Identifying and Explaining Effective Indicators for World Class Universities

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World-Class Universities (WCU) commonly recognized as global research universities or flagship universities are essential in developing a nation's potential for development in the global knowledge economy. The development of WCUs is high on the policy agenda of various stakeholders across the globe in the past decades. Increasing number of nations, regions and higher education institutions, in both developed and developing countries recognize their indispensable roles in economic, social and cultural development respectively. The purpose of this research is to review the performance of universities with the components of the world class university, which University Technology Malaysia is studied as a case study. This research is quantitative and descriptive. The research instrument is questionnaire and defined indicators by fuzzy TOPSIS technique have been analyzed. The indicators have been classified based on the components proposed by Schoenberger which includes: quality, flexibility, innovation, responding time, resources, student services, services after graduation.
The statistical population of this research is the faculty members of the University Technology Malaysia. The sample size is 300 according to the Cochran formula. The stratified random sampling method because of the diversity of the colleges was used The results of the research shows that, in order to reach the world class university the quality, flexibility and innovation are the priority issues that require the more attention of universities.

Keywords: World Class Management, World Class Universities, Performance Indicators, Fuzzy TOPSIS.

Introduction:

As the global environment for tertiary education expands—encompassing not only the traditional student exchanges and scholarly sojourns but also such issues as cross-border investments and market-type competition among institutions—stakeholders in tertiary education must re-evaluate their priorities and expectations. International pressures, largely the result of global flows of tertiary education resources—funding, ideas, students, and staff—have forced institutions to re-examine their missions. In order to benefit from the capacity-building potential of tertiary education, the institutions must be locally relevant yet globally engaged [1].

Recently, there have been several efforts to develop ranking systems for universities. Increasing competititon and need for competitiveness as a result of globalization, knowledge based economy and growing interest of information related to higher education institutions due to increasing mobility of people all served for the remarkable popularity of ranking systems [2].

universities or flagship World-class universities (WCU), commonly recognized as global research academic system and play an important role universities, are cornerstone institutions embedded in any competitiveness in the global knowledge economy. It is widely agreed that in developing a nation's of disciplines universities are committed to creation and dissemination of knowledge in a range these and fields; the delivery of elite education at all levels; serving national needs; and furthering the on the policy international public good [3,4,5]. The development of world-class universities is high

agenda of various stakeholders across the globe [6,7]. Such a "world-class" movement has been intensified by the proliferation of international league table [8,9]. In the past few years, an fuelled and education institutions in both developed and increasing number of nations, regions and higher same race for academic excellence and have adopted a range of developing countries have joined the strategies and implemented various reforms. development

A pioneering effort has been made to define the term 'world class university'. Salemi (2009)[1] presents three major elements of the world-class university that include high concentration in talent, abundant resources and independent management. He believes that a world-class university will be able to choose the best students and the most qualified scholars and researchers, have plenty of resources and a rich learning environment and providing an optimal and independent management. Another definition that Jang Cello Shin and Barrera M.M.[10] have provided from the world-class university are based on three components for global university competition, which include attracting human resources, financial support and excellence in the quality of teaching and research.

the university in the world class has characteristics that it is not seen in ordinary universities. Those features include: prominent faculty, prestigious students, high level research, quality education in international standards, high levels of government and nongovernmental budgets, independent management structure and training facilities [11,12,13].

Schonberger explain that when activities will be carry out in world class that organizations have the following indicators simultaneously, Quality (better or at least equal to the best competitor), Cost (lower or at least equal to the best competitor), flexibility (better or at least equal to the best competitor), Innovation (better or at least equal to the best competitor) and Responding time (shorter or at least equal to the best competitor) [14].

As all countries need to develop a higher education system therefore, this research based on the view points of faculty members of University Technology Malaysia the effective indicators for the world- And priorities of indicator in each level by using Fuzzy TOPSIS are .class university will be examined determined.

Research background

As discussed, the conception of world class university has been proposed by researchers. Most of the concepts presented by each of the authors has many similarities with others. Researchers, such as Altbach (2009) [3], Salemi (2009)[1], describe the dimensions of this concept. Altbach (2011) mentioned that prominent faculty, prestigious students, high level research, quality education in international standards, high levels of government and nongovernmental budgets, independent management structure and training facilities are the concepts that world class universities need to be attention.

Salemi (2009)[1] presents three major elements of the world-class university that include high concentration in talent, abundant resources and independent management.

Moherman et al. (2008)[15] also provided 8 elements for the definition of a world-class university that includes global mission, the diversity of research, new duties for professors, diversified investments, global recruitment, increased complexity, new relationships with management and industry, and Global cooperation.

The world-class university, as the world's leading universities, has played a key role in the development of national competitiveness, in the creation and dissemination of knowledge, in the development of high-skill workforce and in meeting the needs of the community.

In a study titled "Development Strategy for World Class Universities in Chile", that conducted by Salemi [16] in order to identify the strengths and challenges that universities faced to successfully compete and function better, He considered that the lack of a national program for the development of

top institutions, the lack of enough international scholars, the low rate of university internationalization, the lack of accountability, the lack of government investment in national scientific research capacities, are the factors that limited the performance of university [17].
Nokkala et al, [18], examined the impact of ratings on the development of universities and scientific productions and mentioned that ranking improves individualism, standardization, commercialization and homogenization.
Among universities in the world the universities of applied science are moving toward the world class. For example the HAN university with the mission and value of "to be an excellent academic institution in the Netherlands. It offers its students and employees an attractive and professional environment in which to study and work and got a rank in the world class ranking. Moreover, the Hague University of Applied Sciences (Dutch: De Haagse Hoge school), abbreviated THUAS, is a university of applied sciences and community higher professional education institute which is working under the principle of world class.
Sidorenko and Gorbatova [19] mentioned that The goals of rankings are: a) evaluation of higher education at all levels (education, science, administration, financing, and infrastructure); b) providing consumers with reliable information about educational services.
In a summing-up and from the perspective of various experts and theorists, the components of the university are in the world class include: Plurality of research [20], Global competition [21], Global competition (excellence in quality of teaching and research [21], high academic excellence in the talent [1], global recruitment (around the world) [20], Values In the case of humans, global competition in attracting talented students and professors [21], Flexible Management with Independent and Familiar Management [1], Increasing Complexity, Global Mission, New Tasks for Professors [15], University Structure for Teaching and Research [20] sufficient resources [1], investment , new relationships with management ,government and industry [15], Global Competitiveness for Fund raising for Education and Research [20].
As can be seen in a glimpse, the components presented by the researchers have overlap. The most comprehensive look can be described by Schoenberger. Therefore, the Schoenberger components are used in this study[14].

Methodology:
This research is quantitative and the method is descriptive. The statistical population are the lecturers and academic staff of University Technology Malaysia in the year of 2016-2017. The statistical Due to population is 1372 person and the sample size based on Cocharan's Formula [22] is 300 people. the diversity of colleges, stratified random sampling is used.

In this research the indicators from the related literatures and expert team ideas has been chosen and with using the TOPSIS Fuzzy [23,24] have been prioritized.

In order to prioritize and weighting to each of the key indicators in this research, the questionnaire has been designed and distributed among respondent.

For increasing the validity of the questionnaire these following methods have been conducted:

1- Using viewpoints of experts and professionals in universities

2- Using the same survey questionnaire derived from references (articles and books)

3- Questionnaire preliminary distributed among a number of experts in the university and their ideas has been considered.

Cronbach's Alpha is used to estimate the reliability of the questionnaire. Cronbach Alpha is recommended to the questionnaires with multiple choices to answer coefficient formulas [25]. SPSS software has been used for evaluating the reliability of TOPSIS questionnaire. Cronbach's alpha coefficient for the 40 items is 0.651. which indicates the reliability of the questionnaire [26].

Based on the questionnaires containing performance indices of university derived from related literatures and expert team ideas and with Schonberger suggestion [14] in 7 components (Quality, Flexibility, Innovation, Responding time, Recourse, Student service, Service after graduation) have been classified and presented in Table 1.

Table1: Defined indicator based on Schonberger Component

	Indicators
Quality	1.Percentage satisfaction of graduates with technology (ICT service) in the university 2.No of award received by student in national and international level 3.Percentage of graduate securing job in 6 months 4.No of academic programmes initiated for international accreditation 5.No of external experts participating in teaching and learning activities 6.Percentage of postgraduate to total student 7.No of automated system developed for teaching activity 8.Academic staff and management satisfaction with ICT service 10.No of staff with PhD 11.Percentage of academic staff with professional qualifications 12.Competency index for non-academic staff 13. No of new facilities for increasing student learning 14.Percentage raise of digital library content
Innovation	15.Total number of staff appointed at a professional/ committee position in international level 16.No of university linked spin-off companies 17.No of Intellectual property registered 18.No of post doctoral fellows 19.No of publications in citation indexed journals 20.Cumulative impact factor of publications 21.No of staff involved in international joint research projects
Flexibility	22.No of transformation and leadership programs for students development 23.No of student participate in transformation program 24.No of students participation in national and international programs 25.No of staff participating in community engagement activities 26.Reduction in energy consumption 27.Percentage of satisfaction in conducive environment 28.Generated waste from campus activities 29.Overall performance of conducive campus environment
Resource	30.Amount of research grant 31.Cost incurred for operational expenditure 32.Cost generated for training courses/ other activities 33.Allocation amount for entrepreneurial program 34.Amount of tuition fee 35.Income generated from product commercialization
Responding time	36. percentage of quick response to the questions of current and new students
Students services	37.Percentage of introducing students to the top international universities 38.Amount of camps or scientific visits
Service after graduation	39. Percentage of responding and cooperation to inquiries educational institutions, organizations, … 40. Cooperation percentage for duplicate document in case of missing or damaging or…

Fuzzy TOPSIS:

In real-world situation, because of incomplete or non-obtainable information, the attributes are often not exact, so they usually are fuzzy/imprecise, therefore, we propose a fuzzy TOPSIS for analysis in this paper. In this study, performance ratings and weights are evaluated with linguistic terms [22]. These linguistic ratings, employed by specialists to represent the fuzzy performances under certain

criteria, are very good (VG), good (G), medium good (MG), fair (F), medium poor (MP), poor (P) and very poor (VP). The linguistic weights for presenting the importance of criteria are very high (VH), high (H), medium high (MH), medium (M), medium low (ML), low (L) and very low (VL). Assume that all linguistic terms can be represented with triangular fuzzy numbers, and that these fuzzy numbers are limited in the interval [0,1]. Thus these performance ratings would be not normalized. It is suggested that the decision-makers use linguistic variables to determine the importance weights of criteria and rating of actions under various criteria.

Let a set of performance ratings of A_i (i = 1, 2, . . . , m) regarding to criteria Cj (j = 1, 2, . . . , n) denoted by X = {(x_{ij} , | i = 1, 2, . . . , m, j = 1, 2, . . . , n, }.

We assume the fuzzy performance ratings of all decision-makers be positive trapezoidal fuzzy R k = (r l k , r γ k , r ζ k , ru k) (k = 1, 2, . . . , K), Therefore, the aggregated fuzzy numbers performance rating can be formulated as [3],

R k = (r l , rγ , rζ , ru)

$$r^l = \min_k \left\{ r_k^l \right\} \quad , r^\gamma = \frac{1}{K} \sum_{k=1}^{\cdot\cdot} r_k^\gamma \quad , r^\zeta = \frac{1}{K} \sum_{k=1}^{\cdot\cdot} r_k^\zeta \quad , r^u = \max_k \left\{ r_k^u \right\}$$

Let the fuzzy performance rating of each alternative and importance weight of the kth decision-maker be xijk = (xi ijk, x γ ijk, x ζ ijk, xu ijk), Wfjk = (w l ijk, w γ jk, w ζ jk, wu jk) with i = 1, 2, . . . , m, j = 1, 2, . . . , n and k = 1, 2, . . . , K, respectively. Hence, the aggregated fuzzy ratings x-ij of actions regarding to each criterion can be calculated as,

x-ij = (x l ij , x γ ij , x ζ ij , xu ij)

where,

$$x_{ij}^l = \min_k \left\{ x_{ijk}^l \right\} \quad , x_{ij}^\gamma = \frac{1}{K} \sum_{k=1}^{K} x_{ijk}^\gamma \quad , x_{ij}^\zeta = \frac{1}{K} \sum_{k=1}^{K} x_{ijk}^\zeta \quad , x_{ij}^u = \max_k \left\{ r_k^u \right\}$$

In addition the aggregated fuzzy weights W-j of each criterion can be calculated as,

W-j = (w l j , w γ j , w ζ j , wu j)

where,

$$w_j^l = \min_k \left\{ w_{jk}^l \right\} \quad , w_j^\gamma = \frac{1}{K} \sum_{k=1}^{K} w_{jk}^\gamma \quad , w_j^\zeta = \frac{1}{K} \sum_{k=1}^{K} w_{jk}^\zeta \quad , w_j^u = \max_k \left\{ w_{jk}^u \right\}$$

Ultimately, one can be expressed the aggregated fuzzy performance ratings and weights in concise by using fuzzy decision matrix format as follows:

$$\widetilde{D} = \begin{bmatrix} \widetilde{x}_{11} & \widetilde{x}_{12} & \dots & \widetilde{x}_{1n} \\ \widetilde{x}_{21} & \widetilde{x}_{22} & \dots & \widetilde{x}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \widetilde{x}_{m1} & \widetilde{x}_{m2} & \dots & \widetilde{x}_{mn} \end{bmatrix}, \qquad \widetilde{W} = [\widetilde{W}_1, \widetilde{W}_2, \dots, \widetilde{W}_n]$$

To avoid the complicated normalization formula used in classical TOPSIS, the linear scale transformation is used to transform the different criteria scale into comparable scale. Normalize fuzzy decision matrix Re = [reij]m×nby the following equations:

$$\widetilde{r}_{ij} = (r^l_{ij}, r^\gamma_{ij}, r^\zeta_{ij}, r^u_{ij}) = (\frac{x^l_{ij}}{d^*_j}, \frac{x^\gamma_{ij}}{d^*_j}, \frac{x^\zeta_{ij}}{d^*_j}, \frac{x^u_{ij}}{d^*_j}) \qquad (j \in B)$$

$$\widetilde{r}_{ij} = (r^l_{ij}, r^\gamma_{ij}, r^\zeta_{ij}, r^u_{ij}) = (\frac{a^-_j}{x^u_{ij}}, \frac{a^-_j}{x^\zeta_{ij}}, \frac{a^-_j}{x^\gamma_{ij}}, \frac{a^-_j}{x^l_{ij}}) \qquad (j \in C)$$

where

$$d^*_j = \max_i \left\{x^u_{ij}\right\} \quad , a^-_j = \min_k \left\{x^l_{ij}\right\}$$

and B and C are associated with benefit (such as the product quality, flexibility and . . .) and cost (such as human cost, threat of China competitors and . . .) criteria sets, respectively. In the normalization method, normalized r-ij are still trapezoidal fuzzy numbers. Therefore, the weighted normalized fuzzy decision matrix is constructed as:

$$\widetilde{V} = [\widetilde{v}_{ij}]_{m\times n}$$

where

$$\widetilde{v}_{ij} = (v^l_{ij}, v^\gamma_{ij}, v^\zeta_{ij}, v^u_{ij}) = (w^l_j x^l_{ij}, w^\gamma_j x^\gamma_{ij}, w^\zeta_j x^\zeta_{ij}, w^u_j x^u_{ij}) \qquad \forall i, j$$

It is obvious that the elements of weighted normalized fuzzy decision matrix V- are approximately trapezoidal fuzzy numbers and between [0,1] as well. Therefore, the ideal solution can be defined as (1,1,. . . ,1). As such, the anti-ideal solution can be defined as (0,0,. . . ,0). In this paper, we determine the fuzzy ideal solution (A∗) and fuzzy anti-ideal solution (A−) as follows:

$$A^* = (\widetilde{v^*_1}, \widetilde{v^*_2}, \ldots, \widetilde{v^*_n}) = \{(\max_i \left\{v^u_{ij}\right\} | j \in B), (\min_i \left\{v^l_{ij}\right\} | j \in C)\}$$

$$A^- = (\widetilde{v^-_1}, \widetilde{v^-_2}, \ldots, \widetilde{v^-_n}) = \{(\min_i \left\{v^l_{ij}\right\} | j \in C), (\max_i \left\{v^u_{ij}\right\} | j \in B)\}$$

where

$$\widetilde{v^*_j} = (v^{l*}_j, \gamma^{l*}_j, \zeta^{l*}_j, v^{u*}_j), \quad \widetilde{v^-_j} = (v^{l-}_j, \gamma^{l-}_j, \zeta^{l-}_j, v^{u-}_j), \quad \widetilde{v}_j = (v_{ij}, \gamma_{ij}, \zeta_{ij}, v_{ij})$$

The problem of ranking fuzzy numbers has been addressed by many researchers [25,]. Yao and Wu [26] defined the signed distance d ∗ on R to rank two fuzzy numbers A- and B- as follows:

$$d(\widetilde{A}, \widetilde{B}) = \frac{1}{2}\int_0^1 ([\widetilde{A}]^L_\alpha + [\widetilde{A}]^U_\alpha - [\widetilde{B}]^L_\alpha - [\widetilde{B}]^U_\alpha)d\alpha$$

In this formula, of course, [e•] L α and [e•] U α are the lower and upper bound of the α-cut of the fuzzy number respectively. Based on, the following definition for comparing and ranking fuzzy numbers is extended as:

$$\begin{aligned}
&\widetilde{B} \prec \widetilde{A} \quad if \quad d(\widetilde{A} \prec \widetilde{B}) > 0 \\
&\widetilde{B} \succ \widetilde{A} \quad if \quad d(\widetilde{A} < \widetilde{B}) > 0 \\
&\widetilde{B} \approx \widetilde{A} \quad if \quad d(\widetilde{A} \prec \widetilde{B}) = 0
\end{aligned}$$

The distance measurement of each alternative (alternative strategies) from A-and B- based on can be currently calculated as:

$$d_i^* = \sum_{j=1}^{n} d(\widetilde{v}_j^*, \widetilde{v}_{ij}) = (\frac{1}{2}) \sum_{j=1}^{n} (v_{j1}^* + v_{j4}^* - v_{ij1} - v_{ij4}) + (\frac{1}{4}) \sum_{j=1}^{n} (v_{j2}^* + v_{j3}^* - v_{j1}^* - v_{j4}^* - v_{ij2} - v_{ij3} + v_{ij1} + v_{ij4}), \quad \forall i$$

$$d_i^- = \sum_{j=1}^{n} d(\widetilde{v}_{ij}, \widetilde{v}_j^-) = (\frac{1}{2}) \sum_{j=1}^{n} (v_{ij1} + v_{ij4} - v_{j1}^- - v_{j4}^-) + (\frac{1}{4}) \sum_{j=1}^{n} (v_{ij2} + v_{ij3} - v_{ij1} - v_{ij4} + v_{j1}^- + v_{j4}^- - v_{j2}^- - v_{j3}^-), \quad \forall i$$

The purpose of this technique is that the chosen alternative should have the shortest distance from the ideal solution and the farthest distance from the anti-ideal solution simultaneously. Therefore, a closeness coefficient index is defined to determine the ranking order of all alternatives strategies. The closeness coefficient for each alternative is obtained as:

$$CC_i = \frac{d_i^-}{d_i^* + d_i^-}, \qquad i = 1, 2, \ldots, m$$

It is evident that an alternative Ai is closer to the $A*$ and farther from A^- as CC_i approaches to 1. Therefore, using the closeness coefficient, we can determine the rank of alternatives A_i , i = 1, 2, . . . , m and select the best one from among a set of practical alternative strategies. As a summary, the fuzzy TOPSIS method based on α-cut sets can be summed up as follows: • Organize a group of experts, and identify the evaluation criteria and determine the alternative strategies according to SWOT sub-factors. • Construct the weighted normalized fuzzy decision matrix V = [v-ij]m×n. • Determine the ideal solution and the anti-ideal solution Calculate the distance measurement of each alternative (alternative strategy) from the ideal solution and anti-ideal solution • Compute the closeness coefficient of each alternative strategy • Rank alternative strategies in terms of their closeness coefficients.

Prioritizing Indicators by Fuzzy TOPSIS Technique

TOPSIS is the most useful technique in multiple criteria decision making for investigating issues in the real world. TOPSIS defines an index called similarity to the positive-ideal solution and the remoteness from the negative-ideal solution. Then, the method chooses an alternative with the maximum similarity to the positive-ideal [29].

In order to prioritize and weighting to each of the key indicators in this research, the questionnaire has been designed and distributed among respondent[30]. TOPSIS method comprises the following steps:

Step 1. Form a committee of decision-makers, then identify the evaluation criteria.

Step 2. Choose the appropriate linguistic variables for the importance weight of the criteria and the linguistic ratings for alternatives with respect to criteria.

Step 3. Aggregate the weight of criteria to get the aggregated fuzzy weight j w ~ of criterion C j , and pool the decision makers' opinions to get the aggregated fuzzy rating ij x ~ of alternative Ai under criterion C j .

Step 4. Construct the (normalized) fuzzy decision matrix

Step 5: Construct the weighted (normalized) fuzzy decision matrix

Step 6: Determine FPIS and FNIS.

Step 7: Calculate the distance of each alternative from FPIS and FNIS,

Step 8: Calculate the closeness coefficient of each alternative.

Step 9: According to the closeness coefficient, determine the ranking order of all alternatives.

Table2: Prioritizing indicators

	Indicator	Weight	Preference
Quality	1.Percentage satisfaction of graduates with technology (ICT service) in the university	0.02491	18
	2.No of award received by student in national and international level	0.03535	6
	3.Percentage of graduate securing job in 6 months	0.03092	10
	4.No of academic programmes initiated for international accreditation	0.038	3
	5.No of external experts participating in teaching and learning activities	0.02783	13
	6.Percentage of postgraduate to total student	0.02441	21
	7.No of automated system developed for teaching activity	0.02854	12
	8.Academic staff and management satisfaction with ICT service	0.02338	23
	9.No of staff with PhD	0.02886	11
	10.Percentage of academic staff with professional qualifications	0.03586	4
	11.Competency index for non-academic staff	0.01428	35
	12. No of new facilities for increasing student learning	0.03913	2
	13.Percentage raise of digital library content	0.02549	17
Innovation	14.Total number of staff appointed at a professional/ committee position in international level	0.03523	7
	15.No of university linked spin-off companies	0.02019	31
	16.No of Intellectual property registered	0.02491	19
	17.No of post doctoral fellows	0.01647	34
	18.No of publications in citation indexed journals	0.03927	1
	19.Cumulative impact factor of publications	0.03324	9
	20.No of staff involved in international joint research projects	0.02336	25
Flexibility	21.No of transformation and leadership programs for students development	0.02714	15
	22.No of student participate in transformation program	0.01409	37
	23.No of students participation in national and international programs	0.02083	29
	24. .Reduction in energy consumption	0.03492	8
	25. Percentage of academic programs with industry advisory panel	0.03539	5
	26.Percentage of satisfaction in conducive environment	0.0183	32
	27.Generated waste from campus activities	0.01786	33
	28.Overall performance of conducive campus environment	0.01409	38
	29 No of staff participating in community engagement activities	0.02448	20
Resource	30.Amount of research grant	0.02254	27
	31.Cost incurred for operational expenditure	0.01423	36
	32.Cost generated for training courses/ other activities	0.02336	26
	33.Allocation amount for entrepreneurial program	0.02641	16
	34.Amount of tuition fee	0.02111	28
	35.Income generated from product commercialization	0.02337	24
Responding time	36. percentage of quick response to the questions of current and new students	0.02719	14

	Indicator	Weight	Preference
Students services	37.Percentage of introducing students to the higher rank international universities	0.01324	39
	38.Amount of camps of scientific visits	0.02374	22
Service after graduation	39. Percentage of responding and cooperation to inquiries educational institutions, organizations, …	0.02539	30
	40. Cooperation percentage for issuing certificate (duplicate document in case of missing or damaging or…)	0.01225	40

As it has been clear in table 2 "No of publications in citation indexed journals" with weight of "0.03927" is the first priority after that "No of new facilities for increasing student learning" with weight of "0.0391" , "No of academic programmes initiated for international accreditation" with the weight of "0.038" , "Percentage of academic staff with professional qualifications with the weight of "0.03586" and "Percentage of academic programs with industry advisory panel" with the weight of "0.03539 are next priorities respectively.

The first five items in the above table is related to quality, innovation and flexibility aspects, therefore, It can be concluded that the quality, innovation and flexibility are the indicator need to have more attentions in order to move on world class.

Conclusion:

In this research the effective indicators for performing the university in the world class has been determined. As the result shows based on the idea of University Technology Malaysia (UTM) lecturer's and academic staff's the most important indicators has been defined and the level of their importance by applying Fuzzy TOPSIS Technique has been calculated.

Regarding the importance of world class, the UTM is moving towards and articulated its views on world class and the actions taken over the last few years can confirm this claim. With setting up centre of excellence and world class laboratories such as the institute of environmental and water resource management, and foster greater international research collaboration with faculties and institutions around the world and to expand expertise in new areas such as nanotechnology, Bioprocess engineering, photochemical,… can be expressed. Therefore, the UTM vision is on to be recognized as a world-class centre of academic and technological excellence and in their objectives mentioned that, To become a world class research university and produce outstanding science and Technology graduate and top- notch research output.

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