PERFORMANCE MEASUREMENT OF PROJECT MANAGEMENT BY USING FANP BALANCED SCORECARD

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ABSTRACT

The Project management (PM) is the implementation of knowledge, processes, tools, and techniques which is needed to manage business processes to create unique product or service. The PM has complexly business process, for monitoring performance of all PM activity be completely and align with business strategy is needed high effort. For this reason, we propose method to measure project performance by using Balanced ScoreCard (BSC) strategy, where keys performance source of BSC is produced by Project Integration Management (PIM). Where the PIM is one of the domains in PM to consolidate other domains activities, they are cost, time, procurement, communication, and also risk management. Inorder to compute Key Performance Indicator (KPI) in many perspective quadrants of BSC, we need computation method to measure priority and weighting value of PIM performance, on this study we use Fuzzy Analytical Network Processing (FANP) to measure qualitative and quantitave by comparing weighting priority between many KPI's in BSC. Furthermore in testing phase, we use data from The SAP Rollout Project in PT. Semen Indonesia Tbk., where from the final result we acquired weighting priority in many perspectives of BSC quadrants to support decission support system for this project. From this study, we have significant contribution to determining strategy to assessment KPI's in BSC perspectives from the PM based on The Project Management Body Of Knowledge (PMBOK), and method to implement FANP to measure weighting priority for this KPI's by modify input methode from quantitative values to qualitative grades.

Keywords: *Project Management(PM), Project Integration Management(PIM), Balanced Scorecard(BSC), Fuzzy Analytic Network Process (FANP), Decission Support System (DSS)*

1. INTRODUCTION

Today, business environment is highly volatile due to uncertainty condition, Therefore many companies are required to be competitively and efficiently in managing they resources. For this reason, many companies prefer to use temporary base resources. Project management business process is being adopted for enterprise resource management, within based on a temporary endeavour designed to produce a product or service that is specific and unique[1].

In our previous study, we have built enterprise management based on project management within prefer to *Project Management Body Of Knowledge* (PMBOK) methodology. PMBOK provides overall knowledge and methodologies to integrate, plan, execute, monitor and complete a project management cycle. it is shown in the Figure 1, that the enterprise software for project management within adopted the PMBOK methodology [2].

On the IT implementation, enterprise information system does not just applied to operational data transactions, but it has also the capacity to do the measurement of the performance of business informations that have been carried out. Through the integration of new technologies, processes and business environments into decision support paradigm, it can be enable to improve performance**.** *The Integrated Decision Support System* (IDSS) have been expanded and upgraded to fulfill these requirement[3].

From previous studies, Barclay has developed a method for measuring the performance of the project implementation within many

viewpoints as well as stakeholder benefits (e.g., customer satisfaction), product benefits(competitive advantage, financial rewards) and the future impact of the company's (value, personal growth, etc.) [4], and the multi-dimensional measurement implemented of the Balanced Scorecard strategy approach (Kaplan and Norton, 1990).
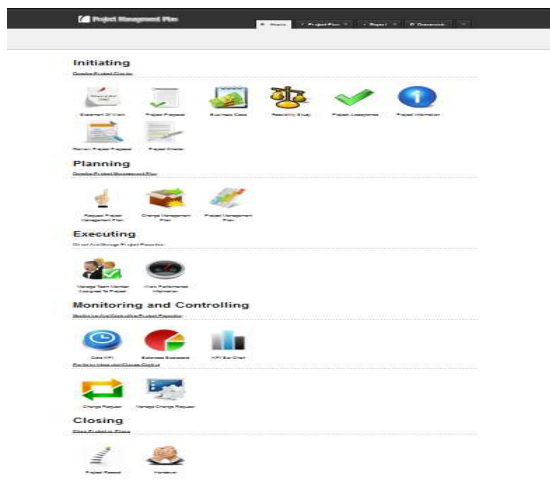

Figure 1: Enterprise Software for project management based on PMBOK methodology [2]

By the using of BSC, it needs a method for measuring the weighting priority, where many studies has done to apply any various methodology, such as:

1. By the using of *multicriteria decision aiding methodology constructivist* (MCDA-C) method, Tadeu combine qualitative and quantitative measurements to support decision makers, which apply the model to guide the search for actions in order to select and prioritize projects put forward by managers [5].

2. The using of *Hierarchy Analytical Processing* (AHP) as well as used in the measurement of the complexity and quality of project implementation with qualitative approach by Vidal, it is able to highlight project complexity sources when building up the global complexity scale and the subscales [6].

3. In particularly, through an emphasis on measuring performance quantitatively, which used statistic approach of *Principal Component Analysis* (PCA), Zaver implemented it to determine the priority of

stages and activities, that have dominant influence on the project works [7].

Form the methods that have been studied yet there is gap for a comprehensive performance measurement by combining quantitative and qualitative measurements, especially in determining weighting priorities for KPI's in the BSC strategy. Therefore this study proposes an integrated method for qualitative and quantitative measurements on KPI's BSC by using FANP. Furthermore the assessment to extracting of many source value of KPI's is adopting the international standardization of business process of project management, based on framework of PMBOK methodology, while in definitive scope only use one of Risk domain knowledge that is implemented by Goldy for maintenance policy selection in industrial unit, based on risk modeling assessment [8].

2. METHODOLOGY

2.1 Project Integration Management (PIM)

According to the PMBOK business process, performance measurement is integrated through the integration process within the PIM [1]. It is intended to direct and control in focus individual process that is monitored by the project manager to keep in accordance with the project planning. Which in practice, KPI's measurement is doing on the *Monitoring and Controlling Project Work* activity.

As shown in the context diagram at Figure 8 (*in the supplement page*), the mapping strategy of KPI's objectives in accordance with the BSC perspective. From the each KPI's also needs assessment of data source and formula for calculate many data transaction, which data sources are collected by PIM from others project management domains such as cost, time, procurement, communication, and risk management as shown in Table 5 (*in the supplement page*). This concept have been compared with other way assessment by using the value management approach [8].

2.2 FANP Qualitative and Quantitative measurement

There are strong argument in the using of FANP method. Firstly, the AHP method is still not able to solve the decision which have many alternative criterias, whereas the four perspectives of balanced scorecard have many sub criteria as an alternative criteria. Secondly, ANP is a

generalization of AHP, when using ANP method although it has been able to deal with problems that have sub-criteria, but the ANP still has not been able to handle qualitative assessment. Whereas in this case, the representation of the balanced scorecard KPI assessment is not only oriented to quantitative weighting, but also to qualitative which is represented as linguistically scale. Therefore, FANP was able to solve a decision other than the quantitative aspect as well as in qualitative form.

FANP method is extension of AHP and ANP priority method within *Fuzzy* logic weighting method. FANP was represented by *Triangular Fuzzy Number* (TFN) value Chang[9]. Where the left point, right point, and the midpoint of the linguistically variables are stretched for measuring the performance of the best alternative in every TFN criteria [10]. As Multicriteria Decision Making (MCDM), this method still can combined by other methods like TOPSIS [11]. In FANP, *Extend Analysis* is used to evaluate relatively criteria and also sub criteria power between fuzzy of pair wise of KPI's.

While the data sources from KPI's is in quantitative value of the data transactions, we need to normalize them into qualitative grades, it is shown in Table 1. Where as one way to give qualitative grades by simple ABCDE, this method can also used to give qualitative output comparison as well as ABC grades[12].

Table 1: Conversion KPI's From Quantitative Value Into Qualitative Grades.

KPI	Grade
KPI>=0.85	A
0.85>KPI>=0.75	B
0.75>KPI>=0.65	C
0.65>KPI>=0.45	D
KPI<0.45	E

To perform pair wise of weighting priority of KPI's dependence between criteria and sub criteria in inner dependence, the grade levels converted to the weighting priority level with AHP evaluation 1 to 9 in odd numbers, it is shown in Table 2. This method is objectively than commonly by using quiz evaluation from stakeholders opinion. Its justification is shown in Table 3.

Table 3: Comparation Of KPI's Pair Wise Priority Weighting

\	A	B	C	D	E
A	1	3	5	7	9
B	1/3	1	3	5	7
C	1/5	1/3	1	3	5
D	1/7	1/5	1/3	1	3
E	1/9	1/7	1/5	1/3	1

Table 3: Qualitative definition of KPI's priority weighting.

Weight	Definition
1	Both KPI are equal important
3	One KPI moderat important than other
5	One KPI stronger important than other
7	One KPI very stronger than other
9	One KPI extreme stronger than other

In next stages, we manage the data according to the standard FANP, where the complete process of FANP in BSC perspective is shown in flowchart at Figure 2.
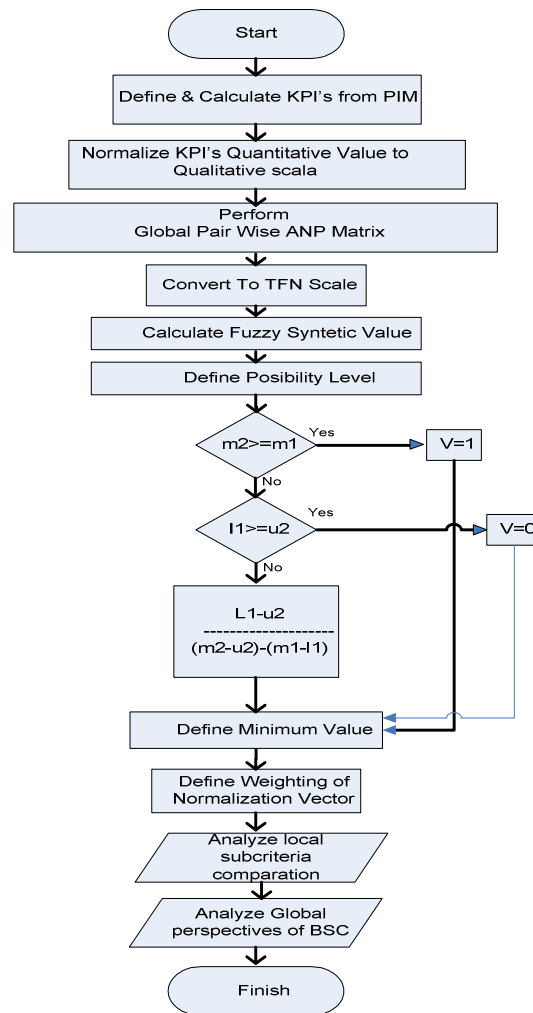

Figure 2: Flowchart of FANP-BSC Process[10]

3. RESULT and DISCUSS

By the finally result of FANP we get weight priority within KPI's BSC, with dependent relation each others, it is shown in Table 4 and visualized in Graph at Figure 3. Where in the four perspectives of BSC, the largest percentage in positive type of KPI found the best performance activity that is

contained in the Finance, while the weakest performance is found in the Customer.

Table 4: Evaluation of weighting priority on KPI's of BSC perspectives by using FANP

Criteria of Perspective	Sub Criteria	Weight	Weight Type	Total
Financial	ROA	0.0	0.00	+	
	CPI	0.40	0.26	+	
	TATO	0.20	0.14	+	0.66
	SPI	0.40	0.26	+	
0.66	ROE	0.0	0.00	+	
Internal Business Process	POD	1	0.23	-	0.23
0.23	POMS	0	0.00	-	
Learning Growth	ET	0.00	0.00	-	
	PLT	0.00	0.01	-	
	POCR	0.36	0.04	-	0.11
	POTR	0.39	0.04	-	
0.11	POSR	0.25	0.02	-	
Customer	CS	0.50	0.00	-	0.00
0.00	NOMV	0.50	0.00	+	

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Pie Chart Balanced ScoreCard

Finance   Internal Process   Learning And Growth   Customer

Figure 3: Graph of BSC Multi-Perspective Performance

3.1. Financial Perspective

Figure 4. KPI performance in the BSC Financial Perspective

Table 5. Performance Evaluation of Financial Perspective

KPI	Value	Validation
ROA	0	The project has not been able to deliver financial profits appropriated with the asset utilization
CPI	0,26	The project was able to perform products and services appropriated with expenditure cost
TATO	0,14	The project was able to use assets efficiently
SPI	0,26	Project defrayal appropriated with activity workbase
ROE	0	The project has not been able to deliver financial revenue

3.2. Internal Process Perspective

Figure 5: KPI performance in BSC Internal Process Perspective

Table 6. Performance Evaluation of Internal Process Perspective

KPI	Value	Validation
POD	0.23	Many delay occurs over works activity
POMS	0.00	Sequence of activities is agree with workbase

3.3. Learning and Growth Perspective

Figure 6: KPI performance in BSC Internal Process Perspective

Table 7. Performance Evaluation of Learning and Growth Perspective

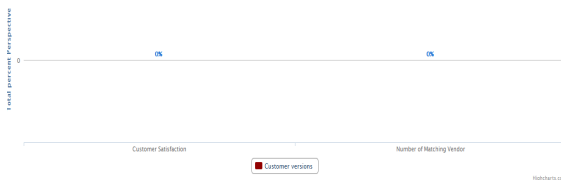| KPI	Value	Validation
ET	0	employee displacement does not occur within the project
PLT	0.01	lower absenteeism
POCR	0.04	Found moderate level of financial risk
POTR	0.04	Found moderate level of time risk
POSR	0.02	Found low level of financial risk

3.4. Customer Perspective

Figure 7: KPI performance in BSC Customer Perspective

Table 8. Performance Evaluation of IP Customer

KPI	Value	Validation
CS	0	Yet ready customer services
NOMV	0	Yet vendors complain

Within finance performance achieve over 66%, So it can be concluded that the implementation of the SAP project at PT. Semen Indonesia Tbk. focuses on the perspective of Finance, where indicated the high priority of the using of capital and assets, but the direct profits of the products is still low, because The SAP products and its services is products and services that is consumed for internal needs and not be a commercial product for sale to external customer.

Furthermore on the Internal business reached 23% at a moderate rate where workbases planning and activities are well defined, but in practically are still have a high level of delay. While on the learning and growth 10.76%, shows the activity of socialization and technical support is still low but in execution is prevalently on all areas. And the last indicated to service customer stakeholder value 0%, because this project is an internal project, so the customer is only internal managerial PT. Semen Indonesia Tbk., and there a complaint against the service management of external stakeholders is still yet. Results of performance of the balanced scorecard analysis on this study, furthermore can be used as a preference in knowledge management system[13], which determining the strategic policy for *The Decision Support System* [14].

4. CONCLUSION

The results of this study concluded, The BSC analyzing can develop strategy model to measure performance from multi domain perspective of project management, which used to support any stakeholders especially project managers that are involve in the project management to manage and improve quality of project business processes.

5. RELATED WORKS

Furthermore, to increase capability of this information system, we need to develop knowledge management system to support the IDSS.

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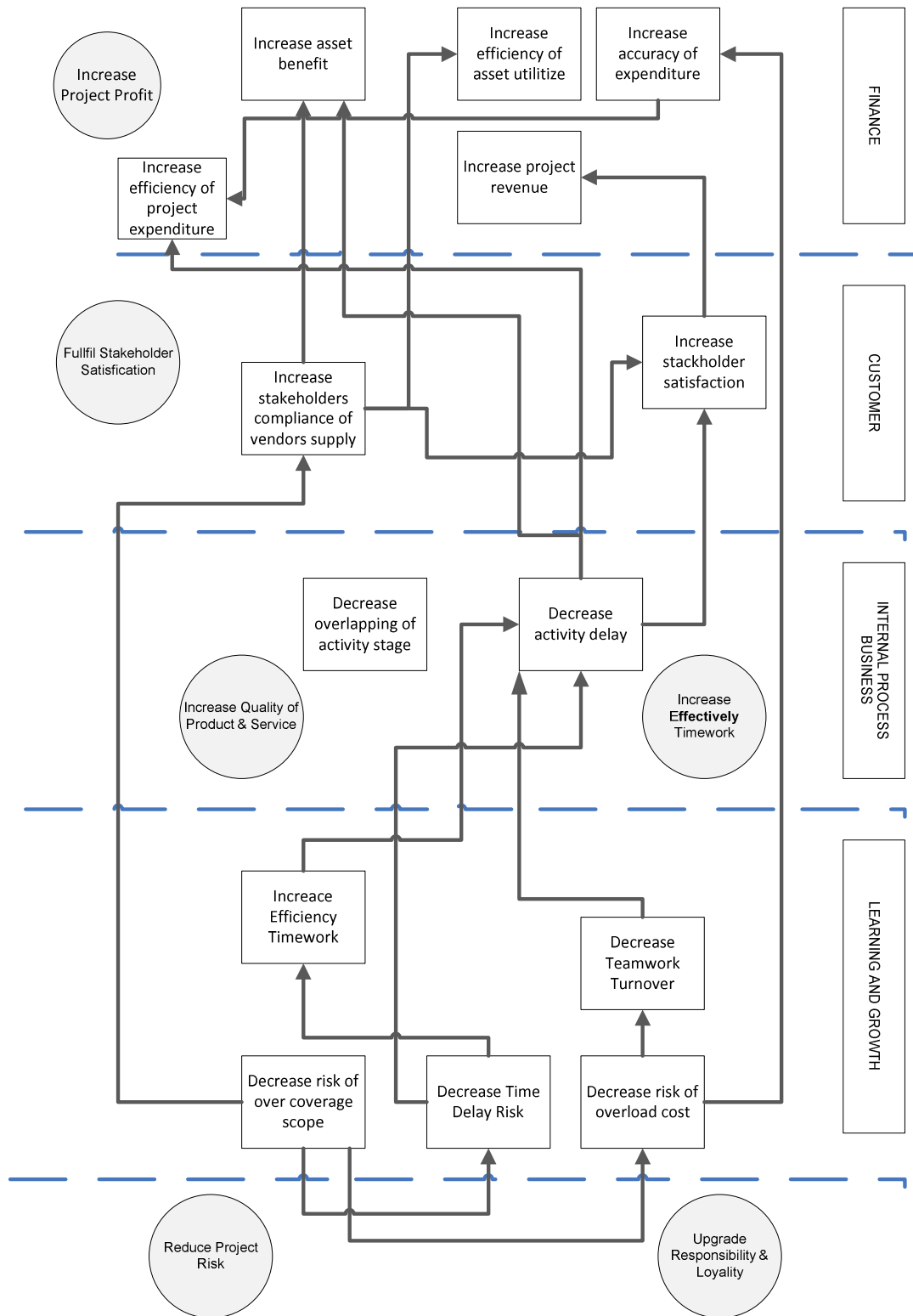
Figure 8, Strategy to develops KPI's in The Balanced Scorecard

Table 1, The Data Sources and Formulas To Develop the KPI's-BSC from many project domains which are integrated within the PIM domain.

No	Perspective	KPI	Formula	Data Source
1	*Finance*	Return Of Assets (ROA)	$ROA = \dfrac{ni}{ta}$	*ev*, earned value *ac*, actual cost (cost management)
		Cost Performance Index (CPI)	$Cpi = \dfrac{ev}{ac}$	*ni,* net income (cost management) *ta*, total assets (asset management)
		Total Asset Turn Over (TATO)	$TATO = \dfrac{income}{EV}$	income, project payment ev, earned value (cost management)
		Schedule Performance Index (SPI)	$SPI = \dfrac{ev}{pv}$	*ev*, earned value *pv*, planned value (cost management)
		Return of Equity (ROE)	$ROE = \dfrac{ni}{se}$	*ni*, net income *se*, shareholder equity (cost management)
2	*Customer*	Customer Satisfaction (CS)	$CS = \dfrac{nc}{ns}$	*nc*, numbers of complain *ns*, numbers of customers (communication management)
		NoMV	$NoMV = \dfrac{nav}{nv}$	*nav*, numbers of accepted vendor *nv*, numbers of vendors (Procurement Management)
3	*Internal Process Business*	PoD	$PoD = \dfrac{nDelay}{nActivity}$	nDelay, numbers of activity delay nAcivity, numbers of activity (Time Management)
		PoMS	$PoMS = \dfrac{nMS}{nActivity}$	*nMS*, numbers of miss activity sequence *nAcivity*, numbers of activity (Time Management)
4	*Learning and Growth*	ET	$ET = \dfrac{nTurnOver}{nActivity}$	*nTurnOver*, numbers of turn over workers *nAcivity*, numbers of activity (Time Management)
		Percentage of Loss Time (PLT)	$PLT = \dfrac{dL}{nE * nDay}$	*dL*, loss day for all employee *nE*, numbers of employee *nDay*, numbers of planning day for one project activities (Time Management)
		Percentage of Cost Risk (PoCR)	$PoCR = \dfrac{nCR}{nR}$	*nCR*, numbers of risk cost *nR*, numbers or total risk (Risk Management)
		Percentage of Time Risk (PoTR)	$PoTR = \dfrac{nTR}{nR}$	*nTR*, numbers of time risk *nR*, numbers or total risk (Risk Management)
		Percentage of Scope Risk (PoSR)	$PoSR = \dfrac{nSR}{nR}$	*nSR*, numbers of scope risk *nR*, numbers or total risk (Risk Management)