

**An Econometric Analysis of PFI Roadside Stations in Japan**

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**October, 2020  
Discussion Paper No.2018**

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**ROKKO, KOBE, JAPAN**

# An Econometric Analysis of PFI Roadside Stations in Japan\*

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## 1. Introduction

The number of Roadside Stations in Japan is increasing rapidly. The purpose of this paper is to conduct econometric analyses of the business of PFI (private finance initiative) and other Roadside Stations. The PFI is a system in which private companies build social infrastructures using funds and know-how from the private sector, which the government then pays to use. Sales revenue is one of the most important targets for Roadside Stations. It depends on the number of customers who visited the station, number of events, parking space, management expenses, and gross business expenses. Conversely, all the latter variables also depend on sales revenue. Therefore, we used a two-stage least squares method to study the mutual influence between these variables. We found that PFI Roadside Stations had distinct economic performances. Therefore, we investigated the reason for their success. Then, we will show some policy implications.

## 2. PFI system for Roadside Station (Michi-no-Eki)

The PFI installation method started in 1999 by utilizing private funds, executive ability, and technical competence for construction of public facilities, maintenance management, and more. So far, it has been introduced into various institutions throughout Japan. A total of 740 PFI projects were implemented in 2018. Implementing PFI projects is multifaceted and complex. Therefore, PFI projects receive orders for multiple operations from the national or local government (hereinafter referred to as the "public sector"). Groups of private companies (called "consortiums") suitable for the execution of each relevant task (design and construction management, construction, maintenance management, operations, etc.) will form one group and participate in bidding on a consortium basis.

If a successful bid is made, a private business operator from the consortium establishes a special purpose company (SPC) which implements the PFI project and makes a contract with the public. Executing a PFI project is one of the most important examples of communication and cooperation between the public and private sectors. Thus, PFI system constructing a "consortium" with business enforcement. It shares one business plan from the consortium. Roadside Stations are the center of the regional activation project, so they should be established by local private companies that have a strong attachment to the area. Because of this, the PFI system is used to

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\* This paper is an extension of our previous work, originally published in Japanese (Matsuo, R. and M. Yamaguchi (2016 b)). We have obtained permission from Toshi-kenkyu (Kansai Urban Studies) to publish the extended paper in English.

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form a consortium to better establish and develop Roadside Stations. Table 1 shows the characteristics of introducing PFI to Roadside Stations.

As shown in Table 1, the basic features of the successful operation of PFI projects can be summarized as follows. First, public institutions, private business operators, and financial institutions should thoroughly consider and agree on appropriate risk sharing. Second, the most important of the seven phases in promoting PFI projects is the selection of PFI business operators in phase 4 (For each phase, see Table 1.). In necessary documents submitted by private companies with bid prices, we must be very careful in preparing a project implementation plan and a business income and expenditure plan. Third, PFI projects related to Roadside Stations are carried out under a BTO system, in which the designated operator undertakes the maintenance and management of the facilities for 15 years after they are constructed. In particular, it is important that the project implementation plan is sufficiently examined during the BTO process. Fourth, without a clear business plan, it may be difficult to continue business after implementation. In the formulation of a project implementation policy, it is important to make a clear contract concerning the responsibility of the business operator in the selection of a private business operator. If such a contract is not made, problems arise in terms of business continuity, as in the case of Hari T.R.S. The station was not approved as a PFI project and not mentioned in the Japan NPO PFI/PPP Association (2012) guidebook. The failure of Hari T.R.S. provides a lesson that sufficient business policies and implementation plans must be considered for PFI projects to be carried out successfully.

Here are some things to keep in mind. Since VFM (higher service quality and lower costs) is examined at the stage from the announcement of the implementation policy to the selection of the specific project, it is natural that the PFI project will have a good result to some extent (but there are other best classes, not PFI.). In addition, PFI has the advantage of reflecting the ingenuity and opinions of each SPC company at the design stage. Another advantage is that it is not necessary to pay the full amount in a lump sum in the facility completion year.

This PFI system was first introduced to Roadside Stations in 2000 at Hari T.R.S. (the case of Hari T.R.S is not recognized as a PFI project now because it failed to comply with the 2001 Guidelines on the PFI). They are now improved by this PFI system: “Mizu no sato Sawara” (Chiba Prefecture), “Hari T.R.S (te-ra-su)” (Nara Prefecture), “Youka Tajima no kura” (Hyogo Prefecture), “Kasaoka Bay Farm” (Okayama Prefecture), and “Ibusuki” (Kagoshima Prefecture), Kyotamba Ajimu no sato (Kyoto Prefecture), and Izu Gateway Kannami (Shizuoka Prefecture). Details of the projects for these stations are shown in Table 2.

Now, the cases of “Kasaoka Bay Farm,” “Mizu no sato Sawara,” “Ibusuki,” and “Youka Tajima no kura” are described in detail. First, the case of “Kasaoka Bay Farm” is shown below. Figure 1 shows the organization chart of the PFI business in “Kasaoka Bay Farm.” Amano Sangyo is a representative of the consortium of PFI companies. Then, we made a business contract with Kasaoka City and obtained the service purchase fee from the city. The department in charge of design, the department in charge of construction, the department in charge of maintenance and management, the department in charge of operating, and the department in charge of independent business at Amano Sangyo are as shown in the figure. There are two characteristics of “Kasaoka

Table 1 Abstract of the Characteristic of the PFI System

No.	Characteristic of the PFI System
(1)	<p>The success of PFI projects depends on whether the public and private sectors can clearly divide their duties. This means the transferring of risks previously taken by the public sector to the private sector. A basic requirement to properly execute PFI projects is an appropriate business plan to determine the roles of public institutions, private companies, and financial institutions, which is made through dialogue and consultation.</p>
(2)	<p>The process of the PFI projects is as follows: The 1st phase is Proposing the Business Idea. The 2nd is the Publication of an Implementation Outline. The 3rd is the Evaluation of the Specified Project. The 4th phase is the Invitation of Private-sector Proposals, Evaluation of Proposals and Selection of Private-sector Firms. The 5th phase is the Conclusion of the Agreements. The 6th phase entails Executing the Project. The 7th and final phase is the Completion of the Project</p> <p>The PFI projects are conducted based on the above procedures, with the 4th phase being the most important. The PFI firms are chosen through public bidding, and necessary documents that are submitted before the bidding process are an important factor in the choice of firms. Companies taking part in the bidding thoroughly consider the execution plan for the designing, building, operation, maintenance, earnings, and expense plan to prepare the reconstructed documents. This set of procedures before the project implementation makes the PFI firms' management more efficient.</p>
(3)	<p>PFI projects involved in Roadside Station management are executed based on the BTO method, which means constructing the facilities (Build), handing over ownership to the governmental agencies (Transfer), and acquiring the management rights (Operate).</p> <p>A well-prepared business plan is crucial. After the implementation of the project, poor business planning could make it difficult for the company to run the station.</p>
(4)	<p>In the Hari-T•R•S(TeRaSu) case, when the PFI project was decided on, the responsibilities to be borne by the private sector were not clearly defined in the contract. Therefore, this case is not recognized as a PFI project because it failed to comply with the 2001 Guidelines on the PFI (Hari-T•R•S, which was built in 2000, is not written in the NPO Japan PFI / PPP Association (2012)).</p> <p>The unsuccessful case of Hari-T•R•S shows us that it is critically important to carefully consider corporate policies and execution plans when making use of private sector dynamism. However, all four PFI cases except Hari-T•R•S used in this analysis comply with the requirements based on the 2001 Guidelines on the PFI because they were built according to those guidelines.</p>

Source: We made this table from the contents of Arioka et al. (2003), and Noda (2003, 2004).

Bay Farm” management. The first feature of the “Kasaoka Bay Farm” is the shipping council of about 300 people, which strives to deliver high-quality products.

The general supermarket tries to sell products at low prices, but the “Kasaoka Bay Farm” particularly focuses on quality. It mainly sells products to the residents of the neighboring

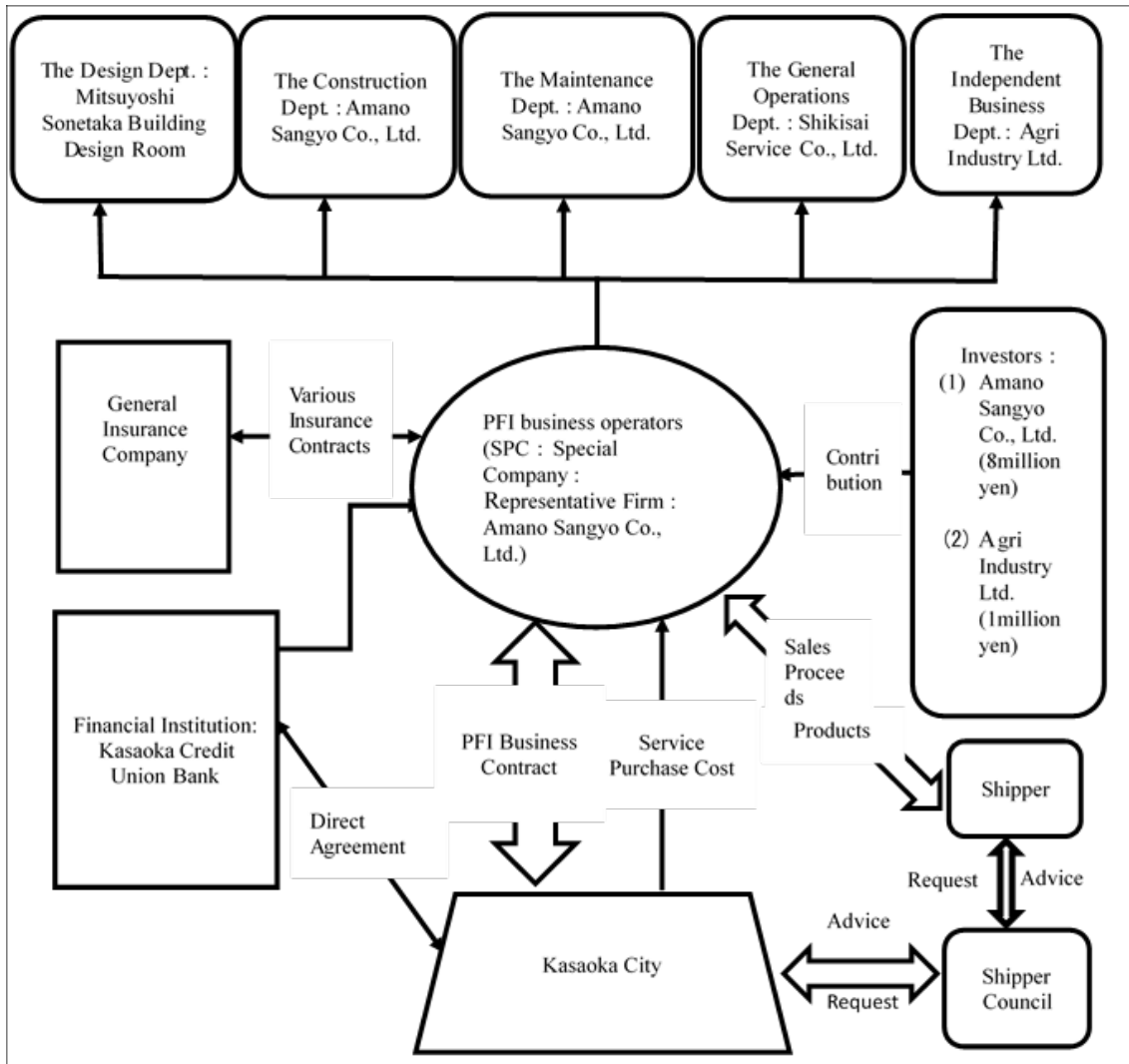
Table 2 List of Roadside Stations constructed by PFI (Business Project Name)

No.	Name of Roadside station	Project name	Field	Project method	Project type	Imple-menting entity	Project spot	Announce-ment date of executive policy	Selection date of special project	Starting date	Project period (years)
(1)	Ibusuki	Ibusuki Community Exchange Facility Project	Sight-seeing facility	BTO	Service purchase type	Ibusuki city	Ibusuki city, Kagoshima	Jan.14, 2003	Mar.26, 2003	Oct.1, 2004	15
(2)	Youka Tajima no kura	Yoka City Development Project	Sight-seeing facility	BTO	Service purchase type	Yabu city	Yabu city, Hyogo	Jan.14, 2005	May.16, 2020	Nov.1, 2006	15
(3)	Mizu no sato Sawara	PFI Project at the Sawara Regional Exchange Center	Other	BTO	Service purchase type	MLIT / Katori city	Katori city, Chiba	May.24, 2007	Sept.28, 2007	Mar.27, 2010	15
(4)	Kasaoka Bay Farm	Project for station improvement on National Route 2 Kasaoka Bypass Road	Sight-seeing facility	BTO	Service purchase type	Kasaoka city	Kasaoka city, Okayama	Aug.13, 2009	Mar.2, 2010	Aug.1, 2011	15
(5)	Kyotamba Ajimu no sato	Kyotamba-cho regional development base facility development project	Sight-seeing facility	DVO	Self-supporting accounting type	Kyo-tamba cho	Kyo-tamba cho, Kyoto	July.31, 2012	Oct.5, 2012	Apr.1, 2015	15
(6)	Izu Gateway Kannami	Kan-nami "Michinoeki / Kawanoeki" PFI Project	Sight-seeing facility	BTO	Service purchase type	Kan-nami cho	Kan-nami cho, Sizuoka	Aug.8, 2014	Nov.10, 2014	Feb.5, 2017	15

Source: We made this table from the data of NPO, Japanese PFI, PPP association (2019).

Fukuyama City. The second characteristic is that the Roadside Station company and its local government communicate and cooperate with each other. The city holds many events by positioning the Roadside Station as a base for promoting tourism. The third characteristic is that there are many valuable assets at the station. The person in charge of purchasing products from a wide range of routes used to work at a major department store (Kataoka (2015), Okayama Prefecture Kasaoka City Construction Industry Department of Tourism and Economic Activity Section (2011). Here are some examples of the many events held in Kasaoka. Winter Illumination "Light Sparkling" (December to late January), Oyster Festival (late January), Strawberry Picking (late February), Rape Blossom Festival (mid-March), Sakuradai Fair (late April), Poppy Fair (mid-May), Opening Festival (July), Sunflower Festival (Early August), Fig Festival (September),

Figure 1 Structure of business “Kasaoka Bay Farm”



Note: Author prepared using “Kasaoka Bay Farm” company data.

Source: We made this figure from Kasaoka City (2011).

Cosmos Festival (October), Watari-gani Festival (November), and the Year-end Fish Market (December).

Next, the case of "Mizu no sato Sawara" is shown below. Regarding the package plan of this Roadside Station, the government established the "River Disaster Prevention Station" and Chiba Prefecture expanded the National Route 356. Katori City then installed the main body of the Roadside Station "Mizu no sato Sawara." In other words, the government, Chiba prefecture, and Katori City cooperated to build the station. As a result, the station became a disaster prevention base, waterfront usage base, cultural exchange base, and a traffic exchange base. Because of these extensive facilities, the total operating expenses of this station are much higher than all other Roadside Stations. At this station, visitors use the disaster prevention base even during normal times. Katori City in Chiba Prefecture, where it is located, is also an important preservation district

for the many groups of historic buildings in the area. The Edo-era style landscape composed from these buildings is quite popular among tourists. In the Edo-period, the town was famous for its riverside and boating business was active (Abe (2011), Kushioka (2012)).

Third, the case of "Ibusuki" is shown. Ibusuki's PFI project has two characteristics. The first feature is the community activity center within the Roadside Station. Agricultural processing unions, local fishermen's unions, Ibusuki citizens' community planning committees, the city council, and the Chamber of Commerce and Industry demanded that the center be established in the future. The second feature is the Kannon-zaki Park Improvement Project. It is facilitated in coordination among the Roadside Station, city park, and local exchange facilities. Kannon-zaki Park is located at the entrance of Ibusuki City and is a new base for regional development. This Roadside Station was developed through the cooperation between private companies and the local government.

Finally, the case of "Youka Tajima no kura" is shown below. Even before the Roadside Station opened, the people in charge prepared for the opening of the farm stands. They visited farmers in Yabu City and made adjustments by themselves. They also asked the farmers to ship their produce to the Roadside Station. The people in charge asked each farmer what kind of vegetables they had and when they would be shipped, and they prepared a variety of vegetables. The shipping organization is called "Tajima Kurando no kai," its members number around 150 (104 individuals and 10 groups). In this way, officials maintain close contact with the producers. Such cooperation is an important element from the theoretical perspective of endogenous development theory. In addition, a system has been introduced in this farm stand where the producer can check the sales status and replenish its stock via mobile phone. The introduction of this system solved the problem of a shortage of goods, and as a result, the number of visitors increased.

In addition, this Roadside Station constructed pipe houses for producers who actively shipped their products. Part of the grants are used to develop the facilities. Currently, there are 19 pipe houses. The installation of these greenhouses resolved the winter shortage problem. The farm stands "vegetable warehouse" with such a wide variety of products popular among users. In "Youka Tajima no kura," there is also a foot bath corner of Togayama Onsen. The restaurant there serves a menu that uses local fresh vegetables, local Youka pork, and Katori rice. Hiyoriyama Kanko, which is a member of the consortium of PFI companies, is a private company that runs the aquarium "Kinosaki Marine World" in its local area. Therefore, it incorporates a variety of management know-how into the operation of this Roadside Station. "Youka Tajima no kura" uses the management expertise and ideas of private companies to communicate closely with producers and consumers. At each of the four Roadside Stations, sales are high, and the number of visitors is large. They are also a base for regional development (Nikkei Construction (2007)). The average sales of the four stations in the fiscal year 2013 was about 266.25 million yen. On the other hand, for the stations given the new type of grant, the average sales amount was about 169.50 million yen. This comparison shows how excellent the management of Roadside Stations established under the PFI system can be.

Next, we consider the motivations and goals of farmers, PFI business operators, and residents involved in the operation of Roadside Stations and how they evaluate its effect. By utilizing PFI systems, the government and the city can lower the cost of design and construction of the Roadside

Stations. In the process of the enforcement of PFI, the government acquires the land and develops the roads and ancillary facilities (toilets, etc.) in the vicinity. Municipalities can utilize the know-how of private business operators, and they can provide public services of excellent quality at low costs. Private enterprises, on the other hand, are entrusted with the management and operation for 15 years, so they can participate with peace of mind. Farmers are also able to ship goods reliably and maintain stable incomes. The POS system makes it easy for farmers to ship their products. The national and local governments are happy to be able to reduce costs through PFI. Local residents can buy fresh, high-quality local vegetables at low prices.

Figure 2 above shows the sales amount of each Roadside Station. Figure 2 shows the number of visitors at Roadside Stations. For PFI, the sales amount data of the above Figure shows that about 25% of PFI stations have more than 400 million yen in sales a year. However, new grant stations have about 10%, and all stations have less than 10% of all sales. The figure also shows that about 75% of PFI stations have more than 200 million in sales. However, the new grant station has about 50%, and all stations have less than 35% of the sales amount. The same can be seen in the figure below. For the number of visitors, about 50 % of PFI stations have more than 850 thousand visitors per year. However, the new grant station has about 18%, and all stations have less than 10% of the number of visitors. Regarding the number of visitors, about 75 % of PFI stations have more than 250 thousand visitors. However, new grant stations have approximately 30%, and all stations have a little more than 20% of the number of visitors<sup>1)</sup>.

### 3. Econometric Analysis of Roadside Stations of PFI

Here, we discuss the numerical values for station rank 1 and rank 10 for the sales amount with respect to 6 variables (sales amount, number of visitors, number of events, parking space, gross business expenses, and management expenses. See Table 4 below). In terms of sales, No. 1 is 688 million yen, and No. 10 is 345 million yen. In terms of parking space, No.1 can accommodate 427 cars and No.10 can have 222 cars. For the number of visitors, No. 1 had 2.5 million people and No. 10 had 670,000 people. In terms of the number of events, No.1 had 42 events and No. 10 had 13. No. 1 had a gross business expense of 3,300 million yen and No. 10 had 1,100 million yen. For management expenses, No. 1 incurred 150 million yen and No. 10 incurred 78 million yen.

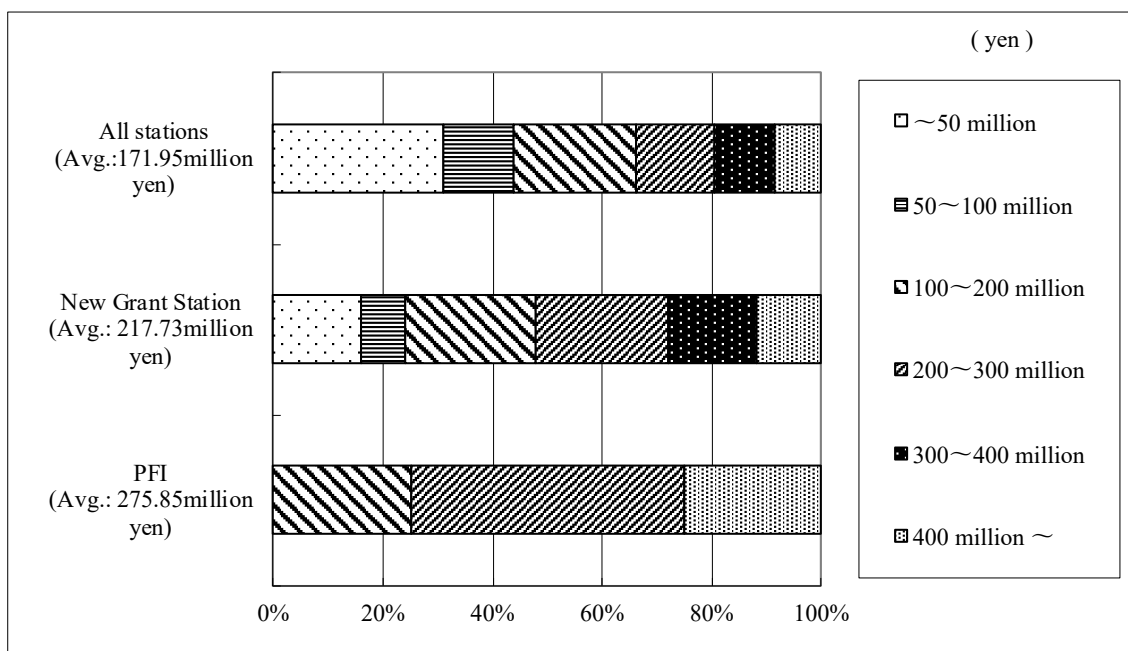
Now, we describe a model and our econometric analysis. Several previous works have dealt with the analysis of Roadside Stations. For the rest function of Roadside Station is debated by

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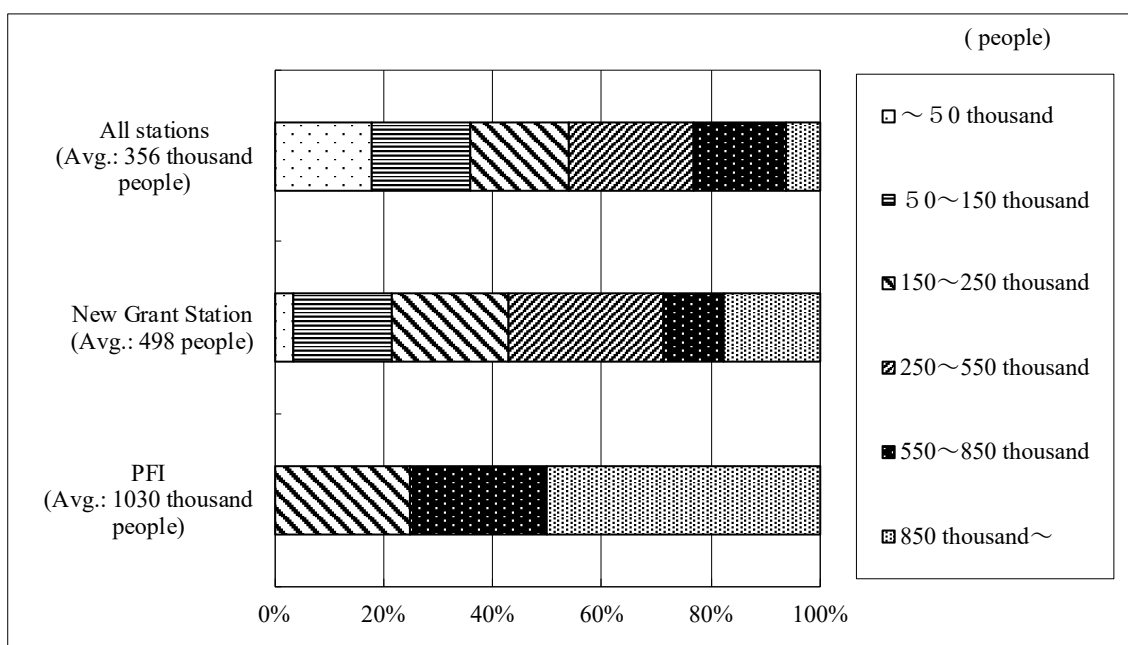
<sup>1)</sup> For this study, we used data from two questionnaire surveys. The first is the “Questionnaire Survey about the Disaster Protection Function of the Roadside Stations to the Station Masters,” which was conducted by NPO Hito-to-Michi-Kenkyukai (Human and Road Research Group; NPO Representative is Junko Matsumoto, and Matsuo is a researcher at this NPO), in August 2012. We sent a survey form to 986 Roadside Stations and received responses from 727 of them (73.7% response rate). The second is the “Questionnaire Survey of Station Masters about the Establishment and Management of the Roadside Stations” which was conducted by this study’s coauthor, Matsuo, in September 2013. Survey forms were delivered to 307 Roadside Stations in the Kinki, Hokuriku, and Hokkaido regions, and responses from 94 of them were received. The response rate was low because some question items were too sensitive, such as the sales numbers and number of visitors. Therefore, we had an effective sample of 83 responses in this study because of some incomplete forms.

Figure 2 Sales amount and Number of visitors of Roadside Station

(1) Sales amount



(2) Number of visitors



Kitamura et al. (2000). Toda and Sakamoto (2013) debated the function of the organization node of a person and the person. For the research of PFI, Kajii et al. (2000) and Takase et al. (2002) studied. Kikuchi et al. (2005), Kikuchi and Taniguchi (2006, 2007), and Taniguchi and Kikuchi (2006) performed energetic analyses of Roadside Stations but used a non-econometric method. Analysis using the least-squares method is rare, but Takase et al. (2002) used the least-squares

method for bus use. However, the estimation results were poor, and many results of the t value were not acceptable. In addition, Shima (2011) also estimated the effects of Roadside Stations by using a dummy variable for agricultural output.

However, many of the results were not significant. Nakamura et al. (2008) used a probit model but failed to achieve good results. For further econometric studies, Ogawa and Suzuki (2002) used principal component analysis, and Kodama et al. (1998) used quantification second kind analysis. Ohta et al. (2003) used a maximum section analysis. However, all these studies use a simple OLS (ordinary least squares) and not a simultaneous equation model. Shimoura and Miyazaki (2002) used inter-industrial relationships and measured the ripple effect. Saito (2012) measured the ripple effect of farm restraints on regional development. Kawamura (2011a, b) studied inter-industrial relationships and measured the ripple effect of Roadside Stations in Gifu prefecture.

Now, we will consider the important elements to increasing the number of visitors, sales amount, parking space, etc. One of the most important purposes of Roadside Stations is to increase sales. To increase sales, we can consider many factors. One is to increase the number of visitors, and another is increasing the number of events, as it has a large parking lot. Moreover, providing good service is also crucial, as is having a good restaurant. Well-maintained buildings and clean toilets are important. Further, management expenses are an important indicator, as they are used for many events and keeping clean toilets, thus increasing the number of visitors. Additionally, having a large parking space is important for sales. Conversely, the sales amount is important for having a large parking space when building the station, because stations that expect high sales would build larger parking spaces.

Based on the above, we now consider building the PFI model of Roadside Stations. Here, we consider six variables—sales amount, parking space, number of visitors, number of events, management expenses, and gross business expenses—that influence each other. Therefore, we must consider multicollinearity as many combinations exist. We created numerous models and obtained the best estimation model. The following are the best-fit and second-best models among all estimations<sup>2)</sup>.

- (1) Sales amount = f(number of visitors, Kinki dummy)
- (2) Parking space = f(gross business expense, Hokkaido dummy)
- (3) Number of visitors = f(gross business expense, PFI dummy)
- (4) Number of events = f(sales amount, PFI dummy)
- (5) Gross business expense = f(number of events, hot spring dummy)

First, we propose the following hypotheses: 1. Both the number of visitors and Kinki dummy would have positive effects on the sales amount. 2. Both business expenses and Hokkaido dummy would have positive effects on the parking space size. 3. Both business expenses and the PFI dummy would have positive effects on the number of visitors. 4. Both the sales amount and PFI

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<sup>2)</sup> All 5 equations of our model are in a situation of over identification. Therefore, we used two stage least square method. In this method, we used the following 4 instrumental variables such as Hokkaido dummy, Kinki dummy, PFI dummy and hot spring dummy.

dummy would have positive effects on the number of events. 5. Both the number of events and the hot spring dummy would have positive effects on gross business expense. Second, the following were the hypotheses of the second-best model. Here, we show only the sales amount aspects:

6. All variables, such as the number of events, management expenses, and PFI dummy, would also have positive effects on the sales amount. 7. Both the sales amount and Hokkaido dummy would have positive effects on the parking space size. 8. Both the sales amount and management expense would have positive effects on the number of events. Third, we had the following hypotheses for the OLS model: 9. All variables such as management expense, PFI dummy, Hokkaido dummy, and hotel dummy would have positive effects on the sales amount.

In constructing the simultaneous equation model, we tested the endogeneity of five endogenous variables: sales amount, parking space size, number of visitors, number of events, and gross business expense. The test was performed using the Durbin-Wu-Hausman test (Greene, William, H., 2003). The test results are shown in Table 3. Results of endogenous tests indicated that all five variables were endogenous. For example, in equation (1), with sales amount as a dependent variable, the number of visitors is considered an endogenous variable because the t-value of the coefficient estimate of the residual term obtained from the OLS analysis of the equation with the number of visitors as the dependent variable and all the operating variables as the independent variable is significant at -1.64.

Similarly because the t-value of the residual term of the gross business expense in equation (2) is -1.67, the t-value of the residual term of the gross business expense in equation (3) is -1.81, the t-value of the residual term of sales amount in equation (4) is -2.09, and the t-value of the residual term of the number of events in equation (5) is -1.67, which are all significant. These variables were found to have serial correlations with the error terms, indicating that they are endogenous variables. Furthermore, the t-value of the residual term of the number of events in “second best equation (1)” is -6.86, the t-value of the residual term of sales amount in “second best equation (2)” is -2.23, and the t-value of the residual term of sales amount in “second best equation (3)” is -1.85, all of which are significant. Therefore, these variables are endogenous.

#### **4. Estimated Result and Fact Findings and its Implications**

Table 4 shows the best, second best, and OLS estimated results among many simultaneous equations. The results are as follows: All hypotheses were correct in the best model. Only one exception came from the second best. The effect of management expenses on the number of events was negative. Here, we realized that the number of events decreases if management expenses increase. In addition, both the Hokkaido and hotel dummies are nonsignificant, although our hypotheses of positive signs were correct. We find the following:

1) PFI shows significant influence on Roadside Station (see Table 4). The number of visitors also increases. Moreover, the number of events increases. The sales amount also increases (see Reference Tables 1 and 2). The increase in the number of visitors increases the sales amount. Its elasticity is 0.16. This means that a 1% increase in the number of visitors would increase the sales amount by 0.16 %. The Kinki area shows a positive effect (60.986 million yen higher than

Table 3 Results of the Endogeneity Test

(Best result)				
No.	Dependent variable	Endogenous variable	t value	p-value
(1)	Sales amount	Number of visitors	-1.64	0.101
(2)	Parking space	Gross business expense	-1.67	0.094
(3)	Number of visitors	Gross business expense	-1.81	0.071
(4)	Number of events	Sales amount	-2.09	0.036
(5)	Gross business expense	Number of events	-1.67	0.096
(Second best result)				
No.	Dependent variable	Endogenous variable	t value	p-value
(1)	Sales amount	Number of events	-6.86	0.000
(2)	Parking space	Sales amount	-2.23	0.029
(3)	Number of events	Sales amount	-1.85	0.070

Table 4 Estimated simultaneous equation model

No.	Dependent variable	Independent variable	Coefficient	z value	p-value	Elasticity
(1)	Sales amount	Number of visitors	227.6816	3.04	0.00	0.16
		Kinki dummy	60986.37	1.86	0.06	
		Constant	54989.81	1.42	0.16	
(2)	Parking space	Business expense	0.000127	3.94	0.00	0.54
		Hokkaido dummy	24.02271	4.35	0.00	
		Constant	32.49901	1.66	0.10	
(3)	Number of visitors	Business expense	0.000624	3.14	0.00	2.67
		PFI dummy	393.7743	1.77	0.08	
		Constant	5.530615	0.05	0.96	
(4)	Number of events	Sales amount	3.99E-05	2.49	0.01	1.31
		PFI dummy	7.155878	1.76	0.08	
		Constant	-1.28455	-0.46	0.65	
(5)	Gross business expense	Number of events	35900.2	2.28	0.02	0.37
		Hot spring dummy	357669	2.00	0.05	
		Constant	277333.9	2.47	0.01	
Reference Table1 Second best simultaneous equatin						
No.	Dependent variable	Independent variable	Coefficient	z value	p-value	Elasticity
(1)'	Sales amount	Number of events	13606.67	1.680	0.099	0.414
		Management expense	0.800515	3.251	0.002	
		PFI dummy	154605.2	1.727	0.091	
		Constant	56475.51	1.270	0.210	
(2)'	Parking space	Sales amount	0.000318	2.327	0.024	0.462
		Hokkaido dummy	60.81331	2.552	0.014	
		Constant	41.14395	1.422	0.161	
(3)'	Number of events	Sales amount	8.13E-05	2.351	0.022	2.671
		Management expense	-6.6E-05	-1.813	0.075	
		Constant	-5.04704	-1.008	0.318	
Reference Table2 OLS estiate method						
No.	Dependent variable	Independent variable	Coefficient	z value	p-value	Elasticity
(1)''	Sales amount	Management expense	1.102605	1.84	0.069	0.253
		PFI dummy	134930.2	1.72	0.089	
		Hokkaido dummy	12217.82	1.04	0.301	
		Hotel dummy	29203.14	0.46	0.649	
		Constant	117829.7	3.92	0.000	

average) on sales amount.

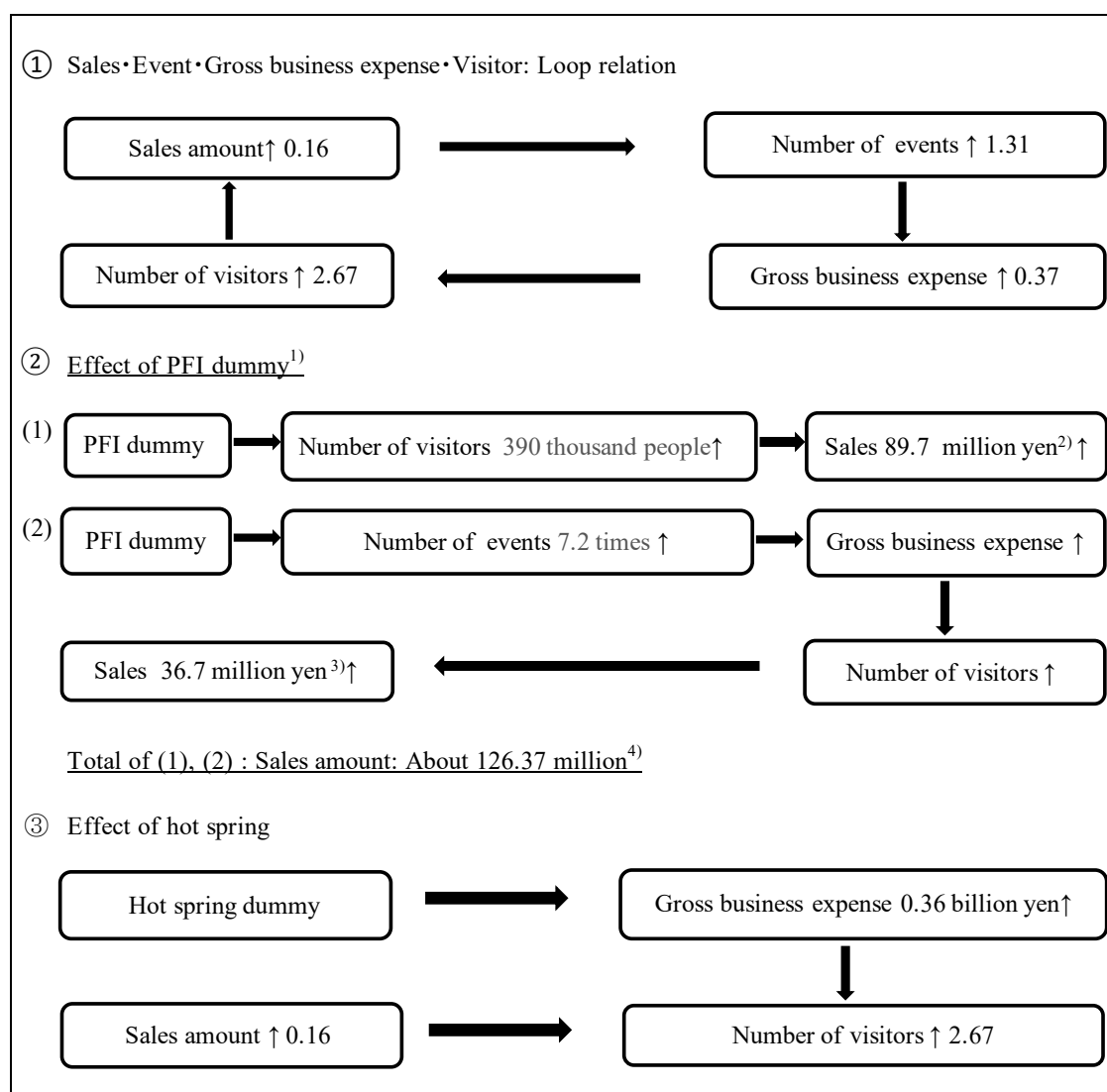
3) The increase in gross business expense increases the parking space size. Its elasticity is 0.54. This means that a 1% increase in gross business expense would increase the parking space by 0.54 %. The Hokkaido area has a larger parking space than average. 4) The increase in gross business expense increases the number of visitors. Its elasticity is 2.67. This means that a 1% increase in gross business expense would increase the number of visitors by 2.67 %. PFI stations have more visitors (394 thousand people more). 5) The increase in sales amount increases the number of events. Its elasticity is 1.31. This means that a 1% increase in sales would increase the number of events by 1.31 %. PFI stations have more events (7.2 times larger) than average. 6) The increase in the number of events increases gross business expense. Its elasticity is 0.37. This means that a 1% increase in the number of events would increase the gross business expense by 0.37 %. The hot spring dummy shows that its gross business expense is 358 million yen higher than average.

We summarize the estimated results in Figure 3. First, we have the following complicated loop relations: The increase in sales would increase the number of events (the elasticity is 1.31). It would also increase gross business expenses (elasticity is 0.37). This increases the number of visitors (the elasticity is 2.67). This also increases the sales amount (the elasticity is 0.16). Second, PFI increases sales by more than 100 million yen than average (126 million yen, as shown in Figure 3. As shown in Note 1, PFI increases the sales amount by 154.61 million yen in the second-best estimation. The PFI of OLS estimation increases 135 million yen.). Third, hot springs increase gross business expenses. This increases the number of visitors. This also increases the sales amount, as shown in Figure 3.

Next, we will consider the results. From the econometric analysis above, it was found that PFI Roadside Stations posted higher sales of 154.61 million yen (from coefficient estimates of PFI dummy variables) per station than the other Roadside Stations. PFI Roadside Stations have higher sales, more visitors, and lower management costs, indicating that they are very efficient. Then, what is the difference between the case where a PFI Roadside Station develops under the initiative and high motivation of farmers, PFI business operators, and residents, and the case where it becomes a problem (What are the problems? Why do the problems occur?), and what is the structure of the problem? These problems should be clarified from the viewpoint of farmers, PFI business operators, and residents.

(1) As a result of the analysis, the following situation was found when PFI Roadside Stations were further developed. Customers often find the cleanliness of buildings and toilets important during breaks. ② A friendly and cheerful attitude of the staff made customers more likely to stop by again. ③ For example, the "Kasaoka Bay Farm" holds many events every month to attract customers. The "300-yen bag of fresh fish and vegetables all-you-can-pack sale" is very popular. ④ PFI business operators hire people who know the region well, such as former convenience store operators, from the private sector. Private companies entrusted with the management of Roadside Stations have abundant management know-how in areas such as direct sales counters and tourist farms and are active in collaborating and communicating with local shippers. In addition, PFI companies appoint former buyers from mass retailers to manage their products and

Figure 3 The loop relationship obtained from the analysis and effects of PFI Dummy Variables and Hot Spring Dummy Variables



Note 1: PFI increases sales by 154.61 million yen in the second-best estimation. The PFI of OLS estimation increases by JPY 135 million.

Note 2:  $393,774 \text{ (People)} \times 227.6816 = 8,9655,094 \text{ (Yen)}$ .

Note 3:  $7.2 \text{ (Times)} \times 35900.2 \text{ (thousand yen)} \times 0.0006239 \text{ (People)} \times 227.6816 \text{ (Thousand yen)} = 36717.43 \text{ (thousand yen)}$ .

Note 4: Total of (1) and (2).

secure a wide range of purchasing routes.

⑥ Adopting an owner system and other in management, the company will create a system to encourage customers to visit again (Refer to Sato (1992)). ⑦ The Roadside Station "Ibusuki" serves as an entrance to the "Ibusuki" sightseeing destination, and is a place where many tourists drop in. ⑧ As for the "Yoka Tajima no kura," since all the buildings of the facilities were built

by the same construction company, the design of its buildings not only has a sense of unity, but it also becomes a functional facility that takes into account the flow of customer traffic. ⑨ The private sector, which is in charge of the management and operation of the Roadside Stations, is involved from the planning stage, and requires the design to enable efficient management and operation.

(2) In the case of problems like poor profits, maintenance tends to be poor only by the private sector. In the event of an earthquake or natural disaster, the sharing of responsibility between the local governments and the private sector becomes a major issue. There can be differences in opinion on responsibilities (at the time of the earthquake, "Sawara" faced this kind of problem.). Since PFI companies are entrusted with management and operation for 15 years, private business operators may fail to make efforts in administrative operations. In other words, it may be difficult for the private sector to take the initiative in maintenance and disaster response.

With the above in mind, we will examine in detail the desirable operation method of PFI and present the ideal way to develop Roadside Stations and, in turn, urban-rural exchange activities in the future. What kind of development method is desirable to make the PFI road station and urban-rural exchange activity meaningful to the endogenous development of a farming village? In this regard, Kajii, Nakayama, Hagiwara, and Kagaya (2000) describe that the key point of PFI introduction is to increase the capacity to attract customers as a complex facility serving various functions and to use ancillary facilities jointly. In addition, according to Sato (1992), Roadside Stations should have the following attractive facilities. Accommodation and meals are provided (Farmer guesthouses, pensions, cottages, public accommodations, food culture, restaurants), sale of special products (Number of events, unmanned sales offices at open-air markets, etc.). Facilities for experiencing rural life and culture (cultural/craft experiences, nature experiences, a farm for citizens and tourism, ownership of crops, etc.). Landscape (townscape, rural landscape, forest landscape, etc.). Direct delivery system, special villagers' system, sister city system, etc.

In other words, a clean, friendly, and cheerful posture is vital. It is also important to hold many popular events such as the "300 - yen bag of fresh fish and vegetables all-you-can-pack sale." In addition, management of Roadside Stations is not effective in revitalizing the local economy on its own, and it is essential to establish attractive facilities and systems such as tourist spots and ownership systems. It is also important to leave it to those who know the area well, such as former convenience store operators. The "Kasaoka Bay Farm" employs former buyers from mass retailers to secure a wide range of purchasing routes. Furthermore, since PFI business operators are entrusted with the management and operation of Roadside Stations for 15 years after their establishment, it is important to form a partnership and network centering on the local area so that Roadside Stations can be a base for regional exchange.

On the other hand, Yamamoto (2008) mentioned that the following eight points are important for the marketing of general Roadside Stations, not just PFI Roadside Stations. The first is that management is led by the private sector. The second is to set up stores that match the location. The third is the importance of a rich product lineup. Fourth, setting the price is up to the shipper and refers to the price in the city supermarket. The fifth is to utilize word-of-mouth, publicity, events, flyers, direct mail, and websites. Sixth, as a sales channel, it is necessary to actively utilize Internet

sales, mail packs, and antenna shops. The seventh is the cleanliness and comfort of the toilet facilities. The eighth point is strategic management from a long-term perspective<sup>3)</sup>. Kojima et al. (2014) provide an overview of the nation's recent support system for Roadside Stations.

According to the paper, the role of Roadside Stations in tackling the challenge of regional revitalization is broadly divided into two categories: "gateway type" and "regional center type." This classification is consistent with the minister's proposal. is consistent with the Minister's proposal. is consistent with the Ministry of Land, Infrastructure, Transport and Tourism's classification method of dividing into two broad categories: "gateway type" and "regional center type" First of all, the "gateway type" has three roles to play, including promotion of inbound tourism, general tourist information, and regional migration. Next, the "regional center type" plays the roles of industrial promotion, community welfare and disaster prevention (For details, refer to Kojima et al. (2014)). After all, in terms of sales, there are quite a few Roadside Stations with higher sales than PFI stations, but in terms of the benefit-cost ratio (ratio of sales to administrative expenses), the PFI Roadside Stations ranked very high, ranking first, sixth, and eighth.

Next, we consider the number of agricultural product shippers at each station. According to a survey conducted by the author, among the number of agricultural product shippers to the "Kasaoka Bay Farm" in 2010, 180 people were agricultural producers in Kasaoka City and 10 people were agricultural producers in the area outside Kasaoka City. In 2014, 200 people were agricultural producers in Kasaoka City and 115 were agricultural producers in the area outside Kasaoka City. In addition, the number of customers from outside the city, such as Fukuyama City, has increased significantly. The number of agricultural product shippers in the "Yoka Tajima no kura" more than doubled from 78 in 2007 to 187 in 2014. Furthermore, the number of agricultural product shippers of "Ibusuki" increased from 189 in 2005 to 203 in 2014. The number of agricultural product shippers of "Sawara" increased from 150 in 2010 to 200 in 2014.

Next, the employment of Roadside Stations is examined as a regional cooperation or contribution. At each PFI Roadside Station, four to eight people are employed as regular employees. If non-regular employees are included, the total increases to about 15–34 people. More than half of the visitors come from outside the area, which is a great help for local revitalization. To achieve this, each PFI makes the following efforts. With regard to "Kasaoka Bay Farm," the fact that many events are held every month, including elaborate events such as "300 - yen bag of fresh fish and vegetables all-you-can-pack sale", and the farmland ownership system is implemented. This has led to the success of regional revitalization (Economy and Tourism Revitalization Division, Construction Industry Department, Kasaoka City, Okayama Prefecture

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<sup>3)</sup> We explain a little more about this. First, we should adopt the method of Private Finance Initiative (PFI). Second, optimal scale based the local area is necessary. Third, many kinds of fresh, tasteful, secure and real valuable goods are necessary. Fourth, producer decides the price. However, the advice of management agency is also important. Also, to observe the price of supermarket and others are also important. Fifth, we should use the bush telegraph, publicity, event, leaflet, DM and homepage. Sixth, it's also important to use the internet sales, You-pack, pilot store. Seventh, cleanness especially the cleanness of the toilet, is very important. Eighth, the strategic and social business with the long-term view are also very important.

(2011)).

With regard to the "Yoka Tajima no kura," the sixth industry is promoted through the development of specialty products utilizing the National Strategic Special Zone (agricultural special zone), events are held in cooperation with tourism facilities, and information on local tourism (Including disaster prevention information such as the installation of disaster toilets) is disseminated (Nikkei Construction (2007)). As for "Ibusuki," a 10-year anniversary festival is held, as well as an event to sell agricultural products from a light truck in the parking lot. At the same time, tourists are encouraged to visit a nearby hot sand bath. (Ibusuki City, Kagoshima Prefecture (2015)). At the Roadside Station "Sawara," there is a year-round festival, a harvest festival, and a fireworks festival. In addition, the festival is linked to events held on boats and jet skis at riverside station "Sawara," next to Roadside Station Sawara, and to a bus fishing festival in which entertainers participate on the Tone River (Abe (2011), Kushioka (2012)).

The above points are consistent with the fact that the number of events has a large impact, such as the indirect loop (Number of events  $\uparrow \Leftrightarrow$  Sales  $\uparrow$ ) obtained from econometric analysis. As mentioned above, the point of "The number of visitors will increase if the facilities are well managed and clean toilets are provided" is consistent with the result of econometric analysis (Total project cost  $\uparrow \rightarrow$  Number of visitors  $\uparrow \rightarrow$  Sales  $\uparrow \rightarrow$  Events  $\uparrow \rightarrow$  Total project cost  $\uparrow$  loop). Considering these policy implications, it is clear that PFIs are still an extremely important way to reduce costs, although there are still many points to be improved.

## 5. Summary and Conclusion

Here, we summarize the findings as follows: 1) PFI contributes to the development of Roadside Stations increasing the number of visitors to these stations. Moreover, the number of events increases. 2) The increase in the number of visitors increases the sales amount. 3) The increase in gross business expense increases the parking space size. 4) The increase in gross business expense increases the number of visitors. PFI stations have more visitors (394 thousand people more). 5) The increase in sales increases the number of events. PFI stations have more events (7.2 times larger) than Non-PFI stations. 6) The increase in the number of events increases gross business expenses. The hot spring dummy shows that gross business expenses are 358 million yen higher than average. In addition, we found the following.

To develop a Roadside Station, a clean, friendly, and cheerful environment is required. It is also important to hold many events, and to hold popular events such as the "300 - yen bag of fresh fish and vegetables all-you-can-pack sale." In addition, management of Roadside Stations alone is not effective in revitalizing the local economy, and it is essential to establish attractive facilities and systems such as tourist spots and ownership systems. It is also important to leave it to those who know the area well, such as former convenience store operators. The "Kasaoka Bay Farm" employs former buyers from mass retailers to secure a wide range of purchasing routes. Furthermore, since PFI business operators are entrusted with the management and operation of Roadside Stations for 15 years after their establishment, it is important to form a partnership and network centering on the local area so that Roadside Stations can be a base for regional exchange.

Our Roadside Stations also have some problems. First, there were differences in opinion on

responsibilities, as in the case of Sawara in earthquake time. Second, it may be difficult for the private sector to take the initiative in maintenance and disaster response. Third, sufficient business policies and implementation plans must be considered in order for PFI projects to be carried out successfully to evade just as in the case of Hari T.R.S.

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## Appendix1 Ranking of visitors and other indicators

### (a) No. 1 to No. 40

Ranking of Sales amount	Sales amount (thousand yen)	Ranking of the number of visitors	Ranking of the number of events	Ranking of Parking spaces	Ranking of Gross Business Expense	Ranking of Management Expense	Ranking of (Sales amount/Gross Business expense)	Ranking of (Sales amount/Management expense)
1	688243	20	2	7	8	2	25	34
2	640000	31	12	6	81	60	1	2
3	442751	13	75	5	33	46	12	7
4	430000	66	16	80	34	50	13	4
5	422731	16	3	38	45	44	6	11
6	407000	10	10	59	46	83	5	1
7	405429	22	33	12	7	34	42	17
8	390000	25	35	19	13	61	33	3
9	384300	14	8	31	15	11	30	36
10	383782	7	51	27	23	30	24	23
11	345000	32	17	65	27	10	22	41
12	340000	41	50	22	57	41	3	18
13	326000	12	6	4	1	33	67	26
14	323000	11	18	30	9	42	44	16
15	320000	43	55	71	49	43	7	15
16	300000	5	36	11	10	6	36	5
17	300000	40	5	55	18	63	47	44
18	280000	38	42	15	35	14	20	39
19	270000	19	34	10	14	4	27	31
20	270000	29	38	33	32	25	40	46
21	269360	48	15	64	50	8	15	45
22	253065	44	7	25	29	65	31	10
23	250000	6	57	16	55	68	11	8
24	240000	24	46	32	68	55	4	13
25	230000	23	49	39	43	71	21	9
26	224000	49	14	34	41	47	23	24
27	220225	2	1	1	47	45	19	27
28	210000	39	52	37	70	21	2	40
29	208000	17	19	52	40	79	26	6
30	207000	54	28	58	56	58	17	14
31	200000	1	40	2	2	39	8	21
32	200000	3	4	9	16	51	46	22
33	200000	18	70	14	61	54	75	30
34	192000	30	68	18	59	3	16	53
35	185000	26	45	76	63	17	14	43
36	164162	55	54	24	44	78	32	12
37	160000	45	74	26	3	5	71	60
38	155529	52	79	21	5	69	64	19
39	155000	53	13	60	51	38	29	35
40	130000	27	43	62	42	22	9	20

## (B) No. 41 to No. 83

Ranking of Sales amount	Sales amount (thousand yen)	Ranking of the number of visitors	Ranking of the number of events	Ranking of Parking spaces	Ranking of Gross Business Expense	Ranking of Management Expense	Ranking of (Sales amount/Gross Business expense)	Ranking of (Sales amount/Management expense)
41	130000	33	20	74	73	76	37	47
42	125000	9	48	17	58	62	28	29
43	120004	4	67	28	11	1	63	75
44	117388	42	24	49	36	73	43	25
45	113600	47	56	46	17	70	55	28
46	107907	8	27	8	12	15	59	57
47	101682	60	39	36	22	40	54	42
48	100000	46	72	29	30	20	50	55
49	93500	28	66	44	83	49	10	38
50	86000	61	9	72	62	64	35	32
51	85752	58	65	67	76	31	18	52
52	75227	62	59	51	67	35	34	51
53	72000	65	83	77	39	67	52	33
54	61000	35	22	23	28	7	61	77
55	60000	51	41	78	26	13	66	71
56	57000	57	37	69	25	23	69	66
57	55737	36	78	48	66	27	41	64
58	50000	67	32	40	20	24	39	37
59	50000	75	80	42	69	82	73	68
60	49000	83	53	50	72	32	38	63
61	45000	71	71	41	4	12	72	72
62	45000	77	26	75	24	19	81	78
63	44200	70	58	83	60	57	49	48
64	40000	74	61	70	54	28	56	70
65	33000	37	60	13	19	18	78	79
66	32680	34	21	53	52	29	65	73
67	30000	15	73	3	6	9	45	58
68	30000	78	64	20	77	56	82	82
69	27500	80	30	68	37	77	74	50
70	27000	50	23	45	21	16	68	49
71	27000	56	25	63	53	81	80	80
72	26900	81	31	81	78	66	48	54
73	24000	21	47	57	64	52	60	65
74	23000	64	11	35	31	37	53	56
75	23000	68	81	66	71	72	79	76
76	20000	79	62	79	80	53	51	67
77	19000	73	29	43	48	75	76	61
78	18639	72	82	54	38	80	77	59
79	17305	82	69	47	75	74	57	62
80	16669	69	76	73	74	48	58	74
81	16000	63	63	61	65	59	70	69
82	11680	59	44	56	82	36	62	81
83	340	76	77	82	79	26	83	83