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Key Performance Indicators Measurement Model Based on Analytic Hierarchy Process and Trend-Comparative Dimension in Higher Education Institution

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Summary: *This research has objective to develop a model of key performance indicators (KPI) measurement in higher education institution. The proposed model is based on combination between AHP, trend analysis and comparative data.. KPIs are determined as description of key success factors related to institution sustainability. These KPIs are categorized into academic, research and supporting KPI. Each KPI has different degree of importance and is weighted using Analytic Hierarchy Process (AHP). On the other hand, KPI's points are set based on its trend over last three years and its current level compared to benchmark or competitor performances. Combination between trend and comparative level is reflected by three types of point: Good (100), Fair (50) and Poor (0). Total Score of all KPIs coresponds to these three types of point and KPI weights. The proposed model contributes in measuring and explaining institution success using multi dimensions of KPI. And it is a tool for organizationl self-assessement.*

1. Introduction

A major consideration in performance improvement and change management involves the selection and use of performance measures or indicators. The measures or indicators selected should best represent the factors that lead to improved student, operational, and financial performance. A comprehensive set of measures or indicators tied to student, stakeholder, and/or organizational performance requirements represents a clear basisfor aligning all processes with organization's goals. Through the analysis of data from tracking processes, measures or indicators themselves may be evaluated and changed to better support organization's goals. Many types of data and information are needed for performance management.

Analysis refers to extracting larger meaning from data and information to support evaluation, decision making, and improvement. Analysis supports a variety of purposes, such as planning, reviewing overall performance, improving operations, change management, and comparing performance with comparable organizations or with "best practices" benchmarks

An organization's performance measurement is focused on key results. Results are used to create and balance value for students and key stakeholders—the community, employers, faculty and staff, suppliers and partners, and the public.

By creating value for students and stakeholders, an organization contributes to improving overall education performance and builds trust. Education organizations must also address the variety of requirements of their various stakeholders. Stakeholders' requirements are of two types: (1) requirements directly related to your organization's educational services and (2) requirements of the stakeholders themselves. For example, parents might request services related to their children's educational program, such as integration of math and science curricula (type 1), and the parents might also request special meeting times with the school to accommodate their work schedules (type 2).

The emergence of the liberalization of education has forced Higher Educational Institutions (HEI) to strive for international standards in order to be able to compete with their competitors. In addition, the student's demands are getting more and more complex. The HEI then must ensure that the students receive high quality service. HEI have responsibility to produce graduates that are able to accommodate challenges emerging in society, such as graduates producings high quality profile and competence.

HEI also have to adjust themselves and develop strategies to respond rapidly to the changes in organizational environment and increasing demands of stakeholders.
The HEI worldwide is facing a dynamic and turbulent environment due to trends such as changing demographics in student populations, decline in public funding and greater emphasis on information and communication technologies in learning and teaching (Conway 2003). HE is shifting from a public service to a market-driven one (Kettunen 2003) and universities now face pressing concerns such as financial constraints and global competition (Webber 2003). As a result, HEI are faced with the need to reform many of their existing management practices and mindsets. One of the current issues of interest is the need for performance management, espescially measurement of Key Performance Indicators. Key Performance Indicators (KPI) is a fundamental concept in the area of performance management.

This research proposes key performance indicators measurement model based on combination between Analytic Hierarchy Process and Trend-Comparative attributs in HEI. Based on above description, there is a need to provide processes that promote KPI selection,its weighting and measurement. In this context, the proposed research attempted to answer the following questions: (a) What procedures are in place in order to make difference importance of each KPI element (weighting system)? (b) How do the HEIs ensure its growth and competitive advantage?

2. Objectives

The proposed research has objective to:

a. To develop a model of weighted key performance indicators (KPI) measurement in higher education institution
b. Provide HEI growth and competitive advantage measurement model
c. Develop combination between AHP and trends and comparisons based decision rule in HEI performance management

3. Model Development

The proposed model consists of:

- Key Success Factors Identification
- KPI Identification

- Building KPI Tree
- Trend and Comparison based Scoring

3.1 Key Success Factors identification

To evaluate HEI performance, basically there are three key success factors (KSF) i.e.: achievement of academic(teaching-learning) atmosphere, achievement of research quality and achievement of community services and supporting activities. These KSFs then become main criteria in measuring HEI performance.

3.2 KPI Identification

Based on, the above criteria, the next step is to identify list of KPI related to each criteria. In order to be more realistic, the selected KPI are analysed by experts group in a Delphi Forum. This forum has objective to determine the most relevant and realistic KPIs for HEI. If there are to many KPI, it will be difficult to manage and measure. So it needs to select the most important KPIs that have significant contribution to HEI performance. In order to class this list in descending order of relevance, the research conducts a survey involving experts who are directly involved in HEI activities. In this case, a questionnaire, in which the experts have to give a mark to each criteria, is distributed. The experts use the three-point scale of "not important", "somewhat important" and "very important" using "Cut off Point" approach as developped by [Tam & al. 2001]. Its result is the selected KPIs according to its degree of importance.

In this case, we have to find first the most important KPIs from list of KPI candidates. The latter will have to relate to academic,research and supporting criteria. This list is completed by experts who are more aware of the problems that HEI have to cope with. It will happen to be finally some selected KPI.

3.3 Building KPI Tree

The next step is to build KPI tree, which is basically composed by three levels : the goals, the criteria and the KPIs. In the evolution of the AHP system that we are presenting, we build the hierarchy which consists of:

- The goal (1st level) : Total score of HEI performance
- The criteria (2nd level): we can find three criteria; "academic(teaching)", "research" and "supporting".
- The rating scale (3rd level): contains KPIs related to each criteria, and its rating scale.

3.3.1 Criteria and KPI Weighting

In the second level (criteria), the three criteria ("academic", "research" and "supporting") are weighted using pairwaise comparison proposed by AHP approach (Saaty 1980). Results of questionnaire survey are translated into pair wise comparison matrix and then it is followed by weighting process.

AHP method provides a fundamental scale to assign pairwise comparison judgment, as shown on tabel 1 [Saaty & al 94]. The meaning of the table is that criterion A is strongly more important than criterion B. For the criteria weighting, the fundamental scale is not sharp enough to assign relevant pairwise judgements. AHP method proposes to create as many refinements as needed for

the specific problem, and to estimate verbally the value of each new point of the scale. This work has to be done by the evaluation team, in order to obtain a consensus about the evaluation scale. The evaluation team had created a scale divided 1 to 9. Also evaluators use their own comparison ruler, but using the same principle than the basic one.

Tabel 1 Fundamental scale for AHP pairwise comparison

Level	**Definition**	**Explanation**
1	Equal importance	Two factors contribute equally to the objective
3	Moderate importance	Experience and judgment slightly favor one factor over another
5	Strong importance	Experience and judgment strongly favor one criterion over another
7	Very strong or demonstrated importance	A factor is favored very strongly over another; its dominance demonstrated in practice
9	Extreme importance	The evidence favoring one factor over another is of the highest possible order of affirmation

Criterion A	**9**	**7**	**5**	**3**	**1**	**3**	**5**	**7**	**9**	**Criterion B**

Each evaluator has to compare elements of the same hierarchy level. First, academic is compared to research. Then, on one hand, academic compared to supporting, and on the other hand three couples have to be compared. Results of these judgments are summarized in pairwise comparison judgement matrices (PCJM) as shown on Tabel 2.

Tabel 2 Pairwise comparison judgment matrix (example)

Criteria	AC	RE	SU	Priority vector
Academic (AC)	1	3.0	1.6	**0.518**
Reasearch (RE)	0.333	1	0.77	**0.195**
Supporting (SU)	0.625	1.3	1	**0.287**
				CR = 0.01

KPIs are wighted using the same way as criteria weighting described above.

3.3.2 KPI Scoring

KPIs are measured based on principles of trends and comparison dimensions. Trends consist of current level and last year performances. For example, if current level is performance of year of 2005-2006, so trends consist of performances of years 2004-2005 and 2005-2006. This

trend shows growth of two latest years. On the other hand, comparison shows position current level performances compared to its competitor performances or benchmarks (Tabel 3).

Tabel 3 - Students are more satisfied with campus environment than comparisons

(1-5 Scale)

Key Performance Indicators	Concerned University		2005-06 Comparisons	
	2004-2005	2005-2006	Public College	Nat'l Sample
Overall	4.04	4.04	3.88*	3.91*
Opportunity for personal Involvement	3.76	3.81	3.65*	3.71*
Attitude of non-teaching staff	3.68	3.74	3.52*	3.60*
Opportunity for student employment	3.55	3.58	3.42*	3.49
Student government	3.41	3.43	3.36	3.4

* Statisticaly lower

How to score KPI? This research proposes the following decision rule as basic for scoring mechanism:

(1) If KPI trend is growing and current level is better than competitor/benchmark, then score is **100**. It means that the organisation is growing and better than competitor/benchmark; see student satisfaction to "opportunity for personal involvement" (Tabel 3 and Figure 3)

(2) If KPI trend is growing and current level is less than competitor/benchmark, or if KPI is declining and current level is better than competitor/benchmark, then score is 50. It means that the organisation is growing but not better than competitor/benchmark. Or it means that the organisation is better than competitor/benchmark, but internally there is no growth compared to historical performance; see student satisfaction to "student government" (Tabel 3 and Figure 3)

(3) If KPI trend is declining and current level is less than competitor/benchmark, then score is 0. It means that the organisation does not grow and does not have any competitive advantage

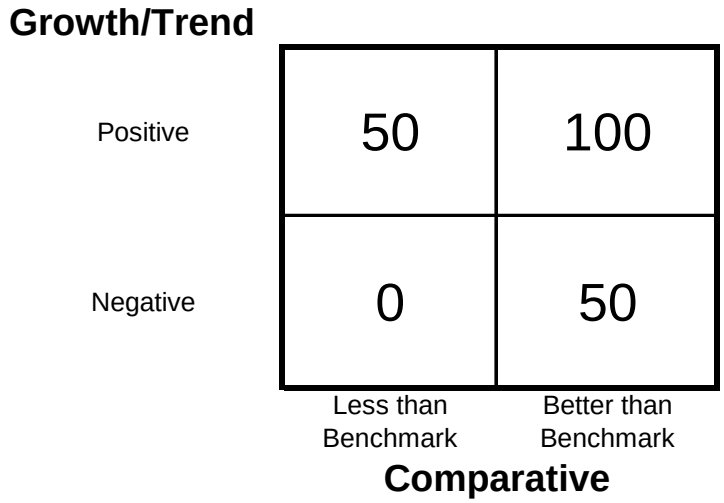

Figure 1 - Scoring Decision Rule

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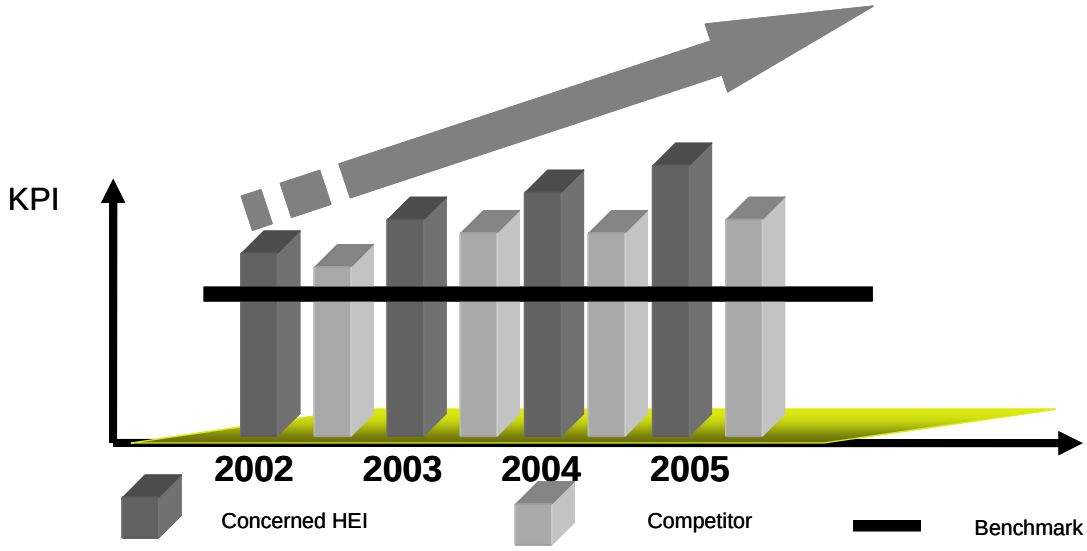

Figure 2- Example of Rule 1: Growing and Better than Competitor/Benchmark

3.3.3 Total Score of HEI Performance

Total score of HEI performance is calculated with the following formula:

Total HEI Performance score = $\Sigma \tilde{W}_i \Sigma (s_{ij} \times w_{ij})$; for i= 1 to k and j= 1 to n

where, i is index for HEI performance criteria (academic, research and supporting);

j is index for KPI-j of criterion-i

W_i is weight of criterion-i

w_{ij} is weight of KPI-j related to criterion -i

3.3.4 Wheel Model of HEI Performance

A simple analogy would be to look at an HEI performance as a wheel and the individual KPIs are the spokes to the wheel (figur 3). Having just one or two spokes loose, can make a wheel out-of-balance. The longer a wheel runs out of balance the more damaging the effect to the organization. When the wheel on a cart becomes so unstable that its primary function fails, you would simply replace the wheel. Obviously, an organization cannot simply replace itself, but your customer can and will replace the wheel (you the Supplier) if you fail to perform to the Customers' needs and expectations.

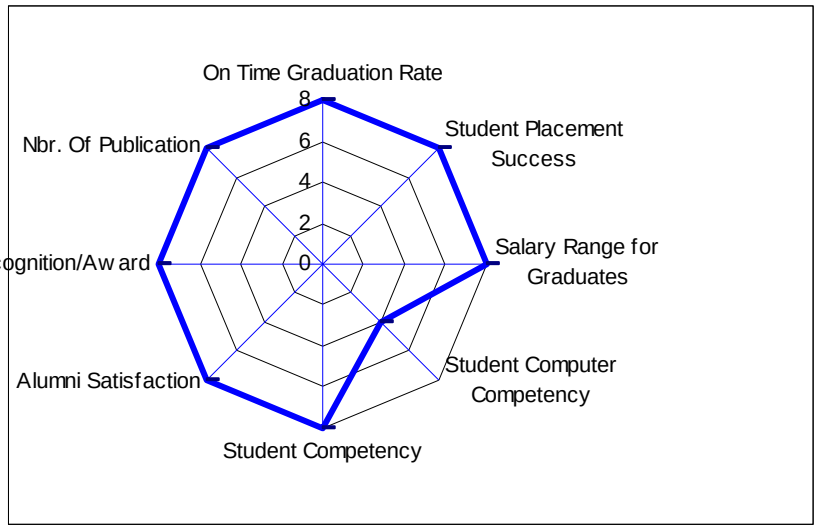

Figure - 3 Wheel model for HEI Performance and its KPIs

4. Discussion and Conclusion

The proposed model concerns HEI performance measurement based on three principal criteria: academic, research and supporting. The Criteria are designed to help organizations use an integrated approach to organizational performance management that results in :

(a) positioning of organization growth
(b) positioning of organization competitive advantage
(c) visualizing organization multi performances in the form of wheel
(d) scoring HEI organizaition performance based on weighted criteria and KPI

The proposed model is standing on the following principle : "there is no the best performance; but there are always better performances to achieve". Better performance of HEI is reflected by growth of organisation results which are demonstrated by current level compared to historical performances; and besides, it is reflected by comparison between current level and the competitor performances or benchmarks. This is related to knowledge management based on internal historical performance achievements and external (competitor) performance achievenents.

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