Comparative Study of IPA Techniques in Biased Cases: Developing Improvement Plans for Electronic Supervision Investigation(ESI) Team*

Danee Lee
Department of Psychology,
Chungbuk National University

Yoori Seong **
Research Fellow
Korean Institute of Criminology and Justice

Abstract

To ensure efficient implementation of the system, appropriate improvement measures and policies must be established. This requires an investigation into the practical difficulties and problems, followed by careful selection of the items to be improved. In this study, we propose using important-performance analysis (IPA) as a method to identify requirements by the subject. IPA is a visual method used to evaluate the need for improvement of each item by analyzing the degree of performance and the degree of importance for various items constituting a system or policy.

In Korea, most studies conducted have used only IPA using the data-centered quadrant model (DCQM). However, this model may not be suitable for a biased case where the degree of performance is generally below average and the importance is above average. In such situations, the analysis results using DCQM may not be applicable for actual system improvement. Therefore, in this study, we performed the Important-Performance Gap analysis (IPGA) and DCQM to diagnose the improvements that need to be made for effective team operation targeting the Electronic Supervision Investigation Team of the special judicial police system newly established in October 2021. As a result, IPGA is appropriate in the biased case.

Keywords: IPGA, IPA, Electronic Supervision Investigation Team, Prioritizing improvements

* The data in this paper is based on the 2021 research report by the Korean Institute of Criminology and Justice, 'A Study on the Implementation and Improvement of the Electronic Supervision Special Judicial Police System'. If you have any further questions about the Electronic Supervision Special Judicial Police System and Electronic Supervision Investigation Team, refer to the report.

** Direct correspondence Yoori Seong: yrseong21@kicj.re.kr
http://dx.doi.org/10.36889/IJCJ.2023.003
Received 15 March 2023; Revised 9 June 2023; Accepted 27 June 2023
INTERNATIONAL JOURNAL OF CRIMINAL JUSTICE, Vol. 5 Issue 1, June 2023, 67-86

Introduction

IPA and IPGA

The analysis technique that can determine priority among various matters is ranked multiple response analysis, which involves respondents ranking items in the survey stage. Alternatively, multi-criteria analysis determines priority among multiple alternatives by applying multiple evaluation criteria. There are various decision-making techniques available, such as Analytic Hierarchy Process (AHP; Saaty, 1980) and Analytic Network Process (ANP; Saaty, 1996). Important-Performance Analysis (IPA), the tool highlighted in this study, is a method developed to evaluate elements of marketing programs. It interprets issues that need to be improved first (Martilla & James, 1977). IPA is easy to apply, and the importance and performance level of each item can be visually checked, making the interpretation of results intuitive. IPA has been widely used in various research and practice fields, including evaluating customer satisfaction with services and products as well as in landscaping, forestry, tourism, medical and scientific fields, technology, education, and social sciences (Evans & Chon, 1989; Go & Zhang, 1997; Dolinsky, 1991; Dolinsky & Caputo, 1991; Markazi-Moghaddam, Kazemi, & Alimoradnori, 2019; Hansen & Bush, 1999; Ford, Joseph, & Joseph, 1999; Ahn, Kim, & Lim, 2018).

The traditional IPA evaluates respondents' needs, satisfaction, and improvement needs based on information about the importance-performance level coordinates of each item, which are located on a matrix centered on the median of importance (Y-axis) and performance level (X-axis). This is known as the middle of the scale - Scale Centered Quadrant Model (SCQM), and the IPA matrix is the figure that visually analyzes the response results based on two axes (Martilla & James, 1977). The IPA matrix intuitively confirms the priority or direction of a product or policy, depending on which quadrant each investigated item is located in one of the four quadrants (Martilla & James, 1977). In general, the first quadrant of the matrix is the ‘Keep up the good work’ area, where items with high relative importance and a high degree of performance are located. In this area, although some achievements or

implementations have already been made, there are items that are still socially and practically important and need to be maintained and further strengthened. Quadrant II is the 'Concentrate here' area, where items with high relative importance but a low degree of performance are located and require focused improvement. The third quadrant is a 'Low priority' area, where items with low relative importance and a low level of performance are located. Both the degree of performance and importance are low; gradual improvement is needed. Finally, the fourth quadrant is a 'Possible overkill' area, where items of relatively low importance but a high performance level are located. They were generally located in the 'Keep up the good work' area in the past, but over time their importance decreases, and they move into the 'Possible overkill' area. In the case of items in this area, depending on the case, it is necessary to continue and maintain the current level of performance, or gradually reduce or eliminate the item.

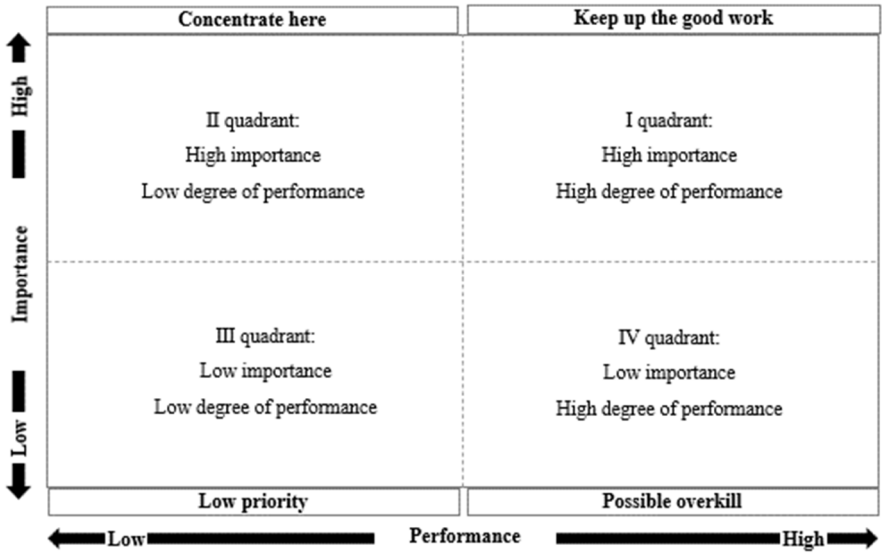

Figure 1. IPA Matrix

The issue with traditional IPA is that it may not always be an appropriate analytical technique for every situation. Several researchers have highlighted

situations and problems where SCQM may not be suitable (Matzler et al., 2004; Abalo, Varela, & Manzano, 2007). One of the challenges is that it is an effective technique only when the evaluation items are distributed evenly (Choi & Park, 2001). In other words, if the importance or performance level or both dimensions contain biased information or measure items with relatively similar importance and performance, the traditional IPA matrix can result in clustering most of the outcomes in one quadrant, leading to erroneous judgments (Rial, Rial, Varela, & Real, 2008). For instance, when evaluating which items should be prioritized for improvement in a new system, most of the items may have very little or no implementation. In such situations, when analyzing using traditional IPA, the coordinates for most of the items are likely to be located in the second and third quadrants, making it challenging to identify the items that require improvement first. To address this problem, researchers have proposed a data-centered quadrant model (DCQM) that generates a matrix using the average values of importance and performance (Hollenhorst, Olson, & Fortney, 1992; Martilla & James, 1977; Rial et al., 2008). Currently, many studies in Korea have employed this DCQM in IPA analysis (Kong, 2006; Ahn, Kim, & Lim, 2018; Seong, Um, & Kim, 2016; Park, 2009; Ryu & Park, 2006, etc.). This method is ideal for analyzing data where the importance or performance level of the item to be measured is uniformly distributed because it allows for a detailed analysis between biased response values.

However, DCQM also has its own set of problems. Firstly, it is observed that even minor shifts in factors can lead to significant changes in priorities (Bacon, 2003; Tontini, Picolo, & Silveira, 2014). Another challenge is that it is difficult to distinguish priorities when the factors to be measured have similar levels of importance and performance. For example, if the items to be measured are generally significant, but the level of performance is insufficient, the content is evenly distributed in the quadrants when using the modified IPA. Even though the content should be located in the area of focus or gradual improvement, the modified IPA may provide misleading results. While the modified IPA may be useful for classifying maintenance, reinforcement, improvement, progressive improvement, and continuous maintenance among the items to be measured, it may not be useful if one intends to select priorities

while reflecting the actual reality in items that are seldom implemented. Also, if a significant number of items are gathered and distributed in a particular area, such as focused improvement or gradual improvement, IPA does not provide a method to select the issues to be solved first among them. To tackle this problem, researchers have developed analysis methods that use the gap between importance and performance (Feng, Mangan, Wong, Xu, & Lalwani, 2014; Rial et al., 2008; Lin, Chan, & Tsai, 2009). The importance-performance gap analysis (IPGA) was the focus of Lin et al. (2009). IPGA generates an IPA matrix by using the difference between importance and performance level measurements, and it is useful because it can derive a major priority among the IPGA matrix, is characterized by providing a (0, 1) cross axis (Lin et al., 2009).

Electronic Supervision Special Judicial Police System and Electronic Supervision Investigation Team

The electronic supervision system was introduced in 2008 to prevent recidivism among sexual violence offenders. Since then, the subject of electronic supervision has been expanded to include sexual assault offenders, abductors of minors, murderers, and robbers. In 2020, the scope of electronic supervision was further extended to cover parole and conditional release under electronic monitoring. As the number of electronic supervision cases increased significantly, various policies were implemented to establish a 24-hour response system and a dedicated department. However, sanctions for violations related to immediate electronic supervision were rarely enforced. For instance, if a person wearing an electronic anklet damages the electronic device or violates the prohibition of going out, the electronic device sounds an alarm and goes through the Electronic Supervision and Control Center. The e-supervision staff, crime prevention team, and local police are contacted to take action. Immediate sanctions are imposed if a subject commits a crime after damaging an electronic device or going out at night. In the past, investigations were frequently delayed because police officers were not proficient with the electronic monitoring system or underestimated the potential risks associated with violations related to electronic supervision.

To address this issue, the 'Electronic Supervision Special Judicial Police System' was introduced. This system enables special judicial police with expertise in the electronic supervision system to investigate violations and ensure prompt and professional investigations. However, in the same year, an incident ('Kang Yun-Seong case') occurred in which a person subject to electronic surveillance murdered two people before and after damaging electronic devices. The Kang Yun-Seong case underscored the critical need for rapid investigation by the special judicial police with electronic supervision. The Electronic Supervision Investigation Team was launched in October 2021 across 13 headquarters, with 82 personnel working 24 hours a day. The team was selected from among the existing electronic supervisory staff. The investigation period for violations of electronic supervision rules was shortened to less than 16.1 days for two months in 2021 after the launch of the Electronic Supervision Investigation Team compared to over 34 days in 2020. This represents that the investigation by the Electronic Supervision Investigation Team is progressing more rapidly than in the past when the investigation was conducted by contacting the local police (Choi, Seong, Kim, & Kim., 2021). However, the initial stage of the establishment faced limited support resources, such as no desks or PCs at the headquarters or rooms for each member of the Electronic Supervision Investigation Team to work.

To enhance the efficient performance of the electronic supervision special judicial police system and the Electronic Supervision Investigation Team, in-depth interviews were conducted with relevant stakeholders, including electronic supervision staff, the police, the prosecution, and administrative practitioners at the Korean Institute of Criminology and Justice (Choi et al., 2021). The study identified the priority items that must be addressed for the successful operation of the Electronic Supervision Investigation Team, including individual competency, system improvement, support system and facility security, and awareness improvement. The Importance-Performance Gap Analysis (IPGA) was used to prioritize these items rated as the degree of performance generally below while the importance was above average.

Although several papers and policy research reports inside and outside

of South Korea use DCQM among IPA techniques to check priorities, there are few research reports and papers using IPGA in South Korea. This study aimed to explore whether the use of IPGA rather than modified IPA is suitable for prioritizing improvement in biased cases.

Method

Research Subject

A survey was administered to all members and team leaders of the Electronic Supervision Investigation Team, and their responses were analyzed using both IPA and IPGA techniques. Out of 64 individuals who responded to the questionnaire, 63 were included in the analysis after excluding one non-respondent. Among the 63 individuals, two did not provide personal information and were excluded from the analysis, resulting in a final sample size of 61 individuals who were all male (as all members of the Electronic Supervision Investigation Team were male) with an average age of 42.4 years (range: 31-52 years). Of the respondents, 10 were team leaders while 51 were team members.

Measuring Tool

First, 20 items necessary for the successful establishment of the Electronic Supervision Investigation Team were selected through advisory meetings and in-depth interviews with experts at the working level. Each item covers a variety of contents, from basic office space to reward systems, authority setting, capacity building, support systems, and awareness improvement. The selected 20 priorities can be broadly divided into four categories, and the specific questions are as follows: 5 questions related to individual competency improvement (e.g., work skills of the Electronic Supervision Investigation Team, investigation education such as investigation and material tracking techniques, effective forced investigation, etc., support for physical training and education, legal system education such as criminal law, objective compensation such as job evaluation or performance rewards), 6 items related

to system improvement (such as appropriate authority, creation of a stable work environment through position and career management, independence from the protection series of electronic supervision, operating as an independent team by granting service authority to the team leader, selecting volunteer-oriented team members, distinct role boundaries), 6 items related to support systems and securing facilities (such as independent office space, specific work guidelines, Kicks system to support police investigation procedures, close cooperation system with dedicated staff, close cooperation system with cooperation-oriented police station, and general programs used by the police for investigation), 3 questions related to awareness improvement (such as the probation officers' positive perception towards the Electronic Supervision Investigation Team awareness, the police, prosecutors, and judges' perception of the seriousness of the subject's violation, and the public's awareness of the work of the Electronic Supervision Investigation Team). The Electronic Supervision Investigation Team and team leaders responded to each item on a 7-point scale, indicating ‘the degree to which it is currently being implemented’ and ‘the degree of importance’.

Analysis Method

The modified IPA calculation method comprises the IPA matrix with the average value of importance and performance of all items as the center of the matrix. The IPGA is a bit more complicated to calculate. In this study, the IPGA calculation method introduced by Tsai, Lin, & Chan (2011) was used.

First, a paired-sample t-test is performed with the importance and performance values to check whether there is a significant difference between the two values. If the difference between the importance and degree of performance is not significant, the distance is not analyzed even if the matter is located in the second quadrant. Next, the relative importance (RI) and relative performance (RP) are calculated using the values evaluated for the importance and performance level. Relative importance is determined by dividing the average importance of j by the average importance of all items. Relative performance is calculated by dividing into three situations. If the

performance average of j is larger than the importance average of j, it is calculated by dividing the performance average of j by the overall or region performance average. Conversely, if the performance average of j is smaller than the importance average of j, the value obtained by dividing the performance average of j by the overall or region performance average is squared by -1 and multiplied by -1. The third situation is when there is no significant difference between importance and performance values in the paired-sample t-test. In this case, RP is 0.

In this study, since the degree of performance for all items was lower than the importance level, the relative level of performance was calculated by dividing the average of the level of performance of each item by the average of the level of performance of all items, multiplied by -1 multiplied by -1 squared. Finally, the RI-RP coordinates were placed on the matrix using a matrix with relative performance as the X-axis and relative importance as the Y-axis. The distance (Dq(j)) from the midpoint (0, 1) of the matrix was then calculated.

Results

The importance and level of implementation of the 20 items necessary for the successful operation and stabilization of the Electronic Supervision Investigation Team were evaluated based on the perceptions of team members. According to the survey results, the item deemed most important by the team members was the “Work skill of the Electronic Supervision Investigation Team” (6.66 out of 7). This high value suggests that team members are concerned about adapting to new tasks. The items with the next highest importance values were “Investigation Education” (6.55), “Independent Office Space” (6.48), and “Awareness of the Police, Prosecutors, and Judges on the Seriousness of Violations of the Subject” (6.45). On the other hand, the item deemed least important was the “Probation Series and Separate Electronic Supervision Series” (4.91).

In terms of implementation, “Independent Office Space” (4.83) was the item with the highest level of implementation by the Electronic Supervision

Investigation Team, followed by "Specific Work Guidelines" (4.32), "Appropriate Authority" (4.25), and "Composition of a Close Cooperation System with Dedicated Staff" (4.16). Even for items with a high level of implementation, the level was only slightly higher than the median value. The items with the lowest level of implementation were "Support for Physical Training and Education Such as Self-defense Skills" (1.97), "Objective Compensation Such as Work Evaluation and Performance Rewards" (2.83), and "Legal System Education Such as Criminal Law" (2.92).

Table 1. Average importance and performance level of the 20 items evaluated by the ESI team

No.	Items	Importance	Performance
1	Work skill of the Electronic Supervision Investigation Team	6.66	3.71
2	Investigation Education (investigation, material tracking technique, effective forced investigation, etc.)	6.55	3.29
3	Support for Physical Training and Education Such as Self-defense Skills	5.47	1.97
4	Legal System Education Such as Criminal Law	6.00	2.92
5	Objective Compensation Such as Work Evaluation and Performance Rewards	6.02	2.83
6	Appropriate Authority	5.88	4.25
7	Creating a stable work environment through position and career management	6.28	3.60
8	Probation Series and Separate Electronic Supervision Series	4.91	3.00
9	Operate as an independent team by giving the team leader the right to serve	5.70	3.75
10	Selection of team members based on applicants	5.73	3.60
11	Clear scope of work	6.19	3.90
12	Independent Office Space	6.48	4.83
13	Specific Work Guidelines	6.38	4.32
14	Support the investigation process of the Kicks system	6.27	3.81
15	Composition of a Close Cooperation System with Dedicated Staff	6.33	4.16
16	Composition of Close Cooperation System with Cooperation-Oriented Police Station	6.17	3.73
17	Various programs used by the police for investigation	5.95	2.95

No.	Items	Importance	Performance
18	Positive perception of all probation officers towards the Electronic Supervision Investigation Team	6.09	3.55
19	Awareness of the Police, Prosecutors, and Judges on the Seriousness of Violations of the Subject	6.45	3.56
20	Public Perception of Electronic Supervision Investigation Team Work	6.03	3.37
	All	6.08	3.56

Modified IPA vs. IPGA

Modified IPA

The results of the modified IPA matrix preparation are presented in Figure 2. The intersection point of the modified IPA matrix in Figure 2 is the average value of importance (6.08) and the average value of performance (3.46), and it is observed that 20 items are evenly distributed in the fourth quadrant. Among the 20 items, nine items are located in the maintenance and reinforcement area, which is the I quadrant, such as the task skill of the Electronic Supervision Investigation Team (1), creation of a stable work environment through position and career management (7), distinct role boundaries (11), independent office space (12), specific work guidelines (manual) (13), support for the investigation procedure of the Kicks system (14), close cooperation with dedicated staff (15), close cooperation with the cooperation-oriented police station (16), and recognition of the seriousness of the subject's violations by police, prosecutors, and judges (19). Moreover, appropriate authority (6), which had already been sufficiently implemented and had lower importance, was given to the area of continuous maintenance in quadrant IV, where the team leader was given service authority to operate as an independent team (9) and volunteer-oriented team member selection (10) were located. However, only two items were located in Quadrant II, an area that needs improvement first, namely investigative education (investigation, location tracking techniques, effective forced investigation, etc.) (2) and positive perceptions of all probation officers toward the Electronic Supervision Investigation Team (18).

IPGA

Table 2 presents the results of the IPGA matrix, including the paired sample t-test outcomes and the calculated values of relative importance and degree of performance. There are only 2 items in the second quadrant in the IPA analysis, whereas 11 items are located in the IPGA analysis. Eleven items were located in the second quadrant and marked with blocks due to their significant interpretation and a considerable distance (Dq(j)) from the midpoint (0, 1). All improvement needs showed a significant difference between the degree of implementation and importance as a result of the paired sample t-test.

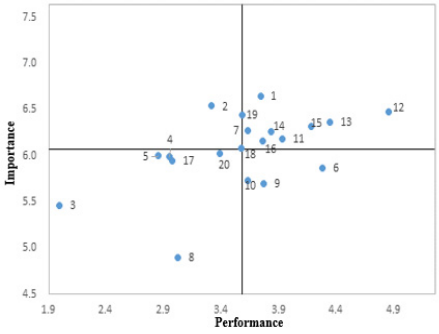

Figure 2. Modified IPA Matrix

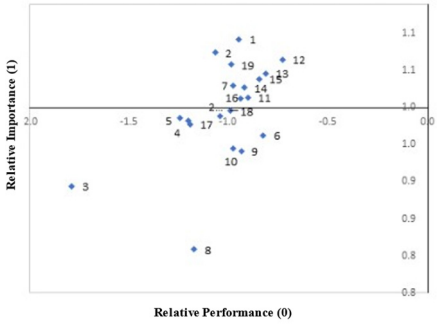

Figure 3. IPGA Matrix

Table 2. Result of difference analysis (IPGA) of importance-performance level for Electronic Supervision Investigation Team improvement needs

Need for Improvement	Performa-nce Importance	t	Relative Performa-nce	Relative Importa-nce	Quadr-ant	*Dq(j)*
Work skill of the Electronic Supervision Investigation Team	-2.94	-14.71***	-0.95	1.09	2	0.95
Investigation Education (investigation, material tracking technique, effective forced investigation, etc.)	-3.25	-15.42***	-1.07	1.07	2	1.07
Support for Physical Training and Education Such as Self-defense Skills	-3.48	-15.77***	-1.79	0.89	3	1.79
Legal System Education Such as Criminal Law	-3.06	-12.98***	-1.21	0.98	3	1.21

Need for Improvement	Performa-nce Importance	t	Relative Performa-nce	Relative Importa-nce	Quadr-ant	*Dq(j)*
Objective Compensation Such as Work Evaluation and Performance Rewards	-3.18	-12.42***	-1.24	0.99	3	1.24
Appropriate Authority	-1.60	-7.49***	-0.83	0.96	3	0.83
Creating a stable work environment through position and career management	-2.67	-13.18***	-0.98	1.03	2	0.98
Probation Series and Separate Electronic Supervision Series	-1.92	-7.04***	-1.17	0.81	3	1.19
Operate as an independent team by giving the team leader the right to serve	-1.98	-7.01***	-0.94	0.94	3	0.94
Selection of team members based on applicants	-2.14	-7.22***	-0.98	0.94	3	0.98
Distinct role boundaries	-2.27	-9.23***	-0.90	1.01	2	0.90
Independent Office Space	-1.65	-7.56***	-0.73	1.06	2	0.73
Specific Work Guidelines	-2.05	-10.28***	-0.82	1.05	2	0.82
Support the investigation process of the Kicks system	-2.44	-12.02***	-0.92	1.03	2	0.92
Composition of a Close Cooperation System with Dedicated Staff	-2.16	-11.23***	-0.85	1.04	2	0.85
Composition of Close Cooperation System with Cooperation-Oriented Police Station	-2.43	-10.54***	-0.94	1.01	2	0.94
Various programs used by the police for investigation	-3.00	-12.70***	-1.19	0.98	3	1.19
Positive perception of all probation officers towards the Electronic Supervision Investigation Team	-2.52	-11.12***	-0.99	1.00	2	0.99
Awareness of the Police, Prosecutors, and Judges on the Seriousness of Violations of the Subject	-2.89	-14.00***	-0.99	1.06	2	0.99
Public perception of Electronic Supervision Investigation Team work	-2.65	-11.42***	-1.04	0.99	3	1.04

* Note 1: *Dq(j)* = the distance between the need for improvement in each area and the midpoint.
* Note 2: *** p <.001
* Note 3: In each area, the items that need improvement and the items with the greatest distance between the midpoints are indicated in bold.

The results of the paired sample t-test and the calculated values of relative importance and degree of performance for the IPGA matrix are presented in Table 2. Items located in the second quadrant, where significant interpretation is possible, and those with a distance (D$q(j)$) far from the midpoint (0,1), are marked with blocks. The paired sample t-test shows a significant difference between the degree of implementation and the importance of all improvement needs.

To check the location of each item, it is recommended to refer to the distance from the origin of each item calculated in Table 2. By checking the IPGA matrix in Table 2 and Figure 3, it can be confirmed that all items need improvement since they are located in either the main improvement area (second quadrant) or the gradual improvement area (third quadrant). Considering that the degree of performance for each item by the Electronic Supervision Investigation Team is generally insufficient, the IPGA matrix distribution with no items located in "keep up the good work" and "possible overkill" can be interpreted as appropriate.

The advantage of IPGA is that it provides prioritization based on the distance from the midpoint (0,1) of what needs improvement. The urgent matters for improvement provided by IPGA analysis and IPGA matrix were investigative education, such as investigation, location tracking techniques, and effective forced investigation (D$q(j)$=1.07). The second priority was the positive perception (D$q(j)$=0.99) of the probation staff as a whole for the Electronic Supervision Investigation Team and the perception of the police, prosecutors, and judges about the seriousness of the subject's violation (D$q(j)$=0.99). Next, improvement was found to be necessary in the order of creating a stable work environment through position and career management (D$q(j)$=0.98), the work skill of the Electronic Supervision Investigation Team (D$q(j)$=0.95), and the formation of a close cooperation system with the cooperation-oriented police station (D$q(j)$=0.94).

Discussion

This study aimed to identify an appropriate IPA technique for selecting

necessary improvements in a newly introduced policy, such as the electronic supervision special judicial police system. At the time of the investigation, some of the Electronic Supervision Investigation Team did not have an independent office space, and the specific work instruction manual was also insufficient, with each Electronic Supervision Investigation Team preparing their own. Hence, it can be confirmed that most of the items distributed in the area of maintenance and reinforcement of DCQM were not realized during the investigation. Therefore, it is inappropriate to use DCQM for prioritization in a biased case, and items located in the possible overkill area in the current Electronic Supervision Investigation Team situation where everything is lacking indicate that DCQM is not suitable for cases with biased distribution.

In IPGA, no items were applicable to the maintenance and reinforcement areas or possible overkill. Improvements are needed in the order of investigation education, positive perception of the probation staff towards the Electronic Supervision Investigation Team, and the perception of the police, prosecutors, and judges about the seriousness of the subject's violation. Considering that the actual Electronic Supervision Investigation Team consisted of special judicial police investigative agents or team members with no investigation experience prior to deployment of the Electronic Supervision Investigation Team (this is the case for most electronic supervisory staff, considering that investigations were not their domain), the result that practitioners evaluate investigation education as a matter that needs improvement with the highest priority is reasonable.

Since the Electronic Supervision Investigation Team was implemented by selecting and supporting some of the dedicated staff, the workload of the dedicated electronic supervisory staff increased, and there was a burden that the Electronic Supervision Investigation Team could investigate the sanction of the dedicated staff ex officio. Hence, it can be interpreted as a result that requires a positive perception of the entire probation staff. Moreover, IPGA is used to extract the improvement priorities desired by the Electronic Supervision Investigation Team reasonably, despite the active investigation of the Electronic Supervision Investigation Team. If the perceptions of the police, prosecutors, and judges engaged in the criminal justice system about the subject's violations

do not change, there is a possibility that the Electronic Supervision Investigation Team's investigation request will not be favorable.

In fact, IPA has been criticized for problems such as the lack of a clear definition of materiality, mixing materiality with 'expectation', and the absence of research on absolute and relative importance (Oh, 2001). Since IPGA is a technique developed to compensate for these shortcomings, it is useful because it allows for the ranking of multiple items even if they are located on the same matrix plane (Cheng, Chen, Hsu, & Hu, 2012; Feng et al., 2014; Lin et al., 2009). However, when interpreting the priorities of IPGA, it should be noted that the intervals between the priorities are not interval scales. For example, the interval between the first priority (investigative education) and the second priority (the positive perception of the probation staff) derived by IPGA is not directly interpreted quantitatively with statistical significance such as p-value or odds ratio. The interval between each priority is not on an interval scale because the priority calculated by IPGA is determined by the size of the distance (D$q(j)$) from the midpoint (0, 1). Therefore, the interval between each priority can be indirectly inferred by distance. Nevertheless, IPGA has the advantage of using a quantitative methodology like IPA to visually interpret items that need improvement, so it can be used in situations where these limitations are not an issue.

The scarcity of papers and research reports using the IPGA method in Korea is expected to be due to the difficulty of the methodology. Traditional IPA and modified IPA have the advantage of providing visual analysis results with simple analysis, which is convenient for both the writer and the reader. However, in cases where data with both importance and degree of implementation (or satisfaction) are concentrated in one direction, such as selecting the policy items to be implemented first in the new system, or choosing the service to be modified first among unsatisfied services, IPGA is more suitable than IPA for finding priorities. Unlike the existing IPA, IPGA has a great advantage in that it provides a ranking of matters to be improved. Therefore, we recommend that IPGA be actively used in biased data.

This study investigated the necessary matters for the smooth operation of the newly introduced Electronic Supervision Investigation Team, targeting

only those working in the electronic supervision special judicial police system. In general, to discuss system improvement proposals, the opinions of experts as well as practitioners of the system are gathered. However, this study only checked the satisfaction or needs of members of the Electronic Supervision Investigation Team who are on duty, which did not converge the opinions of the expert group. Therefore, it is possible that the priorities selected for the stabilization of the Electronic Supervision Investigation Team proposed in this study may be different from the actual priority for the stabilization of the Electronic Supervision Investigation Team. Thus, to select clearer priorities for system improvement, it may be possible to reconfirm the matters for stabilizing the Electronic Supervision Investigation Team targeting academia and experts related to electronic supervision and policy. In addition, to confirm the change and direction of development of the Electronic Supervision Investigation Team, after the system is established, IPGA should be conducted again on the same matters for practitioners and expert groups. And a follow-up study is required, one that draws a comparison between the early and intermediate stages of implementation.

References

Abalo, J., Varela, J., & Manzano, V. (2007). Importance values for Importance–Performance Analysis: A formula for spreading out values derived from preference rankings. *Journal of Business Research, 60*(2), 115-121.

Ahn, S., Kim, S., & Lim, S. (2018). *A study on improvement plans for R&D demonstration projects from the consumer's point of view using IPA analysis*. Heunguk Science and Technology Planning and Evaluation Institute.

Bacon, D. R. (2003). A comparison of approaches to importance-performance analysis. *International Journal of Market Research, 45*(1), 55-73.

Cheng, C., Chen, C., Hsu, F., & Hu, H. (2012). Enhancing service quality improvement strategies of fine-dining restaurants: New insights from integrating a two-phase decision-making model of IPGA and DEMATEL analysis. *International Journal of Hospitality Management, 31*(4), 1155-1166.

Choi, J., Seong, Y., Kim, M., & Kim, M. (2021). *A study on the implementation and improvement of the electronic supervision judicial police system*. Korean Institute of Criminology and Justice.

Choi, K. J., & Park, S. H. (2001). Evaluation of tourist destinations using IPA: A case study of Sansan Lake. *Hotel Management Studies, 10*(1), 275-289.

Dolinsky, A. L. (1991). Considering the Competition in Strategy Development: An Extension of Importance--Performance Analysis. *Journal of Health Care Marketing, 11*(1), 31-36.

Dolinsky, A. L., & Caputo, R. K. (1991). Adding a competitive dimension to importance-performance analysis: An application to traditional health care systems. *Health Marketing Quarterly, 8*(3-4), 61-79.

Evans, M. R., & Chon, K. S. (1989). Formulating and Evaluating Tou Rism Policy Using Importance-Performance Analysis. *Hospitality Education and Research Journal, 13*(3), 203-213.

Feng, M., Mangan, J., Wong, C., Xu, M., & Lalwani, C. (2014). Investigating the different approaches to importance–performance analysis. *The Service Industries Journal, 34*(12), 1021-1041.

Ford, J. B., Joseph, M., & Joseph, B. (1999). Importance-performance analysis as a strategic tool for service marketers: the case of service quality perceptions of business students in New Zealand and the USA. *Journal of Services marketing. 13*(2), 171-186.

Go, F., & Zhang, W. (1997). Applying importance-performance analysis to Beijing as an international meeting destination. *Journal of Travel Research, 35*(4), 42-49.

Hansen, E., & Bush, R J. (1999). Understanding customer quality requirements: Model and application. *Industrial Marketing Management, 28*(2), 119-130.

Hollenhorst, S. J., Olson, D., & Fortney, R. (1992). Use of importance-performance analysis to evaluate state park cabins: the case of the West Virginia state park system. *Journal of Park and Recreation Administration, 10*(1), 1-11.

Kong, K. Y. (2006) Evaluation of Leisure Activity using the IPA method. *Korean Journal of Tourism Research, 20*(3), 285-303.

Lin, S. P., Chan, Y. H., & Tsai, M. C. (2009). A transformation function corresponding to IPA and gap analysis. *Total Quality Management, 20*(8), 829-846.

Markazi-Moghaddam, N., Kazemi, A., & Alimoradnori, M. (2019). Using the importance-performance analysis to improve hospital information system attributes based on nurses' perceptions. *Informatics in Medicine Unlocked, 17*, 100251.

Martilla, J. A., & James, J. C. (1977). Importance-performance analysis. *Journal of Marketing, 41*(1), 77-79.

Matzler, K., Bailom, F., Hinterhuber, H. H., Renzl, B., & Pichler, J. (2004). The asymmetric relationship between attribute-level performance and overall customer satisfaction: a reconsideration of the importance–performance analysis. *Industrial Marketing Management, 33*(4), 271-277.

Oh, H. (2001). Revisiting importance–performance analysis. *Tourism Management, 22*(6), 617-627.

Park, K. H. (2009). A study on the evaluation of ecotourism attractiveness using the IPA technique. *Tourism Research, 24*(2), 1-20.

Rial, A., Rial, J., Varela, J., & Real, E. (2008). An application of importance-

performance analysis (IPA) to the management of sport centres. *Managing Leisure, 13*(3-4), 179-188.

Ryu, J., & Park, Y. (2006) Airline selection attribute evaluation using IPA: domestic airline as an example. *Tourism Research Journal, 20*(2), 157-171.

Saaty, T. L. (1980). *The analytic hierarchy process*. New York: McGraw-Hill.

Saaty, T. L. (1996). *Decision making with dependence and feedback: The analytic network process* (Vol. 4922, No. 2). Pittsburgh: RWS Publications.

Seong, M. K., Um, W. Y., & Kim, Y. H. (2016). Educational needs analysis of private university college students' learning competency through Importance-Performance Analysis (IPA). *The Korean Journal of Education Research, 37*(2), 73-96.

Tontini, G., Picolo, J. D., & Silveira, A. (2014). Which incremental innovations should we offer? Comparing importance–performance analysis with improvement-gaps analysis. *Total Quality Management & Business Excellence, 25*(7-8), 705-719.

Tsai, M. C., Lin, S. P., & Chan, Y. H. (2011). Service failures identification: The involvement of the interrelation effect in service practices. *African Journal of Business Management, 5*(6), 2301.