Development of Key Performance Indicators for the Improvement of University Facility Management Services in Korea

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Abstract
University facilities have significant effects on education and research and should be systematically maintained and managed. The Performance Indicator (PI) implicitly discloses the range of work scope and helps facility managers to achieve the goals and objectives of an organization. Much has been said about the importance of facility management (FM), however, there is no specific standard or guideline pertaining to FM services for campus facilities in Korea.

Therefore, the main objective of this research is to provide facility managers with rigidly selected PIs for improving the quality of FM service of campus facilities. PIs are collected through intensive analysis of primary literature related to FM services and educational facilities. The 44 preselected PIs fell into four areas as classified in the Balanced Scorecard (BSC) and the Delphi survey was conducted twice to identify Key Performance Indicators (KPIs). Finally, the importance-performance analysis (IPA) and Kendall's W are used to analyze the results. The priority on all the 44 PIs was set by considering four sections in the Importance-Performance Analysis (IPA) and finalization of the total of 8 KPIs. This research will serve as a guideline for campus facility managers in making decisions for improving the quality of FM services.

Keywords: university facilities; Facility Management (FM); Balanced Scorecard (BSC); Key Performance Indicators (KPIs); Importance-Performance Analysis (IPA)

1. Introduction
According to the main mission of universities, university facilities are composed of physical environments and spaces for reaching educational goals and objectives, and performing all relative functions (Kim et al., 2010). Jeon (2009) states that university facilities have a direct effect on the educational performance of students since they are closely related to the effectiveness of education and research. According to a survey on the impact of facilities on the recruitment and retention of students (Reynolds and Cain, 2006) conducted in the U.S. and Canada, about 70% out of 6,153 students from 1,013 different institutions replied that campus facilities are 'essential or very important institutional characteristics' when they choose a university. Facility management (FM) is a significantly important part in terms of university management because the overall quality of the university is largely affected by its facilities.

APPA (2007), Association of Higher Educational Facilities in the U.S., asserts that universities can effectively achieve their goals and objectives through the systematic performance measurement on FM activities. In recent years, universities are also asked to pursue commercial values emphasizing competitiveness, effectiveness and profitability from the managerial aspect, as well as educational values. Therefore, FM services should be suitably considered in university management, as effective FM services facilitate not only the provision of a proper physical environment but the reinforcement of managerial aspects as well.

As has been noted by FM experts, there are differences in providing FM services between general building complexes and university facilities in terms of securing sites and managing spaces. Therefore, a need to develop and provide FM services corresponding to the needs of university facilities still exists. However, relatively few studies have been devoted to FM for university facilities.

Universities should strengthen their competitiveness by improving performance in education and research
and stabilize the bottom line through high quality FM services and a systematic FM plan (Shin et al., 2015).

It has been generally accepted that performance measurement could provide more effective methods in management by giving insights into decision-making (Amaratunga and Baldry, 2003). Consequently, the physical environment of facilities and the value of management can be measured by performance indicators (PIs), contributing to the effective achievement of organizational goals and objectives. This research aims to overcome the limitation of previous facility assessment methods which merely focus on the financial perspective. From this point of view, the balanced scorecard (BSC) concept is applied to consider three other perspectives simultaneously in addition to the financial perspective.

Most domestic universities constructed in the 1960-70s are now requiring systematic operation and maintenance. Quickly rising maintenance costs bring budget deficits, which are burdensome for the university. In the current situation in Korea, there is a reduction in the number of students due to the rapid progress of low birthrate and aging. One of the old strategies, 'new construction,' can no longer be a solution. Instead, universities should provide high-quality FM services through the utilization of established facilities and preparing systematic operation and maintenance plans.

The Korean Agency for Technology and Standards announced the 'Korean Standard of Facility Management Service' which is an objective standard for the level of FM service back in 2006. However, the standard only states a comprehensive basis for non-residential buildings. Therefore, evaluation indicators and detailed work scope for universities with their special purpose and function are needed.

To date, no definitive solution has been given to the needs of systematic maintenance instructions and practical manuals for universities in Korea (Lee and Cho, 2008). Therefore, the development of performance indicators focusing on FM services is critical. Although there have been a number of research publications concerning FM manuals and guidelines, relatively few studies have been devoted to comprehensive FM for university facilities considering the financial, environmental and customer satisfaction standpoints. In this regard, other studies also pointed out the necessity for preparing systemic and effective university FM plans (Shon et al., 2003; Cho and Lee, 2008; Ryu and Lee, 2008; Yun et al., 2009).

Therefore, the purpose of this research is to assess the present condition of university facilities in Korea and to provide facility managers with rigidly selected PIs for improving the quality of the FM service of campus facilities. For this purpose, PIs are collected through intensive analysis of primary literature related to FM services and educational facilities. The 44 preselected PIs fell into four areas as classified in the Balanced Scorecard (BSC), and the Delphi survey has been conducted twice to identify Key Performance Indicators (KPIs). Finally, the importance-performance analysis (IPA) and Kendall's W are used to analyze the results.

2. The Concept of Balanced Scorecard (BSC) and Application to Facility Management (FM)

BSC is an organizational performance-measuring tool in financial, customer, internal process and learning and growth perspectives to help an organization achieve its goals and objectives (Olson and Slater, 2002). In BSC, indicators are derived from the organization's vision and strategy concerning financial/non-financial, long-term/short-term, leading/trailing, internal/external, and personal/organizational. They are contrary to each other to maintain a balance.

With the balanced indicators, an organization's vision and strategy can be better shared and managed. BSC allows a comprehensive view by connecting the indicators and organization's objectives because it assumes a non-financial perspective and financial perspective at the same time. Consequently, it has been accepted that BSC overcomes other indicators' limitations of putting too much weight on the financial area, and pursues a strategic focus by successfully connecting an organization's long-term plan and its performance (Kang, 2008).

Similar to BSC, FM itself also needs to develop new PIs which consider not only the financial perspective, such as operation and maintenance cost, but also the non-financial perspective such as users' satisfaction

| Perspective | Financial | Customer | Internal Process | Learning and Growth |
|-------------|-----------|----------|-----------------|---------------------|
| Direction   | - Reflects an organization's financial integrity - Demonstrates stewardship responsibility - Linked to the other perspectives through the relationships between cost and the result | - Considers the relationship with customers - Measures customer satisfaction and performance of services | - Evaluation of delivery of primary service - Emphasis on improvements and measuring results | - Creates a high-performance workplace organization - Considers how the organization enables and encourages employees to contribute effectively - Training – leadership and knowledge sharing - Employee well-being and satisfaction |

Table 1. Direction of FM Based on BSC

Source: Kinnaman, M. (2007) Searching for excellence using APPA's facilities performance indicators. In: NCFMTC Conference.
and employees’ learning and growth. Given the nature of FM, a business practice encompassing multiple disciplines, aligning with the concept of BSC, comprehensive PIs should be developed.

Lavy (2008) states that university FM also needs PIs using the BSC concept for strategic planning and management. Kinnaman (2007) also suggests the direction of FM aligned with BSC as shown in Table 1.

3. Integration and Selection of Performance Indicators (PIs)

Performance measurement is a quantification process of how effectively and efficiently an organization runs, and is a tool for effective management (Amaratunga, D. and Baldry, D., 2002). As one performance measuring method, key performance indicators (KPI) not only measure the performance but also implicitly disclose a range of work scopes and help facility managers achieve the goals and objectives of an organization by providing an initial insight into the process of decision-making.

The development of appropriate indicators is the most important part because meaningful results can be generated from using the right measuring tools. Although there is some research on PIs based on BSC for general buildings, there is no research specifically focused on campus facilities considering BSC with applicable PIs. In order to develop PIs considering both the FM service and characteristics of campus facilities, 11 primary literatures related to FM services (Brackertz and Kenley, 2002; Ho, et al., 2000; Lavy, et al., 2010; António Costa Branco de Oliveira Pedr, et al., 2008; Alani, et al., 2001; Brackertz, 2006; Hicks, et al., 1999; Augenbroe and Park, 2005; Hassanain, 2008; Ugwu and Haupt, 2007; Lavy, et al., 2014) and 10 studies developing PIs for campus facilities (Ryu, 2007; Ryu and Lee, 2008; Moon, et al., 2008; Cho and Lee, 2008; Yun, et al., 2009; Lee, et al., 2011; Song, et al., 2012; Roberts, 2009; Lee, et al., 2012; Leung, et al., 2005) are intensively reviewed and thoroughly analyzed. PIs are extracted from the previous studies about ‘educational facilities’ specific to ‘campus facilities’. As shown in Fig.1., PIs in the previous studies are categorized into 2 - 4 levels, depending on their research scope and objectives. In this research, indicators are extracted and used only from level 2 or level 3 for analysis, which includes more detailed explanations than those of level 1.

While quantitative PIs providing objective standards are easier to compare with each other, qualitative PIs can be more difficult to compare since the definitions and descriptions can be differently shown. Therefore, it is required to integrate and modify raw data, to come up with the final KPIs. The number of raw data points related to FM services and educational facilities from previous studies is 785. Some PIs are rejected under the following circumstances: when items are not interpretable because they are not fully and clearly defined, not relevant to university facilities, and out of this research scope such as building exterior, parking, site, landscape, construction and moving. In the narrowing down process, the comparison between keywords of each PI is conducted to check for similarity. PIs are integrated according to the similarity as shown in Fig.2.

After this process, the authors finalized 44 PIs and these fell into the four areas classified in BSC (Table 2.). PIs are classified by comparing keywords with the direction of FM. For instance, in the case of ‘internal process perspective’, it is all about the question, "What must we excel at? (Kaplan and Norton, 2005)". This perspective includes core skills and strategies that can add value to the organization.

| Raw data: 785 | 1st step) Analysis I |
| | 575 PIs are rejected when |
| | - They only show the name without the meaning or the specific definition. |
| | - It is difficult to understand its original meaning. |
| PIs: 210 | 2nd step) Analysis II |
| | 34 PIs are rejected when |
| | - They are out of the research scope such as building exterior, parking, site, landscape, construction and moving. |
| | - They are not related to the research and education facilities in the university. |
| PIs: 176 | 3rd step) Integration |
| | PIs are integrated based on the similarity of key terms. The standards of similarity are as follows; |
| | - They are identical or synonymous. |
| | - They are subordinated to another PI’s area. |
| PIs: 44 | Fig.2. Integration Process of PIs |
FM contains a wide range of internal processes as a core business. As a result, 10 items are categorized in finance perspective, 5 in customer perspective, 7 in learning and growth perspective, and 22 in internal process perspective as shown in Table 2.

### 4. Delphi Survey

The Delphi technique is established to collect experts' opinions about some areas in which there are either no existing data or too much information available which is not in a unified form. The purpose of a Delphi method is to achieve a consensus viewpoint to create quantitative data models (Hinks and McNay, 1999). Delphi research is normally conducted in two or more rounds and questions in each step contain results from the previous step. Therefore, the range of answers is decreased and the outcome becomes more integrated. In this research, the Delphi survey is conducted twice and is used to judge the importance and performance of each of the 44 PIs. A panel of experts is selected under one condition; over 10 years working experience in a university FM department. At the first round, 26 experts participate and there are 15 experts at the second round. The 5-point Likert scale is used to

| BSC | No. | PIs                                      | Mean | SD   | Mean Rank | Verification statistics |
|-----|-----|------------------------------------------|------|------|-----------|-------------------------|
| Finance | 1 | Building maintenance costs | 4.60 | .500 | 2.92 | Case 25 Kendall's W .324 Chi-square 72.844 df 9 sig .000 |
|      | 2 | Utility costs | 4.28 | .737 | 4.04 |
|      | 3 | Operating costs | 4.08 | .954 | 4.48 |
|      | 4 | Custodial and janitorial costs | 3.96 | .676 | 5.24 |
|      | 5 | Deferred maintenance, and deferred maintenance backlog | 3.96 | .676 | 5.18 |
|      | 6 | Capital costs | 3.84 | .624 | 5.6 |
|      | 7 | Capital renewal cost | 3.76 | .723 | 6.24 |
|      | 8 | Facility condition assessment cost | 3.72 | .737 | 6.24 |
|      | 9 | Occupancy costs | 3.32 | 1.030 | 7.28 |
|      | 10 | Churn costs | 3.16 | .987 | 7.78 |
| Customer | 11 | Adequacy of space assignment | 4.08 | .796 | 2.38 |
|      | 12 | Adequacy of facility security | 4.08 | .845 | 2.46 |
|      | 13 | Customer satisfaction assessment | 3.88 | .765 | 2.71 |
|      | 14 | Hours available | 3.31 | 1.050 | 3.69 |
|      | 15 | Release of survey result | 3.23 | .863 | 3.75 |
| Learning and Growth | 16 | Security and management of workforce | 4.32 | .557 | 2.52 |
|      | 17 | Training programs for worker enhancement of workers' skills | 4.04 | .790 | 3.30 |
|      | 18 | Employee satisfaction assessment | 3.76 | .723 | 4.06 |
|      | 19 | Communication among staff | 3.60 | 1.041 | 4.08 |
|      | 20 | Adequacy of work space | 3.44 | .870 | 4.74 |
|      | 21 | Task record | 3.44 | 1.121 | 4.40 |
|      | 22 | Performance evaluation and report | 3.24 | .926 | 4.90 |
| Internal Process | 23 | Resource consumption-Energy | 4.32 | .627 | 7.22 |
|      | 24 | Safety management | 4.20 | .645 | 8.76 |
|      | 25 | Space utilization | 4.00 | .913 | 9.92 |
|      | 26 | Resource consumption-Water | 4.00 | .645 | 9.98 |
|      | 27 | Security management | 3.96 | .539 | 9.94 |
|      | 28 | Space management regulation | 3.92 | .759 | 10.12 |
|      | 29 | Establishment of space timetable and reservation system | 3.88 | .666 | 10.64 |
|      | 30 | Arrangement of management plan | 3.88 | .666 | 10.22 |
|      | 31 | Computerized facility management system | 3.88 | .927 | 10.44 |
|      | 32 | O&M plan for each facility | 3.76 | .779 | 10.44 |
|      | 33 | Furniture | 3.76 | .831 | 11.50 |
|      | 34 | Waste discharge | 3.72 | .737 | 11.84 |
|      | 35 | Defining O&M work | 3.72 | .891 | 11.74 |
|      | 36 | Assessment of space efficiency | 3.68 | .852 | 12.02 |
|      | 37 | Indoor Environmental Quality (IEQ) | 3.60 | .764 | 12.80 |
|      | 38 | Accessibility | 3.60 | .816 | 12.86 |
|      | 39 | Work efficiency assessment | 3.56 | .870 | 13.14 |
|      | 40 | Reflection of trend requisition | 3.56 | .712 | 13.38 |
|      | 41 | Establishment of management plan | 3.52 | .872 | 13.58 |
|      | 42 | Required performance level | 3.52 | .714 | 13.70 |
|      | 43 | Condition assessment of equipment and tools | 3.48 | 1.085 | 13.76 |
|      | 44 | Establishment of facility performance indicator | 3.48 | .714 | 13.90 |

* Mean rank: The sum of the rank divided by cases. The lower the mean rank means the greater the importance.
evaluate the importance of the PIs and the 3-point scale is used to evaluate the current performance rate of the PIs. The collected data are analyzed by SPSS 23 to assess the degree of overall correspondence among the experts’ responses.

5. Result

5.1 Importance-Performance Analysis (IPA)

The IPA is a method for measuring the importance and the performance of attributes at the same time, easily considering the relationship between two factors (Martilla and James, 1977). Consequently, it allows managers to recognize items which require improvement with a high priority and to manage them in an effective way. In order to conduct the IPA, respondents are asked to answer questions about each factor: How important is this feature with respect to other features? And how well did the feature perform? The answers on the importance and the performance of each factor are graphically displayed on the two-dimensional grid. The priority of management is determined by where each factor is located on the grid as shown in Fig.3.

The factors in section A are considered highly important but show a lower performance rate. Therefore, if facility managers apply more managerial efforts to the factors in section A and try to enhance the performance rate, then the improvement of overall management will be effectively achieved.

Considering both the importance and the performance of factors simultaneously, the IPA method is able to calculate not an absolute but a relative importance with performance level and shows the relative priority of the factors. Therefore, in effectively improving the quality of management, the factors with a high importance and low performance level should be the top targets to be managed.

In this research, the IPA is conducted with 44 PIs which are extracted through multiple integration processes. The two-dimensional plane is represented by the importance values on the vertical axis with a 5-point scale, and the performance values on the horizontal axis with a 3-point scale. The coordinate of each point is the mean of the importance and the performance values (Fig.4.). The x-axis represents the mean of the importance values (3.78) and the y-axis shows that of the performance values (2.07). Managers of campus FM will be able to make strategic facility plans with the IPA results.

Examining the results in each section separately, the factors in section A are ‘PI#12: Adequacy of facility security’, ‘PI#13: Adequacy of space assignment’, ‘PI#14: Customer satisfaction’, ‘PI#17: Secure and manage workforce’, ‘PI#19: Training programs for enhancement’, ‘PI#30: Space utilization’, ‘PI#33: Space timetable and reservation’, ‘PI#37: O&M plan for each facility’, and ‘PI#41: Computerized facility management system’. These factors showing high importance value and low performance value in section A primarily require improvement to effectively manage the facilities. Especially, factors in section D, ‘PI#10: Facility condition’, ‘PI#16: Communication among staff’, ‘PI#18: Task record’, ‘PI#29: Accessibility’, ‘PI#35: O&M work manual’, ‘PI#42: Furniture’, and ‘PI#43: Condition of equipment and tools’, show a low importance value and high performance value. If human and material resources allocated to factors in section D can be reallocated for those in section A, it could be possible to improve the management effectiveness of FM activities.

Examining the results according to the four perspectives as denoted in BSC (Table 3.), in 'Finance' perspective, there are no factors in section A and 7 out of 10 items that are represented in section B showing high importance and performance values as well. In 'Customer' perspective, the performance values of all PIs are below the average. Three out of 5 PIs are included in section A and show a relatively low performance value given their high importance values. In 'Learning and Growth' perspective, there are no PIs in section B, and section A and D include 2 PIs each, so additional efforts are needed in this perspective.

Table 3. The IPA Results Based on BSC Perspectives

| BSC perspective                | A   | B     | C     | D    |
|-------------------------------|-----|-------|-------|------|
| Finance                       | N/A | 1, 3, 4, 5, 6, 7, 8 | 2, 9  | 10   |
| Customer                      | 12, 13, 14 | N/A   | 11, 15 | N/A  |
| Learning and Growth           | 17, 19 | N/A   | 30, 21, 22 | 16, 18|
| Internal Process              | 30, 33, 37, 41 | 23, 24, 27, 28, 31, 39 | 26, 32, 34, 36, 38, 40, 44 | 25, 29, 35, 42, 43 |

Finally, in 'Internal Process' perspective, 4 PIs are included in section A that require improvement and 5 PIs are included in section D. This means that the resource allocation has not been successfully performed.
5.2 Delphi Result

A Delphi survey was conducted twice and the results were used to determine Key Performance Indicators (KPIs) for university FM. The PIs categorized into BSC’s 4 perspectives, and the experts’ responses were analyzed by Kendall’s coefficient of concordance for the first Delphi survey to determine the degree of correspondence. As the experts’ responses for the importance are seen as mutually matched, all data from BSC perspectives are statistically significant. The PIs which received higher scores than the average from each of the four perspectives were extracted as the KPIs. Five PIs from 'Finance' perspective, 3 PIs from 'Customer' perspective, 3 PIs from 'Learning and Growth' perspective, and 9 PIs from 'Internal Process' perspective, providing a total of 20 PIs extracted from the first Delphi survey (Table 2.).

These 20 PIs from the first Delphi survey result were then used in the second Delphi survey. In this process, Kendall’s coefficient of concordance was used to determine whether responses were matched with each other, and PIs higher than the average from each BSC perspective were selected as final KPIs. The total of 8 KPIs were finally selected and are shaded in gray as shown in Table 4. Three PIs; 'Utility costs', 'Building maintenance costs' and 'Operating costs' are from 'Finance' perspective, 2 PIs, 'Adequacy of facility security' and 'Adequacy of space assignment' are from 'Customer' perspective, the two KPIs, 'Safety' and 'Resource consumption-Energy' are from 'Internal Process' perspective, and 1 KPI, 'Secure and manage workforce' is from 'Learning and Growth' perspective.

KPIs which are finally extracted reflect the features of the university. Firstly, as there are many types and numbers of users in the campus, it is important to acquire enough facility space and to assign that space adequately to the users, balancing the needs and capacity. In addition, there are many types of building users including large numbers of students, therefore safety is a main issue in university FM. A university is the one building type with the highest energy use in Seoul, Korea (Seoul Metropolitan Government, 2014), and therefore the energy consumption and utility cost should be highly considered. When energy is effectively managed, the university might greatly save on utility cost. Based on the above, this study developed KPIs which can successfully evaluate the FM performance of universities based on BSC.

Integrating the results of IPA and two rounds of Delphi survey (Table 5.), 5 of 8 KPIs show the high value of both importance and performance, so the current management condition should be consistently maintained and reinforced. The remaining 3 KPIs, 'PI#12: Adequacy of facility security', 'PI#13: Adequacy of space assignment', and 'PI#17: Secure and manage workforce', represent a relatively low performance value given their high importance value as shown in section A. These are the most urgent items to be well planned and managed. Even though these items are evaluated as the most important indicators by campus facility managers, performance values are considered as relatively low. Therefore, if the remaining 3 items in section A as shown in Fig.4 are significantly improved, overall management will be effectively enhanced.

6. Conclusion and Future Research

In this research, the authors suggest a direction for effective FM by improving the quality of FM services of university campus facilities in Korea using the BSC and PIs. Since university FM differs from the general office space FM, this research focuses on university needs and utilizes Delphi survey, conducted with 26 university facility managers, to establish their unique
The IPA method is applied in order to interpret the results. The conclusions of this research are as follows: First, Korean universities currently do not have suitable PIs for university facilities management, as differentiated from general office facilities. PIs are extracted from the previous studies about ‘educational facilities’ including ‘campus facilities’. Throughout the integration process, the 44 PIs fell into four areas as classified in BSC. These PIs will be helpful for facility managers to achieve the goals and objectives of the organization.

Second, using the IPA method, current conditions of campus FM and the importance value of the related factors are analyzed simultaneously. The priority of 44 PIs is determined based on the performance against the importance value, and factors requiring improvements are considered. This result will help facility managers to utilize their limited resources to enhance the overall quality of FM services.

Third, a total of 8 KPIs are selected from the results of Delphi survey. The 8 KPIs are extracted evenly from the 4 different perspectives of BSC and can be utilized as a basic reference for establishing an improved campus FM strategy.

Additionally, with many types of building users including large numbers of students, safety is a critical issue in university FM. Also, as universities are some of the highest energy users in Seoul, energy consumption and utility cost should be highly considered. When energy is effectively managed, the university might greatly save on utility cost.

The scope of this research is limited to the initiation stage of PI development. What remains to be determined by future research is the next stage of PI development including specific evaluation criteria and detailed management guidelines.

Acknowledgement

This work was supported by the National Research Foundation of Korea Grant funded by the Korean Government (NRF- 2013S1A5A8023067).

Table 4. The Result of the Second Delphi Survey

| BSC               | No. | Performance Indicator       | Mean   | SD   | Mean rank | Verification statistics |
|-------------------|-----|----------------------------|--------|------|-----------|-------------------------|
| Finance           | 1   | Utility costs              | 4.45   | .688 | 2.45      |                         |
|                   | 2   | Building maintenance costs | 4.36   | .674 | 2.5       |                         |
|                   | 3   | Operating costs            | 4.27   | .786 | 2.64      |                         |
|                   | 4   | Deferred maintenance, and deferred maintenance backlog | 4.00   | .775 | 3.36      |                         |
|                   | 5   | Custodial and janitorial costs | 3.64   | .505 | 4.05      |                         |
| Customer          | 1   | Adequacy of facility security | 4.20   | .775 | 1.83      |                         |
|                   | 2   | Adequacy of space assignment | 4.13   | .743 | 2         |                         |
|                   | 3   | Customer satisfaction assessment | 3.87   | .834 | 2.17      |                         |
| Learning and Growth | 1  | Securement and management of workforce | 4.36   | .842 | 1.75      |                         |
|                   | 2   | Employee satisfaction assessment | 4.07   | .829 | 2.11      |                         |
|                   | 3   | Training programs for enhancement of workers' skills | 4.07   | .616 | 2.14      |                         |
| Internal Process  | 1   | Safety management          | 4.47   | .516 | 3.47      |                         |
|                   | 2   | Resource consumption-Energy | 4.20   | .862 | 4.3       |                         |
|                   | 3   | Resource consumption-Water | 4.00   | .926 | 4.8       |                         |
|                   | 4   | Security management        | 4.00   | .756 | 4.93      |                         |
|                   | 5   | Arrangement of management plan | 4.00   | .756 | 5.03      |                         |
|                   | 6   | Space utilization          | 4.00   | .756 | 5.13      |                         |
|                   | 7   | Space management regulation | 3.87   | 1.060 | 5.43      |                         |
|                   | 8   | Computerized facility management system | 3.80   | .862 | 5.57      |                         |
|                   | 9   | Establishment of space timetable and reservation system | 3.67   | .976 | 6.33      |                         |

Table 5. The IPA Result of KPIs

| No. | BSC               | PI                             | Performance | Importance |
|-----|-------------------|--------------------------------|-------------|------------|
| 1   | Finance           | Utility costs                  | 2.67        | 4.27       |
| 2   |                   | Building maintenance costs     | 2.5         | 4.62       |
| 3   |                   | Operating costs                | 2.22        | 4.08       |
| 4   | Customer          | Adequacy of facility security  | 2           | 4.08       |
| 5   |                   | Adequacy of space assignment   | 2           | 4.08       |
| 6   | Learning and growth| Secure and manage workforce    | 2           | 4.31       |
| 7   | Internal Process  | Safety                         | 2.44        | 4.23       |
| 8   |                   | Resource consumption-Energy    | 2.33        | 4.31       |

* Mean Rank: The sum of the rank divided by cases. The lower the mean rank means the greater the importance.
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