ACENS-0077
Transition of the Number of Junior High Schools and Pupils in Chugoku Region

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Abstract

The aim of this study is to make clear the reorganization process of junior high schools in Chugoku region. In Japan, depopulation of rural districts has progressed since the period of high economic growth in 1960s. So many municipalities focus on school restructuring due to decreasing the number of students and deterioration of schools.

We compare the features of reorganization due to the closing of school in the Chugoku region with the features of region and the number of students by mathematical quantification theory class III.

At junior high schools, there is a high necessity to judge the appropriate number of schools owing to problems such as a system that requires a teacher for each subject. So, the discussion of reorganization beyond the framework of the old municipality category in the mountain area is essential. Then the reorganization of school should be planned with local residents considering the scale of education.

Keywords: Junior high school, Chugoku Region, Local type, Type of reorganization of schools

1. Background

Depopulation of hilled rural area has progressed since the period of high economic growth in the 1960s. Amid the declining total population of Japan due to the declining birth rate, it is

progressing rapidly now. Especially the population declines remarkably nationwide in the Chugoku region. Even in metropolis such as Hiroshima City and Okayama City, where the prefectural office is located, it is predicted that the population will shift to a decrease faster than the national average. In the mountains and the islands, the reorganization of primary and junior high schools due to the decrease in the number of children progresses, there are many areas where the sustainability of the future community is concerned because of the depopulation, aging and the school abolition. In the municipalities in such depopulated areas, weakening of administrative and financial infrastructure has progressed. Then many municipalities have merged including urban and rural areas through measures to promote the merging of municipalities since 2000. Therefore, many municipalities focus on school restructuring due to decreasing the number of students and deterioration of schools.

As a standard of school restructuring, small-scale schools with small number of students tend to be considered as a target of reorganization. Then school restructuring was progressed by the merger of municipalities. Especially, it is thought that a lot of schools were abolished nationwide in rural areas, which had many small-scale schools. At the time of this reorganization, it seems that many schools were discontinued without consideration of reorganization standards. In the rural areas, the schools have a central presence of the area and have played a role such as the formation of a community. So in many cases, it is expected from the local residents to sustain the school or to utilize abolished school, but it is quite difficult to find a good measure. According to a survey by the Ministry of Education, Culture, Sports, Science and Technology, the number of schools that were discontinued in 1992 is 178 schools. However, 490 primary and junior high schools in 2004. The number of abolished schools will continue to increase in the future, and it is expected that the issues related to the effective utilization of closed schools will become more serious.

2. Methods

First, in each prefecture of Chugoku Region, we will construct the databases on the number of students for each public junior high school, and the databases on newly established / abolished schools in period series from 1949 to 2010. Then, we classify the period based on the trend of the number of students. Finally, using the municipal area as of 1963 as an analysis unit, we will clarify the features of the transition of the junior high school's time and region. In constructing the above data, we collected school basic surveys, which is a statistical survey of the Ministry of Education, Culture, Sports, Science and Technology. After constructing the data, we will proceed with the analysis in the following way.

Since there are individual differences in the number of students and the area of each local government, we carry out mathematical quantification theory class III and categorize geographical types of local governments.

In addition to the geographical types, we will categorize types of municipalities by sample scores indicating local condition. First, 137 municipalities that have kept one school in the 1963's municipality category until 2010 are classified as one school type. Then, concerning the remaining 208 municipalities, we will categorize municipalities by cluster analysis (ward method) using the number of schools in 1963, each school change rate. The data we use is the number of schools in 1963 and each school change rate.

Based on the above typing, we obtain basic knowledge of the reorganization process. We compare the features of reorganization due to the number of schools in the Chugoku region with the features of region and the number of students by mathematical quantification theory class III.

3. Results

3.1 Time Classification Based on Trends in the Number of Students

Changes in the number of students and schools in all the prefectures of Chugoku region are shown in Fig 1. Based on the change of the number of students in all prefectures, we classify the phase from Period I to Period V.

In the period I (1949-1962), the number of students increases due to the influence of the first baby boom. There are few changes of the total number of schools, but in order to cope with the increase or decrease in the number of students, there are many movements of new schools or abolished schools. Compared with the next phase from Period II to Period V, the rapid increase and decrease are conspicuous.

Meanwhile, in Period II (1963-1975) after the first baby boom, the number of students rapidly decreases. 218 principal schools and branch schools in total were abolished (principal school: from 937 schools to 790 schools, branch school: from 54 schools to 13 schools). There are few new schools, and the reorganization has been actively promoted as the number of students decreased significantly.

Thereafter, in Period III (1976-1985), the number of students increased due to the second baby boom, and the number of new schools increased by 46 schools. Responding to an increase in the number of students has been taken, and the number of schools to be discontinued has also decreased considerably compared to the previous years.

In Period IV (1986-2002), the number of students begins to decrease greatly again. Though 48 schools are closed, 28 schools are newly established. The total number of school changes is -20. The number of students has drastically decreased, but the number of schools is not much reduced.

Period V (2003-2010) also continues to be at the same level as in Period IV, and the number of students decreases. During this period, however, the total number of closed schools is 51 schools, and the number of schools has been greatly reduced compared to Period IV. On the other hand, there are only 10 schools newly established, which can be inferred that the reorganization of the junior high school was advanced when the municipal merger of Heisei era was done.

Overall, the number of students in Period I and Period II has changed greatly, and the number of schools sharply diminished accordingly. However, even though the number of students increased or decreased to some extent after Period III, the number of schools is almost unchanged.

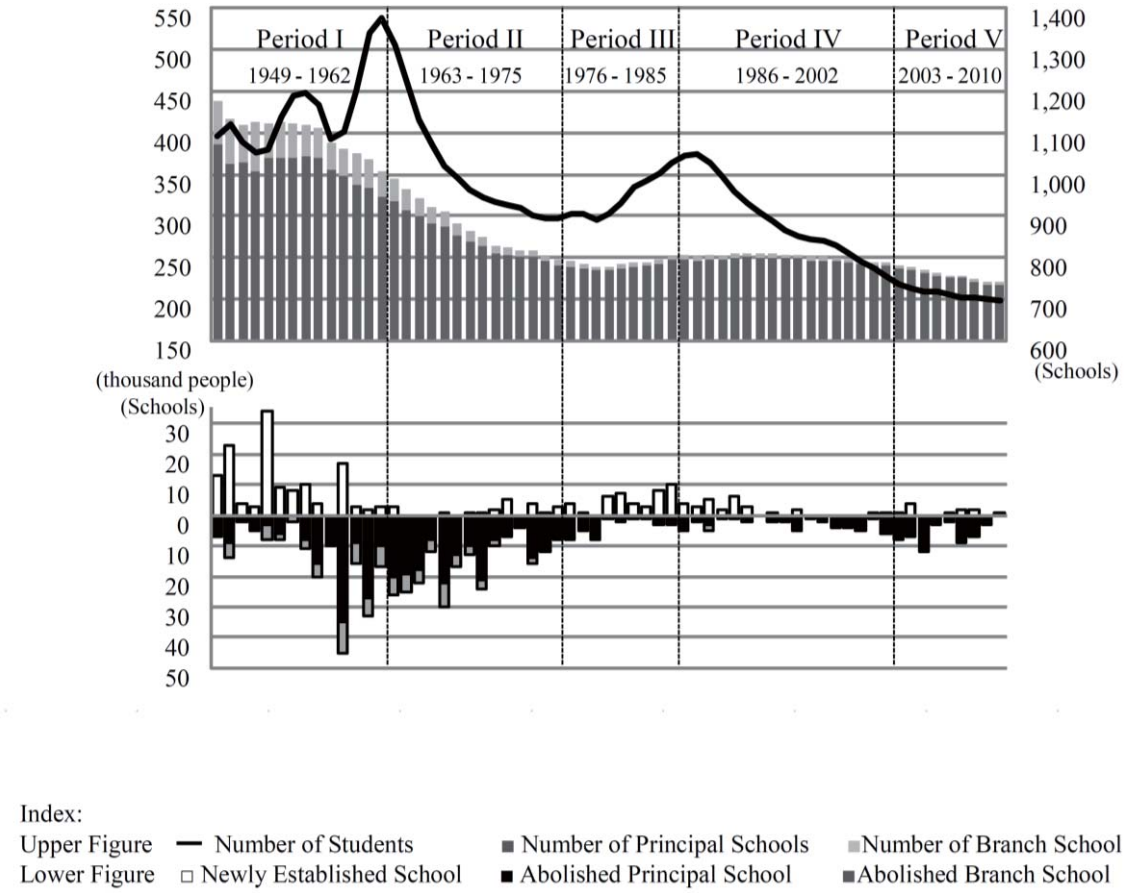


Fig. 1: Number of Junior high schools, Students and Reorganization

3.2 Local Conditions

First, we will organize individual differences in the number of students and the area of each municipality. Based on the following setting indicators, we carry out classification of geographical conditions of local governments by conducting mathematical quantification theory class III.

1） Agricultural area type: The type of agricultural area is set by the municipality as of 1950. Therefore, in 1963, several types of agricultural districts were found within one municipality, but in this case, the agricultural area type with high area ratio was applied.

2） Student density (people / km^2): number of students in 1963 / area of municipality. As the student density of urban and rural region is different, it is set as an indicator.

3） Number of students in 2010 (people): As the scale of the number of students as of 2010 is the difference between the current urban and rural areas, it is set as an index.

4） Student change rate in 47 years (%): (number of students in 2010 - number of students in 1963) / number of students in 1963.

Table 1 shows classification categories list and category scores of mathematical quantification theory class III. The first axis has categories showing urban features on the plus side and categories showing intermountain features on the minus side. So, the first axis is interpreted as the axis showing the characteristics of the scale of the municipality. The second axis is the maximum / minimum value of each category on the plus side, the medium value of each category is placed on the minus side. That is interpreted as the axis showing the characteristics of the intermediate area.

As a result of classification of local condition by cluster analysis (ward method) using the sample scores of 1st and 2nd axis, the municipalities are categorized into four types, urban type (100 municipalities), intermediate type (93 municipality), mountain type 1 (46 municipalities), and mountain type 2 (107 municipalities), (Table 2, Fig.2).

Urban type (100 municipalities) has feature that the student density in 1960 is 71.2 (people / km^2) and the average number of students in 2010 is 1594.3 people. Then the student change rate in the 47 years is -16.2%, and students are not decreasing the most. As a result, in 2010, the number of schools was 4.4 schools and the number of schools has increased since 1963. Municipalities in this type belong to major cities in the prefecture, and they center on the Seto Inland Sea and Sea of Japan side.

Intermediate type (92 municipalities) is the municipalities located between the urban type and the mountain type, and this municipalities have distances from major cities and belong to flat land agricultural area types. The area average is 72.5 km^2, which is the same size as urban type 69.1 km^2. Meanwhile, the student density is 24.1 people / km^2, compared with urban type 71.2 people / km^2. And the change rate of the student is a large difference of -74.2% compared to -16.2% of urban type. The average number of students in 2010 is 256.8 people, which is about

1/6 the scale of urban type, and the difference from urban type is remarkable.

The mountain type is divided into two types, 1and 2. Mountain type 1 (45 municipalities) has the smallest number of municipalities among the four types and it is in the flat and mountainous areas. As of 1963, the average of number of students was 1026.1 people, which is very close to the intermediate type. On the other hand, the number of students in 2010 is 168.4 people, which is lower than the intermediate type by nearly 100 people. And the student density is 13.0 people / km^2, which is 2 times lower than the intermediate type. In addition, the area average of the municipalities is 117.5 km^2, and it has the largest area among the 4 types. Compared to the intermediate type, the student change rate is -74.7% for the intermediate type and -82.4% for the mountain type 1, so there is no big difference. On the other hand, student density and the number of students in 2010 are significantly different from the intermediate type, problems due to regional features such as distance to school and number of classes, etc. are more likely to occur than in the intermediate type when the reorganization is conducted. Therefore, in conducting reorganization, it is considered that this type was needed a more careful plan.

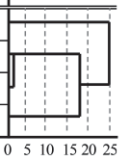
Mountain type 2 (107 municipalities) is the type with the largest number of municipalities among the four types, and this type is distributed in the mountainous area on the inland side. The number of students has decreased by almost 90% in 47 years, and the student density is the lowest value of 10.5 people / km^2. 106/107 municipalities excluding Yamaguchi Prefecture Asahi village, the number of their schools in 2010 is one school. The average number of students (2010) is 66.0 people, which is 1/3 times lower than the mountain type 1.

Table 1: Category and Score of Mathematical quantification theory class III

Category			Sample Number*	First Axis	Second Axis
Variable	Category Number	Category Classification			
Agricultual area type	11	Mountain	129	-0.77	0.43
	12	Intermediate	101	-0.22	-1.30
	13	Flat	16	0.76	0.57
	14	Urban	100	1.09	0.67
Student Density (people/km^2)	21	~5.9	76	-0.98	1.06
	22	6.0~11.9	95	-0.84	-0.49
	23	12.0~29.9	90	0.46	-0.97
	24	30.0~	85	1.33	0.63
Number of Students in 2010 (people)	31	~99.9	105	-1.24	1.36
	32	100.0~299.9	119	-0.39	-1.41
	33	300.0~799.9	64	1.07	-0.56
	34	800.0~	58	1.87	1.05
Change Rate of Students (%)	41	~ -80	154	-1.08	0.61
	42	-79.9~ -60.0	114	0.31	-1.52
	43	-59.9~	78	1.68	1.02

Table 2: Local condition and Basic data

Type	Sample Number*	Ave. of local condition			Ave. of basic data				Ave. of sample score		Tree Diagram
		Student change rate in 47 years (%)	Number of students in 2010 (people)	Student density (people/km²)	Area (km²)	Number of students in 1963 (people)	Number of schools in 1963 (schools)	Number of schools in 2010 (schools)	First Axis	Second Axis	
Urban	100	-16.2	1594.3	71.2	69.1	2990.4	4.1	4.4	0.95	0.30	
Intermediate	93	-74.7	256.8	24.1	72.5	1018.6	2.0	1.3	0.00	-0.83	
Mountain 1	46	-82.4	168.4	13.0	117.5	1026.1	2.8	1.3	-0.44	-0.26	
Mountain 2	107	-86.8	66.0	10.5	475.4	546.3	1.8	1.0	-0.70	0.55	



* Sample Number denotes the number of municipalities.

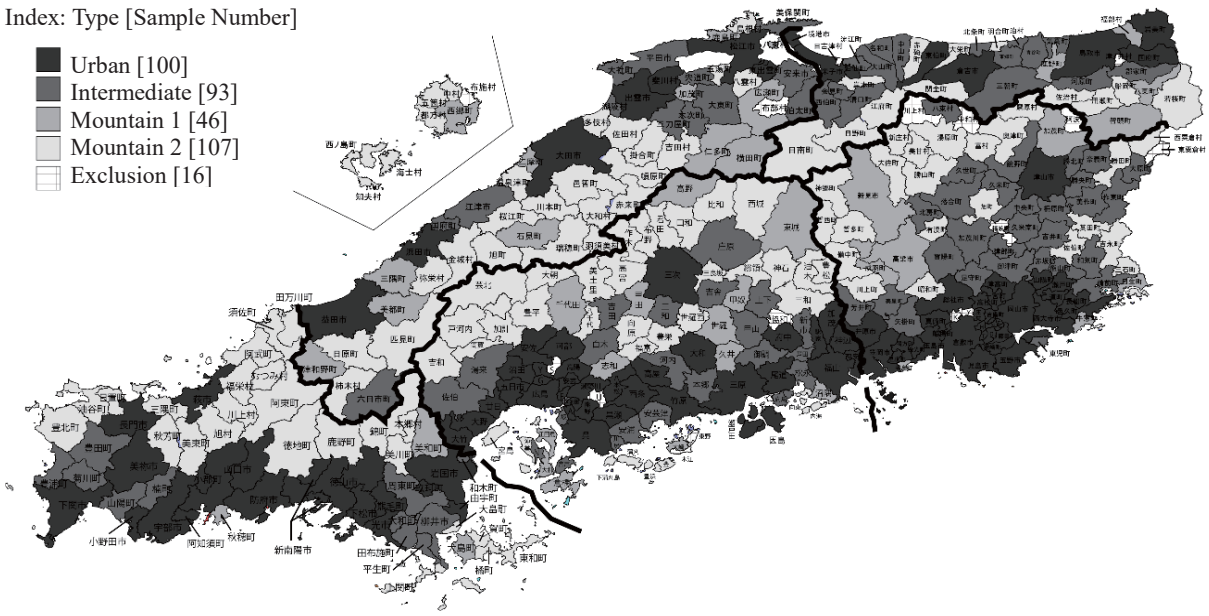


Fig. 2: Distribution of Local type

3.3 Classification of School Reorganization Process

As of 1963, 22 municipalities that do not have a school or have become 0 school by 2010 are excluded because they cannot be analyzed. In the remaining 345 municipalities, 137 municipalities that have only one school as of 1963, and have kept one school until 2010 are defined as one school type. Then, for the remaining 208 municipalities, we categorize them by cluster analysis (ward method), using the number of schools in 1963 and the student change rate of each period. Through analysis, they were classified into 4 types, keeping schools type, one school type, increasing school type, and decreasing school type (8 types if divided finely by period). To compare the features of each type, the results of types of school reorganization are shown in Table 3, and the distribution of types of school reorganization is shown in Fig 3.

Keeping schools type of school is classified into city type (18 municipalities) and town / village type (42 municipalities), and this type keeps the number of schools and is not consolidated much. The average number of schools that municipalities have in 1963 is characteristic because of a large difference from the city type of 12.1 schools and the town / village type of 3.4 schools.

One school type (137 municipalities) is municipalities that have only one school in one municipality in 1963, and continues to keep one school until 2010.

Increasing school type (20 municipalities) is municipalities that 15/20 municipalities are in Hiroshima prefecture. The rate of increase of schools in the period III is remarkably high in this type due to the second baby boom, and commuter towns / new towns were established in the suburbs. It is considered that the new school was set up to respond to the increase in the number of students.

Decreasing school type is divided into four types: Period II decrease type (68 municipalities), Period III decrease type (18 municipalities), Period IV decrease type (19 municipality), and Period V decrease type (23 municipalities). This is the only type that the number of students continues to decrease from Period II to Period V. The change rate of the number of students is similar to that of the 4 types, but it is characterized by the difference in when the school decreases.

Period II decrease type is the second largest type after the one school type. Due to the substantial declining population in Period II, the number of schools greatly decreased by the end of Period II, and many local governments became one school per one town / village. Thereafter there is no decrease in the number of schools.

In Period III decrease type, it is considered that the number of students decreased in spite of the second baby boom in Period III, and the reorganization was promoted by local government.

In Period IV decrease type, the change rate of students in Period III is -16.0%, which is the highest decreasing rate among all types. It is considered to have been reorganized in Period IV for the future school management, though the municipalities have kept the number of schools in Period II and III.

In the period V decrease type, municipalities have 4.0 schools on average, and there is little consolidation until the end of Period IV. About half of the schools in Period V decreased due to the policy reorganization of Heisei municipal merger and the fact that the change rate of students in Period IV is -47.0%, which is the highest among all types.

In addition, reorganization due to Heisei municipal merger is not much seen in the whole of 5 prefectures.

Table 3: Reorganization type of Junior high schools

Type [Sample Number]	School Ave. (1963)	Change Rate of Schools (%)				Change Rate of Students (%)			
		Period II	Period III	Period IV	Period V	Period II	Period III	Period IV	Period V
Keeping (city) [18]	12.1	-0.6%	7.1%	0.7%	0.4%	-32.7%	17.9%	-39.3%	-8.1%
Keeping (town/village) [42]	3.4	-1.7%	-0.1%	0.6%	4.5%	-45.0%	13.3%	-39.3%	-9.1%
One school [137]	1.0	0.0%	0.0%	0.0%	0.0%	-48.7%	10.8%	-33.6%	-19.5%
Increasing [20]	1.5	8.3%	78.3%	26.8%	-2.5%	34.8%	86.2%	-37.1%	-4.9%
Decreasing (II) [68]	3.0	-59.1%	0.0%	0.0%	0.0%	-57.2%	-3.2%	-36.4%	-23.6%
Decreasing (III) [18]	2.4	-3.7%	-50.4%	0.0%	0.0%	-61.0%	-13.1%	-35.8%	-30.6%
Decreasing (VI) [19]	3.2	-6.0%	-1.3%	-47.9%	0.0%	-58.6%	-16.0%	-36.6%	-28.9%
Decreasing (V) [23]	4.0	-7.2%	0.0%	-4.3%	-49.8%	-55.7%	-5.4%	-47.0%	-27.7%

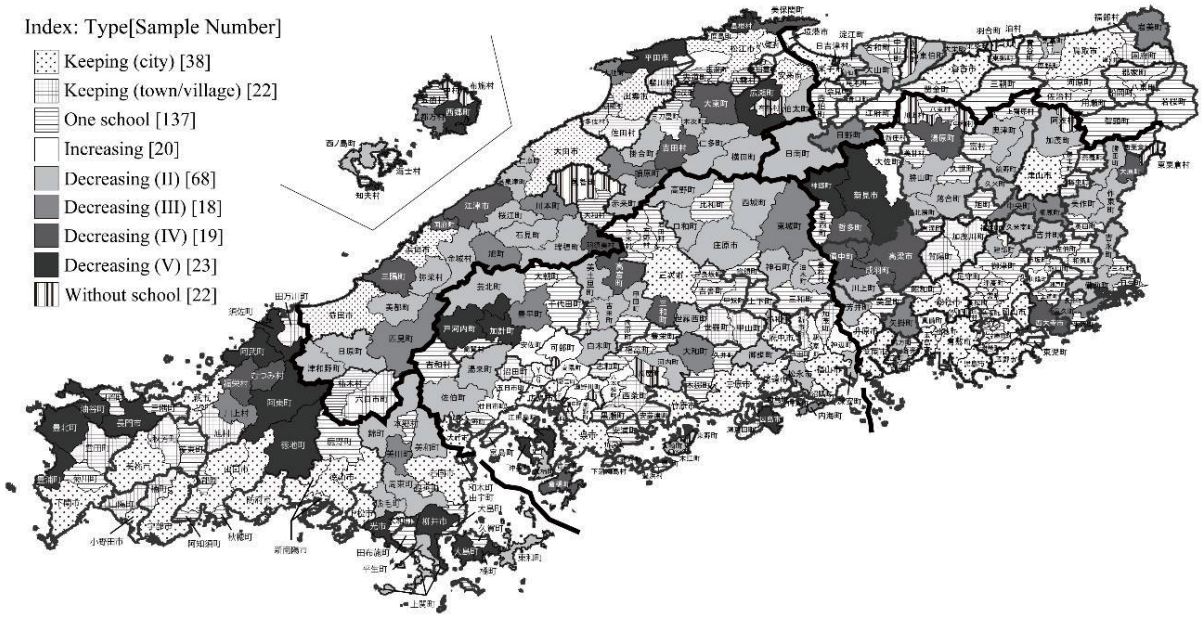


Fig. 3: Distribution of Reorganization type of Junior high schools

3.4 Knowledge

In the Chugoku area progressing typical school closing, we compare the features of reorganization due to the trend of the number of schools with the number of students and regional features by mathematical quantification theory class III. Then we reveal the regional characteristics of the transition of the number of students and schools. Figure 4 shows the composition ratio of regional type and school reorganization type.

Municipalities in the Seto Inland Sea side such as Okayama City and Hiroshima City and cities in the Sea of Japan side such as Matsue City have urban characteristics. So, there is no significant decrease in the number of pupils. Then the municipalities which keep or increase the number of schools account for 80%.

In the intermediate type, the number of students decreased by more than 70% in 47 years. The area of the municipalities is about the same as the urban type, but the student density is 1/3 of the urban type. When the intermediate type is compared with mountain type 1 and 2, there are few decreasing types and there are many one school types. Even in one school type, the number of students in 2010 is about 100 or more, and it is considered that the possibility of reorganization that goes beyond the scope of the municipality boundaries is less than in the mountain type.

The mountain type is in the mountain area along the Chugoku Mountains and this type is abolished schools in Period II and Period V. It is divided into mountain type 1 with more students than mountain type 2 and mountain type 2 with average number of students 66.0 in 2010. Especially in the mountain type 2, the student density is the lowest among the four classes, 10.5 people / km^2, and the decreasing school type and one school type account for more than 90%. Then 106/107 municipalities have only one school in the municipality.

At junior high schools, there is a high necessity to judge the appropriate number of schools owing to problems such as a system that requires a teacher for each subject. So, the discussion of reorganization beyond the framework of the old municipality category in the mountain area is essential. Then the reorganization of school should be planned with local residents considering the scale of education.

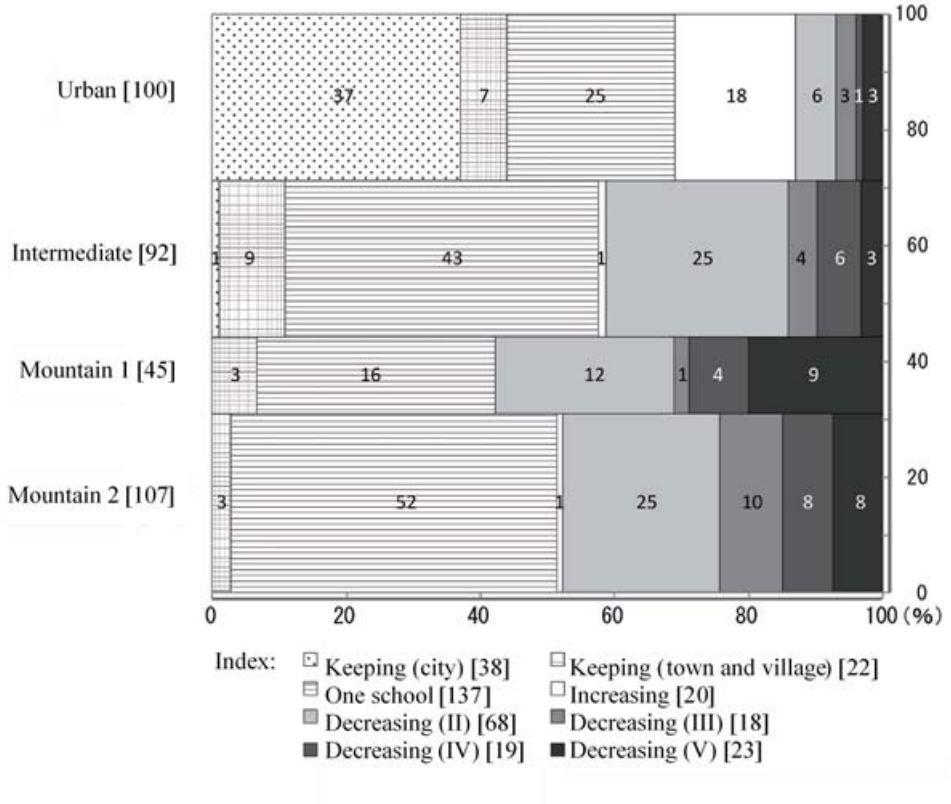


Fig. 4: Composition ratio of Local type and Reorganization type

4. References

Fujino, T. and Aizawa, H. and Sugawara M. (2010) The cause of public elementary schools closing down and the subjects of them. Architectural Institute of Japan, No.649. 579-585.

Saito, N. (2008) A Study on the Closing/Integrated Process of Public Elementary/Junior High Schools and on Re-use of the School Facilities: The actual situation of closing/integrated schools for the past 30 years in Ibaraki prefecture and its effects on the rural communities, Architectural Institute of Japan, No.627. 1001-1006.

Nozawa, H. and Taniguchi, G. and Tsunekawa, K. and Tabata E. (2012) A Study on Review of Conversion about Public School Facilities –In case of Aichi, Gifu, Mie, prefecture-, Architectural Institute of Japan, No.674. 865-872.

Yamamoto, S. and Nakazono, M. and Shimizu, S. (2014) Transition of Children and Primary School Number in Yamaguchi Prefecture (1949-2011), Architectural Institute of Japan, No.20(44), 237-240.