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Research Article

Marketization of Higher Education Institute; Identifying a Set of Performance Measurements Based on Analytic Hierarchy Process

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Abstract: Nowadays, Higher Education is bearing significant alters. These alters are in replying to diversity factors; the expansion of information and communication technologies, globalization, internationalization and regionalization, progress network society, developing information society, socio-cultural orientations and demographical orientations. The marketization in higher education leads to change the roles of Governments. 'Marketization' in universities and colleges is a famous feature of the current wave of answerability. On the other hand, since there has been massive growth in the number of universities during the past decades, under the precedent of an increasing number of universities and shortage of education source, universities have to consider economic aim into their purpose to achieve profits through exposure social services. As a result, encountering the high competitive condition of students' recruitment, all universities have to void with conservative management practice and sub it by applying implications of business operations to attain the perdurable development and permanence. The main reason of this study is to introduce the Key Performance Indicators (KPI) measurement in higher education institution and determining their importance based on the opinion and experience of previous researchers. Furthermore, this study suggests a methodology to determine the weight and amount of significance of each measurer by using Analytic Hierarchy Process (AHP) technique which is one of the techniques in Multi-Criteria Decision Making (MCDM). The AHP, as a reparative method, supposes full aggregation among criteria and expands a linear increasable model. The weights and scores are achieved mainly by pair wise comparisons among all options.

Keywords: AHP, key measurer, multiple criteria decision making, performance evaluation, university

INTRODUCTION

Quality in higher education is intricate concept and there is a shortage of an appropriate definition of quality (Harveya and Greena, 1993). O'Neill and Palmer (2004) explained the quality in education as the diagnosis between what a student anticipate obtaining and their conception of real acquire. Guolla (1999) demonstrated that student's utilized quality is a precedent to student consent. Positive insights from service quality can aim in student satisfaction and student consent will cause to attract novel students through verbal communication, or they return to the University to pass more courses (Wiers-Jenssen *et al*., 2002; Marzo-Navarro *et al*., 2005).

In higher education as in commerce, there are believable standards of evaluating. Instead of focusing on monetary performance, higher education has an emphasis on academic measures. Evaluation in higher education has stressed on variable that are measurable (Jalaliyoon and Taherdoost, 2012). Institution of higher education performance appraisal denotes to all procedures and activities and ends at data gathering concerning:

- The reliability of goals and purposes
- The appropriateness of plans and strategies
- The capability to begin and attain alterations and finally
- The effectiveness of educational and administrative courses

It can refer to the organizational/managerial level, to learn agenda level and comprise qualitative and quantitative indexes of inputs, progressions, outputs and results (Taherdoost *et al*., 2011). Performance evaluation in university helps to process and enables organizations to respond to the commitments and permit to compare the higher education institution in national and international level. Also, it is a necessary condition for development and assessment essential sector for international process and sector for confirming the excellence (Anninos and Chytiris, 2008).

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According to the extensive discussion concerning university responsibility, the appraisal of their Performance and the publication of consequences should be more attention (Ewell, 1999; Banta and Borden, 1994; Fuhrman, 1999, 2003; Pounder, 1999; Wakim and Bushnell, 1999; King, 2000; Welsh and Metcalf, 2003). Since decisions may be made by persons (e.g., students) to choose a university for studies, by the government for the purpose of resources allocation and by the organizations themselves to introduce changes and development wherever essential. Therefore universities are responsible:

- To the scholarly force (working in an appropriate condition and providing plenty opportunities for educational development)
- To the government to use the resources resourcefully and effectively
- The collegians and the society (plenary learning skill, scientific teaching and occupational teaching to obtain and increase life quality) (Vidovich and Slee, 2001; Löfström, 2002)

As a result, the assessment of their performance demonstrates to be an extremely important process for universities with numerous recipients of its outcomes.

On the other hand, Key Performance Indicators (KPI) is the clue for universities to make decision. For example, In the 1970s a research has been done to design a national index for comparing, schools, universities and their agendas, including "ranking of doctoral programs", "Gorman Classification of master and PhD programs and "Carnegie Classification"." Since then, the phrase "performance indicators" has been recommended in Higher education in Europe governmental part that was the appearance of performance indicator around the world (Borden, 1994).

Cuenin (1987) has been defined the performance indexes, a challenge taken up by a variety of peak bodies such as the Organization for Economic Co-operation and Development's (OECD) Institutional Management in Higher Education's Performance Indicators Workgroup began in 1989. The Workgroup describes performance indicators as "signals obtained from data bases or attitude that signify the necessity to discover digression from either principled or other preselected levels of performance"; indicators "observe improvements or performance, signal the need for more assessment situations, or help in evaluating quality" (Kells, 1992). Kells (1992) also mentioned that there are at least three diverse types of indicators:

- Indicators to examine institutional reply to government targets or policies
- Indicators of training/learning research and service
- Indicators required in university management"

Cave *et al*. (1990) described that "the expansion of performance evaluation is unavoidable and will have a great effect on higher education institutions. Therefore, it is essential to be conscious of the possible dangers besides advantages of performance indicators". The utilization of indicators in assessing organizational performance in higher education has shifted through a number of separate parts (Doyle, 1995). The first being their apply as a mechanism to assign resources in 1960s; moving through their use as a resource of information input into financial decisions and evaluating attainment of national priorities in the 1980s; to a different move in their use in the 1990s for quality assurance and control.

In the survey of some of the performance measurer in UK high education system, Birch (1977) studied the data of Lough Borough university explained that KPIs have a very essential role in the regular collection of data on education.

Based on the previous researches about effective factors in universities performance evaluation which each higher education institutions need to pay more attention to remain in competitive environment, these measures are introduced and the level of their importance will be determined.

LITERATURE REVIEW ON DETERMINING KEY PERFORMANCE INDICATOR (KPI)

The first factor which described by Azma (2010) are area and facilities. In addition, this factor also has been explained by Lee (2010) under the name of service. It is significant for managers to improve protection performance of educational facilities, concentrating on areas such as preservation, building systems, safety technology and improvements, if possible forecasting in time problems and occasion. These are the elements which affect on the students` satisfaction. Bad circumstances of equipments can intervene straightly not only in the organization economics, but also by dropping the overall accessibility of buildings while concurrently interfere with occupants' safety. Therefore, both equipments and installations related with the function of school organizations ought to be kept in good circumstances. The resources devoted to the preservation and operation of school building substructures come chiefly from the government budget and the operation and preservation budgets are repeatedly meager, so, maintenance management and an obvious description of its structure and organization is essential once the maximum result of the total expend is aim (Vieira and Cardoso, 2010).

The second element is "research and scientific journals". The related literature of some countries such as Netherlands (Early 1980s), England (1979), Australia (1986), Germany (since 1976), France and USA (since 1910) mentioned that "holding scientific lectures, holding conferences, faculty members' attendance to the conferences, faculty members' publications, expanding the library sources and the

access to data banks" are some issues that universities need to be attention to them (Lee, 2010).

The third factor which has been defined as a factor which has effective role in universities performance is "processes". The process has high impact on customer satisfaction and attaining of an organization's financial goals. The most important business processes comprise novelty, functions and post service. Novelty emphasizes on long-term improvement and making of novel services. The operations process is pertained to the current services and livery to current customers. The process emphasizes on effective, constant and timely delivery of current services to current customers. Post-service process state the services provided to customers after the main delivery of services (Krishnan *et al*., 2008).

Birch (1977) and Hsieh (2004) introduced "education and technology" as a factor which has influence on university performance, therefore it can be consider as a forth factor. Another important issue for educational improvement is technology (American Psychological Association, 2008; Peng *et al*., 2006). Technology in education has been shown to increase intrinsic motivation, enhance critical thinking and develop a more global perspective (Speaker, 2004). Technology has become a fundamental part of the educational setting since its debut in the early 1980s (Plumm, 2008). Goodman (2001) suggests that integrating technology into education can create new types of learning environments for students and will in fact enhance basic learning processes.

The fifth factor "cultural and social services" was in compatible with the findings of some others, Eynde (2002) for example who considers that these KPIs are useful indicators for the assessment of performance. The purpose of services is the excellence of their learning experience and their academic achievement (Ciobanu, 2013) so, for increasing learning opportunities and community involvement it could be Carried out by conducting internship programs, experimental units or curriculum integration (UNESCO, 2002). Training students in order to prepare them to active participation in society is the vital role of student services. These services will encourage and establish open manner of making decision and reasonable settlement of disputes (McInnis, 2004).

Azma (2010) introduced "faculty members" and "employees" as other affecting factors for universities so it can be considered as a sixth and seventh factors. Faculty members have significant role in universities activity. To commit themselves completely to their training commitments, to take part in the improvement of departments programs, schools or even the total university, to cooperate in academic activities and, supporting university in its objective to provide public service are the responsibilities of faculty members. The employees are essential elements in organization to achieve the organizational success. If the operational aims of Employees are not aligned to the organization mission and vision, the enterprise will be doomed to fail and incapable to attain long term objectives. The vast emphasis must be placed on evaluating the abilities and achievements of the employees who perform short-term strategies that are aligned with long-term objectives, to make sure an organization wide collaboration (Leen *et al*., 2009).

The eighth and ninth factors, "students" and "graduates" are respectively in compatible with the study of Hallahan and Kauffman (1989). In recent years, a lot of universities make an effort to have sustainable improvement, although the development has not yet totally penetrated to all regulations, educational and university directors (Lozano *et al*., 2013). The role of university students are directors, scientist, consumers, researchers, policy makers and entrepreneurs of the future and also decision makers in diverse areas (political, social, environmental, economic, etc.) (Lozano, 2006; Waas *et al*., 2010; Zilahy and Huisingh, 2009). Therefore, universities in fact teach people to do important social roles efficiently (Frank and Meyer, 2007). If future ability is capable to create decisions which are useful to the environment, society is more possible to make improvement towards sustainability.

In this regard, universities must realize and satisfy the needs of present and future generations, ascertaining themselves as directors of alteration towards sustainability (Lozano *et al*., 2013). And also Chalkley (2006) emphasized that "higher education's most helpful contribution to sustainability which provide great numbers of graduates with the knowledge, abilities and values that make possible business, government and society as a whole to development toward more sustainable ways of living and working." He demonstrated that it is significant to have graduate features to understand the learning realm of the desired results for sustainability.

The tenth factor "financial affairs" is also extremely important factor in assessment of performance of universities as affirmed by Rubinson and Pfeiffer (2005) and Carrin and James (2005). As in recent years there has been huge growth in the number of universities and regarding to the background of development of universities and shortage of educational resources, universities need to consider economic purpose to their goals in order to gain revenue through the provision of social services (Hung-Yi *et al*., 2011). This view shows the past operation of an organization. It could be distinguished whether organization increases growth, return and threat control from using strategies. The indicators of evaluation frequently comprise operational revenue; activities expenses, cash flows, return on investment, net profit rate, etc. It discloses the growth of organization by revenue, payoff and consumption rate of benefits and so on (Table 1).

Table 1: Identified performance measurements in higher education institute

Researcher	Key Performance Indicator (KPI)
Azma (2010) and Lee (2010)	Area and facilities
Lee (2010)	Research and scientific journals
Busin (2003)	Processes
Birch (1977) and Hsieh (2004)	Education and technology
Eynde (2002)	Social services
Azma (2010)	Faculty members
Azma (2010)	Employees
Hallahan and Kauffman (1989)	Student
Hallahan and Kauffman (1989)	Graduates
Rubinson and Pfeiffer (2005) and Carrin and James (2005)	Financial affairs

Regarding to define the key performance indicators which are significance for university assessment, in the next step amount of their priority will be measured.

RESEARCH METHODOLOGY

Analytical Hierarchy Process is one of the most comprehensive systems which are designed to make decisions with multiple criteria. This technique provides to formulate the problem as a hierarchical and also consider various quantitative and qualitative criteria's. This process involved various options in the decision and able to use sensitivity analysis on the following criteria and benchmarks. In addition, by using paired wise comparisons questionnaire will facilitate judgments and calculations (Jalaliyoon *et al*., 2012). Also, it shows the compatibility and incompatibility decisions which is the advantages of multi criteria decision making (Lee, 2010).

In AHP, an intricate problem can be alienated into several sub-problems based on the hierarchical level where each level defined a set of criteria or attributes concerned to each sub-problem. The steps sequence of AHP is stated in following (Saaty *et al*., 2007).

Structure of pair wise comparison matrices: The first step is to recognize all feasible alternatives from a single alternative. Next, it is essential to recognize all pertinent indexes affecting the selection of a single alternative from the pool of feasible alternatives.

Extraction the weight: Using the increased exponent for matrix:

$$W = \lim_{k\to\infty} \frac{A^k.e}{e^T.A^k.e}$$

Which $e^T = (1,1,\ldots,1)$.

It is necessary to decide when the matrix is inconsistent; calculations must be repeated several times till the convergence among collection in two successive iterations of the process is achieved.

Then, $A^k.e$ is calculated. For example, for k = 1 the following result is obtained:

$$A^k.e = \begin{bmatrix} a_{11} & a_{12} & \ldots & a_{1n} \\ a_{21} & a_{22} & \ldots & a_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ a_{n1} & a_{n2} & \ldots & a_{nn} \end{bmatrix} \times \begin{bmatrix} 1 \\ 1 \\ \vdots \\ 1 \end{bmatrix} = \begin{bmatrix} \sum_{j=1}^{n} a_{1j} \\ \sum_{j=1}^{n} a_{2j} \\ \vdots \\ \sum_{j=1}^{n} a_{nj} \end{bmatrix}$$

The result of $e^T.A^k.e$ is calculated as follows:

$$e^T.A^k.e = e^T.(A^k.e) = \begin{bmatrix} 1 & 1 & \ldots & 1 \end{bmatrix} \times \begin{bmatrix} \sum_{j=1}^{n} a_{1j} \\ \sum_{j=1}^{n} a_{2j} \\ \vdots \\ \sum_{j=1}^{n} a_{nj} \end{bmatrix} = \sum_{i=1}^{n}\sum_{j=1}^{n} a_{ij}$$

Then regarding to achieve the weight, below formula is used:

$$W^k = \lim_{k\to\infty} \frac{A^k.e}{e^t.A^k.e}$$

At the end, the final answer and weights of the items, derived from Eigenvectors are:

$$W = (W_1 + W_2 + \ldots + W_{n-1} + W_n)$$

Consistency evaluation: The good judgments can be appraised by means of the inconsistency ratio CR. This is very important phase of the AHP method. In brief, before defining an inconsistency indicator, it is essential to define the consistency indicator CI of an n * n matrix introduced by the ratio:

$$C.I. = \frac{(\lambda_{Max} - n)}{(n-1)}$$

where, λ Max is the maximum Eigen value of the matrix. Then the consistency ratio is then calculated by using this formula:

CR = CI/RI

where, RI is a known random consistency index obtained from a large number of simulations runs and varies depending upon the order of matrix. Random indices for unstable matrix sizes are shown in the Table 2 (Shyjith *et al*., 2008).

In general, a consistency ratio of 0.10 or less is acceptable (Saaty, 1980). If the consistency ratio is more than 0.10, the operator must reassess the weight assignments within the matrix violating the consistency limits.

Table 2: Random indices (Saaty, 1980)

Criteria	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
R.I.	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48	1.56	1.57	1.59

Table 3: Collected data matrix

	Area and facility	Research and scientific journals	Processes	Education	Cultural and social service
Area and facility	1.000	1.991	2.405	2.065	3.253
Research and scientific journals	0.500	1.000	1.849	1.531	1.991
Processes	0.414	0.539	1.000	1.991	1.656
Education	0.482	0.652	0.500	1.000	0.828
Cultural and social service	0.307	0.500	0.604	1.208	1.000
Faculty members	2.830	0.361	0.482	0.267	0.828
Employee	4.288	2.234	2.234	1.991	1.991
Student	0.539	0.414	0.730	0.539	0.882
Graduates	0.414	0.399	1.000	0.882	1.208
Financial affairs	0.340	0.500	0.787	0.612	1.065
	Faculty members	Employee	Student	Graduates	Financial affairs
Area and facility	0.351	0.229	1.849	2.405	2.925
Research and scientific journals	2.764	0.446	2.405	2.495	1.991
Processes	2.065	0.446	1.370	1.000	1.267
Education	3.730	0.500	1.849	1.134	1.630
Cultural and social service	1.208	0.500	1.134	0.828	0.939
Faculty members	1.000	0.500	0.913	0.394	1.221
Employee	2.000	1.000	1.000	2.764	4.093
Student	1.090	1.000	1.000	0.394	0.394
Graduates	2.534	0.361	2.528	1.000	1.630
Financial affairs	0.817	0.244	2.528	0.612	1.000

RESULT ANALYSIS

According to the research methodology, an instrument has been designed and distributed among fourteen professors of universities. The survey has been completed by researchers and specialists who are facing and aware of the dilemmas of Higher Education Institution.

Since it is intricate to manage and appraise of too many KPIs, it is suggested to minimize the number of KPIs by choosing the most significant ones which have vital contribution to Higher Education Institution performance. As mentioned above, by applying AHP technique and distributing the questionnaire based on pair wise comparison among experts, the significance degree of each factor is determined.

After collecting the data, the geometric mean is calculated to combine all data in one matrix which is shown in Table 3. According to above mentioned formula for consistency, the data has been analyzed. Table 4 proved the consistency of the survey. The R.I is 0.0214 which is below 0.1 and acceptable (Saaty, 1980).

Calculations must be repeated several times till the convergence among collection in two successive iterations of the process is achieved, five iterations have been calculated. Table 3 illustrates the weighs of key performance indicators. It can be demonstrated that "faculty member" with the weight of 0.2163 has the most priority Education and Technology, Area and Facility are in second and third position respectively. On the other hand, Cultural and Social Service" with the weight of 0.0490 has the lowest priority (Table 5).

Table 4: Calculated performance indicators' weights

Measurer	Weight
Faculty members	0.2163
Education and technology	0.1702
Area and facility	0.1259
Research and scientific journals	0.0893
Employee	0.0883
Student	0.0836
Graduates	0.0658
Financial affairs	0.0615
Processes	0.0499
Cultural and social service	0.0490

Table 5: Consistency calculation

W	R_{ij}	$W*R_{ij}$	λ max	C.I	R.I
0.1702	1.000	0.1702	10.29	0.032	0.0214
0.1259	1.991	0.2506			
0.0893	4.405	0.3934			
0.0883	2.065	0.1824			
0.0658	3.253	0.2140			
0.0490	0.351	0.0172			
0.2163	0.229	0.0495			
0.0499	1.849	0.0924			
0.0836	2.405	0.2009			
0.0615	2.925	0.1797			

As it is clear the consistency rate is 0.0214 which is less than 0.1 that indicate there is a strong degree of consistency among the pair-wise ratings and the responses are compatible so, it is acceptable.

CONCLUSION

Universities world-over are trying to excel in their teaching and research. Universities are required to increase the number of student and also they need to increase the specializations and regulations however, they require paying more consideration to quality of education and learning program.

As the evaluation of university performance is an essential priority, which means scheming the essential structure for university appraisal, making indicator to evaluate the process and implementing performance appraisal systems (this may include institutions, specialists or both) so, this study suggests the most effective measurers and amount of their importance in universities. The lack of attention of the criteria will lead universities to difficulties in developing an action plan or process and cannot compete with other rivalry in competitive environment.

Since Key Performance Indicators (KPIs) assist organizations to recognize how they are performing in relation to their strategic aims and objectives. In the widest concept, a KPI can be described as providing the most significant performance information that make possible organizations or their stakeholders to recognize whether the organization is on track or not. In the research ten indicators for higher education institution based on the opinion and experience of researcher has been defined. Each KPI has diverse degree of significance and has weighted by applying Analytic Hierarchy Process (AHP).

Regarding to literature and analyze the data by Analytical Hierarchy Process (AHP) Faculty members with the highest weight as the most important measurer in universities and cultural and social service with the least weight is the least important factor. Education and Technology, Area and Facility, Research and Scientific Journals, Employee, Student, Graduates, Financial Affairs, Processes, are other measurers respectively.

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