

The Impact of Michi-no-Eki with Daily Life Facilities on Changes in QOL

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Abstract: Michi-no-Eki is expected to be a roadside station with daily life facilities such as a supermarket, a restaurant and a play park, in order to improve the well-being of local people. However, the method quantitatively evaluating the necessity of Michi-no-Eki with daily life facilities has not been developed yet. Therefore, it might be difficult for local authorities to determine the appropriate location and design of Michi-no-Eki with daily life facilities considering local situation. This study aims to clarify the factors influencing the impact of Michi-no-Eki with daily life facilities on changes in Quality of Life (QOL) of local people, in order to obtain fundamental knowledge to develop the method mentioned above. Results show that Michi-no-Eki with daily life facilities would improve the QOL of some local people (10-33%). In addition, we clarified the characteristics of local people whose QOL would be improved by constructing a Michi-no-Eki with daily life facilities.

Keywords: Michi-no-Eki, Daily Life Facilities, Quality of Life

1. INTRODUCTION

Michi-no-Eki means “Roadside Station” in Japanese. The Michi-no-Eki system was originated in Japan in 1993. The number of Michi-no-Eki has been growing and now 1,180 Michi-no-Ekis have already opened in Japan. The main objectives of Michi-no-Eki are to provide road users with a safe and comfortable road traffic environment and to contribute to the local economy. To fulfill the main objectives mentioned above, Michi-no-Eki has at least three basic functions as follows: (1) Refresh - rest facilities that include free 24-hour parking and restrooms, (2) Community - regional co-operation where cultural centers, tourist attractions, recreation and other local development facilities promote interaction with the region and (3) Information - where road, tourist and emergency care information is readily available.

Recently, MLIT (Ministry of Land, Infrastructure, Transport and Tourism) of Japan established a special support program for Michi-no-Eki greatly contributing to regional vitalization from the perspectives of the local economy and society (MLIT, 2015). MLIT expects two types of Michi-no-Eki: gateway type and area-based type. The gateway type is a Michi-no-Eki promoting inbound tourism and relocation to local areas in order to bring in energy from outside the region. The area-based type is a Michi-no-Eki that contributes to local well-being, local industries and disaster prevention in order to create vitality within the region. On the other hand, there are still some issues: (1) how to enhance the functions of Michi-no-Eki, (2) the appropriate location of and the total number of Michi-no-Eki and (3)

how to evaluate the effect of Michi-no-Eki (Basic Policy Subcommittee, MLIT, 2015). In 2019, MLIT regarded the period 2020-2025 as the third stage of Michi-no-Eki and expects Michi-no-Eki to solve the issues related to population aging (Basic Policy Subcommittee, MLIT, 2019). In addition, improvement of both qualities of daily life and mobility services is listed as one of the medium-to long-term road policy directions (Basic Policy Subcommittee, MLIT, 2019).

From the above, it is urgent and important to develop useful tools (e.g., statistical model) to enable local authorities to determine the appropriate location and design of area-based Michi-no-Eki for local well-being.

This study focuses on area-based Michi-no-Eki for local well-being and mainly aims to model and calculate its impact on changes in QOL of local people.

2. LITERATURE REVIEW

Over the past few decades, some studies have been made on various functions of Michi-no-Eki. Iida (2000) clarified the factors influencing the usage of Michi-no-Eki for taking a rest, based on a questionnaire data collected from car drivers, and also suggested some improvements in three basic functions to increase the users. Oizumi *et.al.* (1999) calculated the effect of Michi-no-Eki on regional vitalization applying DEMATEL method to a questionnaire data collected from Michi-no-Eki managers or civil servants in charge of Michi-no-Eki. Yamamoto and Yuzawa (2012) analyzed the impact of farmer's market in Michi-no-Eki on regional revitalization based on a questionnaire data collected from Michi-no-Eki users, farmers, farmer's market managers and Michi-no-Eki managers. Akiyama *et.al.* (2013) and Tanaka *et.al.* (2016) clarified current situations and issues of Michi-no-Ekis as a disaster shelter based on a questionnaire data collected from Michi-no-Eki managers. Thus, although many studies have focused on three basic functions and the function of disaster prevention of Michi-no-Eki, little attention has been given to Michi-no-Eki with daily life facilities (e.g., a supermarket, a restaurant and a play park) for local well-being.

On the other hand, Watanabe *et.al.* (2012) clarified locating some daily life facilities in a Michi-no-Eki is effective to improve Michi-no-Eki users' satisfaction. Fujisawa (2017) emphasized that locating daily life facilities in/around Michi-no-Eki is more reasonable choice than creating a new small local hub with daily life facilities. Ise and Minato (2018) modeled how much money the local people would spend at Michi-no-Eki with daily life facilities in order to evaluate its profitability. Murakami and Oyabu (2016) examined how a Michi-no-Eki in a rural area improved regional economy based on a sales data of a light meal shop at the case study Michi-no-Eki and a questionnaire data collected from the customers.

Michi-no-Eki with daily life facilities is located essentially to improve local well-being, therefore, it is important to evaluate it in terms of not only profitability but also the effects on local well-being. Ise and Minato (2019) modeled the impact of Michi-no-Eki with daily life facilities on changes in social capital. However, as far as we know, there have been few research studies on the impact of Michi-no-Eki with daily life facilities on changes in QOL of local people.

As a result of reviewing previous studies, it becomes clear that there is not enough knowledge to develop an evaluation method to enable local authorities to determine the appropriate location and design of area-based Michi-no-Eki for local well-being.

3. METHODOLOGY

In this section, we briefly explain the research process of this study: (1) case study Michi-no-Eki; (2) questionnaire survey; (3) current usage of daily life facilities in Michi-no-Eki; (4) impact of Michi-no-Eki for local well-being on changes in QOL; (5) factors influencing the impact of Michi-no-Eki for local well-being on changes in QOL; (6) impact evaluation of Michi-no-Eki for local well-being on changes in QOL.

First of all, we selected “Kakinosato-Kudoyama” as a case study Michi-no-Eki in Kudoyama Town, Wakayama Prefecture, Japan. “Kakinosato-Kudoyama” is one of the area-based Michi-no-Ekis and has some daily life facilities (a supermarket, a restaurant and a play park). Secondly, to collect data used in this study, we conducted a questionnaire survey of all households (two questionnaire sheets per household) in Kudoyama Town, Wakayama Prefecture, Japan. In total, 718 respondents were obtained from distributed 3,282 questionnaire sheets.

In Section 6, we describe the distribution of the frequency of using daily life facilities in the Michi-no-Eki. In addition, we clarified the patterns of the usage of daily life facilities in the Michi-no-Eki.

In Section 7, we focus three scenarios of construction of Michi-no-Eki with daily life facilities considering the results in Section 6, and analyze the impact of each scenario on changes in QOL of local people.

In Section 8, we use multiple regression analysis to clarify the factors influencing the impact of each scenario on changes in QOL of local people.

In Section 9, we evaluate the impact of each scenario on changes in QOL of local people in Kudoyama Town, Wakayama Prefecture, Japan based on the models developed in Section 8.

4. CASE STUDY MICHI-NO-EKI

The case study Michi-no-Eki is “Kakinosato-Kudoyama” which is one of the area-based Michi-no-Ekis (Figure 1). This Michi-no-Eki was opened on April 26, 2014 based on the results of questionnaire survey of people in Kudoyama Town. This Michi-no-Eki has three

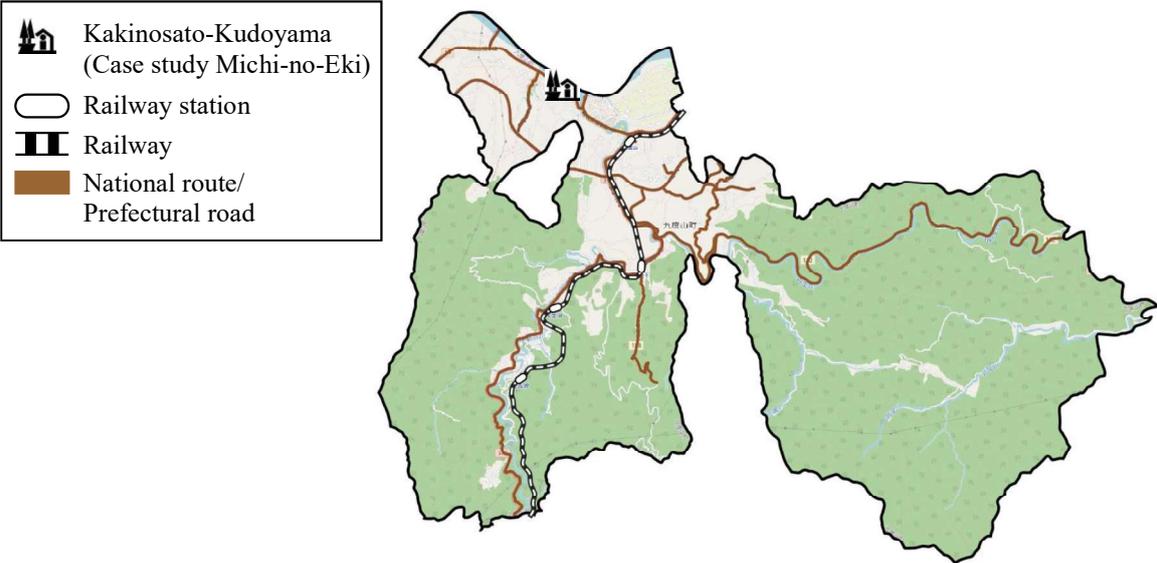


Figure 1. Kakinosato-Kudoyama and Kudoyama Town, Wakayama Prefecture, Japan



Figure 2. Supermarket and restaurant



Figure 3. Play park

daily life facilities (a supermarket, a restaurant and a play park) in addition to the three basic functions of Michi-no-Eki (Figure 2 and 3), in order to improve the QOL of people in Kudoyama Town. The supermarket in this Michi-no-Eki is the only supermarket in this town which sells fresh foods (e.g., vegetables, fruits and meats) and daily necessities. In the play park in this Michi-no-Eki, there are two equipment for children and four benches. The supermarket opens from 9:00 to 18:30 except Jan. 1 - 3 and the restaurant opens every day from 9:00 to 16:30.

Although this Michi-no-Eki is about 900m away from Kudoyama station, it is very close to the station catchment area (defined as within 800m of a station (MLIT, 2014)). Therefore, it can be said that the accessibility of this Michi-no-Eki by train is good. On the other hand, there is no bus services in this town so that the nearest bus stop from this Michi-no-Eki is in the neighbouring city (Hashimoto City). The distance between this Michi-no-Eki and the nearest bus stop is about 600m which is twice the radius of the bus stop catchment area (defined as within 300m of a bus stop (MLIT, 2014)). In addition, the bus runs only 6 times per day. Therefore, it can be seen that the accessibility of this Michi-no-Eki by bus is very poor.

According to the 2015 Population Census of Japan, Kudoyama Town where this Michi-no-Eki is located, had the sixth-smallest population in 30 municipalities of Wakayama Prefecture. The population (including age-unknown population) of this town in 2015 was 4,377 with 2,016 males and 2,361 females, and the number of households was 1,649. As shown in Table 1, the percentage of the population aged 65 and over reached 42.2%, which was the sixth-highest in Wakayama Prefecture. Before this Michi-no-Eki was opened, there was no supermarket in this town. Therefore, many of those aged 65 and over in this town had difficulty shopping and strongly needed to improve the shopping accessibility in this town.

Table 1. Age distribution by gender in Kudoyama Town in 2015

Age group (years)	Male		Female		Total	
	N	%	N	%	N	%
0-14	184	9.1	177	7.5	361	8.3
15-64	1,057	52.4	1,112	47.1	2,169	49.6
65-74	382	18.9	448	19.0	830	19.0
75+	393	19.5	622	26.4	1,015	23.2
Total	2,016	100.0	2,359	100.0	4375	100.0

5. QUESTIONNAIRE SURVEY

The questionnaire survey of all households (two questionnaire sheets per household) in Kudoyama Town was conducted from October to December 2016, in order to mainly model and evaluate the impact of area-based Michi-no-Eki on QOL of local people. The detailed procedure of the questionnaire survey is as follows: (1) all members of our laboratory put an envelope enclosing two questionnaire sheets and a stamped return envelope in a postbox from house to house; (2) we collected questionnaire survey sheets by postal mail. As a result, 718 respondents, which is about 16.4 percent of the population of Kudoyama Town, were obtained from distributed 3,282 questionnaire sheets (1,641 households).

The main questionnaire items are shown in Table 2: individual attributes, accessibility, current usage of daily life facilities in “Kakinostato-Kudoyama” and QOL before and after “Kakinostato-Kudoyama” opened. Quality of Life surveys are conducted in many countries. European Quality of Life Survey 2012 covers a range of questions such as employment, income, housing and living conditions, family, health, work-life balance, life satisfaction and perceived quality of society (Eurofound, 2012). Eurostat, that is the statistical office of the European Union, organize a set of QOL indicators for the EU on the basis of the 9 dimensions including overall experience of life (Eurostat, 2015). Kawamura and Taniguchi (2013) used life satisfaction to measure the QOL by referring to National Survey of Lifestyle Preference conducted by Cabinet Office, Government of Japan. Life satisfaction was selected as one of the indicators for measuring the QOL in all surveys mentioned above. We therefore use daily life satisfaction as the indicator measuring QOL in this study. In addition, Eurostat stated that “the indicator on overall life satisfaction is currently the most commonly used subjective well-being measure and often used and recommended as a suitable overall headline summary indicator of subjective well-being” (Eurostat, 2017).

Table 2. Main items of questionnaire survey

Items	Details
Individual attributes	<ul style="list-style-type: none"> - Address - Gender - Age - Occupation - Household structure - Pain-free walking time - Car and motorbike ownership
Accessibility	<ul style="list-style-type: none"> - Distance from home to the nearest station - Distance from home to the nearest bus stop - Distance from home to the nearest fresh food store (other than the supermarket in “Kakinostato-Kudoyama”) - Distance from home to “Kakinostato-Kudoyama”
Current usage of daily life facilities in “Kakinostato-Kudoyama”	<ul style="list-style-type: none"> - Frequency of visiting “Kakinostato-Kudoyama” - Frequency of using daily life facilities in “Kakinostato-Kudoyama”
QOL before and after “Kakinostato-Kudoyama” opened	<ul style="list-style-type: none"> - QOL before and after “Kakinostato-Kudoyama” opened

6. CURRENT USAGE OF DAILY LIFE FACILITIES IN MICHI-NO-EKI

6.1 Frequency of Using Daily Life Facilities

As shown in Figure 4, about 75% of people visit “Kakinosato-Kudoyama” once or more in 3 months. For the supermarket/restaurant, people who use at least one of them once or more in 3 months, accounted for more than 50%. On the other hand, most people in this town do not use the play park frequently.

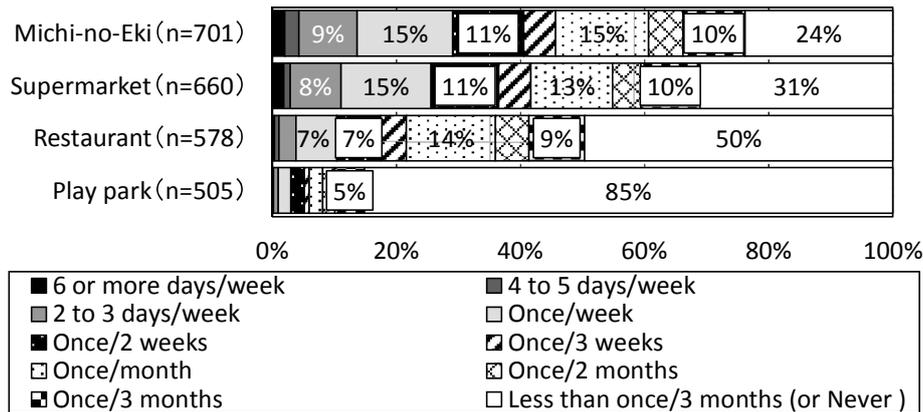


Figure 4. Frequency of using daily life facilities in “Kakinosato-Kudoyama”

6.2 Patterns of the Usage of Daily Life Facilities

We defined people who use daily life facilities in “Kakinosato-Kudoyama” once or more in 3 months as regular users and others as non-regular users. Figure 5 shows the patterns of the usage of daily life facilities in “Kakinosato-Kudoyama” among regular users.

As a result, P2 (Supermarket + Restaurant), which shows the percentage of regular users who use both the supermarket and the restaurant, is the highest (29.8%). The second highest is P1 (Supermarket) of which percentage is 26.4% and P4 (Supermarket + Restaurant + Play park) is the third highest (8%).

From the above, the main daily life facility in this Michi-no-Eki for people living in Kudoyama Town is the supermarket. However, the other two facilities (especially the restaurant) are also important because the percentage of regular users who use more than one daily life facility is not so low (39.2%).

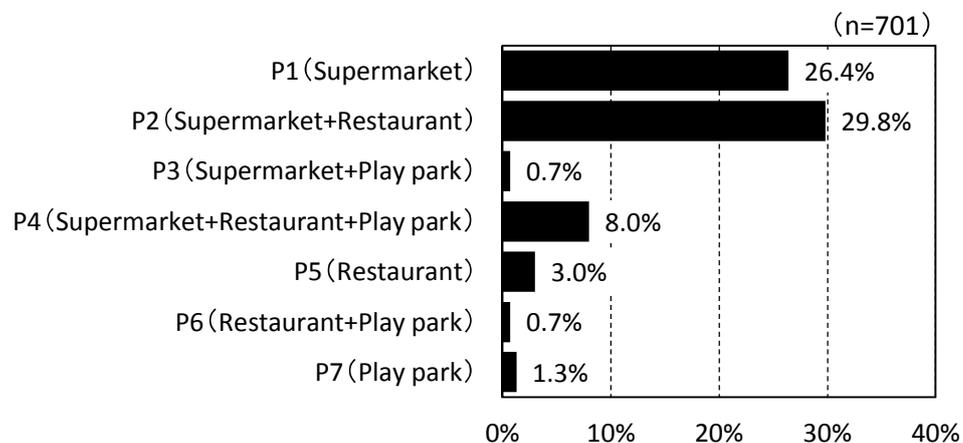


Figure 5. Patterns of the usage of daily life facilities in “Kakinosato-Kudoyama”

7. IMPACT OF MICHI-NO-EKI FOR LOCAL WELL-BEING ON CHANGES IN QOL

7.1 Quantifying Changes in QOL

As mentioned in Section 5, we use daily life satisfaction as the indicator measuring QOL. Therefore, we asked respondents to answer their daily life satisfaction before and after “Kakinoyama-Kudoyama” opened. There are five options to the question: “Extremely satisfied (2 points)”, “Somewhat satisfied (1 point)”, “Neither satisfied nor dissatisfied (0 point)”, “Somewhat dissatisfied (-1 point)” and “Extremely dissatisfied (-2 points)”. This study quantifies the change in QOL by subtracting the daily life satisfaction before the Michi-no-Eki opened from that after the Michi-no-Eki opened. The range of the change in QOL is from -4 points to 4 points.

7.2 Scenarios of Construction of Daily Life Facilities in Michi-no-Eki

Focusing only on three daily life facilities in “Kakinoyama-Kudoyama”, the number of their construction cases is seven (except for the case that there are no daily life facilities in a Michi-no-Eki) (see Figure 5).

This study focuses on three construction scenarios of daily life facilities shown below.

(1) Scenario 1 (Supermarket)

This is the case of the construction of Michi-no-Eki with a supermarket in addition to basic functions.

(2) Scenario 2 (Supermarket + Restaurant)

This is the case of the construction of Michi-no-Eki with a supermarket and a restaurant in addition to basic functions.

(3) Scenario 3 (Supermarket + Restaurant + Play park)

This is the case of the construction of Michi-no-Eki with a supermarket, a restaurant and a play park in addition to basic functions.

7.3 Concept for Handling the Changes in QOL in Each Scenario

Scenario 1 is the case of the construction of Michi-no-Eki with a supermarket in addition to basic functions. As indicated in Figure 5, P1 - P4 include people who use the supermarket. However, it can be thought that people other than those of P1 use the supermarket because the other two facilities (a restaurant and a play park) are available in the Michi-no-Eki. If such assumption is correct, people other than those of P1 do not use the supermarket. This means that the Michi-no-Eki with supermarket does not change their QOL. Therefore, we modify the changes in QOL of respondents other than those of P1 to 0 point in Scenario 1, in order to avoid the overestimation (Table 3).

Table 3. The way of handling the changes in QOL in each scenario

Scenario	Way of handling the Changes in QOL
Scenario 1 (Supermarket)	The Changes in QOL of respondents other than those of P1 is 0 point.
Scenario 2 (Supermarket+Restaurant)	The Changes in QOL of respondents other than those of P1, P2 and P5 is 0 point.
Scenario 3 (Supermarket+Restaurant+Play park)	No modification

Scenario 2 is the case of the construction of Michi-no-Eki with a supermarket and a restaurant in addition to basic functions. P1, P2 and P5 include people who use the supermarket and/or the restaurant. Based on the consideration mentioned above, we modify the changes in QOL of respondents other than those of P1, P2 and P5 to 0 point in Scenario 2.

Scenario 3 is the case of the construction of Michi-no-Eki with a supermarket, a restaurant and a play park in addition to basic functions. This scenario makes all patterns of the usage of daily life facilities possible so we do not modify the changes in QOL of respondents in Scenario 3.

We also focus on Scenario 0 in order to compare with three other scenarios mentioned above. The Scenario 0 (No daily life facilities) is the case of the construction of Michi-no-Eki with only basic functions so we modify the changes in QOL of respondents of P1 - P7 to 0 point in Scenario 0.

7.4 Results

Figure 6 shows the changes in QOL in each scenario.

As a result, the impact of Michi-no-Eki with only three basic functions (Scenario 0) on the changes in QOL of local people is very low. On the other hand, in the Scenario 1 - 3, the percentage of local people whose QOL would be improved is about 10-33%. Therefore, locating more daily life facilities in a Michi-no-Eki is more effective to improve the QOL of local people.

We also analyzed the differences of the positive changes in QOL in Scenario 0 and each of Scenario 1 - 3: (1) the difference of the positive changes in QOL between Scenario 0 and 1 is about 9%, (2) that between Scenario 0 and 2 is about 25.6% and (3) that between Scenario 0 and 3 is 31.4%. Thus, it can be said that a supermarket and a restaurant in a Michi-no-Eki especially contribute to improve the QOL of local people.

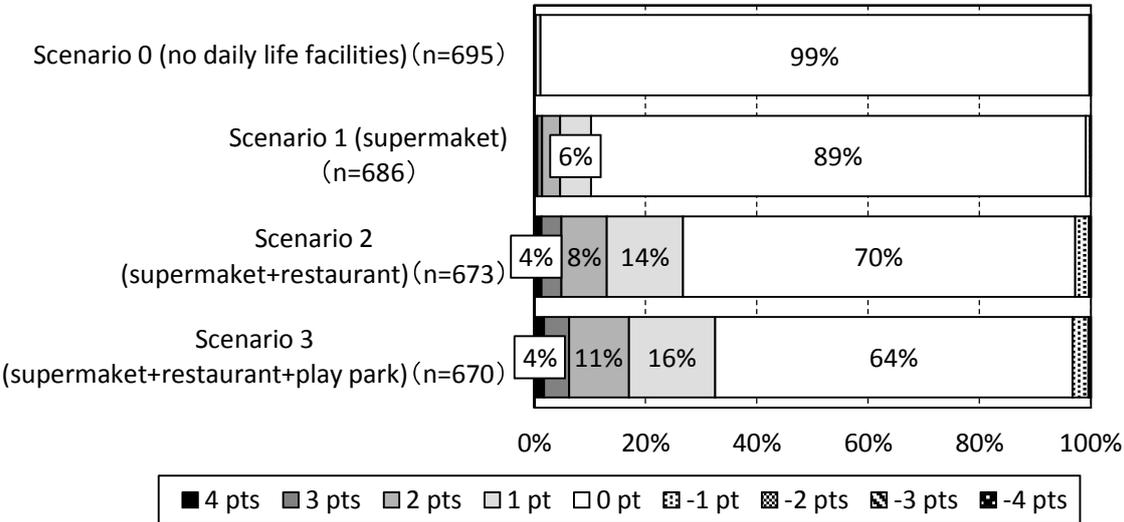


Figure 6. Changes in QOL in each scenario

8. FACTORS INFLUENCING THE IMPACT OF MICHI-NO-EKI FOR LOCAL WELL-BEING ON CHANGES IN QOL

8.1 Independent Variables for Analysis

One of the objectives of this study is to enable to calculate the impact of Michi-no-Eki with daily life facilities on changes in QOL of local people at small area level (250m mesh level) by using existing statistical data. Therefore, we selected independent variables that can be created from the following three databases: (1) National Population Census - national-wide data aggregated at 250m mesh level, (2) National Land Numerical Information - national-wide point data and (3) Electronic Telephone Directory - national-wide point data. The independent variables we selected are shown in Table 4.

Table 4. Independent variables for analysis

Independent variables	Details
Individual attributes	<ul style="list-style-type: none"> - Gender - Age - Gender and age - Household size - Family type
Accessibility	<ul style="list-style-type: none"> - Distance from home to the nearest station - Distance from home to the nearest bus stop - Distance from home to “Kakinosato-Kudoyama” minus Distance from home to the nearest fresh food store - Distance from home to “Kakinosato-Kudoyama”

8.2 Analytical Procedure

Analytical procedure of the modeling is as follows: (1) determine whether there are any statistical differences in the changes in QOL between independent groups of each variable by applying one-way analysis of variance (one-way ANOVA); (2) clarify the characteristics of local people whose QOL would be improved by constructing a Michi-no-Eki with daily life facilities by applying multiple regression analysis. All independent variables used in the analysis (2) achieve statistical significance in the analysis (1).

8.3 Results

Table 5 - 7 show the results of modeling the impacts of Scenario 1-3 on the changes of QOL of local people.

From the result of Table 5, a Michi-no-Eki with a supermarket and three basic functions would be effective to improve the QOL of people living less than 3km away from the nearest station except for non-elderly people living alone. The result in Table 5 is quite different from the results of Scenario 2 and 3. Only two variables achieved statistical significance in one-way ANOVA before modeling. Further studies are needed in order to clarify the reason why the result of Scenario 1 is quite different from the other two results.

In the results of both Table 6 and 7, almost all variables, which achieved statistical significance in one-way ANOVA before modeling, are the same. As it can be seen in both tables, the Michi-no-Eki, that meets the conditions of Scenario 2 or 3, would be effective to improve the QOL of people who have the following characteristics: elderly female; live less

than 3km away from the nearest station; live closer to the Michi-no-Eki than the nearest fresh food store; live near the Michi-no-Eki. We used the variable “Gender and age” in Scenario 2 because the p-statistic of the variable is lower than those of “Gender” and “Age”. However, the variables “Gender” and “Age” also achieved statistical significance in the analysis (1) in Scenario 2.

It is probable that, “Kakinosato-Kudoyama” is not difficult to access from a station on foot as mentioned in Section 4, so the variable “Distance from home to the nearest station” achieved statistical significance in all scenarios.

Table 5. Multiple regression result (Scenario 1: a supermarket)

Independent variables		Unstandardized Coefficients	Standardized Coefficients	t-statistics
Household type	Non-elderly one-person household	-0.143	-0.040	-1.047
	Others	0	0	-
Distance from home to the nearest station	Less than 3 km	0.170	0.085	2.220**
	More than 3 km	0	0	-
(Intercept)		0.009	-	0.120

***: p<0.01, **: p<0.05, *: P<0.10

Sample size: 677, Multiple R: 0.0967, F-statistic: 3.1810**

Table 6. Multiple regression result (Scenario 2: a supermarket and a restaurant)

Independent variables		Unstandardized Coefficients	Standardized Coefficients	t-statistics
Gender and age	Male in all age groups/ Female under 65 years	-0.206	-0.106	-2.744***
	Others	0	0	-
Distance from home to the nearest station	Less than 3 km	0.234	0.075	1.818*
	More than 3 km	0	0	-
Distance from home to “Kakinosato-Kudoyama” minus Distance from home to the nearest fresh food store	-9 ~ -6 km	0.760	0.119	2.012**
	-6 ~ 2 km	0.169	0.034	0.582
	More than 2 km	0	0	-
Distance from home to “Kakinosato-Kudoyama”	Less than 200 m	0.448	0.083	1.806*
	201 m ~ 8 km	0.200	0.066	1.370
	More than 8 km	0	0	-
(Intercept)		-0.025	-	-0.077

***: p<0.01, **: p<0.05, *: P<0.10

Sample size: 659, Multiple R: 0.1890, F-statistic: 4.0262***

Table 7. Multiple regression result (Scenario 3: a supermarket, a restaurant and a play park)

Independent variables		Unstandardized Coefficients	Standardized Coefficients	t-statistics
Gender	Male	-0.152	-0.075	-1.929*
	Female	0	0	-
Distance from home to the nearest station	Less than 3 km	0.201	0.058	1.409
	More than 3 km	0	0	-
Distance from home to “Kakinosato-Kudoyama” minus Distance from home to the nearest fresh food store	-9 ~ -6 km	0.725	0.103	1.738*
	-6 ~ 2 km	0.247	0.046	0.772
	More than 2 km	0	0	-
Distance from home to “Kakinosato-Kudoyama”	Less than 500 m	0.473	0.172	2.548**
	501 m ~ 8 km	0.160	0.067	0.988
	More than 8 km	0	0	-
(Intercept)		-0.033	-	-0.092

***: p<0.01, **: p<0.05, *: P<0.10

Sample size: 656, Multiple R: 0.1879, F-statistic: 3.9577***

The Michi-no-Eki that meets Scenario 2 or 3 would improve the QOL of local people, even if the Michi-no-Eki is a little farther than the nearest fresh food store from their home. This may result from the number of daily life facilities in a Michi-no-Eki. The Michi-no-Eki that meets Scenario 2 or 3 incorporates some daily life facilities such as a supermarket, a restaurant and a park, so that local people can achieve more purposes in those Michi-no-Eki than at the nearest fresh food store.

As the results of one-way ANOVA, gender achieved statistical significance in Scenario 2 and 3 but did not achieve statistical significance in Scenario 1. This difference may result from the differences both in the opening hours between the supermarket and the restaurant and in employment rate between male and female. The opening hours of the supermarket are 9:00 - 18:30 so many people can visit here after work (Normal business hours in Japan are 9:00 - 17:00). However, the opening hours of the restaurant is 9:00 - 16:30 so it is difficult for many people to visit here after work. In addition, in Japan, the male employment rate is higher than the female employment rate.

9. IMPACT EVALUATION OF MICHINO-EKI FOR LOCAL WELL-BEING ON CHANGES IN QOL

9.1 Data for Impact Evaluation

Table 8 shows the data using for impact evaluation of Scenario 1-3 on the changes in QOL of local people. We use GIS to calculate the distances necessary for the accessibility indicators. Before the calculation, we deleted all meshes of which population is 0.

The calculation procedure is as follows: (1) find the shortest route between the center point of each mesh area and points of facilities (stations, fresh food stores and “Kakinoyama-Kudoyama”); (2) find the nearest station and the nearest fresh food store of each mesh area from the results of (1); (3) calculate the distances between the center point of each mesh area and “Kakinoyama-Kudoyama”, and between the center point of each mesh area and the nearest facilities.

Table 8. Independent variables available in the model

Indicator	Details	Database
Population	- Population by gender/age/gender and age - Household size - Family type	- National Population Census (250m mesh level)
Accessibility	- Distance from the mesh area to the nearest station - Distance from the mesh area to “Kakinoyama-Kudoyama” minus Distance from the mesh area to the nearest fresh food store - Distance from the mesh area to “Kakinoyama-Kudoyama”	- National Land Numerical Information - Electronic Telephone Directory

9.2 Results

Figure 7 - 9 show the results of the impact evaluation of Scenario 1- 3 on the changes in QOL of local people. Each mesh size is 250m x 250m. The darker the red color, the more positive changes in the QOL of local people.

It can be seen that, the farther a mesh area is from “Kakinoyama-Kudoyama” and/or stations, the less positive changes in the QOL of local people are. In addition, the more daily life facilities in the Michi-no-Eki, the darker the red colors of many mesh areas: the total

changes in QOL in Scenario 1 is 826 points, that in Scenario 2 is 1,965 points and that in Scenario 3 is 2,480 points. These results indicate that locating more daily life facilities in a Michi-no-Eki is more effective to increase not only the total changes in QOL in Kudoyama Town but also the areas (meshes) where the QOL improved significantly.

In summary, it can be said that the models we developed in this study contribute local authorities to determine the appropriate location and design of the Michi-no-Eki with daily life facilities in terms of the QOL of local people.

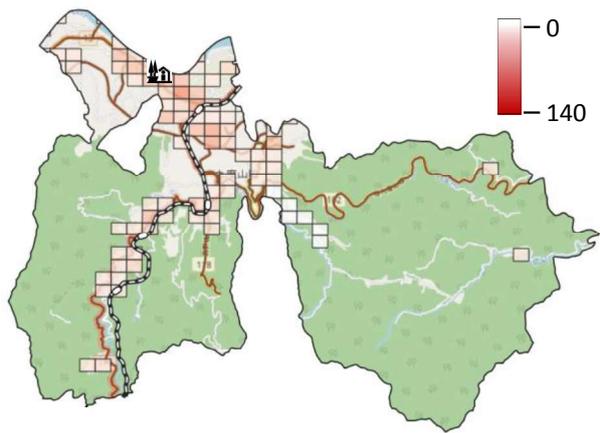


Figure 7. Impact evaluation result (Scenario 1: a supermarket)

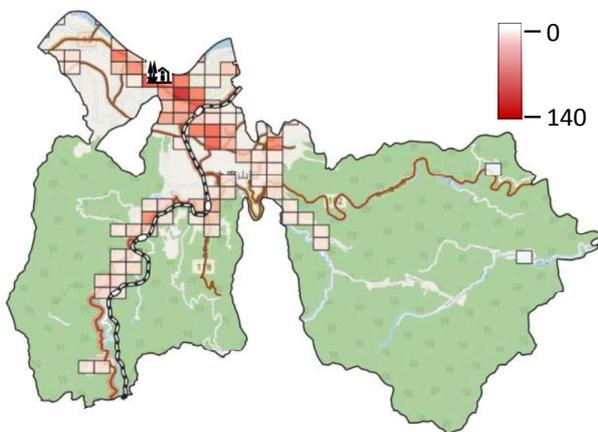


Figure 8. Impact evaluation result (Scenario 2: a supermarket and a restaurant)

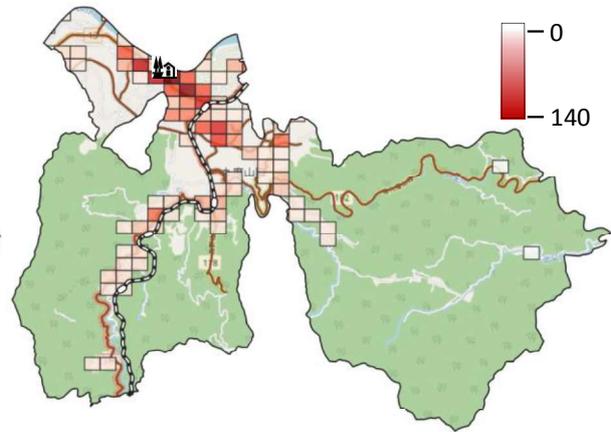


Figure 9. Impact evaluation result (Scenario 3: a supermarket, a restaurant and a play park)

10. CONCLUSION AND NEXT

This study focused on area-based Michi-no-Eki for local well-being and mainly aimed to model and calculate its impact on changes in QOL of local people.

Some major results are summarized as follows.

- (1) People living in Kudoyama Town mainly use the supermarket in “Kakinosato-Kudoyama”. However, the other two facilities (especially the restaurant) are also important because the percentage of regular users who use more than one daily life facility is not so low.
- (2) Locating more daily life facilities in a Michi-no-Eki is more effective to improve the QOL of local people.
- (3) The Michi-no-Eki which meets the conditions in Scenario 2 or 3, would be effective to improve the QOL of people who have the following characteristics: elderly female; live less than 3km away from the nearest station; live closer to the Michi-no-Eki than the nearest fresh food store; live near the Michi-no-Eki.

This study enabled to calculate the impact of three types of Michi-no-Eki with daily life facilities on changes in QOL of local people at small area level (250m mesh) and town level. Therefore, it can be said that this study contributes local authorities to determine the

appropriate location and design of a Michi-no-Eki with daily life facilities in terms of QOL of local people.

Future issues are summarized as follows.

- (1) It is necessary to focus on four construction scenarios of daily life facilities other than Scenario 1 - 3 in this study.
- (2) It is also necessary to deal with daily life facilities other than those in “Kakinosato-Kudoyama” (e.g., a post office, a clinic, a town hall branch, a library).
- (3) All models in this study are beneficial for local authorities in charge of Michi-no-Eki because all models achieved statistical significance in one-way ANOVA. However, it is important to improve the accuracy of the models.
- (4) In Subsection 7.3, we handle the change in QOL in each scenario to avoid the overestimation. However, this may lead to underestimation of the changes in QOL in each scenario. Therefore, it is also important to develop models in each scenario without making any changes to the change in QOL in order to estimate an interval of possible values of the change in QOL.

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