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STUDY ON ASSESSING THE VALUE OF THE TENGUIWA IRRIGATION CANAL

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ABSTRACT: In Japan, following changes in socioeconomic conditions, such as financial deterioration, an increase in social capital, and a decrease in population, ideas about infrastructure improvement have greatly changed. Recently, irrigation canals possessing historic value have attracted the attention of the public as assets for community development. The present study focused on the Soja district, in which many historical and cultural resources exist but where these resources have not been developed. A questionnaire was administered to the local residents and revealed the value of the Tenguiwa Irrigation Canal as an environmental asset. The present study also examined the relationship between the value of the Tenguiwa Irrigation Canal as an environmental asset and the direction of community development in the Soja district.

Keywords: Irrigation canal, historic value, environmental asset, Maebashi-shi

1. INTRODUCTION

1.1 Purpose of the study

In Japan, following changes in socioeconomic conditions, such as financial deterioration, an increase in social capital stock, and a decrease in population, ideas about infrastructure improvement have greatly changed. Recently, irrigation canals possessing historic value have attracted the attention of the public as assets for community development.

The aim of the present study is to understand the residents' awareness of the value of the Tenguiwa Irrigation Canal as an environmental asset and the direction of community development in the Soja district.

1.2 Overview of the study

There have been previous studies on irrigation canals. First, Marumo et al. assessed the value of the Yanagawa canal [1]. Second, Maki et al. assessed the value of the Old Mita Channel [2]. Third, Yamashita et al. assessed the value of the Tamagawa Channel [3]. However, only a few studies have assessed the value of an irrigation canal as an environmental asset [4], and comprehensively and quantitatively examined the residents' awareness of the direction of community development.

The present study focused on the Tenguiwa Irrigation Canal in the Soja district, Maebashi City, assessed the value of the Tenguiwa Irrigation Canal, and quantitatively examined the direction of community development in the Soja district.

2. STUDY REGIONS AND SURVEY METHODS

2.1 Study regions

The present study investigated the Tenguiwa Irrigation Canal in the Soja district, Maebashi-shi, Gunma Prefecture, in which urban development had not been carried out. The Tenguiwa Irrigation Canal is an agricultural water channel passing through Maebashi-shi, Takasaki-shi, and Tamamura-machi from the Tone River (Fig. 1).

In 1604, Nagatomo Akimoto, the lord of Soja Castle, dammed up the Tone River to create the Tenguiwa Irrigation Canal. Therefore, the canal has a history of more than 400 years. Flower beds and promenades have been prepared along the canal, and the local residents enjoy walking along the promenades. A volunteer organization was established to protect the environment around the

Fig. 1 Tenguiwa Irrigation Canal

Tenguiwa Irrigation Canal, and the organization has been inspecting facilities and maintaining the flower beds and promenades by weeding, planting, and seeding.

2.2 Survey methods

Table 1 presents core information about the survey administered in the investigated localities.

Table 1 Details regarding the questionnaire survey

Date of survey	- Distribution: July 24-27, 2010 - Collection: August 15, 2010 (latest posting date)
Location of data collection	Soja district, Maebashi-shi, Gunma Prefecture
Data collection method	- Distribution: Putting in mailbox - Collection: Mailing
Items	(1) Satisfaction levels about the Tenguiwa Irrigation Canal and the surrounding environment (2) Direction of community development
Distribution and collection	- Number of questionnaire cards distributed: 1,000 - Number of questionnaire cards collected: 253 - Recovery: 25.3%

3. VALUE ASSESSMENT OF THE TENGUIWA IRRIGATION CANAL

3.1 Assessment of the environment around the Tenguiwa Irrigation Canal

Regarding the environment around the Tenguiwa Irrigation Canal, the residents were asked to evaluate the items shown in Table 2 using a five-point scale from “very good” to “very bad”.

3.2 Extraction of environmental factors regarding the Tenguiwa Irrigation Canal

To summarize the assessment results of the above 20 items, a factor analysis was performed. Table 3 shows the results of the factor analysis. Four environmental factors, i.e., “facility improvement,” “natural landscape,” “regional characteristics,” and “safety and security” were extracted from the factor analysis.

3.3 Model for assessing the Tenguiwa Irrigation Canal as environmental assets

Fig. 2 shows a model for assessing the Tenguiwa Irrigation Canal as an environmental

Table 2 Assessment items

C1	Management of fences
C2	Management of trees and plants
C3	Garbage scattering
C4	Crime-free
C5	Sidewalk construction
C6	Walking safety
C7	Nighttime illumination
C8	Traffic safety
C9	Safe playground
C10	Rest facility
C11	Waterside organisms
C12	Rich in nature
C13	Quality of landscape
C14	Bird-watching
C15	Water sanitation
C16	Rich in trees
C17	Peace of mind
C18	Region exchange
C19	Local history
C20	Community symbol

Table 3 Results of the factor analysis

	Facility improve-ment	Natural land-scape	Regional charac-teristics	Safety and security
C5	**0.7901**	0.1707	0.1805	0.0994
C6	**0.7195**	0.0934	0.1568	0.3377
C3	**0.6811**	0.1349	0.1691	-0.0656
C1	**0.6189**	0.2047	0.0466	0.0878
C2	**0.6154**	0.2070	0.1764	0.1140
C8	**0.5976**	0.0333	0.0629	0.1798
C13	0.2340	**0.7264**	0.1977	0.0023
C12	0.1752	**0.7227**	0.1715	-0.0341
C14	0.1045	**0.6993**	0.0036	0.1294
C16	0.2765	**0.5987**	0.1618	0.0921
C17	0.3116	**0.5920**	0.3706	0.2734
C15	0.2145	**0.5100**	0.3189	0.2162
C11	-0.1119	**0.4239**	0.0378	0.2374
C20	0.2015	0.2017	**0.8283**	0.1793
C19	0.1721	0.2436	**0.7927**	0.1138
C18	0.2634	0.3908	**0.4556**	0.3177
C9	0.1330	0.0649	0.1296	**0.8251**
C7	0.2445	0.0383	0.1372	**0.4249**
C4	0.3535	0.1817	-0.1078	**0.3936**
C10	0.0196	0.1282	0.1033	**0.3837**

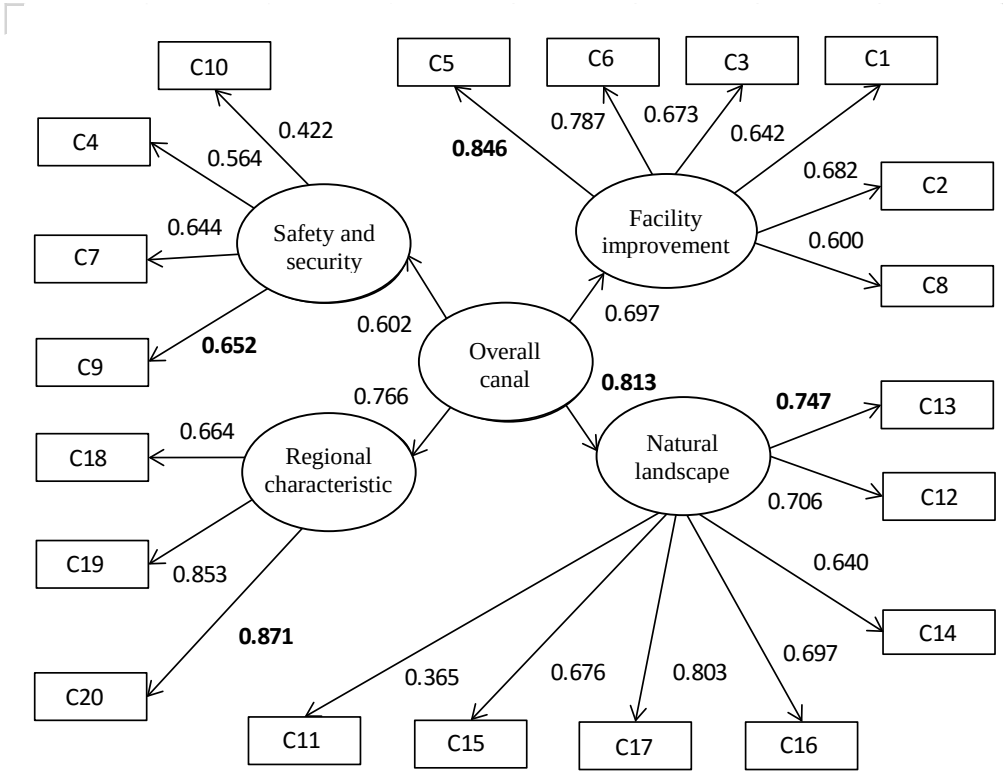

Fig. 2 Model for assessing the Tenguiwa Irrigation Canal as an environmental asset

asset using satisfaction levels. In this model, "overall canal" represents a comprehensive assessment of the environment of the Tenguiwa Irrigation Canal. Under "overall canal," four environmental factors, i.e., "facility improvement," "natural landscape," "regional characteristics," and "safety and security," that were extracted in the factor analysis were allocated as potential factors (level 1). Under these four potential factors, assessment items shown in Table 2 were allocated as observation variables (level 2). The adjusted goodness of fit index of the model was 0.765. The t-values of all path coefficients satisfied a level of significance at 0.1%.

A covariance structure analysis was performed for this model. The values of the path coefficients indicated that the effect of "natural landscape" (0.813) on "overall canal" was the greatest. Of the items under "natural landscape," the effect of "C13: Quality of landscape" (0.747) was the greatest.

Of the items under "facility improvement," the effect of "C5: Sidewalk construction" (0.846) was the greatest. Of the items under "regional characteristics," the effect of "C20: Community symbol" (0.871) was the greatest. Of the items under "safety and security," the effect of "C9: Safe playground" (0.652) was the greatest.

4. VALUE ASSESSMENT OF THE TENGUIWA IRRIGATION CANAL AND THE DIRECTION OF COMMUNITY DEVELOPMENT

4.1 Assessment of the Tenguiwa Irrigation Canal

The results of the covariance structure analysis revealed that the effect of "natural landscape" on the value of the Tenguiwa Irrigation Canal as an environmental asset was larger than that of other environmental factors. Of the items under "natural landscape," the effect of "quality of landscape" was the greatest.

4.2 The direction of community development

Table 4 shows the results of the regression analysis, in which the comprehensive assessment of the environment of the Tenguiwa Irrigation Canal was used as an objective variable and "community development using regional history and culture" and five other items were used as explanatory variables. These explanatory variables were expressed in terms of a five-level assessment of the residents' intensity in considering the direction of community development.

Table 4 Results of the regression analysis

Variable	Partial regression coefficient	Standard regression coefficient	T-value	Judgment
Community development using regional history and culture	0.1358	0.1770	2.4093	* 5%
Community development performed mainly by local residents	0.0061	0.0093	0.1286	
Assignment of traditional buildings as to be preserved	0.0250	0.0297	0.3270	
Community development using ancient tombs and castle sites	0.1034	0.1302	1.5080	
Development of streets and parks by performing land readjustment	-0.0760	-0.0901	-1.0098	
Conservation of landscapes, stores, and houses although it may be inconvenient	0.0039	0.0053	0.0640	
Constant term	2.4499		7.7161	** 1%

The result of the regression analysis, the item of the comprehensive assessment of the environment of the Tenguiwa Irrigation Canal, the effect of "Community development using regional history and culture" (0.1770) was the greatest. And, t-values satisfied a level of significance at 0.5%.

Consequently, the comprehensive assessment of the environment of Tengiwa Irrigation Canal was related to the direction of community development using history and culture in the Soja district.

5. CONCLUSION

Previously, land for roads had been prepared by laying irrigation canals underground in Japan because social infrastructure, such as urban roads, had not been sufficiently provided. Recently, irrigation canals have been reassessed as environmental assets. This study focused on the Soja district, in which many historical and cultural resources exist but where these resources have not been developed.

The questionnaires by resident in Soja district were revealed the value of Tenguiwa Irrigation Canal as an environmental asset and the relationship of community development.

The results were as follow:

First, the result of the covariance structure analysis showed that the factor of natural landscape on the value of Tenguiwa Irrigation Canal as an environmental asset was larger than that of the environmental factors. Second, the result of regression analysis showed that the relationship between the comprehensive assessment of the environment of Tengiwa Irrigation Canal and the direction of community development using regional history and culture in Soja district.

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