

THE APPLICATION OF A UTILITY-BASED BALANCED SCORECARD TO AN INDUSTRY SETTING

Alisha D. Youngblood, Ph.D., University of Alabama in Huntsville
Terry R. Collins, Ph.D., Texas Tech University
Heather L. Nachtmann, Ph. D., University of Arkansas

Abstract

This paper discusses a case study that is performed to show the application of a Utility-based Balanced Scorecard (UBSC) to a real world organization. The reason for this is two-fold: (1) to allow for direct comparison of the UBSC versus the traditional BSC; and (2) to provide real-world insight into the development and use of the UBSC. The paper provides the background of the organization, an overview of the traditional Balanced Scorecard already being used by the organization, a description of the development of the organization's UBSC, and the practitioner's comparison of the UBSC to other performance measurement systems.

Introduction

A Utility-based Balanced Scorecard (UBSC) has been developed to combine the balanced, forward-facing capabilities of Kaplan and Norton's traditional Balanced Scorecard (BSC) with the quantitative analysis of multi-attribute utility theory. The UBSC method allows decision makers to evaluate multiple alternatives for capital investments, resource allocation, or prioritization of interests, particularly in those cases where the organization is more likely to operate under different business environments and have different short-term or long-term priorities or objectives. For this paper, a case study is presented that features an organization that had previously begun implementation of a traditional Balanced Scorecard. A study is conducted to determine the additional data requirements for implementing the UBSC in an organization already using the popular BSC. The anecdotal results from the industry practitioner provide insight into the additional efforts and benefits of the development and use of the UBSC in an industrial setting. Recommendations are made for the implementation of the UBSC in other organizations.

The methodology for the development of a UBSC can be found in Youngblood and Collins (2002, 2003-a, and 2003-b). A simulation analysis validating the methodology is featured in Youngblood, Collins, and Nachtmann (2004).

Description of Organization

This case study features an organization that distributes a variety of materials within the United States and

around the world. In order to preserve the anonymity of the organization it will be referred to as MLD. MLD is part of a parent organization (henceforth referred to as DO) that is composed of about a dozen divisions.

MLD's principal focus is to distribute a variety of materials on a global scale. It is comprised of over twenty facilities, located primarily in the United States and Europe. There are over three and a half million different stock numbers housed in over three hundred million cubic feet of storage space. MLD's employees complete almost twenty five million transactions every year. The broad range of materials handled by MLD includes non-perishable foods, clothing, textiles, industrial supplies, construction materials, paper goods, and medical supplies. Shipments may be processed as either routine or priority.

Overview of MLD's Scorecard

The parent organization, DO, has implemented a balanced scorecard initiative across all of its divisions including MLD. As part of this initiative, some metrics are being required of all of the divisions because of the high importance of the measure relative to the parent organization. These required metrics may or may not be relevant to a particular division, as will be seen later in the discussion of the measures tracked by MLD.

The traditional balanced scorecard is being developed for all of the divisions within the parent organization including MLD. It consists of the four typical perspectives: Financial, Internal Process, Learning & Growth, and Customer. Each perspective includes several strategies. The strategies are developed by the parent organization and are uniform across all divisions. In the current scorecard system for MLD, there are three strategies associated with each perspective.

For each of the strategies, several measures (or metrics) are tracked as an indication of organization performance. As discussed earlier, a few of these measures are developed by the parent organization, but the individual divisions have some flexibility to develop measures that are pertinent to their specific mission.

Most of the measures used to monitor performance have been identified; however, as is often the case some of the metrics have been tracked for a longer

period of time than others. Also, some are measured more frequently than others. The frequency of measurement is based in part on the difficulty involved in compiling the data and overall stability of the metric. Measures that see less fluctuation are often measured less frequently.

MLD utilizes a color-based indicator system to draw a manager's attention to the performance of a specific attribute being measured. Green is used to identify metrics that are measuring at or near the established standard. Yellow and red limits are also set as indicators for determining if a metric is not at standard. Yellow is considered "cautionary" for metrics that are measuring below standard, therefore managers should focus the necessary attention to resolving any problems. Red is a threshold value, a measurement below which would signal that a metric is failing to perform at the necessary level. Indicator values are given for select metrics as examples.

For most metrics, performance that exceeds the established target is considered excellent. There are a few measures that are exceptions to this rule. These measures have an upper threshold that is referred to as a "good red." The measures that meet this criterion are generally those that are related to forecasting and modeling, such as the percentage of savings realized from implementing a particular project. It is important to note cases where savings or costs are better than anticipated so that forecasters are given an indication to review the models used to generate the original estimates. Incorrect models could lead to poor decision making processes and the selection of bad alternatives. For some metrics other than those related to modeling, a "good red" could also be an indication that targets were incorrectly set and may need to be adjusted for future reporting periods.

The information contained in this case study is considered proprietary, so some of the data have been disguised. Careful attention has been given to data alteration such that it does not affect the outcome. For the sake of brevity, the Balanced Scorecard tables for MLD are not being included in this paper. The metrics used to monitor the four perspectives are described in the following four sections and are the same as the metrics used in the UBSC.

Financial Perspective. MLD's parent organization has identified three primary strategies with respect to the financial perspective of the organization:

1. Resource transformational strategies,
2. Minimize total supply chain costs, and
3. Promote confidence in financial stewardship.

The metrics used to monitor performance in these strategies are described next.

Resource Transformational Strategies

Percent of budget requests received: This is one of the measures that is required to be reported by all divisions of DO. It has been constant at MLD for the past few years, but continues to be tracked because the metric has more meaning for other divisions of the parent organization. Also, discontinuing a metric may have negative consequences. If budget requests are not granted, then this needs to be noted since it could negatively affect the organization's ability to perform vital functions later. In addition, ceasing to measure an aspect of the business may lead some to believe that the associated attribute is no longer considered critical.

Accuracy of group workload forecasts: This measures how close a forecast was to the actual workload that occurred. All forecasts assume some uncertainty, but measuring the deviation from the forecast is important to the feedback loop. If the deviation is greater than what was anticipated for that forecast, there may be a need to update the parameters and assumptions being used in the model.

Minimize Total Supply Chain Costs

Unit cost rate deviation from goal: Although it is referred to as unit cost rate deviation from goal, the measure is reported within MLD as both an actual cost and a deviation. Managers for the parent organization request this to be reported from the divisions as a percentage because the actual costs vary across divisions. Reporting the deviation as a percentage aids in comparison across divisions. Managers within MLD prefer to see the actual unit cost rate as this is more meaningful for their use.

Percent of POM savings realized: All projects and process changes under consideration by MLD must have an associated Program Objectives Memorandum (POM) submitted to the parent organization which details the expected costs and benefits of the project. These are done about three to four years prior to the anticipated implementation of projects. Measuring the percent of savings realized is a feedback method for judging the effectiveness of models used to project anticipated savings resulting from process changes. This is one of the metrics that utilizes a "good red" indicator to trigger an examination of the parameters and assumptions incorporated into a model.

Promote Confidence in Financial Stewardship

CFO improvement plan milestones completed on time: This metric is associated with a review by an outside auditor. The goal is to have the organization's financial systems compliant by FY07.

Percent of financial audit findings resolved: The metric examining resolution of financial audit findings

is the result of an internal review/audit. It will look at not only CFO findings, but also other audit findings with financial implications, such as credit card and internal reviews.

Internal Process Perspective. The internal process perspective is composed of three strategies:

1. Implement perfect order fulfillment,
2. Implement revised business processes,
3. Maintain best value enterprise information technology.

The measurements used to track performance in these areas are described below.

Implement Perfect Order Fulfillment

Percent of requisitions that meet customer time definite delivery standards: Reporting on time definite delivery standards has not yet begun. Customer Relationship Management (CRM) is working with customers on an individual basis to establish customer-defined delivery times. It has yet to be determined as to how individual links within the supply chain will be measured.

Priority requisitions processed within one day: Within MLD, the percent of requisitions processed within one day is broken down into priority and routine requisitions. For the current target of 90% for priority requisitions, a measure of 80.3% would trigger a “yellow” (caution) and a measure below 66.6% or below would trigger a “red” (underachieving).

Routine requisitions processed within one day: The current target for routine requisitions is 80%. For routine processing, a measure of 75% would trigger a “yellow” (caution) and a measure below 75% or below would trigger a “red” (underachieving).

Implement Revised Business Processes

Line items completed per paid equivalent: DO has yet to establish metrics for this strategy, but MLD is currently utilizing the number of line items per paid equivalent as an internal measure. This is being developed to track ongoing process reengineering projects. Within MLD, a paid equivalent is similar to a full time equivalent. This is another measure where long-term improvement is planned.

Maintain Best Value Enterprise Information Technology

MLD portfolio investment performance: Portfolio investment performance is based on the IT Investment Scoring Criteria Process established by the Portfolio Management Team. The baseline for the system is the actual performance during FY03 and reporting is expected to begin in FY04. Targets will be 100% of the baseline Business Value. A value between 70% -

85% will trigger a yellow (cautionary) light and 70% is considered the lower performance threshold.

Learning & Growth Perspective. There are three primary strategies incorporated into the Learning and Growth Perspective for MLD:

1. Deliver proper knowledge and skills to meet MLD’s commitments to customers,
2. Create and manage a customer-focused corporate culture, and
3. Provide a quality and safe work environment.

The performance metrics used for this perspective are described next.

Several of the metrics included in this perspective are measured through the use of an assessment survey. This survey is sent on a semi-annual basis to randomly selected employees. A third party contractor is responsible for creating, distributing, and collecting the surveys. Once the employees’ anonymous responses are received, the contractor compiles the results and reports the aggregate data to MLD. The general topics covered in the survey include employee perceptions of skills possession, MLD, and the workplace environment. Multiple questions related to each topic area are asked in order to fully evaluate these areas.

Deliver Proper Knowledge and Skills

Skills gap: There is not yet reporting on the measurement of employee skills gap. This is still being developed by DO headquarters through the help of a third party contractor. The long-term goal is to have a skill gap rating of zero, which would indicate that employees have all of the skills necessary to properly perform their jobs. Some of the difficulty inherent in this metric is the determination of what the needed skills are for each job classification and how to elicit an accurate skill rating for each employee.

Percent of planned IDP training completed: An Individual Development Plan (IDP) is created for each employee to address skill deficiencies. An IDP includes the identification of specific weakness, determination of training necessary to correct the deficiency, and measurement of what was learned during the completion of training. This is measured quarterly to see if MLD is on track to reach target by the end of a fiscal year. One fourth of the target level should be completed each quarter.

Employee perceptions of skills possession: Employee perception of skills perception is currently measured two different ways. A Likert scale is used by employees in a self-assessment with a value of one representing a bad skills set, a three is an average skills set, and a value of five is an excellent skills set. The average of all data points is reported on the scorecard.

Also included on the scorecard is the percentage of employees who rated themselves with an above-average or excellent skills set (a four or five). The use of this measurement provides more information than simply the average.

Create and Manage a Customer-Focused Corporate Culture

Leadership assessment: A leadership assessment instrument has been created but results are not yet being reported. For each individual's assessment, surveys are sent to three levels relative to the individual: employees whom the individual supervises, the individual's peers, and the individual's supervisor. The survey is designed to rate one's leadership abilities as perceived from various points of view. It has not yet been decided how this information will be aggregated and reported on the scorecard.

Employee perceptions of MLD culture: The employee perception of MLD culture is measured through the use of the semi-annual survey sent to employees which was briefly described earlier. Four sub-measures are used: mission, consistency, involvement, and adaptability. For each of the sub-measures included in the aggregate measure a Likert scale is used. As before, the ratings range from one to five, with one being poor, three is average, and five is excellent. As with employee perception of skill possession, the percentage of employees who rated the metric with a four or five is also recorded. The data points are averaged and reported on the scorecard. In past years, the average of each of these measures were averaged into a single number to represent the aggregate measure, but the numbers are now presented in segmented form.

Provide a Quality and Safe Work Environment

Employee perceptions of workplace environment: The employee perception of workplace environment is also measured through the use of the employee survey. The five sub-measures included in this aggregate measure are: communication, learning/development, physical environment, rewards, and work/life balance. As with the employee perception of MLD culture, these numbers were previously averaged together before reporting. They are now presented in segmented form. Also presented is the percentage of employees who rated the workplace as either a four or five.

Exit survey assessment: An exit survey, which is different than the survey used to measure employee perception, is sent to randomly-selected employees who have recently left DO. This includes those who have retired or elected to pursue other career options. Those employees who have left under adverse conditions are not surveyed. Topics addressed in this

survey include the former employees' perceptions of advancement and recognition, compensation benefits, and quality of work life at DO. The percentage of employees whose average rating of MLD is a four or five is also reported.

Parity index: The parity index addresses diversity and measures how closely the workforce represents the local area. The three populations measured are minorities (including Hispanics), Hispanics (measured separately), and women. The target level for minorities and Hispanics is 100%. An index greater than 100% indicates that the proportion of the employees in a facility who are minority or Hispanic is greater than the proportion of the local population who are of the same minority status. The target level for women is 65% because the physical nature of many of the positions in the MLD warehouses does not attract a high number of female applicants. Although it is not reported on the scorecard, the information collected is broken down by job categories, as some types of jobs within a facility will attract more female applicants than other types of jobs.

Reduction in lost time case rate: Accident reduction is addressed through the measurement of lost time case rate. The number reported is the number of accidents per 1000 employees per year that results in administrative leave. The target level is lowered each year to indicate the goal of long-term reductions. This reduction is planned through the implementation of safety awareness programs and improved processes.

Customer Perspective. DO has particular difficulty with the customer perspective since it is virtually impossible for them to measure their market share as many other organizations do. MLD's customers have the option of purchasing from outside vendors if necessary. Many of these outside purchases are sent directly to the customer via UPS or another carrier, but occasionally some are routed through the distribution center for transport with other items already being transported by MLD. DO is able to track the outsourced portion of materials that is sent through the distribution center. They are not able to track those materials that are shipped directly to the customer.

Overarching metric: Customer Satisfaction Index

The overarching customer satisfaction index is shown on the scorecard, but is not affiliated with a particular strategy. The ratings of other divisions are not shown on the scorecard, but MLD has the highest rating of any division within DO. Many of the other divisions have a rating as low as the 50% level. MLD is the only division that rates in the 70% level. The latest results of this show 25.2% of respondents rated MLD's

performance at five (very satisfied) and 64.0% rated it at four (satisfied).

In addition to the overarching customer satisfaction index, three strategies are monitored in the customer perspective:

1. Focus, manage, and measure logistics support by customer segment based on customer requirements,
2. Negotiate and honor performance agreements with customer segments, and
3. Ensure seamless logistics support to customer segments throughout the customer's transition when the operating environment changes.

The measures associated with these strategies are described next.

Focus, Manage, and Measure Logistics Support

Customer response on order fulfillment survey: Customer surveys are sometimes used in industry to measure satisfaction, and this is the method currently employed by DO. MLD has had concerns in the past with "respondent burnout" since often the same person in a particular organization is expected to complete and return a survey on multiple occasions over a period of time. This may result in responses that are not truly indicative of the customer's satisfaction level. At MLD, once a month ten randomly-selected customers who have phoned in with a problem are called back to determine if their problem was satisfactorily resolved.

Negotiate and Honor Performance Agreements

Percent of negotiated distribution agreement terms perfectly fulfilled: Some of MLD's customers do not have the same level of resources on hand to forecast demand as those available to MLD. In order to meet customer needs more effectively, MLD will often develop an initial forecast for an individual customer as a demand baseline. They will then meet with the customer to discuss the forecast to see if it looks reasonable and if changes are anticipated.

Ensure Seamless Logistics Support

Percent of contingency processes exercised on a regular basis: DO and MLD function in an arena where the business environment and operating conditions may shift suddenly and drastically. An attempt is being made to develop processes within the organization that remain constant throughout these shifts. Consistency in this area is expected to reduce the occurrence of errors, expedite the delivery of materials to the customer, and thus increase customer satisfaction.

Percent of required contingency plans in place to respond to surge: This metric measures the number of

plans in place to respond to drastic demand shifts and whether those plans are expected to be sufficient.

Development of Organization's UBSC

Because MLD already has a traditional Balanced Scorecard in place, the initial steps in the UBSC model, that involve the development of a qualitative BSC are omitted in this portion of the case study. These steps are addressed in the preceding section of this chapter which describes the performance measurement system already in place at MLD.

To cull the necessary information for quantifying the performance metrics, a form is created for the industry practitioner to complete. This completed form is shown in Exhibit 1. The perspectives and metrics included on the form are those that are already incorporated into MLD's BSC described in the previous section. The column "Value" is the current performance level for each metric. In some cases this information is not yet available and reported, but the contact person within the organization estimated the performance. The "Baseline" value is the initial value for the metric. The "Min" and "Max" columns show the minimum and maximum values anticipated for each of the metrics. The final column, "Slope," indicates whether the utility function will have a positive or negative slope.

The leadership assessment metric is left blank for this analysis. This metric is new to MLD's BSC and it has not yet been determined how this information will be aggregated and reported on the BSC. Because of this, the manager did not feel comfortable estimating parameters for this metric. For the UBSC it is also necessary to determine the weights of the perspectives and the metrics within each perspective. The manager ranks the Internal Process perspective as the most important, followed by the Financial/Stakeholder perspective. The Learning and Growth and Customer perspectives are considered equally important. Swing weighting exercise is performed to weight the perspectives. The resulting weight for Internal Process is 33%, Financial/Stakeholder is weighted at 27%, and the remaining two perspectives are each 20%. The same exercise is conducted for the metrics. For the measures in the Learning and Growth perspective that are compiled from several survey-based sub-measures, a weighting factor is determined that encompasses all of the sub-measures of a metric equally. This is to simplify the process for the decision maker who had previously indicated that these sub-measures are of equal importance. The resulting weights for the perspectives and metrics are shown in the organization's UBSC (Exhibit 2). As is the case for the Metric Quantification in Exhibit 1, leadership assessment is not weighted.

Exhibit 1. Metric Quantification

<i>Metric</i>	<i>(Units)</i>	<i>Value</i>	<i>Baseline</i>	<i>Min</i>	<i>Max</i>	<i>Best</i>	<i>Slope</i>
Financial/Stakeholder Perspective							
% budget request received		100.0%	100.0%	92.0%	100.0%	100.0%	positive
Accuracy of group workload forecasts (business areas)		70.0%	3.5%	0.0%	10.0%	0.0%	negative
Unit Cost Rate deviation from goal		-9.2%	0.0%	-10.0%	10.0%	-10.0%	negative
% of POM savings realized		125.0%	100.0%	75.0%	125.0%	125.0%	positive
CFO improvement plan milestones completed on time		100.0%	100.0%	90.0%	100.0%	100.0%	positive
% of financial audit findings (CFO, credit card, internal, etc) resolved		100.0%	100.0%	90.0%	100.0%	100.0%	positive

<i>Metric</i>	<i>(Units)</i>	<i>Value</i>	<i>Baseline</i>	<i>Min</i>	<i>Max</i>	<i>Best</i>	<i>Slope</i>
Internal Process Perspective							
% of requisitions that meet customer time definite delivery standards		90.0%	85.0%	80.0%	98.0%	98.0%	positive
Priority requisitions processed within one day		75.0%	85.5%	80.0%	98.0%	98.0%	positive
Routine requisitions processed within one day		65.0%	75.7%	70.0%	90.0%	90.0%	positive
Line Items completed per Paid Equivalent (PE)		298.4	261.6	250.0	325.0	325.0	positive
MLD Portfolio investment performance		100.0%	80.0%	88.0%	100.0%	100.0%	positive

<i>Metric</i>	<i>(Units)</i>	<i>Value</i>	<i>Baseline</i>	<i>Min</i>	<i>Max</i>	<i>Best</i>	<i>Slope</i>
Learning and Growth Perspective							
Skills Gap		82.0%	75.0%	75.0%	100.0%	100.0%	positive
% of planned IDP training completed		68.0%	75.0%	70.0%	100.0%	100.0%	positive
Employee Perceptions of Skills Possession		70.5%	48.0%	45.0%	100.0%	100.0%	positive
Leadership assessment							positive
Employee perceptions of MLD Culture	Mission	36.3%	42.0%	40.0%	100.0%	100.0%	positive
	Consistency	37.4%	42.0%	40.0%	100.0%	100.0%	positive
	Involvement	34.2%	42.0%	40.0%	100.0%	100.0%	positive
	Adaptability	37.3%	42.0%	40.0%	100.0%	100.0%	positive
Employee perceptions of Workplace Environment	Communication	42.6%	55.0%	50.0%	100.0%	100.0%	positive
	Learning / Development	26.1%	55.0%	50.0%	100.0%	100.0%	positive
	Physical Environment	46.9%	55.0%	50.0%	100.0%	100.0%	positive
	Rewards	24.6%	55.0%	50.0%	100.0%	100.0%	positive
Exit Survey Assessment	Work Life Balance	35.8%	55.0%	50.0%	100.0%	100.0%	positive
	Advance / Recognition	43.3%	45.0%	40.0%	100.0%	100.0%	positive
	Compensation / Benefits	42.2%	45.0%	40.0%	100.0%	100.0%	positive
	Quality of Life	43.2%	45.0%	40.0%	100.0%	100.0%	positive
Parity Index	Minorities	100.00	100.00	50.0	100.0	100.0	positive
	Hispanics	100.00	100.00	50.0	100.0	100.0	positive
	Women	63.00	65.00	60.00	82.00	82.00	positive
Reduction in Lost Time Case Rate		2.00	3.86	-5.0	10.0	10.0	positive

<i>Metric</i>	<i>(Units)</i>	<i>Value</i>	<i>Baseline</i>	<i>Min</i>	<i>Max</i>	<i>Best</i>	<i>Slope</i>
Customer Perspective							
Overarching metric: Customer Satisfaction Index		77.00%	77.00%	75.00%	90.00%	90.00%	positive
Customer response on Order Fulfillment survey		77.00%	77.00%	75.00%	90.00%	90.00%	positive
% of negotiated Distribution agreement terms perfectly fulfilled		82.00%	82.00%	80.00%	95.00%	95.00%	positive
% of contingency processes exercised on a regular basis		65.00%	65.00%	50.00%	100.00%	100.00%	positive
% of required contingency plan in place to respond to surge		83.33%	83.33%	70.00%	100.00%	100.00%	positive

Following the elicitation of the metric ranges and weights, a risk profile analysis is conducted for each metric. The "Value" column in the organization's UBSC, shown in Exhibit 2, indicates the current performance level for each metric. The "Poor" column is the "worst-case" performance level which is equal to a utility of zero. The "Exceptional" column is the "best-case" performance level which is equal to a utility of one. "Below Average," "Average," and "Above Average" are the intermediate performance levels equal to utility values of 0.25, 0.50, and 0.75, respectively. "Score" is the utility value that corresponds to the current performance level, given the utility function resulting from the risk analysis. The "Weight" is the scaling factor for each metric as provided in Exhibit 2. The "Wt. Score" is the product of the "Score" and the "Weight" for each metric. These are summed within each perspective to give the "Total" for that perspective. The "Total Score for all Perspectives" is the result of multiplying the Score for each perspective by the Perspective Weight for the perspective. The resulting UBSC is shown Exhibit 2.

The Total Score for all Perspectives for MLD is 0.45. This is on a scale of zero to one and could be considered approximately "Average" performance. The perspective with the highest performance is the Financial/Stakeholder perspective with a Score of 0.80, a little greater than "Above Average." The most heavily weighted perspective is the Internal Process Perspective, at 33%. This perspective's Score is 0.42, which is almost exactly the same as the Total Score for all Perspectives. The perspectives with the lowest scores are the Learning and Growth and Customer perspectives, which are the least-weighted perspectives at 20% each.

Given that the overall performance for MLD is approximately "Average" the organization should look closely at the UBSC to determine those areas where attention is most warranted. Because the Learning and Growth and Customer perspectives are so low, the metrics within these perspectives should be a priority. In particular, the metrics related to Employee Perceptions of MLD Culture and Employee Perceptions of Workplace Environment are rated very poorly. While the UBSC is not designed to indicate to managers the appropriate course of action to take to correct these problems, it opens up the lines of

communication between managers so that the process of improvement may begin.

Comparison of UBSC vs. BSC

There are two factors in the UBSC method that can be easily compared to the traditional BSC through examining the development process of both methods. These are the number of inputs and the number of outputs. The number of inputs and outputs for the BSC and UBSC for MLD are shown in Exhibit 3. This organization monitors 35 metrics, excluding the leadership assessment. Because MLD already determines the current performance level, a target value, a cautionary value, and a warning value for each metric, their total number of inputs for their BSC is 140. The UBSC requires six pieces of information for each metric: the current performance level, five values for determining the utility function, and weights for all 35 metrics and 4 perspectives. This is a total of 249 input variables. Although the initial number of inputs is much greater for the UBSC, the extra information elicited is expected to be very beneficial to the organization. As stated earlier, much of the value in developing a performance measurement system is the increase in communication between managers and the increase in understanding the system being measured.

MLD has an output value for each of the 35 metrics since their current BSC indicates general performance for each metric through the use of color indicators where green indicates good performance, yellow indicates cautionary performance levels, and red indicates warning performance levels. The UBSC gives a numeric utility value for each of the 35 metrics, the 4 perspectives, and the system as a whole. This is a total of 40 outputs for the UBSC. The type of output for the UBSC is more meaningful to practitioners than the output of the BSC. Having a numeric score provides a more complete and accurate indication of performance than an indicator color. For example, in the UBSC developed for MLD, the Employee Perception of MLD Culture has a utility score of zero in the UBSC. The BSC would indicate a warning performance level with a red indicator, but the score of zero gives a stronger indication of how poor the performance is than the color indicator does.

Exhibit 2. Organization's UBSC

Financial/Stakeholder Perspective		Perspective Weight= 27%							
Metric (Units)	Value	Poor	Below avg	Average	Above avg	Exceptional	Score	Weight	Wt. Score
% budget request received	100.0%	92.0%	93.0%	96.5%	99.0%	100.0%	1.00	12.5%	0.13
Accuracy of group workload forecasts (business areas)	70.0%	10.0%	7.0%	4.0%	2.0%	0.0%	0.00	12.5%	0.00
Unit Cost Rate deviation from goal	-9.2%	10.0%	5.0%	0.0%	-5.0%	-10.0%	0.96	25.0%	0.24
% of POM savings realized	125.0%	75.0%	90.0%	100.0%	110.0%	125.0%	1.00	25.0%	0.25
CFO improvement plan milestones completed on time	100.0%	90.0%	95.0%	99.0%	99.5%	100.0%	1.00	12.5%	0.13
% of financial audit findings (CFO, credit card, internal, etc) resolved	100.0%	90.0%	95.0%	100.0%	100.0%	100.0%	0.50	12.5%	0.06
Total:									0.80

Internal Process Perspective		Perspective Weight= 33%							
Metric (Units)	Value	Poor	Below avg	Average	Above avg	Exceptional	Score	Weight	Wt. Score
% of requisitions that meet customer time definite delivery standards	90%	80.0%	85.0%	90.0%	95.5%	98.0%	0.50	20.0%	0.10
Priority requisitions processed within one day	75%	80.0%	85.0%	90.0%	95.5%	98.0%	0.00	20.0%	0.00
Routine requisitions processed within one day	65%	70.0%	72.5%	79.5%	86.5%	90.0%	0.00	20.0%	0.00
Line Items completed per Paid Equivalent (PE)	298.40	250.00	262.50	288.00	313.00	325.00	0.60	20.0%	0.12
MLD Portfolio investment performance	100%	88.0%	89.5%	93.5%	97.5%	100.0%	1.00	20.0%	0.20
Total:									0.42

Learning and Growth Perspective		Perspective Weight= 20%								
Metric (Units)	Value	Poor	Below avg	Average	Above avg	Exceptional	Score	Weight	Wt. Score	
Skills Gap	82.0%	75.0%	80.0%	95.0%	97.5%	100.0%	0.28	11.1%	0.03	
% of planned IDP training completed	68.0%	70.0%	75.0%	85.0%	95.0%	100.0%	0.00	11.1%	0.00	
Employee Perceptions of Skills Possession	70.5%	45.0%	55.0%	65.0%	75.0%	100.0%	0.64	11.1%	0.07	
Leadership assessment	0.0%						0.00	0.0%	0.00	
Employee perceptions of MLD Culture	Mission	36.3%	40.0%	55.0%	65.0%	75.0%	100.0%	0.00	5.6%	0.00
	Consistency	37.4%	40.0%	55.0%	65.0%	75.0%	100.0%	0.00	5.6%	0.00
	Involvement	34.2%	40.0%	55.0%	65.0%	75.0%	100.0%	0.00	5.6%	0.00
	Adaptability	37.3%	40.0%	55.0%	65.0%	75.0%	100.0%	0.00	5.6%	0.00
Employee perceptions of Workplace Environment	Communication	42.6%	50.0%	55.0%	65.0%	75.0%	100.0%	0.00	2.2%	0.00
	Learning / Development	26.1%	50.0%	55.0%	65.0%	75.0%	100.0%	0.00	2.2%	0.00
	Physical Environment	46.9%	50.0%	55.0%	65.0%	75.0%	100.0%	0.00	2.2%	0.00
	Rewards	24.6%	50.0%	55.0%	65.0%	75.0%	100.0%	0.00	2.2%	0.00
Work/Life Balance		35.8%	50.0%	55.0%	65.0%	75.0%	100.0%	0.00	2.2%	0.00
Exit Survey Assessment	Advance / Recognition	43.3%	40.0%	55.0%	65.0%	75.0%	100.0%	0.05	3.7%	0.00
	Compensation / Benefits	42.2%	40.0%	55.0%	65.0%	75.0%	100.0%	0.04	3.7%	0.00
	Quality of Life	43.2%	40.0%	55.0%	65.0%	75.0%	100.0%	0.05	3.7%	0.00
Parity Index	Minorities	100.0	50.0	60.0	70.0	80.0	100.0	1.00	3.7%	0.04
	Hispanics	100.0	50.0	60.0	70.0	80.0	100.0	1.00	3.7%	0.04
	Women	63.0	60.0	65.0	70.0	80.0	100.0	0.15	3.7%	0.01
Reduction in Lost Time Case Rate	2	-5.00	-2.50	3.00	7.50	10.00	0.45	11.1%	0.05	
Total:									0.24	

Customer Perspective		Perspective Weight= 20%							
Metric (Units)	Value	Poor	Below avg	Average	Above avg	Exceptional	Score	Weight	Wt. Score
Overarching metric: Customer Satisfaction Index	77.00%	75.0%	77.0%	82.0%	87.0%	90.0%	0.25	16.7%	0.04
Customer response on Order Fulfillment survey	77.00%	75.0%	77.0%	82.0%	87.0%	90.0%	0.25	16.7%	0.04
% of negotiated Distribution agreement terms perfectly fulfilled	82.00%	80.0%	82.0%	87.0%	92.0%	95.0%	0.25	33.3%	0.08
% of contingency processes exercised on a regular basis	65.00%	50.0%	65.0%	85.0%	95.0%	100.0%	0.25	16.7%	0.04
% of required contingency plan in place to respond to surge	83.33%	70.0%	83.3%	90.0%	96.7%	100.0%	0.25	16.7%	0.04
Total:									0.25

Total Score for all Perspectives= 0.45

The BSC already implemented by MLD contains some of the same variables required for the UBSC. MLD's BSC already monitors current performance and indicates a target value for each metric. Like the BSC, the UBSC requires the current value for a metric. However, the UBSC requires five values for the utility function rather than a single target value. For some metrics, the target value for the BSC is the performance level considered "Exceptional" for the UBSC. For others, this target level is considered by the practitioner to be the "Average" or "Above Average" value because long-term improvements are thought to be possible. The UBSC also requires a weighting factor for each metric and a weighting factor for each of the four perspectives.

Exhibit 3. Comparison of Inputs and Outputs for UBSC and BSC

	Number of Inputs	Number of Outputs
MLD's BSC	140	35
MLD's UBSC	249	40

The BSC used by MLD does not produce the same types of output as the UBSC does. For each of the metrics the BSC indicates good, cautionary, or warning performance. The UBSC provides a numeric utility value for each metric. The BSC does not aggregate the performance of all metrics within a single perspective. The UBSC weights the individual metrics and then sums these utility values into a single Score that rates the performance of the perspective. The UBSC provides a single utility value or Total Score for all Perspectives that describes the performance of the organization which is not a feature of the BSC. The UBSC weights the individual metrics and perspectives by relative importance to the managers which is not characteristic of the BSC.

Practitioner Assessment

A practitioner assessment is used to examine the advantages and disadvantages of using the UBSC method rather than the performance measurement method already in place. The results of the case study are mostly anecdotal, but they provide insight into the development and use of the UBSC method. The questions asked of the practitioner and the answers provided are next. The practitioner's responses are in bold text.

1. How does the UBSC compare to the traditional BSC with respect to the time and effort devoted to developing the measurement system?

The UBSC requires more time and effort to develop than the traditional BSC. A greater understanding

of the overall system and individual attributes is necessary.

2. How does the UBSC compare to the traditional BSC with respect to the time and effort devoted to *using* the measurement system?

The methods are equivalent in their usage, since once the information is gathered for developing the system only the current performance levels are monitored.

3. Does the UBSC methodology provide you with *more* information than the traditional BSC? If yes, what additional information is obtained?

The UBSC definitely provides more information than the BSC. The BSC relies on the intuition and experience of the person who is interpreting the output. The UBSC provides information on a rating scale that can be used by managers and employees of any experience level.

4. Does the UBSC methodology provide you with *more valuable* information than the traditional BSC? If yes, what is the additional value?

It depends on how the UBSC is being used. Because so much more information is being given, if the performance metrics or parameters being used are not chosen carefully the UBSC can be misleading. The practitioner recommends careful verification and validation of all parameters by users on many levels to ensure accurate performance measurement.

5. How could the information obtained from the UBSC methodology be used?

The practitioner felt that the UBSC was a companion to the BSC for performance measurement. It provides interested parties with more detail about the metrics that over which they may exercise some control. The practitioner also commented that the UBSC is an excellent communication tool that could be posted on the organization's website for all employees to see.

In the comparison made between the UBSC and the BSC, the practitioner mentioned what is often emphasized in performance measurement literature: the development of a good performance measurement system requires a thorough knowledge of the system being measured. Many practitioners agree that the greatest benefit of implementing the measurement system is simply the gain in understanding and communication among managers of all levels.

The practitioner also emphasizes that the value of the information resulting from the UBSC is only as accurate as the information used to develop the UBSC.

A poorly constructed performance measurement system can be more detrimental than no measurement system at all. If a manager uses the results of a haphazardly-created UBSC to make decisions without checking the validity of the UBSC output, the decisions may be worse than the decisions that would have been made using only instinct and intuition if the UBSC were not in place.

References

- Youngblood, Alisha D., and Terry R. Collins, "Addressing Trade-offs in the Balanced Scorecard to Facilitate Performance Improvement," *Proceedings from the 2002 ASEM National Conference*, (October 2002).
- Youngblood, Alisha D., and Terry R. Collins, "Addressing Balanced Scorecard Trade-offs Issues Between Performance Metrics Using Multi-Attribute Utility Theory," *Engineering Management Journal*, Vol. 15, No. 1 (March 2003-a), pp. 11-17.
- Youngblood, Alisha D. and Terry R. Collins, "Addressing Trade-off Issues Between Performance Metrics Using Multi-Attribute Utility Theory," *12th Annual Industrial Engineering Research Conference*, (May 2003-b).
- Youngblood, Alisha D., Terry R. Collins, and Heather Nachtmann, "Investigation of a Utility-based Balanced Scorecard," *13th Annual Industrial Engineering Research Conference*, (May 2004).

About the Authors

Alisha D. Youngblood, Ph.D. is an Assistant Professor in the Industrial and Systems Engineering department at the University of Alabama in Huntsville. She earned her Ph.D. in Industrial Engineering from the University of Arkansas. Her research interests include engineering management, performance measurement, economic decision analysis, and logistics. She is an active member of IIE, ASEE, ASEM, and INFORMS.

Terry R. Collins, Ph.D., P.E. has been involved in performance measurement for 20 years in both an industry and academic setting. He currently serves on the faculty in the Industrial Engineering Department at Texas Tech University. He has held faculty positions at the University of Houston serving as the Faculty Advisor for the Texas Manufacturing Assistance Center focusing on performance enhancement, and University of Arkansas where he was the Director of the Operations Management Program and Arkansas Productivity Center. He currently serves as the South Central Regional Director for the American Society of Engineering Management.

Heather Nachtmann, Ph.D. is an Assistant Professor of Industrial Engineering at the University of Arkansas. She received her Ph.D. in industrial engineering from the University of Pittsburgh. Her research interests include economic decision analysis, decision-making under uncertainty, engineering valuation, and engineering education. She is a member of AACE International, ASEE, ASEM, IIE, INFORMS, and SWE.