Design of Performance Management System for **Underground Mining Construction Using Integrated** Performance Management System

Agus Hotlan Napitu

Abstract—One of Underground Expansion Construction goal is to finish the underground mine expansion projects promptly which meet criteria of safety, cost and quality as well as client satisfaction. The project completion is very critical as it will directly affect the mine production commencement. In achieving the target, Underground Expansion Construction must continuously improve its productivity and performance by implementing suitable, comprehensive, and integrative performance management system framework. However, currently Underground Expansion Construction does not have performance management system that integrates resources, operation and organization output. The key performance indicator only focuses on the project progress and often disregard other important factors. Consequently, some problems exist and business performance is not optimal. The aim of this study is to assist Underground Expansion Construction by designing performance management system that can integrate all relevant aspects in its operation. The results of data analysis decides IPMS (Integrated Performance System) as the selected framework for mining construction since this framework is very comprehensive, easy to understand and suitable for construction context. By applying IPMS, Underground Expansion Construction is expected to nurture better performance and achieve its strategic objectives in 2020 as IPMS provide clear link between performance management system and business strategy. This research is limited to design of performance management system in Underground Expansion Construction as construction business unit under one of multinational mining company.

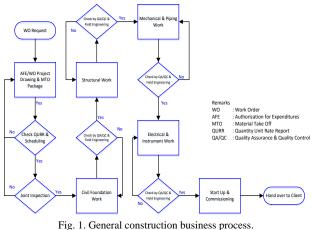
Index Terms-Construction, performance management system, projects, underground mine.

I. INTRODUCTION

Underground Expansion (UGX) Construction is one of business unit of a multinational mining company that explores, mines, and processes ore containing copper, gold and silver. This multinational mining company operates in Indonesia with two mining methods, the open-pit mining and underground mining. The open-pit mine is approaching its final stage and will be continued with underground mining method as the pit has been quite deep and no longer efficient and safe for open pit mining method. In order to anticipate this issue, the company is now working on development of new underground mine and expected to start its operation in next two years.

The main goal of UGX Construction is to construct all ore

flow system (crushers and conveyors) and underground fixed facilities such as mine offices, maintenance workshops, messhalls, health facilities, mosques, chapels, warehouses, etc. The project execution shall meet criteria of safety, schedule, cost and quality as well as client satisfaction. Completion of the project is very critical, as it will directly have impact on the mine production commencement. Company targeted the ore flow system phase one should be finished in January 2018 and phase two in 2022. In performing its tasks, UGX Construction is supported by Field Engineering, Project Control, QA/QC (Quality Assurance/Quality Control) and Safety team. UGX Construction has strategic objectives to be world class mining construction with zero fatality, on schedule, efficient cost and high quality in 2020. General construction business process is depicted in Fig. 1.



In accomplishing the tight schedule target, UGX Construction must continuously improve the productivity day by day. Any problem will potentially cause UGX Construction fail to achieve the goal and strategic objectives in 2020. This study emphasis on evaluation of current UGX Construction condition especially in term of performance management system. After identifying the issues and analyzing the root causes, suitable performance management system framework then selected and designed to help UGX Construction achieving its goal. Some recommendations are also provided in order to make strategic objectives in 2020 a success. The research is limited to design of performance management system in UGX Construction as underground mining construction business unit under one of mining company in Indonesia.

Manuscript received May 27, 2017; revised July 25, 2017.

Agus Hotlan Napitu is with School of Business and Management, Institut Teknologi Bandung (ITB), Bandung, Indonesia (e-mail: agus.hotlan@sbm-itb.ac.id).

II. BUSINESS ISSUE

Recently, UGX Construction faces some problems that directly impact to its performance. Lack of experienced and skilled employees in executing underground expansion project, poor safety performance, construction productivity declined and poor quality were the most discernible problems. Total manpower involving in underground construction is 1463 employees but 50.1% of them is classified as new hire and low skill. In term of safety performance, by the end of October 2016, it is recorded five serious injury occurred within UGX Construction division. Moreover, safety statistic indicates that accident trend tends to increase. Fig. 2 shows the safety performance of UGX Construction for the last 5 years. TRIR and LTIFR refer to Total Reportable Injury Rate and Lost Time Injury Frequency Rate. TRIR is a commonly used lagging indicator that measures Total Reportable Injury multiplied by 200,000 divided by the hours worked. Meanwhile, LTIFR measures Total Lost Time Injury multiplied by 200,000 divided by the hours worked.

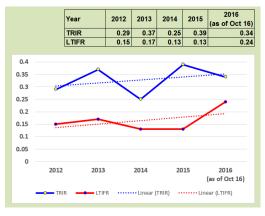


Fig. 2. Safety statistic for the last 5 years.

The other concern is related to progress of the project. Construction productivity weakened and some projects were delay. As of 31 October 2016, monthly productivity report showing productivity factor (PF) below the target and 7 of 37 active projects were behind schedule. Likewise, based on interview result with QA/QC (Quality Assurance/Quality Control) team, it was clearly observed the room for improvement in term of quality. Moreover, there were also complaints from client regarding the work quality.

Further analysis to find the root causes concluded that all above problems occurred due to UGX Construction does not have performance management system that integrates resources, operation and organization output. The current key performance indicator only focuses on the project progress and often neglect other important factors. Also, it was clearly noticed that between one key performance indicator and other was not linked and integrated. For that reason, a new PMS (Performance Management System) is certainly required in UGX Construction in order to improve the performance and achieve its strategic objectives.

III. RESEARCH METHODOLOGY

Research is started from problem identification and analysis regarding the PMS within UGX Construction. Afterward, the objective of the study defined, that is to enhance performance of mining construction and achieve its strategic objectives through a new PMS implementation. The literature review is used to determine the root cause and selecting the most suitable PMS for mining construction. Root cause is found out using an approach through examining the resources capability, internal process and organization output of UGX Construction. This approach is in reference to IPMS (Integrated Performance Measurement System) concept taken from book How to Create a World Class Company [1]. Hereinafter, data collection and processing is conducted. Data is obtained through interview, company's document and literatures such as books and earlier research. Finally, the new PMS for UGX Construction is designed using IPMS framework.

IV. BUSINESS SOLUTION

A. Alternative Business Solution

Preceding section concluding the problem that UGX Construction does not have Performance Management System (PMS) that integrates resources, operation and organization output can be resolved by designing and implementing new PMS [2], [3]. Performance management system in construction is mostly project-based, specifically the productivity issue in project management [4]. There are several kinds of performance management system framework which can be chosen such as MBNQA (Malcolm Baldrige National Quality Award), BSC (Balanced Scorecard), Performance Prism, and IPMS (Integrated Performance Management System).

1) MBNQA

MBNQA [5] is an award established by the U.S. Congress in 1987 to raise awareness of quality management and recognize U.S. companies that have implemented successful quality management systems. The dual goals of the Baldrige criteria [6] are to improve value to customers, which results in marketplace success, and to improve overall financial and company performance to meet the needs of shareholders, owner, and other stakeholders. MBNQA shows that it is not necessary to trade off financial results for satisfied employees or customers. MBNQA framework has seven perspectives known as Baldrige Criteria for Performance Excellence: leadership, strategic planning, customer and market focus, measurement, analysis and knowledge management, human resources focus, process management, business performance results.

2) Balanced scorecard

Balanced Scorecard [7], [8] is commonly used in the world and the standard for all performance management developed afterward. Balanced Scorecard measures organization's performance in four perspectives: financial, customer, internal process and learning and growth. However, the learning and growth perspective lead to confusion in implementation due to the multi-interpretation in implementation and measurement method has not been explained clearly [1]. In addition, Balanced Scorecard does not discussed the benchmarking procedure in details.

3) Performance prism

Performance Prism [9] is a PMS which update the Balanced Scorecard framework. Performance Prism

methodology projecting satisfaction to all interlinked stakeholders such as communities, customers, employees, government and suppliers. Some of Performance Prism weaknesses are only provide few performance standard, there is no template example, the benchmarking procedure is not described explicitly and the model is very complicated since it consists of 5 interrelated perspective [10], [11].

4) Integrated performance management system

Integrated Performance Management System [11] can be considered as a refinement of the Balanced Scorecard and Performance Prism concepts. Integrated Performance Management System combines the simplicity of Balanced Scorecard design and the Performance Prism attention on stakeholders. Integrated Performance Management System framework is comprehensive and easy to understand. Explanation of the process of designing is given in details, starting from performance management systems foundation, methods of analysis of the business environment information, how to connect to the strategy, performance measurement frameworks, measures performance management system updating process implementation and performance management system. Integrated Performance Management System methodology also discusses the benchmarking procedure clearly and easily implemented.

Comparison between four performance management system frameworks above [1] is shown in Table I. Considering the earlier review, Integrated Performance Management System (IPMS) is selected as suitable PMS framework for UGX Construction. This decision is based on its relevance to address problems in this study and its suitability for construction context. In addition, IPMS framework has several advantages [1] as cited below:

- Provide simple and structured approach which focus on process ad result.
- Support stakeholder to determine strategy, target and evaluate all together.
- Provide potential system to measure performance fairly in terms of roles, responsibility and reward determination.
- An excellent framework to determine accountability.
- Divide responsibility to all parties to improve performance.

B. IPMS Design

A good performance management system should have a

Performance No Aspect MBNQA **Balanced Scorecard** IPMS Prism 1 Procedure to design PMS Stated explicitly Stated explicitly General overview Stated explicitly Explicit examples from Framework and Design of PMS (e.g. framework, Framework and Framework, distinct model, 2 empirical companies' example, suggestion) examples distinct model example and detail indicator data 3 perspectives and 9 3 Level/Perspective 7 perspectives 4 perspectives 5 perspectives sub-perspectives which are inter correlated Stated clearly on Stated clearly on each Stated clearly on 4 Stated clearly on each perspective Reason on choosing variable each perspective each perspective perspective 5 Knowledge-based approach No No Yes No Portrait in Discussed Not discussed 6 Benchmarking Process Discussed clearly perspective 7 conceptually explicitly Specifically described (using Described in the Clearly 7 Variable linkage No framework Correlation Analysis/AHP/Gap distinguished perspectives Analysis)

TABLE I: COMPARISON OF PERFORMANCE MANAGEMENT SYSTEM FRAMEWORK

closed connection with accountability, in which contains performance indicator as a target and measurement reference. The good performance management system should outline seven criteria [12]:

1. Directly related to corporate strategy.

2. Variables should be measured by non-financial measurement.

3. Flexible and varies depending in the location of company.

4. Dynamic, constantly updated in line with changing times.

5. Simple feedback for the operator and manager in charge.

6. Quick feedback for the operator and manager in charge.

7. Directed to the improvement not only monitoring.

PMS for UGX Construction will be designed in reference to the Integrated Performance Management System (IPMS) framework [1] as depicted in Fig. 3. The IPMS framework comprises five stages; stage 0 - Foundation, stage 1 - Basic Information, stage 2 - Design, stage 3 - Implementation and stage 4 - Refreshment but this study only discuss until stage 3 as this PMS is new for UGX Construction.

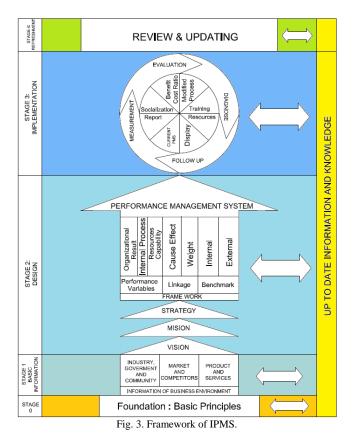
1) Stage 0: Foundation:

In developing a good performance management system in the mining construction, there are four guiding principles and five rules as a foundation for designing integrated performance management system [1]. The principles are partnership between construction stakeholders, empowerment of employees, integrated performance improvement and independent team. In addition to those principles, the rules should be applied in designing integrated performance management system are simple and easy to understand, long-term oriented, time based, focus on continuous improvement and using quantitative approach.

2) Stage 1

Basic Information: Basic information of business environment is required as input in designing PMS for UGX Construction. As UGX Construction is one of business unit that serves company operation, the basic information only refer to the information regarding business process and the product created by UGX Construction.

Construction business process has been presented in Fig. 1. The UGX Construction product is mining construction completion that meet criteria of safety, schedule, cost and quality as well as client satisfaction.



3) Stage 2: design

IPMS stage 2 contains vision, mission, and strategy and PMS framework including performance variable, linkage and benchmark. This stage start with vision, mission and strategy. As one business unit that serves company operation especially in preparing mining infrastructure prior to production commencement, UGX Construction does not have particular vision and mission but has a strategic objectives. UGX Construction follows the vision and mission of company as stated below [13]:

- Vision: To be a world-class mining company that creates excellent values and is a source of pride for all stakeholders including employees, society and the nation.

- Mission: Committed to creatively transform natural resources into prosperity and sustainable growth through best mining practices.

As stated earlier, UGX Construction has strategic objectives that is to be world class mining construction with zero fatality, on schedule, efficient cost and high quality in 2020. Strategic objectives are one of fundamental building blocks of strategic plan. Strategic objectives are long-term and should be aligned with organization mission and mission. By comparing the UGX Construction strategic objectives and company's vision and mission above, it can be concluded that strategic objectives is already good and aligned with vision and mission of the company. Hence, the strategic objectives can be translated into strategy in the designing of the new performance management system. Business strategies of UGX Construction are as follows;

1. Applying integrated project management in organizing the project execution.

2. Enhancing safety behavior and implementing accident prevention program.

3. Improving employees' knowledge and skills in executing the construction projects.

4. Implementing cost efficiency program.

Those strategies are then interpreted into performance variables that will be elaborated in the performance management system framework. Performance variables of the Integrated Performance Management System consists of three perspectives: organization output, internal process and resources capability. Organization output, internal process and resources capability has two aspects, four aspects and three aspects accordingly. Each perspective can be broken down into aspect as shown in Table II.

Perspective	Aspect				
	Financial				
Organization output	Nonfinancial				
	Innovation Process				
	Operation Process				
Internal Process	Marketing Process				
	Aftersales Services				
	Human Capital Resources				
Resources Capability	Technology Resources				
	Organization Resources				

TABLE II: IPMS PERSPECTIVES

Performance Variable

In accordance with Table II and UGX Construction business strategy, performance variables is developed for each relevant aspect. The relevant aspects for UGX Construction are financial, nonfinancial, innovation process, operation process, human capital resources, technology resources and organization resources. There are twenty three performance variables developed for UGX Construction. The detail of performance variables is presented in Appendix.

Variable Linkage

The linkage between performance variables is very important in performance management. Some methods that can be used to explore the performance variables linkage are factor analysis, correlation analysis, fishbone diagram and Analytic Hierarchy Process [1]. The linkage among variables for each perspective is illustrated in Fig. 4.

Fig. 4 exhibits that linkage among variables will ease improvement process to variable which have not achieve the target yet. Basically, the logic for the linkage is resources capability becomes direct input to internal process, and internal process become direct input to organizational result. For example, schedule compliance is influenced by performance factor, process innovation, schedule planning deviation, hours improvement per task and rework whilst productivity factor is affected by employees absenteeism, employees skills, equipment availability, literature availability, leadership, culture and team work. Therefore, in order to improve schedule compliance, UGX Construction must put the priority on those seven factors.

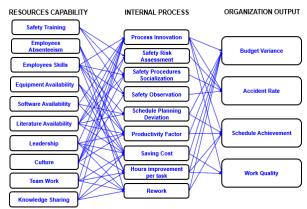


Fig. 4. UGX Construction performance variable linkage.

Benchmarking

Benchmarking is the systematic search for best practices, innovative ideas, and highly effective operating procedures to learn from others what they do right and then imitate it to avoid reinventing the wheel [14]. The essence of benchmarking is to encourage continuous learning and to lift the organization to a higher competitive level [15]. By performing benchmarking, organization can know the best practices and improving its performance [16]. In this study, benchmarking is carried out by using internal benchmarking type. Internal benchmarking compares against the best within the same organization or corporation [17].

Benchmarking is conducted to other business unit within company that executing general infrastructure construction in lowland area, called as Lowland Construction. Lowland Construction is considered as better construction in term of performance compared to UGX Construction. This business unit is established in 1990 and has many experiences in executing the construction project. Benchmark result for performance variable in 2015 is described in Table III.

Performance Variable (Year 2015)	UGX Construction	Lowland Construction						
TRIR (Total Reportable Injury Rate)	0.39	0.37						
LTIFR (Lost Time Injury Frequency Rate)	0.13	0.00						
Average Productivity Factor (PF)	0.98	1.03						
Average Spending Cost	Over budget	On Budget						
Safety Training Achievement	95%	100%						
Employee Absenteeism	3%	3%						
Rework	5%	0%						

TABLE III: BENCHMARKING RESULT

4) Stage 3 implementation

There are four main pillars in implementing performance management system which is performance measurement, evaluation, diagnosing, and follow up. To support those pillars, the new performance management system must consider some aspects including current performance management system, the report must be supported by the new current PMS, socialization, analysis of benefit to cost ratio, training, resources allocation and communicative display [1]. The major steps in implementing this new PMS are finalization by senior management or steering committee, resources adjustment, socialization to all employee levels and implementation within UGX Construction activities.

Report and Display

The report specification should be sorted according to the purpose, whether to executives or operational level. Each level has a different regarding depth, detail and period of report. The report of performance management system should be designed as real time reporting and can be accessed online for both performance information and decision making aspect.

Displaying performance data to internal business unit will help each individual and team to increase the spirit and competitive work environment. The attractive and better way in communicating performance to all stakeholders is via display graphic such as spider-web diagram and dashboard. The example of display graphic for UGX Construction's performance management system is presented in Fig. 5. Performance of 50% or below will be considered as low performance and the ceiling indicated by red line. Meanwhile, the green and blue line indicate the target and actual achievement respectively.

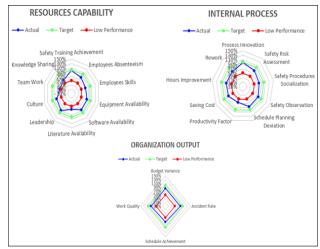


Fig. 5. UGX Construction performance display.

V. CONCLUSION AND RECOMMENDATION

To resolve the issues in UGX Construction regarding performance management system, Integrated Performance Management System (IPMS) is chosen as framework. The reason for this selection is due its simple design, relevant to address problems and its suitability for construction context. By implementing IPMS, UGX Construction is expected to gain better performance so that the goal and the strategic objectives in 2020 can be achieved.

Strong commitment and solid teamwork from all employee levels within UGX Construction are toughly required in implementing the new performance management system. IPMS shall be cascaded down from management level until operational level in order to make the performance measurement, evaluation, diagnosing, and follow up process run well and smoothly. Finally, as this study may be not cover all aspects and construction's business environment may change anytime, the regular review and continuous improvement process should be done for enhancing and perfecting this IPMS design.

Perspectiv				ARIABLES FOR UG Indicator					
e	Aspect	Variable	Objectives	(KPI)	Formula	Standard	Period	Target	Status
	Financial	Budget Variance	To measure how good planning and implementing accuracy of project budgeting in meeting the cost target.	% budget variance	(Actual cost finished project - Budget) : Budget	0% - 5 %: Excellent >5% - 10%: Good >10% - 20%: Poor >20% - 40%: Very Poor >40%: Extremely Poor	Annually	<10%	New
Organizatio n Output		Accident	To measure and reduce the accident rate (TRIR, LTIFR),	TRIR (Total reportable injury rate)	(Total reportable injury x 200.000) : total workhours	TRIR below 0.22	Annually	<0.22	New
		Rate	to measure compliance to the safety standard	LTIFR (lost time injury frequency rate)	(Total lost time injury x 200.000) : total workhours	LTIFR below 0.05	Annually	<0.05	New
	Non-Finan cial	Schedule Achievement	To measure and improve how good the project execution in meeting the schedule target.	% project finished as per schedule.	(Total project finished as per schedule : total project)	100 %: Excellent 97.5% - <100%: Good 95% - <97.5%: Poor 92.5% - <95%: Very Poor <92.5%: Extremely Poor	Annually	>97.5%	New
		Work Quality	To measure and enhance how good quality of project in satisfying the client.	% satisfied client	(Total satisfied client : total client)	100 %: Excellent 97.5% - <100%: Good 95% - <97.5%: Poor 92.5% - <95%: Very Poor <92.5%: Extremely Poor	Annually	ually >97.5%	New
Internal Process	Innovation	Process Innovation	To measure the improvement of construction process through innovation	% new better and safer work method	Number of new work method standard : number of target based on deliverable list	>= 80 %: Excellent 60% - <80%: Good 40% - <60%: Poor 20% - <40%: Very Poor <20%: Extremely Poor	Annually	>60%	New
	Operation	Safety Risk Assessment	To measure and improve safety risk assessment process.	Risk assessment achievement	(Actual risk assessment - target) : target	100 %: Excellent 97.5% - <100%: Good 95% - <97.5%: Poor 92.5% - <95%: Very Poor	Annually	>97.5%	New

Perspectiv e	Aspect	Variable	Objectives	Indicator (KPI)	Formula	Standard	Period	Target	Status
						<92.5%: Extremely Poor			
		Safety Procedures Socialization	To measure and increase the effectiveness of safe procedure socialization	Achievement of safe procedure socialisation	Total safe procedures socialized : total existing procedures	100 %: Excellent 97.5% - <100%: Good 95% - <97.5%: Poor 92.5% - <95%: Very Poor <92.5%: Extremely Poor	Annually	>97.5%	New
		Safety Observation	To identify and improve safety observation quantity and quality on construction workforces	% safety observation achievement	Total safety observation : total target	100 %: Excellent 97.5% - <100%: Good 95% - <97.5%: Poor 92.5% - <95%: Very Poor <92.5%: Extremely Poor	Monthly	>97.5%	New
		Schedule Planning Deviation	To measure and enhance the accuracy of schedule plan	% average of deviation from schedule plan	(% progress - % plan) : (%plan)	0% - 5 %: Excellent >5% - 10%: Good >10% - 20%: Poor >20% - 40%: Very Poor >40%: Extremely Poor	Annually	<10%	New
		Productivity Factor	To measure and improve the productivity in executing the project.	Productivity factor (PF)	Total hours budgeted : total hours consumed	>= 1.05: Excellent 1.00 - <1.05: Good 0.90 - <1.00: Poor 0.80 - <0.90: Very Poor < 0.80: Extremely Poor	Monthly	>1.00	New
		Saving Cost	To measure and improve the cost efficiency of ongoing project.	% saving cost	(Budget - actual cost ongoing projects) : budget	>= 10 %: Excellent 5% - <10%: Good 2% - <5%: Poor 0% - <2%: Very Poor < 0%: Extremely Poor	Quarterly	>5%	New

Perspectiv e	Aspect	Variable	Objectives	Indicator (KPI)	Formula	Standard	Period	Target	Status	
		Hours improvement per task	To measure and improve the hours consumed for similar task	% average of hours improvement for similar task	(Average hours previous task - average hours current task) : average hours previous task	>= 5 %: Excellent 2% - <5%: Good 1% - <2%: Poor 0% - <1%: Very Poor < 0%: Extremely Poor	Annually	>2%	New	
		Rework	To identify the time spent for rework and prevent it.	Rework hours	Total rework hours : total project hours	<1%: Excellent >1% - 2%: Good >2% - 3%: Poor >3% - 5%: Very Poor >5%: Extremely Poor	Annually	<2%	New	
Resources Capability	Human Capital		Safety Training	To measure and increase employees knowledge on safety	Safety mandatory training achievement	(achievement : target)	100 %: Excellent 97.5% - <100%: Good 95% - <97.5%: Poor 92.5% - <95%: Very Poor <92.5%: Extremely Poor	Annually	>97.5%	New
		Employees Absenteeism	To measure and minimize employees absenteeism	% Absenteeism	(total absenteeism : total scheduled working day)	<=1%: Excellent >1% - 2%: Good >2% - 3%: Poor >3% - 5%: Very Poor >5%: Extremely Poor	Annually	<2%	New	
		Employees Skills	To measure and increase employees competency	% on the job training (OJT)	(total attendance : total employees)	100 %: Excellent 97.5% - <100%: Good 95% - <97.5%: Poor 92.5% - <95%: Very Poor <92.5%: Extremely Poor	Annually	>97.5%	New	
	Technolog y	Equipment Availability	To measure and increase equipment availability in supporting construction job	Equipment availability	Total equipment available : equipment needs	100 %: Excellent 97.5% - <100%: Good 95% - <97.5%: Poor 92.5% - <95%: Very Poor <92.5%: Extremely Poor	Annually	>97.5%	New	

Perspectiv e	Aspect	Variable	Objectives	Indicator (KPI)	Formula	Standard	Period	Target	Status
		Software Availability	To measure and increase software availability in supporting construction job	Software availability	Total software available : Total software needs	100 %: Excellent 97.5% - <100%: Good 95% - <97.5%: Poor 92.5% - <95%: Very Poor <92.5%: Extremely Poor	Annually	>97.5%	New
		Literature Availability	To measure and increase literature availability in supporting construction job	Construction codes and standard availability	Total construction codes and standard available : Total codes and standard needs	100 %: Excellent 97.5% - <100%: Good 95% - <97.5%: Poor 92.5% - <95%: Very Poor <92.5%: Extremely Poor	Quarterly	>97.5%	New
		Leadership	To measure and improve leadership level within organization.	Leadership effectiveness index	Survey result	>= 80 %: Excellent 70% - <80%: Good 60% - <70%: Poor 50% - <60%: Very Poor <50%: Extremely Poor	Annually	>70%	New
	Organizatio n	Culture	To measure and increase employees understanding and application regarding organization culture.	Strategy and value understanding level	Survey result	>=80 %: Excellent 70% - <80%: Good 60% - <70%: Poor 50% - <60%: Very Poor <50%: Extremely Poor	Annually	>70%	New
		Team Work	To measure and improve team work level within organization.	Team work level	Survey result	>= 80 %: Excellent 70% - <80%: Good 60% - <70%: Poor 50% - <60%: Very Poor <50%: Extremely Poor	Annually	>70%	New
		Knowledge Sharing	To measure and activate knowledge sharing within organization.	Knowledge sharing level	Survey result	>= 80 %: Excellent 70% - <80%: Good 60% -	Annually	>70%	New

Perspectiv e	Aspect	Variable	Objectives	Indicator (KPI)	Formula	Standard	Period	Target	Status
						<70%:			
						Poor			
						50% -			
						<60%:			
						Very Poor			
						<50%:			
						Extremely			
						Poor			

ACKNOWLEDGMENT

Author thanks Prof. Dermawan Wibisono, PhD, Bambang Muliano, Hansen Berman and Marta Sim for all knowledge sharing, helps and supports during the research and paper writing.

REFERENCES

- [1] D. Wibisono, *How to Create a World Class Company*, Penerbit ITB, 2016.
- [2] M. Armstrong, Performance Management: Key Strategies and Practical Guidelines, 3rd ed., Philadelphia, USA: Kogan Page Ltd, 2006.
- [3] F. Deng, H. J. Smyth, and A. M. Anvuur, "A critical review of PMS in construction: Towards a research agenda," 28th Annual ARCOM, Edinburgh, UK, September 2012.
- [4] H. A. Bassioni, A. D. F. Price, and T. M. Hassan, "Performance measurement in construction," *J. Manage. Eng.*, vol. 20, no. 2, pp. 42-50, 2004.
- [5] ASQ. (2016). Malcolm Baldridge national quality award overview. ASQ, The Global Voice of Quality. [Online]. Available: http://asq.org/learn-about-quality/malcolm-baldrige-award/overview/ overview.html
- [6] M. Brown, Baldrige Award Winning Quality: How to Interpret the Baldrige Criteria for Performance Excellence, 17th ed., CRC Press Book, 2008.
- [7] R. S. Kaplan and P. D. Norton, *The Balanced Scorecard: Translating Strategy into Action*, Boston, MA: Harvard Business School Press, 1994.
- [8] S. R. Kaplan and P. D. Norton, The Strategy Focused Organization: How Balanced Scorecard Companies Thrive in the New Business Environment, Harvard Business Review, 2001.

- [9] A. Neely, C. Adam, and M. Kennerly, *The Performance Prism The Scorecard for Measuring and Managing Business Success*, London, UK: Pearson Education Limited, 2002.
- [10] K. Lunger, "Why you need more than a dashboard to manage your strategy, business," *Intelligence Journal*, vol. 11, no. 4, pp. 8-11, 2006.
- [11] D. Wibisono, Manajemen Kinerja: Konsep, Desain dan Teknik Meningkatkan Daya Saing Perusahaan, Penerbit Erlangga, 2006.
- [12] D. Wibisono, Manajemen Kinerja Korporasi dan Organisasi, Penerbit Erlangga, 2011.
- [13] The PTFI website. (2016). *About PTFI*. [Online]. Available: http://ptfi.co.id
- [14] D. H. Besterfeild, C. Besterfeild, G. H. Besterfeild, and M. Besterfeild, "Total quality management," *Pearson*, USA, 2003.
- [15] D. Wibisono and M. Khan, "The conceptual framework of knowledge-based performance management system," *Gadjah Mada International Journal of Business*, vol. 12, no. 3, pp. 393-414, September 2010.
- [16] M. S. Attiany, "Competitive advantage through benchmarking: Field study of industrial companies listed in Amman stock exchange," *Journal of Business Studies Quarterly*, vol. 5, no. 4, 2014.
- [17] Andersen, "Industrial benchmarking for competitive advantage," *Human Systems Management journal*, vol. 18, 1993.



Agus Hotlan Napitu was born in Samosir Island on August 5, 1985. He attained bachelor degree in 2008 from Electrical Engineering Department, University of Indonesia, Indonesia and currently as an MBA student at School of Business and Management, Institut Teknologi Bandung, Indonesia.