Certificate of Presentation

This Certificate is Awarded to

Dr. Ahmad Mubin

in appreciation of intellectual contribution in

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March 26-27, 2016

(Alexandru Trifu)
Conference Chair

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"PERTRE ANDERI" of IASI, Romania

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Preface

Dear Distinguished Delegates and Guests,

The Conference Committee warmly welcomes our distinguished delegates and guests to the 2016 International Conference on Education and Information Management (ICEIM-2016) held on March 26-27 in Istanbul, Turkey.

ICEIM-2016 is organized by International Foundation for Research and Development (IFRD). The conference is aimed at discussing with all of you the wide range of problems encountered in present and future issues in economies and Societies. ICEIM-2016 is organized in collaboration with Yildirim Beyazit University, Turkey, Shinawatra International University, Thailand, PERTRE ANDERI of IASI, Romania and National Academy of Management, Ukraine where researchers from around the world presented their work. The conference committee is itself quite diverse and truly international, with membership around the world.

Proceeding records the fully refereed papers presented at the conference. Main conference themes and tracks are Management, Education and Information Management. Conference aims to bring together researchers, scientists, engineers and practitioners to exchange and share their experiences, new ideas and research results about all aspects of the main conference themes and tracks and discuss the practical challenges encountered and the solutions adopted. The main goal of the event is to provide a scientific forum for exchange of new ideas in a number of fields that interact in depth through discussions with their peers from around the world.

Conference has solicited and gathered technical research submission related to all aspects of major conference themes and tracks. All the submitted papers have been peer reviewed by the reviewers drawn from the scientific committee, external reviewers and editorial board depending on the subject matter of the paper. Reviewing and initial selection were undertaken electronically. After the rigorous peer-review process, the submitted papers were selected based on originality, significance, and clarity for the purpose of the conference. Conference program is extremely rich, featuring high-impact presentations. The high quality of the program guaranteed by the presence of an unparalleled number of internationally recognized top experts. Conference will therefore be a unique event, where attendees will be able to appreciate the latest results in their field of expertise, and to acquire additional knowledge in other fields. The program has been strutted to favor interactions among attendees coming from many diverse horizons, scientifically, geographically, from academia and from industry.

We would like to thank the program chairs, organization staff, and members of the program committee for their work. We are grateful to all those who have contributed to the success of ICEIM-2016 especially our partners. We hope that all participants and other interested readers benefit scientifically from the proceedings and find it stimulating in the process. Finally, we would like to wish you success in your technical presentations and social networking.

We hope you have a unique, rewarding and enjoyable time at ICEIM-2016 in Istanbul.

With our warmest regards,

Conference Committee
March 26–27, 2016
Istanbul, Turkey.

ICEIM-2016

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PAPERS

STRATEGY OF THE FACULTY OF ENGINEERING PERFORMANCE IMPROVEMENT TO SUPPORT THE STUDY PROGRAM AND UNIVERSITY ACCREDITATION

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Abstract

The faculty of engineering (FEng) has quite huge role in accreditation assessment study programs and university, so that it needs strategy of FEng performance improvement continuously. Therefore, it requires a performance measurement system (PMS) that can be used to plan, measure and evaluate the FEng success rate. Designing PMS of FEng is using Academic Scorecard model approach and National Accreditation Agency for Higher Education (NAA-HE) standards. This research aims to identify factors that influence PMS design process, designing PMS using approach Academic Scorecard model and NAA-HE standards, and measuring and evaluating performance of FEng. Based on designing the PMS results and strategic objectives, it can be determined that KPI (Key Performance Indicator) and it is obtained 62 KPIs. KPIs determination result is used as a reference in the measurement and assessment of FEng performance by using Objective Matrix (OMAX) and Traffic Light Systems. Performance value with the range of 0-3 (red) means low performance, 4-7 (yellow) means good performance, and 8-10 (green) means excellent performance. Later the measurement and assessment of FEng performance can be used as a strategy for sustainable performance improvement to support the study programs and university accreditation for both at national and international levels.

Keywords**:** *Performance Measurement*, *Faculty of Engineering, NAA-HE, Accreditation, KPIs.*

Introduction

In order to realize public accountability, the study program and university should establish internal quality assurance system actively. In order to prove that the system of internal quality assurance has been implemented properly, the study program and university must be accredited by external quality assurance agency that is the National Accreditation Agency for Higher Education (NAA-HE) and for engineering field it will be diverted to Indonesian Acreditation Board for Engineering Education (IABEE). On accreditation by NAA-HE, faculty value contribution is fairly large 15% of the final total value (NAA-HE, 2008).

Considering that the faculty of engineering (FEng) role is quite large in accreditation assessment study programs and university, so that it is needed strategy of FEng performance improvement continuously. Therefore, it requires a performance measurement system (PMS) that can be used to plan, measure and evaluate the FEng success rate in accordance with the FEng vision, mission and objectives. PMS is very helpful to leaders in implementing strategy by comparing actual results with strategic objectives.

Organization performance Improvement requires a measurement system by using a method that is not only capable of measuring current organization performance (lag), but it is also able to drive performance improvement in the future (lead). The measurement system is

implemented in an organization which has a huge impact on human behavior inside and outside the organization. To be successful and grow in the competition in this age of information, organizations must use measurement and management systems which are derived from the strategies and capabilities of the organization (Kaplan, et.al, 2000)

The case study in this research is done in the Faculty of Engineering (FEng), University of ABC, which currently has 6 Programs are Mechanical Engineering, Civil Engineering, Electrical Engineering, Industrial Engineering, Informatics Engineering, and D3 Electrical Engineering. Based on the results of initial observations and internal documents of search results, it is known that the performance measurement system (PMS) held is still partial, not comprehensive and integrated.

The purpose of this study includes: (1) identifying factors that influence the design process performance measurement system of FEng, (2) designing a performance measurement system in an integrated approach to the Academic Scorecard model and the National Accreditation Agency for Higher Education (NAA-HE) standards, and (3) measuring and evaluating performance of FEng for refinement and improvement of performance continuously.

Based on above description, it is very important to conduct study about strategy of FEng performance improvement through designing performance measurement system of FEng, in order to improvement and enhancement of performance in a sustainable manner using the Academic Scorecard model approach and of NAA-HE standards. Thus, the expected integration of efforts to improve and increase performance on aspects of academic management, stakeholders desire and satisfaction, internal business, innovation and learning, which can further enhance the level of accreditation of study program in the FEng and can increase the competitiveness of FEng both nationally and global.

Literature Review

Performance measurement is a management tool which is used to improve the quality of decision making and accountability, and also used to assess the achievement of goals and objectives (Vanany, 2009). Neely, et.al (1995) defines performance measurement as the process of quantifying the efficiency and effectiveness of action, and performance measurement system as the set of metrics used to quantify the efficiency and effectiveness of an action. According to Neely (2004) and Vanany (2009) there are some characteristics of the performance measurement system, namely: (1) it is able to provide a balanced picture of the organization, which reflects the financial and non-financial conditions, internal and external, and the efficiency and effectiveness of the organization, (2) it is able to describe the organizational performance condition consisely, (3) it is able to describe the organizational needs as a multi-dimensional, (4) it is able to measure the organizational performance comprehensiveness, so that knowable the things what should be eliminated as well as any needs to be added, and (5) it is able to integrate the organization both its functions and corresponding its hierarchy.

Performance measurement system is very helpful for leaders to implement a strategy by comparing actual results with strategic objectives. A performance measurement system involves a certain systematic method of setting business goals together with periodic feedback reports that suggested an increase of the target (Simons, 2000). Some of the benefits of performance measurement system for the organization (Vanany, 2009), namely to: (1) planning, control and evaluation, (2) controlling changes, (3) communication, (4) measurement and improvement, (5) motivation , (6) the allocation of resources, and (7) focus on the long term.

The Academic Scorecard (ASC) model is one tool that can be used to design a performance measurement system of the organization. ASC was introduced by Neil F. Harold in 1996. ASC is the Balanced Scorecard (BSC) model, which was introduced by Robert S. Kaplan and David P. Norton in 1992. The Balanced Scorecard concept has shown success in private enterprise and

government sectors. In a private company, The Balanced Scorecard concept emphasize to increase its profits. While in the public sector, the success of the organization mission becomes a benchmark of the success of the project (Mulyadi, 2001). ASC has a purpose and a function similar to the BSC.

The perspective in the BSC includes finance, customers, internal business processes, and learning and growth. Meanwhile, according to O'Neil, et.al (1999) ASC has four perspectives, namely academic management, stakeholder, internal business processes, and innovation and learning. ASC model is one tool that can be used to measure the performance of higher education (Zaidah, 2010). ASC model, as seen in Figure 1, gives executives an overall framework to translate the organization vision and business strategy into a comprehensive set of integrated performance measures. This system translates the organization mission and strategy into objectives and measurement, and it organizes into four different perspectives.

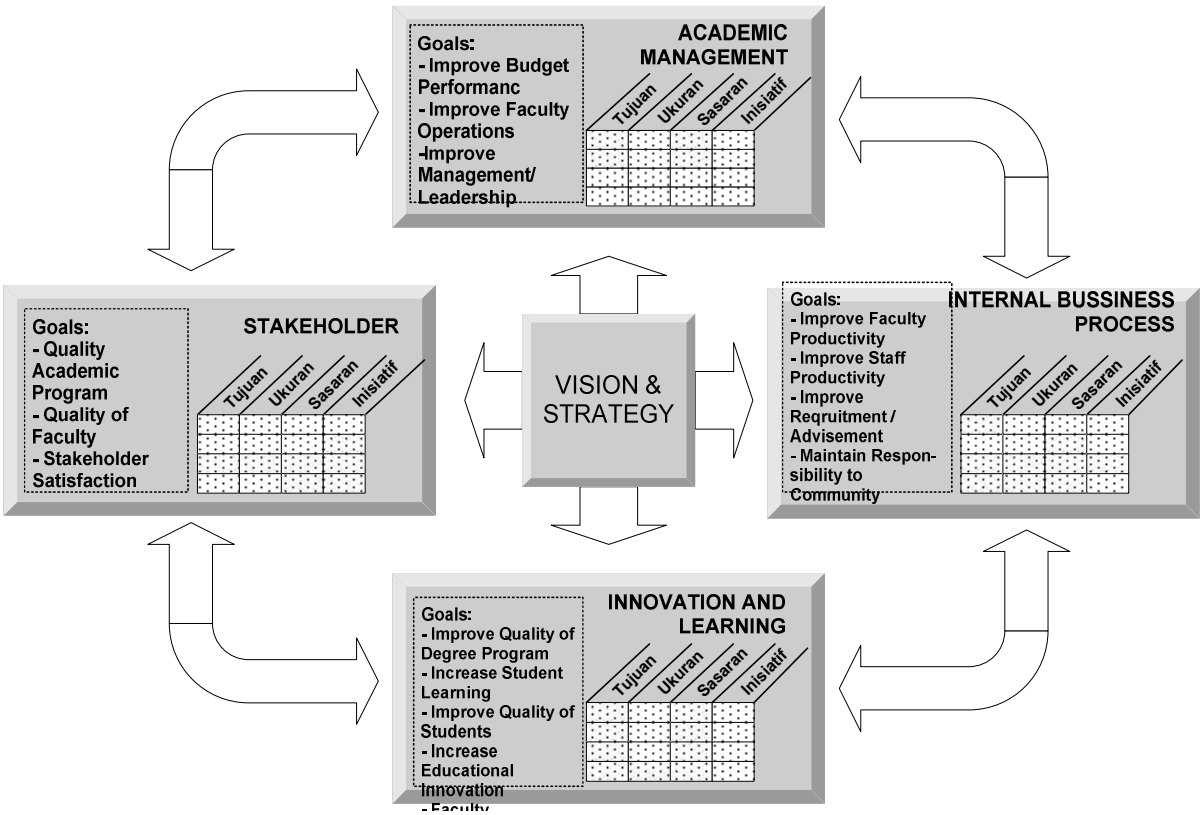

Figure 1. Framework of Academic Scorecard (O'Neil, et.al, 1999)

The process of designing the performance measurement system (PMS) with the Academic Scorecard model based on framework of the Balanced Scorecard. Designing PMS includes; determination of measurement architecture, determination of strategic objectives of each perspective (the perspective of academic management, stakeholder, internal business processes, and innovation and learning), determination of Key Performance Indicators (KPI) and weighting (Mubin, 2005; O'Neil , et.al, 1999; Suartika, et.al, 2007; Vanany, 2009).

Determination of measurement architecture includes organizational unit selections and identification of strategic business unit linkages. Determination of strategic objectives for each perspective is derived from the organization's strategy. From the existing strategic objectives, KPIs can be determined through discussions, interviews and investigation on internal documents

that describing the system in the organization. After the entire organization KPIs can be identified and arranged hierarchically, KPI weighting is then performed to know the contribution or influence to each indicator of overall organizational performance. Weighting method used is Analytical Hierarchy Process (AHP) (Saaty, 1993), whereas for the calculation of the score using the Objective Matrix (OMAX) methods and evaluation using the Traffic Light System (TLS) methods (Mubin, 2011; 2013; Riggs, 1987).

Research Methods

Framework for solving the problem in this research is divided into five phases, namely:

1. Preliminary research phase.
2. Identification phase of factors that influence the designing PMS in accordance with the Academic Scorecard (ASC) concept and the National Accreditation Agency of Higher Education (NAA-HE) standards.
3. Designing phase of PMS, using the ASC model approach and NAA-HE standards begins with the preparation of strategic objectives based on the vision, mission, objectives and strategies of FEng, then the determination of Key Performance Indicators (KPIs) and the preparation of the KPIs hierarchically, further weighting perspectives and KPI to determine the contribution or influence of each of overall FEng performance.
4. Phase of performance measurement and evaluation, measurement of KPI and perspectives performance values is performed that equal to the multiplication of the weights with a score of KPI and perspectives. Weighting using software Analytical Hierarchy Process (AHP) and the calculation of the score used Objective Matrix (OMAX) methods, in which performance score of the OMAX body ranges on a scale of 0-10, which means there are 11 levels of achievement for each KPI, whereas evaluation using Traffic Light System (TLS) methods.
5. Analysis and conclusion.

Results and Discussion

Designing Performance Measurement System (PMS) is performed using the stages that includes; determination of measurement architecture, determination of strategic objectives, and determination of Key Performance Indicators (KPIs), designing is done using the Academic Scorecard (ASC) model approach and NAA-HE standards.

Strategic objective is a condition that will be realized in the future, and the elaboration of organizational goals. To translate strategy into action steps (operations) comprehensively and coherently is needed Academic Scorecard models approach and NAA-HE standards. With Academic Scorecard framework and NAA-HE standards, then determined the strategic objectives of four perspectives, namely the academic management, stakeholder, internal business processes, as well as innovation and learning.

Based on the NAA-HE there are seven standards that include Standard 1 (Vision, Mission, Goals and Objectives, and Strategy of Achievement), Standard 2 (Governance, Leadership, Management System and Quality Assurance), Standard 3 (Students and Graduates), Standard 4 (Human Resources), Standard 5 (Curriculum, Learning and Academic Atmosphere), Standard 6 (Funding, Facilities and Infrastructure, and Information Systems), and Standard 7 (Research, Community Service and Cooperation).

Determination of KPIs through interviews, discussions and investigation on internal documents is describing the system in FEng. KPIs determined for each perspective and NAA-HE

standards. The results of KPI determination appropriate strategic objectives of each perspective and NAA-HE standards obtained a 62 KPIs and sub KPIs, consisting of 22 KPIs and 40 sub KPIs.

Based on the general design, the results of FEng Performance Measurement System using Academic Scorecard (ASC) model and NAA-HE standards, then it made the KPIs hierarchical structure as shown in Figure 2.

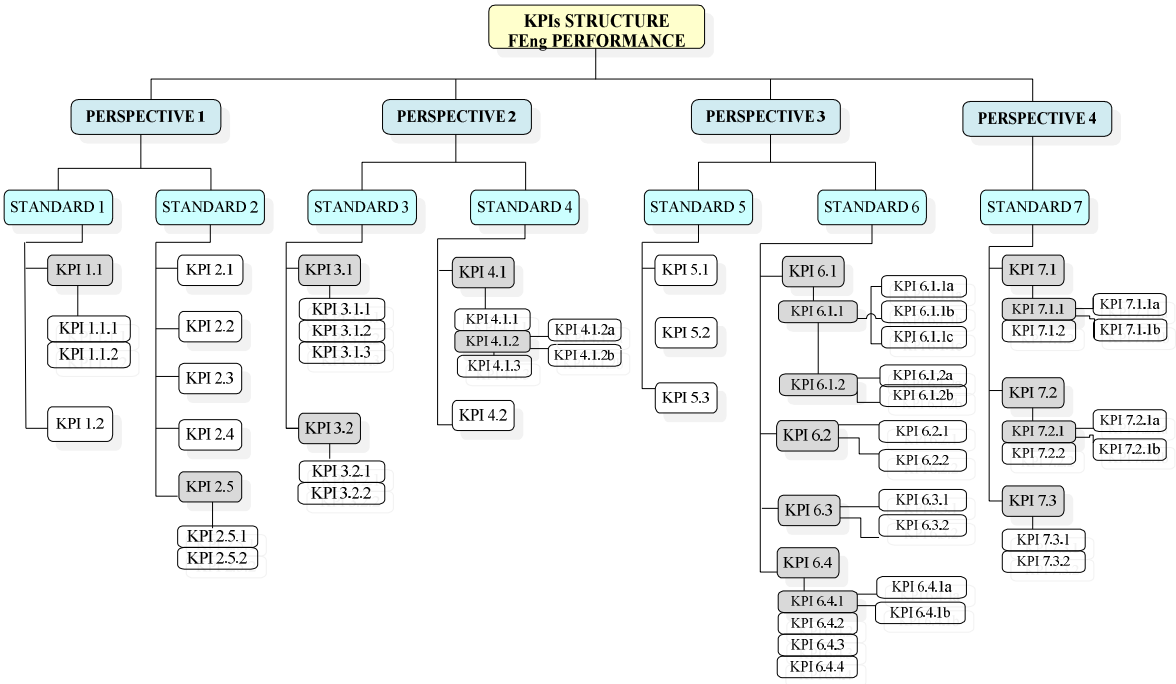

Figure 2. KPIs Hierarchy Structure of FEng Performance

Caption of Figure 2:

No.	Standard	Description
1	Standard 1	Vision, Mission, Goals and Objectives, and Strategy of Achievement
2	Standard 2	Governance, Leadership, Management System and Quality Assurance
3	Standard 3	Students and Graduates
4	Standard 4	Human Resources
5	Standard 5	Curriculum, Learning and Academic Atmosphere
6	Standard 6	Funding, Facilities and Infrastructure, and Information Systems
7	Standard 7	Research, Community Service and Cooperation
	KPI	**Description**
1	KPI 1.1	Vision, Mission, Goals, Objectives, and Strategy.
2	KPI 1.1.1	Having a vision, mission, goals, and objectives are clear and realistic.
3	KPI 1.1.2	Having a strategy of target achievement with clear timescales.
4	KPI 1.2	The level of understanding of the vision, mission, goals, and objectives of the Faculty by all internal stakeholders.
5	KPI 2.1	Having documents, data and information that is valid and reliable.
6	KPI 2.2	Have an organizational structure able to move institution function efficiently.
7	KPI 2.3	The level of Reach of Faculty leadership characteristics is powerful.
8	KPI 2.4	The level of compliance with SOP and completeness of the documents.
9	KPI 2.5	The implementing unit of quality assurance.
10	KPI 2.5.1	Having a quality assurance unit at the central level / faculty.
11	KPI 2.5.2	The level of implementation of quality standards are complete.
12	KPI 3.1	Admission of new students

13	KPI 3.1.1	The level of consistency in the implementation of new admissions with a complete document.
14	KPI 3.1.2	The ratio of new students who transfer against the new students who are not transfers.
15	KPI 3.1.3	The level of motivation of the transfer admissions.
16	KPI 3.2	The average of study period of graduates and average GPA.
17	KPI 3.2.1	The average value of graduate study period and the average GPA.
18	KPI 3.2.2	The level of efforts to develop and improve the quality of graduates.
19	KPI 4.1	Permanent lecturers.
20	KPI 4.1.1	The level of adequacy and qualification of lecturer in the Faculty.
21	KPI 4.1.2	Efforts to develop and improve the quality of full-time lecturers.
22	KPI 4.1.2a	The average value of lecturer workload is in the ideal range.
23	KPI 4.1.2b	The ratio of lecturers that task of studying and amount of study program (SP)
24	KPI 4.1.3	The level of the faculty effort in developing permanent lecturer staff.
25	KPI 4.2	The level of adequacy and qualification of educational staff.
26	KPI 5.1	The level of faculty role in the preparation, implementation and curriculum development.
27	KPI 5.2	The level of faculty role in monitoring and evaluating the learning process.
28	KPI 5.3	The level of participation / endorsement of the Faculty in the creation of academic atmosphere conducively.
29	KPI 6.1	Source and sufficiency of funds.
30	KPI 6.1.1	Source and sufficiency of funds.
31	KPI 6.1.1a	Total of operational funds per student per year.
32	KPI 6.1.1b	The average of research funding per permanent lecturer per year.
33	KPI 6.1.1c	The average value of the services / dedication to the community fund per year per permanent lecturer.
34	KPI 6.1.2	The adequacy of the funds obtained of the Faculty.
35	KPI 6.1.2a	Total funds insufficient all operational and development necessity.
36	KPI 6.1.2b	The level of funding development efforts.
37	KPI 6.2	Facilities: the value of considerable investment being made.
38	KPI 6.2.1	The level of investment for procurement of facilities.
39	KPI 6.2.2	The level of financial realistic and support for the facilities investment plan.
40	KPI 6.3	Infrastructure: the quality and adequacy of access and development plan.
41	KPI 6.3.1	The level of completeness of infrastructure for activities *Tridharma* of HE.
42	KPI 6.3.2	The level of planning and funding for provision of infrastructure completely.
43	KPI 6.4	Information Systems.
44	KPI 6.4.1	Information systems and facilities used by Faculty in the learning process.
45	KPI 6.4.1a	Have computers that are connected to a wide network / internet.
46	KPI 6.4.1b	Have computers that are connected to a wide network/internet with database software.
47	KPI 6.4.2	Accessibility of data in information systems.
48	KPI 6.4.3	The effectiveness of using the mailing list and email facilities.
49	KPI 6.4.4	Have a plan of development.
50	KPI 7.1	Research activities.
51	KPI 7.1.1	The number of research activities.
52	KPI 7.1.1a	The average value of the amount of research per lecturer per three years.
53	KPI 7.1.1b	The average of research funding amount per lecturer per year.
54	KPI 7.1.2	There are efforts and the effectiveness level of an increase the number of research and funds.
55	KPI 7.2	Services activities / dedication to the community (DtC).
56	KPI 7.2.1	Total activity, total funds of DtC, and efforts to the development of service activities / DtC.
57	KPI 7.2.1a	The average number of DtC activities per lecturer per three years.
58	KPI 7.2.1b	The average amount of DtC funds per lecturer per year.
59	KPI 7.2.2	There are efforts and the effectiveness of an increase the number of DtC activity and its funds.

60	KPI 7.3	The number and quality of effective cooperation that support the implementation of the Faculty mission.
61	KPI 7.3.1	Number of cooperation with institutions within the country, and its relevance to SP.
62	KPI 7.3.2	Number of cooperation with institutions abroad, and its relevance to the expertise field of SP.

In Figure 2 the KPI hierarchical structure of FEng performance shows that the hierarchical structure is composed of perspectives, standards, KPIs and sub KPIs. FEng performance is measured from every perspective and standards. Perspective performance of academic management is measured by KPI performance of standard 1 and standard 2, stakeholder perspective is measured by KPI performance of standard 3 and standards 4, internal business perspective is measured by KPI performance of standard 5 and standard 6, as well as the perspective of innovation and learning is measured by KPI performance of standards 7.

Assessment of performance includes the perspective performance, KPI performance and overall performance. Performance value is equal to the weight multiplied by the score. The weight is obtained from the questionnaire comparison of interests and software of Analytical Hierarchy Process (AHP). The score is obtained from Objective Matrix (OMAX), in which performance score of the OMAX body ranges on a scale of 0-10, which it means that there are 11 levels of achievement for each KPI, whereas evaluation using Traffic Light System (TLS) methods. If the performance values 0-3 (red) which means that performance achievements is low and priorities to be improved, performance values 4-7 (yellow) which it means that performance achievements is already good but it still needs improvement, and performance values 8-10 (green) which it means that performance achievements is an excellent performance. Currently the performance measurement process is still ongoing, so it has not obtained the results of the assessment yet.

Conclusion

Factors that influence on the designing of Faculty of Engineering (FEng) performance measurement system, namely the academic management, stakeholder, internal business, innovation and learning. Other factors that influence the appropriate NAA-HE standards are standard 1 up to standard 7.

The results of designing the FEng performance measurement system, involves determining strategic objectives, defining KPIs (Key Performance Indicators), formatting KPIs hierarchical structure, designing of weighting, FEng performance measurement and assessment. Based on the vision, mission, objectives and strategies can be created as strategic objectives in each perspective and NAA-HE standards.

Based on the strategic objectives, it can be determined that KPIs (Key Performance Indicators) and it obtained as much as 22 KPIs and 40 sub KPIs, which is consist of 11 KPIs and sub KPIs on the perspective of academic management (standard 1 and 2), 14 KPIs and sub KPIs on stakeholder perspective (standard 3 and 4), 24 KPIs and sub KPIs on internal business perspective (standard 5 and 6), and 13 KPIs and sub KPIs on innovation and learning perspective (standard 7).

The results of KPIs determination are then used as reference in making KPI hierarchical structure, weighting, measurement and assessment of FEng performance. Performance value 0-3 (red) which it means that performance achievements are low and priorities is needed to be improved, performance grades 4-7 (yellow) which it means that performance achievements are good but it still needs improvement, and the value of the performance 8-10 (green) which it means that performance achievements is excellent. Currently the process of performance measurement and assessment is still ongoing, so it has not obtained the results of the assessment yet. Later the measurement and assessment of the FEng performance can be used as a strategy for sustainable

performance improvement to support the accreditation of study programs and universities both at national and international levels.

Reference

Kaplan, R.S. and Norton, D.P. (2000), *Balanced Scorcard: Translating Strategy into Action*, Translated (in Indonesian) by Peter R., Erlangga Press, Jakarta.

Mubin, A. (2005), *Designing Performance Measurement Systems of PG. Kebon Agung Malang by using Sustainability Balanced Scorecard Methods*, Thesis, Industrial Engineering – ITS, Surabaya.

Mubin, A (2011), *Sustainability Balanced Scorecard Application As A Model For Designing The Industry's Environmental Performance Measurement Systems*, Paper on Internasional Conference by Association of Pacific Rim Universities (APRU), 4 - 5 July 2011, Tsinghua University, Beijing, China.

Mubin, A (2013), *Designing Sustainability Performance Measurement System**s** on Industry (The case study in the automotive component industry)*, Research Report of P2M-HDL Faculty of Engineering, UMM, Malang.

Mulyadi (2001), *Balanced Scorecard: Contemporary Management Tool for multiplier Company Financial Performance*, 2nd Edition, Salemba Empat Press, Jakarta.

NAA-HE (2008), *Accreditation of Study Program Guide*, Jakarta.

Neely, A. Gregory, M. and Platts, K. (1995), "Performance Measurement System Design: A Literature Review and Reseach Agenda", *International Journal of Operation & Production Management*, 15, 4, 80 – 118.

Neely, A. (2004), *Business Performance Measurement*, Cambridge University Press, UK.

O'Neil, Harold, E.M. Bensimon, M.A. Diamond, and M.R. Moore (1999), *Designing and Implementing an Academic Scorecard*, http://www.scholarshipofengagement.org/ benchmarking/ scorecard.pdf.

Riggs, J.L. (1987), *Production Systems: Planning, Analysis, and Control*, Fourth Edition, John Wiley & Sons, Singapore.

Saaty, T.L. (1993), *Decision Making for Leaders, Analytical Hierarchy Process for Decision Makers in Complex Situations*, Translated (in Indonesian) by Liana S., PT. Pustaka Binaman Pressindo Press, Jakarta.

Suartika, I.M, Patdono, S., and Syairuddin, B. (2007), Design and Implemention of Performance Measurement System with Integrated Performance Measurement Systems Methods (Case Study: Department of Mechanical Engineering, University of Mataram), *Journal of Industrial Engineering*, Vol. 9, No. 2, December 2007: 131-143.

Simons, R. (2000), *Performance Measurement & Control System for Implementing Strategy*, Prentice Hall, New Jersey.

Vanany, I. (2009). *Performance Measurement: Model & Application*, 2nd Prints, ITS Press, Surabaya.

Zaidah, Y. (2010), Performance Measurement of Faculty of Engineering, University of Trunojoyo Using Academic Scorecard (ASC) and Analytical Hierarchy Process (AHP) Methods, *Rekayasa*, Vol. 3, No. 2, October 2010: 108-114.