Improving Nuclear Safety E&T Workshops using the Importance-Performance Analysis Method

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1. Introduction

After the Fukushima nuclear accident, the international community has taken various measures and activities to secure a high level of nuclear and radiation safety. Due to the nature of radiation disasters, it is also critical for countries to cooperate to secure nuclear safety at the international level. As for embarking countries of nuclear energy, it is vital to construct a foundation for safety management through developing competence in knowledge through education and training (E&T). In this context, nuclear safety E&T can be regarded as one of the critical methods in achieving global nuclear safety.

Ever since its establishment, the International Nuclear Safety School (INSS) of the Korea Institute of Nuclear Safety (KINS) has been providing nuclear safety E&T workshops to international experts and students. Under the framework of KINS-IAEA Practical Arrangement in 2008, experts from regional safety networks such as the experts from Asian Nuclear Safety Network (ANSN) countries have been invited to participate in the E&T workshops in Korea [1].

However, due to its relatively short history, there is not much quantitative evaluation to improve the existing nuclear safety E&T workshops. This study aims to evaluate the E&T workshops quantitatively and to provide policy implications by using the Importance-Performance Analysis.

2. Methods

2.1. Importance-Performance Analysis

Importance-Performance Analysis is a method frequently used in marketing. This technique has the advantage of comparing and analyzing relative importance and performance for each variable at the same time [2]. Due to its intuitive and straightforward application, the following analysis has been used in areas other than marketing to evaluate performance and importance [3].

First, the performance of each category can be obtained from the mean of each question of the survey data. Second, the importance of each category can be calculated from the pre-obtained performances through various methods, including the 'regression coefficient approach' and 'correlation analysis.' This study uses correlation results to find the mean values of importance.

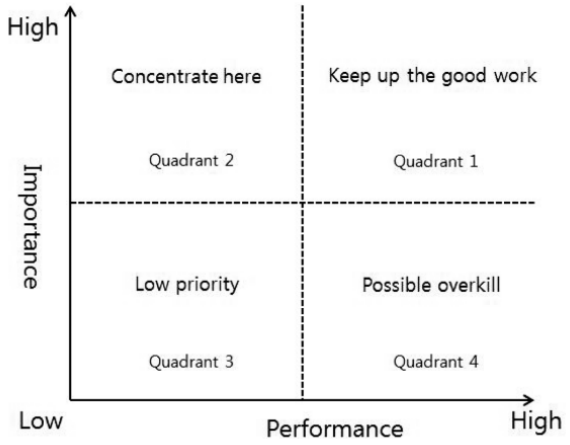

Fig. 1. Importance-Performance Analysis Grid (adopted from Ha, Choi, and Son, 2014)

After finding both performance and importance, each data will be provided in the four quadrants as in Fig. 1. Quadrant 1 shows the area of both high performance and importance that has pleasing outcomes. Quadrant 2 shows an area of low performance but high importance that needs to be improved. Quadrant 3 shows an area of low performance and low importance that does not need much attention currently. Quadrant 4 shows high performance but low importance that does not require maintaining the current level of effort.

2.2. Survey data

Survey data collected from KINS E&T workshops were used in the evaluation. For various reasons, including privacy, not all surveys and their questions were used in this analysis. All survey questions were organized on a five points scale. The questions are shown in Table 1.

Table 1: Survey Questions for E&T Workshops

Survey No.	*Survey Question*
Q1_1	Relevancy of lectures
Q1_2	Overall curriculum
Q1_3	Work exercises and case studies
Q2_1	Lecture room
Q2_2	Lecture equipment
Q2_3	Accommodation
Q3_1	Course management ability
Q3_2	Useful experience
Q3_3	Willingness to participate again
SAT	General satisfaction

3. Results

The mean values of the performance have been obtained through the survey data. To find the mean values of importance, the correlation coefficient of survey questions from Q1_1 to Q3_3 was calculated with the SAT (general satisfaction). All correlations were significant at the 0.01 level, and its results are as shown in Table 2.

Table 2: Correlation Results

Survey No.	*Correlation coeff.*	*n*	*Mean*	*S.D.*
Q1_1	0.624**	87	4.43	0.603
Q1_2	0.568**	87	4.34	0.696
Q1_3	0.323**	84	4.21	0.729
Q2_1	0.572**	87	4.71	0.526
Q2_2	0.527**	87	4.75	0.487
Q2_3	0.458**	85	4.51	0.766
Q3_1	0.794**	86	4.59	0.639
Q3_2	0.806**	87	4.45	0.586
Q3_3	0.854**	87	4.71	0.480

*p<0.05, **p<0.01

Then, each correlation coefficient was divided by the sum of all correlation coefficients (5.526) to provide an intuitive view for mean values of importance. The results of both performance and importance are as shown in Table 3.

Table 3: Importance and Performance Results

Survey No.	*Performance*	*Importance*
Q1_1	4.43	0.113
Q1_2	4.34	0.103
Q1_3	4.21	0.058
Q2_1	4.71	0.104
Q2_2	4.75	0.095
Q2_3	4.51	0.083
Q3_1	4.59	0.144
Q3_2	4.45	0.146
Q3_3	4.71	0.155

In order to create data-centered quadrants, the medians of the sum of mean performance and importance were calculated. The median value for performance was 4.51, and the median for importance was 0.104. Consequently, they were used as a reference line to the X and Y-axis.

The Importance-Performance Analysis results show that the current nuclear E&T workshops proved to have satisfying results for quality of lecture rooms (Q2_1), course management ability (Q3_1), and participants wish to participate again (Q3_3) as they are plotted in the quadrant 1. The quality of lecture equipment (Q2_2) was also satisfactory; nevertheless, they are not as relevant to prioritize than the variables in quadrant 1 as it is plotted in the quadrant 4.

Overall curriculum (Q1_2), work exercises and case studies (Q1_3), and accommodation (Q2_3) have been discovered to have the lowest priority among all variables as they are plotted in the quadrant 3. On the other hand, there needs to be an improvement in having relevant lectures (Q1_1) and providing useful experiences (Q3_2) as they were plotted in quadrant 2. The Importance-Performance Analysis results of nuclear safety E&T workshops is shown in Fig. 2.

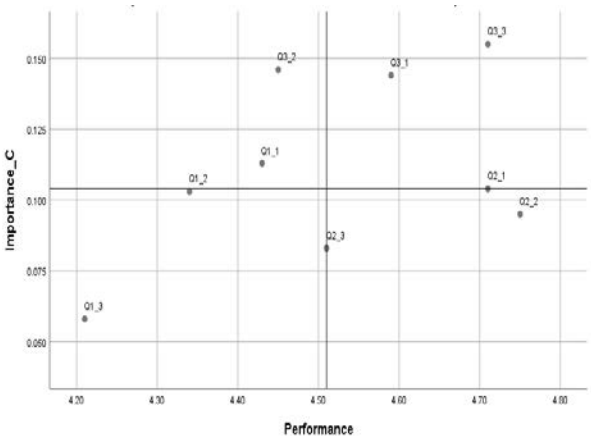

Fig. 2. Importance-Performance Analysis Results

4. Discussion and Conclusion

As achieving global nuclear safety gained more emphasis, the importance of human capacity building has also risen. The INSS has provided nuclear safety E&T workshops for over a decade, and now there are sufficient data to begin quantitative evaluation of the workshops. Through using an analysis technique used in marketing, this study attempted to evaluate different variables by categorizing them into four different quadrants. As a result, there needs improvement in providing useful experiences and lectures that are relevant to the participants' needs. To do so, receiving feedbacks through providing preliminary questionnaires to participant may increase the quality of the workshops.

Nevertheless, there are several limitations to this study. First, only a small number of samples were tested (n=87). Second, some questions such as Q3_3 cannot be improved as they are the results of the E&T workshops. Thus, to improve the results of this study, a more significant number of samples and a new type of questionnaire will be helpful in conveying relatively more insightful results.

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