economic infra vulnerable area' type that the company investment becomes withered and that the economic infra becomes weakened due to reduction of the economically active population. As for Cluster type (3), the sewage supply rate shows highest as 4.31, and the next sequence is the central area accessibility (4.29) and company increase rate (4.21). This can be classified as 'Central area accessibility vulnerable area' type for the as it shows that the supply of the basic infra facility and the regional investment are poor as the accessibility to the central area is low. As for Cluster type (4), the sewage supply rate shows highest as 4.20, and the aged housing rate shows high as 3.92. As for Cluster type (4), the central area accessibility (2.53) is comparatively good area being different from Cluster type (3), but as the basic infra supply rate is low and also as the aged housing area, it can be classified as 'Residential environment vulnerable area' type. And, as for Cluster type (5), the central area accessibility shows highest as 4.68, and the next sequence is the sewage supply rate (4.14) and aging index (4.04). The area belonging to Cluster type (5) can be known as 'Aged population vulnerable area' type containing the regional characteristics that the aging population rate is high among the central area accessibility vulnerable areas.

TABLE IV
CLASSIFYING CHARACTERISTICS OF DECLINE AREAS IN CHUNGCHEONG REGION(EUP/MYEON)

| Type (EA) | Characteristics of Decline | Eup/Myeon |
|---|---|---|
| Type1 (29) | Population and housing aging area | Boryeong_Misanmyeon, Boryeong_Seongjumyeon, Boeun_Maromyeon, Cheonan_Ipjangmyeon, Gongju_Yugueup , Jecheon_Baegunmyeon, Nonsan_Seongdongmyeon, Okcheon_Annaemyeon, Boryeong_Ungcheoneup , Boeun_Songnisanmyeon Buyeo_Naesanmyeon, Cheongwon_Miwonmyeon , Yeongi_Jeondongmyeon, Gongju_Gyeryongmyeon, Cheongyang_Jeongsanmyeon, Okcheon_Iwonmyeon, Hongseong_Gwangcheoneup, Chungju_Dongnyangmyeon, Jecheon_Geumseongmyeon, Danyang_Maepoeup, Jeungpyeong_Doanmyeon , Yeongi_Sojeongmyeon , Asan_Daesaneup , Cheongwon_Munuimyeon, Chungju_Angseongmyeon, Chungju_SuanboMyeon, Eumseong_Saenggeukmyeon, Chungju_Sinnimyeon, Chungju_Salmimyeon |

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| Type2 (16) | Economic infra vulnerable area | Gongju_Janggimyeon, Cheongwon_Buyongmyeon , Seocheon_Sichomyeon , Seocheon_Hwayangmyeon, Asan_Buseokmyeon, Boryeong_Cheongnammyeon, Buyeo_Jangammyeon, Seocheon_Maseomyeon, Geumsan_Namimyeon, Goesan_Buljeongmyeon, Buyeo_Seokseongmyeon, Cheongyang_Daechimyeon, Eumseong_Wonnammyeon, Seocheon_Janghangeup, Geumsan_Burimyeon , Boeun_Suhanmyeon |
|---|---|---|
| Type3 (42) | Central area accessibility vulnerable area | Yeongi_Nammyeon, Buyeo_Yanghwamyeon, Boryeong_Cheongsomyeon , Okcheon_Cheongsanmyeon, Yeongdong_Haksanmyeon, Boeun_Sanoemyeon, Boeun_Hoenammyeon, Yesan_Daesulmyeon, Yesan_Sinammyeon, Buyeo_Sedomyeon, Yeongdong_Sangchonmyeon, Boeun_Janganmyeon, Buyeo_Imcheonmyeon, Buyeo_Oesanmyeon , Gongju_Tancheonmyeon, Okcheon_Cheongseongmyeon, Hongseong_Janggokmyeon, Gongju_Sagokmyeon, Gongju_Sinpungmyeon, Nonsan_Noseongmyeon , Yeongdong_Simcheonmyeon, Yesan_Sinyangmyeon, Jecheon_Susanmyeon, Seocheon_Munsanmyeon, Yeongdong_Yongsanmyeon, Yeongdong_Hwanggganmyeon, Nonsan_Yangchonmyeon, Jecheon_Deoksanmyeon, Asan_Seonjangmyeon , Dangjin_Godaemyeon , Yesan_Daeheungmyeon, DanYang_Yeongchunmyeon, Geumsan_Jinsanmyeon, DanYang_Eosangcheonmyeon , Cheongyang_Ungokmyeon, Seocheon_Pangyomyeon , Dangjin_Daehojimyeon, Jincheon_Baekgokmyeon, Chungju_Sotaemyeon, Goesan_Mungwangmyeon , Gongju_Useongmyeon, Dangjin_Jeongmimyeon |
| Type4 (51) | Residential environment vulnerable area | Hongseong_Gyeolseongmyeon, Seocheon_Hansanmyeon, Buyeo_Hongsanmyeon, Buyeo_Nammyeon, Buyeo_Chunghwamyeon, Seocheon_Biinmyeon, Cheongyang_Namyangmyeon, Goesan_Yeonpungmyeon, Yeongdong_Yangsanmyeon, Hongseong_Galsanmyeon, Buyeo_Oksanmyeon, Yeongdong_Chupungnyeongmyeon, Boryeong_Jusanmyeon , Seocheon_Masanmyeon, Nonsan_Yeonmueup, Yeongdong_Maegokmyeon, Cheongyang_Cheongnammyeon, Boeun_Naebukmyeon, Gongju_Iinmyeon , Cheongyang_Jangpyeongmyeon, Goesan_Jangyeonmyeon , Cheongyang_Hwaseongmyeon, Dangjin_Sunseongmyeon , Yesan_Ogamyeon, Asan_Dogomyeon, Eumseong_Soimyeon, Hongseong_Geummamyeon, Cheongyang_Mokmyeon, Nonsan_Gayagokmyeon , Seocheon_Jongcheonmyeon, Yesan_Godeokmyeon, Seocheon_Gisanmyeon, Buyeo_Guryongmyeon, Boeun_Samseungmyeon, Buyeo_Eunsanmyeon, Yeongdong_Yanggangmyeon, Yesan_Gwangsimyeon, Chungju_Eomjeongmyeon, DanYang_Jeokseongmyeon, Boeun_Tanbumyeon, Yesan_Eungbongmyeon , Chungju_Sancheokmyeon, Asan_Unsanmyeon, Yeongi_Dongmyeon, Nonsan_Yeonsanmyeon , Seocheon_Seomyeon, Boeun_Hoeinmyeon, Nonsan_Beolgokmyeon, Asan_Gobukmyeon , Gongju_Jeonganmyeon, Okcheon_Annammyeon |
| Type5 (28) | Aged population vulnerable area | DanYang_Daegangmyeon, DanYang_Danseongmyeon, Asan_Palbongmyeon , Taean_Geunheungmyeon, Cheonan_Dongmyeon, Hongseong_Eunhamyeon, Goesan_Cheongcheonmyeon, Jecheon_Cheongpungmyeon, Cheonan_Susinmyeon, Yeongdong_Yonghwamyeon, Chungju_Gageummyeon , Cheongwon_Gadeokmyeon, Taean_Sowonmyeon, Cheongwon_Bugimyeon, Hongseong_Seobumyeon, Cheongwon_Hyeondomyeon, Taean_Wonbukmyeon, Cheongwon_Nangseongmyeon , Asan_Songakmyeon, Dangjin_Myeoncheonmyeon, Cheonan_Seongnammyeon , Goesan_Sosumyeon , Jecheon_Bongyangeup, Asan_Yeonginmyeon, Cheongwon_Namilmyeon , Taean_Iwonmyeon, Geumsan_Boksumyeon , Boryeong_Jugyomyeon |

## IV. CONCLUSION

According to the findings, Cheongyang-Gun, Seocheon-Gun and Taean-Gun as well as the three southern Guns (Boeun, Okcheon and Yeongdong), Danyang-Gun and Goisan-Gun were relatively high in their declination. The results of the clustering analysis on 166 Myeon and Eup areas showed that the areas feature aged population and housings (29 areas), poor economic foundation (16), poor accessibility to the center (42), poor residential environment (51) and areas with aged population(28).

The present study assesses and characterize the declination in rural areas in Chungcheong Province, Korea. The findings are likely to help any central government or municipality establish and streamline aid projects for improving the living facilities such as cultural and welfare facility, agricultural production facility, water supply facility and housing rehabilitation.

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