

# Integrating Balanced Scorecard and Analytic Hierarchy Process Techniques for Evaluating Corporate Performance

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## Abstract

A good business performance measurement system is an effective tool to sustained growth in profits. Although interest in creating performance measurement models is widespread, a well-designed system is rare. To be successful in today's competitive environment, a performance measurement system should incorporate strategic success factors and contain financial and non-financial measuring index to carry out strategic management. In the 1990s, Kaplan & Norton introduced a concept called the Balanced Scorecard. The Balanced Scorecard supplements traditional financial measures with criteria that measured performance from three additional perspectives - those perspectives of customers, internal business processes, and learning and growth. This paper presents five measuring index criteria for each perspective. To calculate the relative priority for these measuring index, we investigate weights investigated by interviews with management consultant. Then, AHP method is employed for calculating priority weight. Our evaluation model may be referred to as the Balanced Analytic Hierarchical Performance Model(BAHPM) in the sense that the analytic hierarchical scheme, along with the AHP, is applied. The BAHPM is the first kind of analytical model to cover a wide variety of measures. In comparison with previous evaluation models, our model shows strengths in structural flexibility, ease of incorporating feedback, group evaluation capacity, participation promotion, sensitivity analysis, and computational simplicity. A prototype based on the BAHPM can be applied to various industry sectors.

## 1. Introduction

Currently, corporations have various types of evaluation systems. The selection of evaluation items which should be used creates important circumstances and condition for its corporation. In this thought, we suggest the criterion for financial and non-financial assessment items for the Kaplan & Norton's BSC model by calculating the relative priority weight for these assessment items. The standards of the assessment items were classified by analyzing existing theories, and relative priority weights were investigated by interviews with management consultants. Then, the AHP method was used for calculating priority weight.

## 2. Related studies & our supplementary performance evaluation index

According to Drucker, knowledge is the new means of production in the future society. Based on Sveiby (1997), it is in the knowledge based industry where the intensive degree of knowledge can be increased when we sort the service industry by its degree of intensiveness.

Following Porter & Miller's research(1985), Sdyrme & Amidon(1977) introduced management consulting, chemistry, financial service and high technology by dividing industry, in terms of the degree of knowledge which is required corporate product. Determination of the types of growth evaluation items is indispensable in corporative activity. Well-selected growth evaluation items lead corporations to better achieve their goal efficiently. In the 1990s, Kaplan & Norton(1996) introduced a concept called the balanced scorecard. The balanced scorecard supplemented traditional financial measures with criteria that measured performance from three additional perspectives - those perspectives of customers, internal business processes, and learning and growth. Therefore, it enabled companies to track financial results while simultaneously monitoring progress in building the capabilities and acquiring the intangible assets they would need for future growth. In this paper, we put actual measuring index together, standardizing 4 perspectives by Kaplan & Norton as framework. Then, we deduced five measuring index criteria for each perspective. Table 1 explains this.

## 3. Balanced Analytic Hierarchical Performance Model

To calculate the relative priority for these measuring index, we investigate weights investigated by interviews with management consultant. Then, AHP method is employed for calculating priority weight(Saaty, 1977). AHP is well known scale for that purpose such as deriving relative scales using judgment or data from a standard scale, and performing the subsequent arithmetic operation on such scales avoiding useless number crunching. As a result, a hierarchy of three leveled hierarchical scheme is produced. The hierarchical scheme as explained is shown in [Figure 1]. To recognize the importance of the BSC method, at the 1<sup>st</sup> level, the hierarchy consists of four criteria: financial perspective, internal perspective, internal business process perspective, and learning & growth perspective. At one level lower(the 2<sup>nd</sup> level), the measures

include performance criteria such as revenue growth, investment, unit cost, and so on. The lowest level (the 3<sup>rd</sup> level) includes working departments in the field to be measured by high level performance measures.

The modeling method proposed in this study may be referred to as the Balanced Analytic Hierarchical Performance Model(BAHPM) in the sense that the analytic hierarchical scheme, along with the AHP, is applied. The BAHPM is an effective analytical and comprehensive performance model to cover a broader base on measure in the currently changing environment in accounting information systems than simply financial measures. The Expert Choice software makes

a significant contribution toward understanding the important phenomenon of complex, unstructured decision problems.

#### 4. Conclusion

The subcriteria are not depicted for simplicity. Although the hierarchy consist of only four hierarchical levels, it can be extended to cover more levels. Furthermore, this three-level hierarchical schema is dynamic over time. As a company evolves, the hierarchy must be adjusted accordingly. Another interesting aspect is that the hierarchy is not company-invariant. The hierarchy must be adjusted depending on the unique situation faced by each individual company or division. Basically,

[Table 1 : Supplementary Performance Evaluation Index]

Perspectiv e	Definition	Measuring Index	References
Financial	Financial Assets define the financial performance expected from the strategy, serve as the ultimate targets for the objectives and measures of all the other asset.	Revenue growth	(1),(4),(5),(7),(8),(17),(19),(22),(23),(26),(27),(28),(35)
		Investment	(2),(3),(5),(8),(15),(19)
		Profitability	(1),(2),(3),(4),(5),(7),(8),(13),(14),(16),(17),(19),(20),(22),(23),(28)
		Asset utilization	(1),(3),(5),(8),(19),(20)
		Unit cost	(2),(3),(4),(5),(8),(9),(14),(18),(19),(20),(27),(28),(37),(40)
Customer	The customer perspective enables companies to align their core customer outcome measures—satisfaction, loyalty, retention, acquisition, and profitability – to targeted customers and market segments. It also enables them to identify and measure, explicitly, the value propositions they will deliver to targeted customers and market segment.	Customer profitability	(1),(4),(5),(14),(19),(34),(38),(40)
		Customer acquisition	(4),(5),(6),(8),(10),(15),(17),(19),(20),(26),(28),(34),(37)
		Customer retention	(2),(8),(10),(19),(30),(32)
		Customer satisfaction	(4),(5),(8),(15),(16),(17),(18),(19),(20),(23),(26),(28),(29),(35),(34),(36),(37),(40)
		Market share	(1),(5),(7),(8),(10),(15),(19),(27),(28),(35),(36)
Internal Business Process	This category typically covers statements about the scope, equipment and efficiency of the business activities.	Product/service development	(3),(4),(5),(8),(9),(10),(11),(12),(16),(17),(18),(19),(20),(22),(24),(27),(28),(37),(40)
		Market identification	(5),(17),(20)
		Customer management	(3),(5),(8),(10),(16),(17),(20),(23),(28)
		Operation process	(1),(4),(5),(8),(10),(11),(14),(19),(28),(32),(37),(39),(40)
		Environment	(1),(14),(21),(22),(35),(39)
Learning and Growth	Defines the intangible assets needed to enable organizational activities and customer relationships to be performed at ever-higher levels of performance.	Skill	(5),(8),(9),(10),(11),(12),(14),(19),(23),(24),(31),(32),(34),(36),(37),(40)
		Knowledge sharing	(5),(10),(17),(19),(20),(24),(25),(28),(29),(30)
		Infrastructure	(8),(19),(32),(36)
		Applications	(1),(4),(5),(8),(15),(16),(17),(19),(23),(24),(28)
		Organizational culture	(2),(3),(5),(6),(9),(10),(16),(17),(18),(22),(23),(34),(35),(37)

the hierarchical schema is designed to accommodate any number of levels and

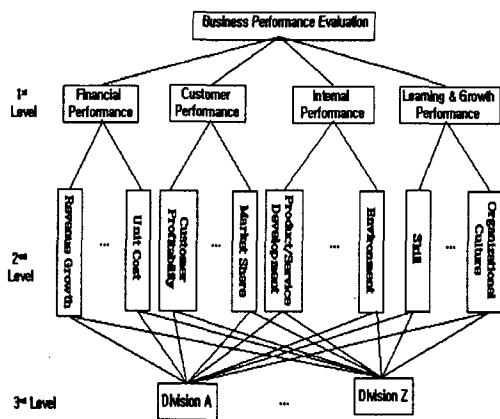
alternatives. New levels or alternatives can be easily added to or deleted from the hierarchy. We can

conclude that the hierarchy is highly flexible. The solution suggested in this paper is the first kind of analytical model to cover a wide variety of measure while providing operational control as well as strategic control. In comparison with previous evaluation methods, the methodology shows many advantages such as structural flexibility, ease of incorporating feedback, group evaluation capacity, participation promotion, sensitivity analysis, and computational simplicity.

5. Case: LG-EDS' example

The application of the BAHPM is illustrated with a study on the LG-EDS in Seoul, Korea. LG-EDS is one of the leading company providing system integration. LG-EDS made more than half of profit in the outside of their large business including public works. Accordingly, LG-EDS has many divisions in relation to

[Figure 1: Hierarchical schema for performance measurement]



their outside project, each project division(or department) has various management system according to their specific project character. As a result, it was concluded that LG-EDS needed more fair and improved performance measuring system for their departments belong to their various project division. The consultant suggested an experiment using financial, customer , internal business process , and learning and growth perspective criteria. Each computing step of the BAHPM is explained as follows:

First, financial, customer, internal business process, and learning & growth perspective criteria are compared and the result is stored in

a vector  $W_t$ . For convenience, the relative weights are arranged in the order of financial, customer, internal business process, and learning & growth:

$$W_t = (0.434, 0.044, 0.115, 0.407)$$

Next, let us move down to the 2<sup>nd</sup> level. The following vector  $A$  is the sub-criteria relative weights of financial perspective criteria(revenue growth, investment, asset utilization, unit cost).

$$A_0^1 = \begin{bmatrix} 1 & 4 & 1/2 & 1 \\ 1/4 & 1 & 1/2 & 1 \\ 2 & 2 & 1 & 2 \\ 1/2 & 3 & 1/2 & 1 \\ 1 & 1 & 1/2 & 1 \end{bmatrix}$$

Then, the relative weights of middle level performance criteria with relation to each top level criterion are to be computed. First, the local weights are arranged in the order of revenue growth, investment, asset utilization, unit cost and stored in the vector  $W_{t1}$  ;

$$W_{t1} = (0.249, 0.102, 0.317, 0.174, 0.159).$$

For convenience, the sub-criteria relative weights for the other perspectives are computed and stored in a vector from  $W_{t2}$  to  $W_{t4}$ .

$$W_{t2} = (0.205, 0.141, 0.087, 0.460, 0.106)$$

$$W_{t3} = (0.181, 0.256, 0.196, 0.200, 0.167)$$

$$W_{t4} = (0.258, 0.221, 0.151, 0.217, 0.153)$$

Also, each relative weights are arranged in the order of the column 'measuring index' in the [table 1]. Second, for each weight computation, an inconsistency ratio( $r$ ) was computed and checked for acceptance, i.e., in this case, the result is accepted because  $\lambda(=0.017) \leq 0.1$  In the AHP, the computing result is accepted if the 'r' is less than 10%; otherwise, the input matrix is adjusted until it is acceptable or another comparison method like absolute measurement may be employed. As a result, the order of each sub-criteria combined with 1st level criteria is calculated as follows: Profitability(0.1377), Revenue Growth(0.1080), Skill(0.1049), Knowledge Sharing(0.0899), IT Application(0.0880), Asset Utilization (0.0753), Unit Cost(0.0688), Organizational Culture (0.0622), IT Infrastructure(0.0616), Investment (0.0441), Market Identification(0.0295), Operational Process(0.0231), Customer Management (0.0226), Product/Service Development(0.0209), Customer Satisfaction(0.0203), Environment (0.0193), Customer Profitability(0.0090), Customer Acquisition(0.0062), Market Share (0.0047), Customer Retention(0.0039). LG-EDS can adopt these performance measures for further analysis. The measures serve as the basis for

the rate of performance change. In other words, they can be further used for evaluating their performance of each department, because the 3<sup>rd</sup> level is connected to the 2<sup>nd</sup> level – the sub-criteria of each perspective – in the BAHPM. So, 5 different departments (an object of measuring performance) were selected at the 3<sup>rd</sup> level, and each department was deduced independent model. In conclusion, the final result indicating each department's performance could be determined.

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