

Applying IPA on Services Quality for Farm Irrigation Engineering - A Case Study for Kaohsiung Irrigation Association

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-----ABSTRACT-----

The purpose of development Irrigation Association in Taiwan is to service farmers, improve irrigation and drainage facilities and get the most out of the economy for all members. Therefore, this study takes a case of Kaohsiung Irrigation Association as object, and explores the effect on the service quality to maintain the sustainable development of agriculture.

The research takes the service quality scale of Kaohsiung Irrigation Association as the questionnaire and applies importance-performance analysis (IPA) to view the demand on service quality. Through 22 factors and 5 phases to analysis the questionnaire by statistical method including difference analysis, independent T test, one-way analysis of variance and correlation analysis. The result shows that the background parameters and five phases have significant effects such as level of education and position. The analysis of IPA is found that 17 factors in the first quadrant mean that members and users will have confidence and extreme recognition and identity on service quality of water conservancy.

The results will explore the important issues of concern on service quality in Kaohsiung Irrigation Association, and could give as a reference to improve the future of construction and provide the ability to play a good role in supervision to strengthen the quality and service efficient in farmers' organizations.

Keywords - Service quality, IPA, farm Irrigation engineering, questionnaire, expert interview.

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I. INTRODUCTION

Taiwan's implementation of farmland-water is an important part of sustainable agriculture, and the construction of irrigation and drainage services when related to farmers' livelihoods. Currently it has set up seventeen Irrigation Association in Taiwan, in addition to the deployment of water, and is responsible for the construction, improvement, maintenance and management of its jurisdiction of irrigation facilities, in order to maintain the quality and effectiveness of irrigation water.

To improve project quality and efficiency, it is an important topic and worthy study to view the demand and cognition from service quality of water conservancy engineering facility. It will identify strategies to improve the response to ensure that the productive function of irrigation and water conservancy facilities. This study is divided into two phases. The first will collect this works supervisors, superiors check case, as engineering service quality or lack of statistics in nearly three years. And then it will review of the relevant literature, theory and observation engineering quality supervision case and data collection, and then shall analyze, compare, generalize.

The research has attempted to five dimensions of SERVQUAL scale for the architecture to be prepared questionnaire and application Importance-Performance Analysis (IPA) to analyze the farmers, members, supervision and constructors on satisfied with the quality for farmland water conservancy in Kaohsiung area and to find out the primary key attributes of the points terror situation that can improve user satisfaction. This study can be specifically described as follows: (1) to confirm the importance items of the project during construction management from the water conservancy and to build the quality scales on service; (2) to apply IPA to analysis the expectations on service quality from farmer, members and supervision subcontractors; (3) to investigate the advantages and disadvantages of quality control on performance, and to find out the real user expectations and attention; (4) based on questionnaires and interviews, to identify strategies to enhance the satisfaction of the project from water conservancy and to refer the corrective measures for projects.

II. LITERATURE REVIEW

2.1 The quality management system of Kaohsiung Irrigation Association in engineering

Currently the quality management system is in accordance with procurement law and three-level quality control. In addition to self-handle design, construction and contracting is handled in accordance with regulations. For fair and open, fund-raising follows the procurement contract by law, and the quality requirements in accordance with three-level quality control. By statistical results, there are top 20 items of common construction missing in quality from works supervisors with Irrigation Association in Taiwan as described in Table 1.

Table 1 Top 20 items of common construction missing in quality

Ranking	Construction missing	Quantity	Percentage of occurrence
1	No sample testing on construction work and materials / equipment.	28	6.26
2	Not been implemented independent quality control or inspection criteria not setting to perform quantization.	24	5.37
3	The competent authorities / vendors of project management with other missing.	16	3.58
4	Deletions on Concrete Construction.	15	3.36
5	Inadequate transportation facilities with warning on construction site.	15	3.36
6	Not been implemented to execute construction log.	14	3.13
7	Not setting testing of timing for each material/ equipment in construction.	14	2.13
8	No setting standards of quality management for each material / equipment in construction.	13	2.91
9	Not review inspection reports of material.	13	2.91
10	No execution on quality audit.	12	2.68
11	Not setting test schedule of each material/equipment and construction.	10	2.24
12	No immediate notification contractor for found missing to improve within the time limit.	10	2.24
13	Not meeting specifications on pouring and tamping concrete.	10	2.24
14	No automatically checking records of labor safety from contractor.	10	2.24
15	Other missing of quality control from subcontractors.	9	2.01
16	Other missing of quality control from supervision units.	9	2.01
17	Not approved or indeed review on supervision plan.	7	1.57
18	Not reporting the supervision statements.	7	1.57
19	Without missing correction and prevention strategies on environmental protection and construction safety.	7	1.57
20	Other missing of earthworks engineering.	7	1.57
Total		447	

Through awareness and the demand from the users and the owners of the project, it will take a higher incidence of missing as the need to improve the assessment of the project on quality service. So this study can use as questionnaire based on the need of service quality.

2.2 Importance-Performance Analysis

Importance - Performance Analysis(IPA) is used to analysis service quality of customer, and applying a two-dimensional matrix to list the importance and satisfaction. Chapman and Kozak and Nield noted that IPA is often applied to the analysis advantages and disadvantages of products, services, banking and others [2] [4]. Tonge and Moore explained that the model has been widely used to survey importance and satisfaction of service quality in the industry[9]. IPA method is mainly to collect the feel degree from respondents, so "important" sometimes means to "pay attention" and "expect", and "performance" is sometimes to "cognitive" and "satisfaction" with a peer scale to analysis. Regardless to say "important" and "satisfaction", it uses the same title to measure respondents' reactions degree.

IPA is calculated the average of individual item on "important" and "satisfaction", and followed by questions of "Important" and "satisfaction" to draw to the average on two-dimensional plane coordinates[5]. The study takes

"importance" as the y-axis, "satisfaction" as the x-axis, and then allows to divide the midpoint coordinate formed four quadrants as defined as Fig. 1. The first quadrant is "keep up the good work" and indicates the degree of importance and performance that are high, and the points fall in this quadrant should be maintained. The second quadrant is "concentrate here" and denotes a high degree of importance but low of performance. The points are within this quadrant that managers should strengthen to improve the area. The third quadrant is "low priority" and indicates the degree of importance and performance are both low that have lower priority. The fourth quadrant is "possible overkill" and indicates a low degree of importance and the high levels of performance. The points in this quadrant are excess supply.

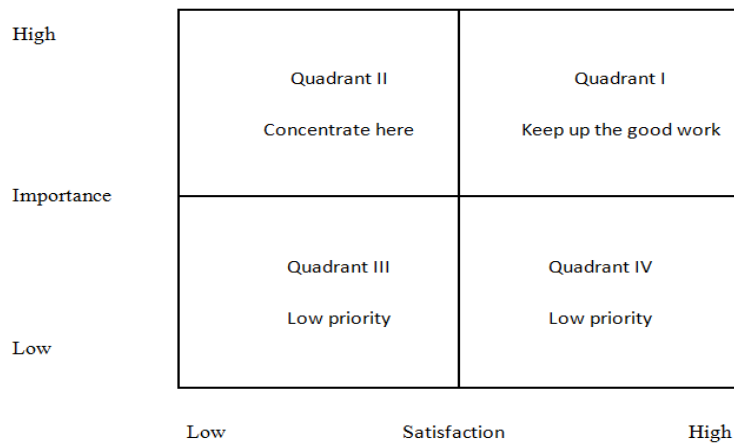


Fig. 1 Four quadrants of IPA [6]

III. METHODS FOR DETERMINING THE KEY FACTORS

3.1 The Scope and Objects of this research

Kaohsiung Irrigation Association has vast irrigation area and business area of about 20,367 hectares of irrigated area. It also develops agriculture with water resources project including three regions in Kaohsiung. Therefore, this study will take the facilities and channels engineering of Kaohsiung irrigation and water conservancy for the scope of the study, and its satisfaction study helps managers understand the project quality. In this study, it selects the members of Kaohsiung water conservancy, outsourcing supervision and subcontractor as a questionnaire survey.

3.2 The establishment of quality architecture

In this study, through analysis and review of relevant literatures to check common deletion, it establishes preliminary conceptual architecture, shown in Fig. 2. It applies Dimension of Service Quality for the 10 determinants[1] [3][7] and presented the service quality rating scales in order to construct a questionnaire of five phases and 22 factors for the project satisfaction[8][10]. Through the survey of importance and satisfaction, the research further interviews with professionals to determine indicators of satisfaction.

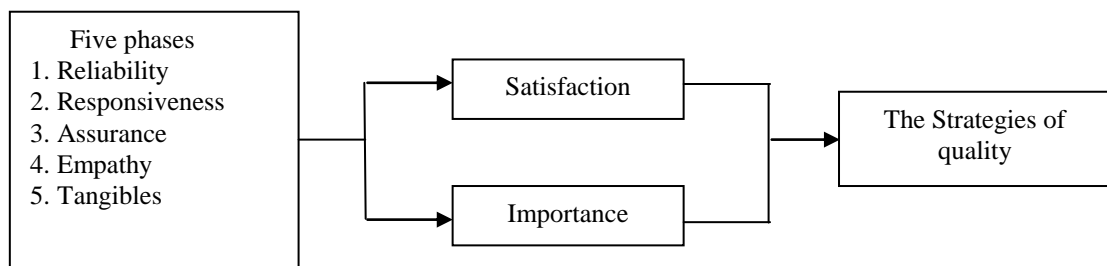


Fig. 2 The framework of questionnaire Investigation

The contents of questionnaire are based on missing statistics from nearly three years on works supervisors of Irrigation Association. And through the analysis, comparison and induction, it prepared questionnaire with five dimensions for the SERVQUA architecture and be measured a five-point Likert scale.

The questionnaire data were analyzed by using SPSS 20.0 for Windows to statistical analysis and data verification, including descriptive statistical analysis, independent sample t test, one-way analysis of variance, and the importance of performance analysis.

IV. RESULTS AND DISCUSSIONS

In this study, the questionnaire distribution time is September 2015 to December 2015, a total of 330 questionnaires, back to 322 questionnaires, excluding invalid questionnaires, actual 301 valid questionnaires, the recovery of 91%. The result of reliability validity on importance and satisfaction are as shown in Table 2. All Cronbach's α coefficient values were greater than 0.7, so this questionnaire has good reliability and internal consistency is quite high.

Table 2 Cronbach's α of importance and satisfaction

The Phase	Cronbach's α of importance	Cronbach's α of satisfaction
Reliability	0.912	0.913
Responsiveness	0.881	0.864
Assurance	0.831	0.828
Empathy	0.843	0.821
Tangibles	0.907	0.863

4.1c Descriptive Statistics

This study on descriptive statistics is used to describe the basic features of the data from questionnaire samples including six personal background variables: Gender, Age, Education, Occupation, Position and Stayed involved in coordinating and handling the project of Kaohsiung Irrigation Association. The results showed that Gender (men 69.10%, female 30.90%); Age(aged less than 20 years of 3%, 20 to 40 years was 27.6%, 40 to 60 years the majority of 52.5%, above 60 years old 19.6%); Education (for junior high school a and containing less 21.9%, senior high school 29.9%, college majority 37.9%, graduated school above 10.3%); Occupation(agriculture, forestry, animal husbandry and fisheries majority 45.2%, services 32.2 %, military and government personnel 3.3%, manufacturing 14.6%, self- employed 4.7%); Position (members 58.1% , outsourcing supervision 5.6% , owner supervision 15.9% , subcontractor 20.3%); Stayed involved in coordinating and handling the project of Kaohsiung Irrigation Association (participation 84.1%).

In order to understand the basic background variables on satisfaction whether there are significant differences exist, the study used one-way analysis of variance and independent samples t-test to analysis. The results are shown that no significant on gender for each phases; Education on Reliability and Certainty has significant differences. In addition, Occupation on three phases such as Reliability, Responsiveness and Tangible has significant differences, as described in Table 3.

Table 3 The significant differences on Occupation and the phases

The Phase	Occupation	Average	Standard deviation	Standard error	P-value	Post hoc tests
Reliability	O1	4.1279	.56917	.04881	.001	4>1
	O2	4.2577	.52118	.05292		1>3
	O3	3.5200	1.37663	.43533		2>3
	O4	4.3545	.59901	.09030		5>3
	O5	4.3143	.58026	.15508		
Responsiveness	O1	3.9173	.59243	.05080	.002	2>1
	O2	4.1675	.54333	.05517		2>3
	O3	3.6750	1.20790	.38197		4>1
	O4	4.2330	.68071	.10262		4>3
	O5	4.0536	.65176	.17419		
Assurance	O1	3.9761	.63965	.05485	.013	2>3
	O2	4.1108	.52906	.05372		4>3
	O3	3.6000	.96609	.30551		5>3
	O4	4.2386	.63097	.09512		4>1
	O5	4.1964	.68766	.18378		
Empathy	O1	4.1103	.57529	.04933	.371	
	O2	4.1375	.60620	.06155		
	O3	3.9333	.69921	.22111		
	O4	4.2803	.67798	.10221		
	O5	4.2619	.75310	.20127		
Tangibles	O1	4.0417	.49431	.04239	.003	4>1
	O2	4.1186	.48529	.04927		4>3
	O3	3.8000	.83074	.26270		5>3
	O4	4.2917	.56391	.08501		5>1
	O5	4.4286	.55360	.14796		5>2

*p<0.05 **p<0.01 ***p<0.001

- (1) O1 means agriculture, forestry, animal husbandry and fisheries majority for Occupation.
- (2) O2 means services for Occupation.
- (3) O3 means military and government personnel for Occupation.
- (4) O4 means manufacturing for Occupation.
- (5) O5 means self-employed for Occupation.

4.2 Correlation Analysis Of Service Quality

In this study, it used Pearson correlation analysis to investigate the correlation between the phases on service quality of engineering projects. The results are shown in Table 4, and the significant levels are greater than 0.01 between the relevant dimensions.

Table 4 Correlation coefficients for five phases

	Reliability	Responsiveness	Assurance	Empathy	Tangibles
Reliability	1				
Responsiveness	.684**	1			
Assurance	.597**	.769**	1		
Empathy	.589**	.678**	.682**	1	
Tangibles	.662**	.707**	.711**	.667**	1

** Correlation is significant at the 0.01 level (2-tailed).

4.3 The Analysis Of Ipa

For understand the importance of service quality, it applies IPA to show four quadrants that will commonly be utilized in practice and divided the matrix. Attributes located in Quadrant I (both performance and importance are high) are “keep up the good work”. It means that respondents indicated not only that the service provides a very important from water conservancy and agree fairly good service quality on project. Attributes located in Quadrant II (performance are high and importance is low) is “concentrate here”. In this Quadrant, respondents believe that the service provides is very important, but members do not agree with the current service. Attributes in Quadrant III (performance and importance are low) are minor weaknesses and called “Low Priority” that do not require additional effort. Attributes located in Quadrant IV (performance is low and importance is high) are “Possible Overkill” and require immediate attention for improvement. It means that members and participants of these projects have a good evaluation, but not the most important items.

Through IPA analysis for 22 factors, the study found that there are 17 factors in the first quadrant as shown in Fig.3 , the average of them are greater than 4, and thus it represents extreme affirmation and recognition. The administrative authorities should continue to focus on the field, and then continue to keep membership expectations. There are four factors in the second quadrant and shows that it is necessary to take priority for improvement on project management to promote service quality. The factors in quadrant I and quadrant II are shown as Table 5.

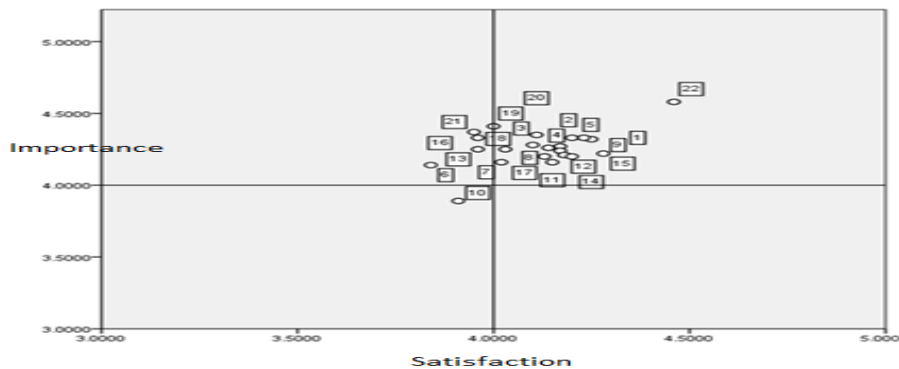


Fig. 3 The factors on the matrix by IPA

Table 5 The factors in the first quadrant

Quadrant I (both performance and importance are high)	
Reliability	F1. It will ensure confident on the quality for water conservancy. F2. It will certainly satisfactory quality of the project during construction and completed for water conservancy. F3. It will be satisfied with safety working and environmental protection for water conservancy. F4. It will be satisfied with construction projects and commitments for water conservancy.

	F5. It will be satisfied with construction and coordination and meetings for water conservancy.
Responsiveness	F11. It will be satisfied with supervisors and contractors to respond the problems in construction. F12. It will be satisfied with warranty period after construction from supervisors and contractors.
Assurance	F14. Supervisors and contractors will be security-conscious on farmers farming during construction. F15. It agree that construction supervisors and contractors can meet the needs of farmers. F18. It agrees with the outcome of the project integration environment statement from contractors.
Empathy	F7. It believes that supervisors and contractors in construction will not oversight for commitments. F8. It agrees that the supervisor and the contractor can take the initiative to improve the quality missing in construction. F9. It believes that supervisors and contractors can respond quickly for poor quality in construction.
Tangibles	F17. It agrees that the project transparency and openness is helpful. F19. It agrees that restoration of the environment is indeed and road repair intact after construction. F20. It will be satisfied without debris on site after construction. F22. It believes that irrigation and drainage systems in line with the needs of farmers.

F1 means that factor 1 from factors 22 of the questionnaire.

F2 means that factor 2 from factors 22 of the questionnaire.

V. CONCLUSION

In this study, it takes the service quality scale of Kaohsiung Irrigation Association as the basis of the questionnaire and applies importance-performance analysis (IPA) to view the demand of members, vendors, supervision units and stakeholders on service quality.

The analysis of questionnaire has applied difference analysis, independent T test, one-way analysis of variance and correlation analysis. The researchers found that the background parameters have significant effects such as level of education and position. Also through the correlation analysis, there are significant direct correlation between five phases.

The results of applications IPA analysis are shown that located in the first quadrant has seventeen factors; in the second quadrant has four factors and in the third quadrant has one factors. The factors in the first quadrant mean that members and users will have confidence and extreme recognition and identity on service quality of water conservancy. The factors on the second quadrant that the average of the satisfaction of all below 4.0. It shows the need to give priority to its construction management. The results based on IPA has been listed factors of important concerns and low satisfaction, and can refer to the proposal as the current construction mode and correction of the missing. In addition, it will enhance satisfaction of service quality for the water conservancy.

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Biographies and Photographs



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