Essay

> Often the technical and business sectors of IT organizations work in opposition, toward different goals and objectives. The authors propose a method that integrates strategic and project measurement systems, supporting long-term growth, stability, and competitiveness.

Aligning Strategic and Project Measurement Systems

Shirley A. Becker, Florida Institute of Technology

Mitchell L. Bostelman, American Management Systems

T oday's competitive software development market requires effective alignment of strategic and project management systems for organizational survival and growth. A strategic management system is requisite for ensuring that a corporate vision includes the needs of customers and stakeholders while promoting internal learning and innovation. An effective strategic management system offers many benefits:

♦ the development of a learning environment for process improvement;

♦ effective use of resources and assets;

♦ a focus on areas critical for financial success;

♦ opportunities for innovation and technological advances;

♦ a mechanism for corporate buy-in and commitment that promotes personal interaction and negotiation at all levels;

♦ the ability to assess corporate, business unit, and technological trends; and

♦ an analysis of market potential and competitive domain.

A strategic management system will not guarantee organizational commitment and accountability unless the strategy can be translated into a set of operational goals and metrics.[1] Corporate executives must formulate a clear strategy based on experience, vision, and insight, and then communicate how to implement it. Even if senior management develops an effective strategy, it will dissipate at the operational level if project managers devise their own project goals and measurement systems.[2] A success at the project level will then be out of sync with the corporate strategy in terms of market opportunities, technological innovations, competitiveness, or other strategic factors.

A project management system, driven by corporate strategy, is just as important. Ideally, this system measures an organization's project performance with goals and metrics. Too often, the project measurement component is viewed by management as a final objective or is developed in isolation of organizational goals, resulting in unpredictable project success.[3] Managers need a strategy that identifies "who are we, what are we doing, and where are we going," and that focuses the project on "what should we be doing, are we doing it, and how can we improve." Without such an approach, the misalignment illustrated in Figure 1 may become an organizational reality.

An alignment of strategic and project management systems is possible through the integrated use of two popular measurement tools: the Balanced Scorecard[4,5] and the Goal Question Metrics approach.[6] The BSC uses high-level perspectives to encompass an organization's corporate vision. These perspectives can be used as a whole or separately to identify the focal areas associated with achieving the organizational vision. The GQM approach develops a project measurement system that includes project goals, baselines, and metrics for ongoing assessment of project work.

Previous work has proposed the use of BSC as a common measurement mechanism for strategic, management, and personal levels of work.[1] A variation of the BSC, the IT Balanced Scorecard, has been developed by the European Software Institute to provide a framework for strategically managing investments in software process improvement initiatives.[7] The application of GQM has most recently been described as part of a risk management measurement-based frameworks,[8] an information systems project measurement program,[3] and an organization-wide process improvement plan.[9] This work reflects the growing popularity of GQM as a
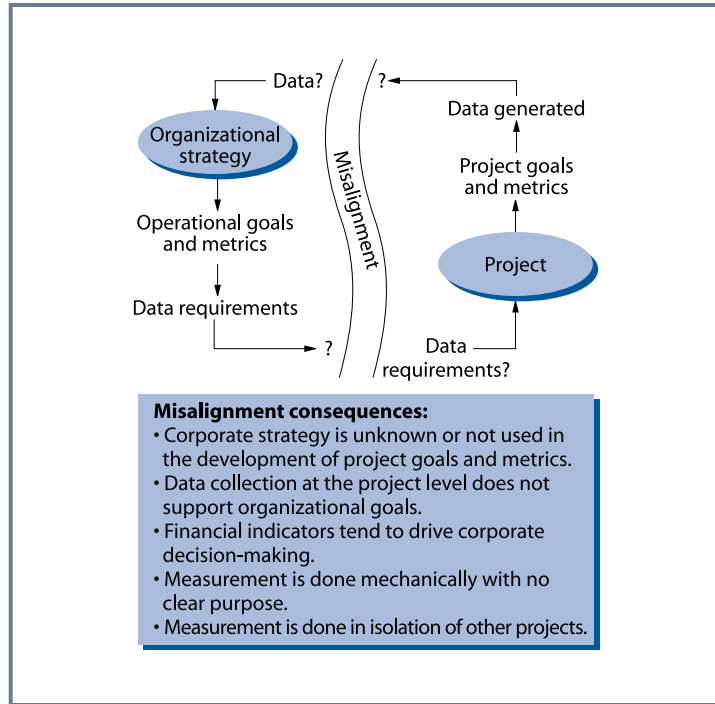

Figure 1. When strategic and project management systems are misaligned, communication between corporate executives and project managers is limited and ineffective.

measurement technique, though it has limitations.[10]

In his evaluation of the GQM technique, David Card points out that a measurement system needs to include the business goals of a software product being measured.[10] With this in mind, we propose that an integrated BSC and GQM approach can provide a comprehensive measurement program, incorporating the organization's goals, when GQM is used in a more general measurement framework.

BALANCED SCORECARD

Many organizations have chosen the BSC technique as a strategic management tool because it is easy to use, it has automated tool support, and it is comprehensive.

The BSC technique, illustrated in Figure 2, translates a corporate vision into financial and non-financial measurement perspectives. There are four tightly integrated perspectives on which you can base a comprehensive set of organizational goals and metrics:

♦ Financial—This is an important measurement because the shareholders are concerned with the financial results of the organization. Financial assessment typically includes revenue growth, productivity, resource utilization, efficiency, and investment opportunities.

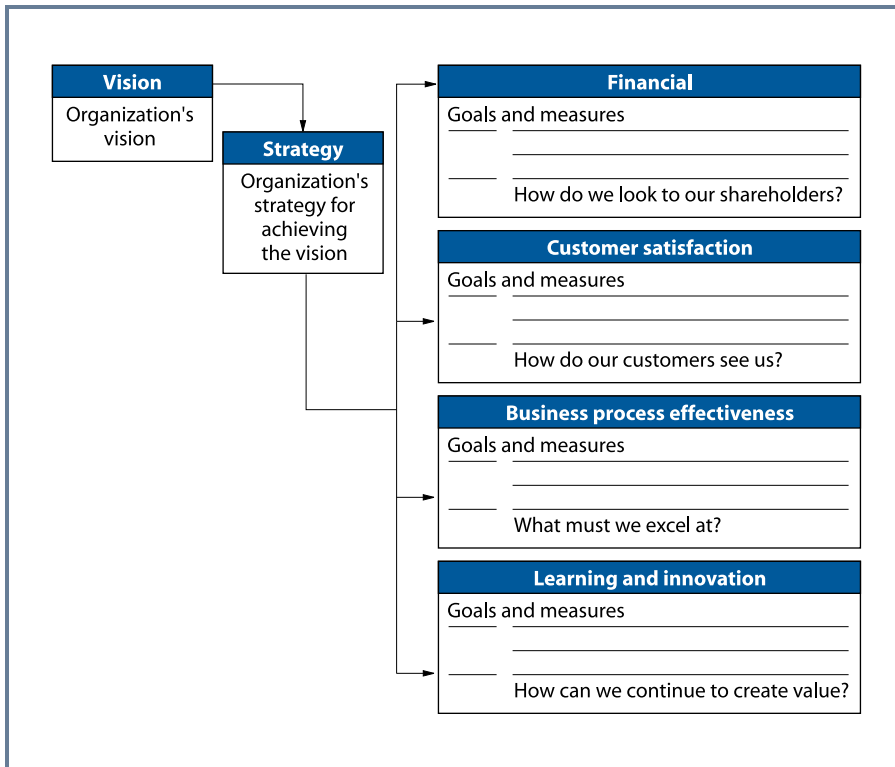♦ Customer satisfaction—Customer satisfaction

Figure 2. The BSC approach to business planning and strategic management.

is necessary for long-term market maintenance and growth. The key areas of assessment include market share, customer satisfaction and retention, and profitability.

♦ Business process effectiveness—Key business processes allow organizational maturity and improvement. These internal processes can be assessed in terms of operational modes of work and documented procedures and policies.

♦ Innovation and learning—To promote innovation and continuous learning, an organization needs to assess its employee assets, information systems capabilities, and technology competencies because both people and organizational infrastructure are valuable.

Financial results will improve when innovation and learning and business process effectiveness are used to develop products and services that sustain customer satisfaction. Because financial measures are generally used for a particular goal, they are typically considered lagging indicators. By incorporating nonfinancial measures as leading indicators, you can enable a proactive environment whereby measurement data provides timely feedback on your organization's financial success.

GOAL QUESTION METRICS APPROACH

GQM is a structured approach to implementing a strategy at the project level.[6,11] The measurement system is based on specific goals; once a goal is identified, then an appropriate set of metrics is selected to assess its achievement. This approach differs from other measurement techniques that dictate a set of metrics to assess project performance. GQM derives the project's assessment metrics from goals and not from a predetermined, possibly misaligned, set of criteria.

In the GQM approach, a goal is formalized in a statement that is broken down into basic information sources: purpose, issue, object, and viewpoint. Then, questions are formed that quantify that goal. Once the questions have been developed, each question is supported with an appropriate metric set.

COMMON MEASUREMENT FRAMEWORK

A common measurement framework supports the alignment of organizational and project goals. The BSC ensures that the four perspectives establish organizational goals and metrics that can be used to develop all project measurement systems. Within the BSC structure, GQM provides a standard approach for identifying goals, establishing baselines, and defining metrics. Figure 3 shows the integration of BSC and GQM.

This framework promotes top-down alignment of measurement systems so that project managers will no longer work in isolation of the strategic initiatives of the organization. It also ensures that bottom-up data requirements are established to support measurement activities at both the project and strategic levels of work.

At the strategic level, we can use GQM within the context of the BSC perspectives. GQM can be used to establish strategic goals that can then be supplemented with appropriate metrics. Table 1 illustrates this concept by showing how to identify a goal related to a BSC perspective. In this example, the goal is to assess the supply of engineers produced from academic engineering institutes in the US and Canada. That goal is followed by two questions that

Table 1
Example of GQM Structural Decomposition

Goal	Purpose	To assess the supply of engineers produced from accredited US and Canadian academic engineering institutions
	Issue	The supply of engineers from accredited US and Canadian institutions for each academic year since 1950
	Object	Survey data of accredited institutions located in the US and Canada
	Viewpoint	Accredited academic engineering institutions
Question		What is the supply of engineers from accredited academic institutions located in the US and Canada since 1950?
Metric		Total number of engineers that have a terminal degree in an engineering field from an accredited institution in the US and Canada categorized by academic year since 1950
Question		What is the change in supply of engineers from accredited academic engineering institutions in the US and Canada since 1950?
Metrics		Percentage change each year, trend analysis for previous 38 years

Metrics summarized for illustrative purposes

in turn are answered by a set of metrics.

The combined BSC and GQM framework bridges the gap between business and technical management, and it offers several potential benefits:

♦ A common vision—promotes buy-in and commitment throughout the organization. Common goals are agreed upon by senior management, represented in an understandable format, and made accessible to all participants in measurement activities.

♦ Information infrastructure—promotes a standard way of collecting and disseminating information from the senior executive level to project management. Goals and measurement systems can be developed using a common framework, and, as a result, information can be accessed more readily for experiential learning and improvement throughout the organization.

♦ Balanced perspective of internal and external dependencies—promotes a broader perspective throughout the organization on internal and external factors that affect project success. Project and senior management can have access to information to incorporate the four BSC perspectives. For example, the customer perspective includes market analysis and customer acquisition, satisfaction, and retention considerations.

AN INITIAL STUDY AND LESSONS LEARNED

We applied the integrated BSC and GQM framework in an organization developing a Web-based software survey tool. The boxed text "Project Profile" is a partial list of the organization's mission, operational goals, and project information. Though the
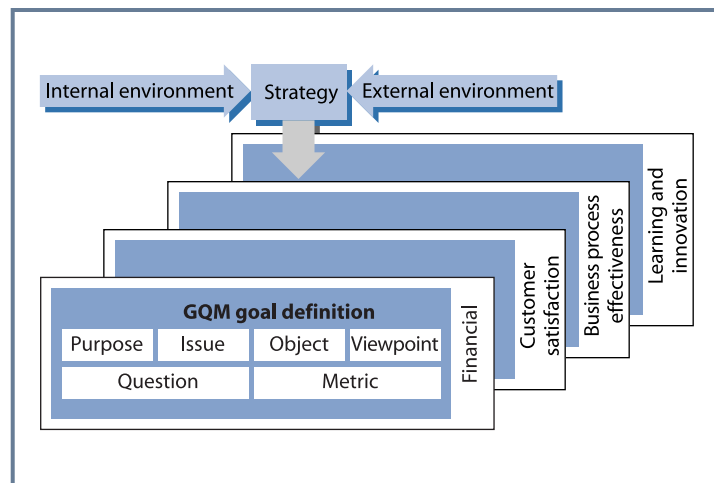

Figure 3. The integration of the BSC and GQM techniques promotes a clear and focused measurement strategy.

findings from the study were inconclusive, we will briefly describe the use of the integrated framework in this study as a basis for future work.

The project measurement system initially in place was the project manager's intuition, "I will know it when I get there," where "it" referred to the management of schedules, quality, resource use, and software functionality. The team subjectively measured project work by anticipating the "rhythm and pattern of the project" based on experience, with virtually no reliance on historical data or formal data collection.

We introduced the BSC and GQM framework to formalize the data collection after the company recognized the project was out of control. The staff and upper management then worked together to establish measures to guide the project. The project goals were aligned with the organization with an

emphasis on meeting the customer's needs in terms of timely and accessible survey data.

Our objective was to formalize the financial and nonfinancial goals of this informal project measurement program and align them with the organization's BSC. The project profile shows these BSC and GQM goals at the operational and project levels, which were aligned for data collection and measurement activities. The four BSC perspectives became the basis for goal setting at both the operational and project levels of work.

For example, the project established this strategic goal: improve the customer satisfaction of

academic and other institutions by providing accessibility and timely access to survey data. They supplemented the goal with measurement types identified during the use of GQM. These included timeliness of published data, data validation and verification, accessibility to historical data, Web-based data collection, and query tool support. At the project level, this required the alignment of project goals that focused on the development of a Web-based product. This information is summarized in the boxed text, "Project Profile."

The project did show the alignment potential for data collection and evaluation as shown in Figure 4. The project was considered a success because the tool was fully functional by the due date and it did not exceed allocated resources. However, our results were inconclusive because we could not determine if the team gained control of the project solely based on the BSC and GQM approach. We do know that the development of measures gave feedback on project areas that were misaligned with strategic goals. It also impacted the decision-making process by instituting an approach based on project goals that were aligned with the business vision.

In this study, senior management was willing to provide strategy information and supported the project measurement system. However, this isn't always the case. Executives may restrict access to strategic management data, making it virtually inaccessible to project managers. At the same time, project managers may be unwilling to relinquish control over project data that is necessary for assessing strategic performance. These and other types of organizational impediments need to be studied further to identify ways for effectively transferring new technology.

We found that the BSC perspectives provided a focus during the GQM exercise. We identified both financial and nonfinancial indicators, which broadened the perspective of what needs to be measured at the project level. Our experience affirms that training, expertise, and well-defined processes are needed to make this a viable approach.

The size and scope of our study did not yield sufficient data on the cost effectiveness of using the integrated BSC and GQM framework. This is an essential component of future research to provide insight on the financial and nonfinancial implications of short-term and long-term use. Additional research is needed to determine the implications of using this approach on larger projects that require

the coordination of senior and project management as well as development teams. Information requirements also require further study to effectively align data requirements at the senior and project management levels. We have initiated development of an information infrastructure that uses databases and Web technology to support data collection and abstraction capabilities.

Many organizations are looking for ways to align their strategic and project management systems. We've addressed this concern by introducing a means of aligning these systems with a BSC and GQM common framework. However, there is still much to be learned about the effectiveness and practicality of using this technique. Through further research we can study the viability of such an approach, since there is great potential for coordinating efforts at the senior and project management levels. ❖

Figure 4. The alignment potential of the company using the integrated GQM and BSC framework.

REFERENCES

1. R.S. Kaplan and D.P. Norton, "Using the Balanced Scorecard as a Strategic Management System," *Harvard Business Rev.*, Jan./Feb. 1996, pp. 75-83.
2. S. Pellegrinelli and C. Bowman, "Implementing Strategy through Projects," *Long Range Planning*, Vol. 27, No. 4, 1994, pp. 125-132.
3. D.T. Edberg, "Creating a Balanced IS Measurement Program," *Information Systems Management*, Spring 1997, pp. 32-40.
4. R.S. Kaplan and D.P. Norton, "The Balanced Scorecard—Measures that Drive Performance," *Harvard Business Rev.*, Jan./Feb. 1992, pp. 71-79.
5. R.S. Kaplan and D.P. Norton, *The Balanced Scorecard: Translating Strategy into Action*, Harvard Business School Press, Boston, Mass., 1996.
6. V.R. Basili, G. Caldiera, and H.D. Romback, "Goal Question Metric Paradigm," *Encyclopedia of Software Engineering, Vol. 1*, J.C. Marciniak, ed., John Wiley & Sons, New York, 1994, pp. 528-532.
7. M. Ibáñez and D. Reo, "Aligning Software Process Improvement with Business Goals: ESI Balanced Scorecard," *Proc. European Software Eng. Process Group Conf.*, London, 1998.
8. J. Offen and R. Jeffrey, "Establishing Software Measurement Programs," *IEEE Software*, Mar./Apr. 1997, pp. 45-53.
9. F. van Latum et al., "Adopting GQM-Based Measurement in an Industrial Environment," *IEEE Software*, Jan./Feb. 1998, pp. 78-86.
10. D. Card, "What Makes for Effective Measurement?" *IEEE Software*, Nov./Dec. 1993, pp. 94-95.
11. V. Basili and D. Rombach, " The TAME Project: Toward Improvement-Oriented Software Environments," *IEEE Trans. Software Eng.*, June 1998, pp. 748-773.
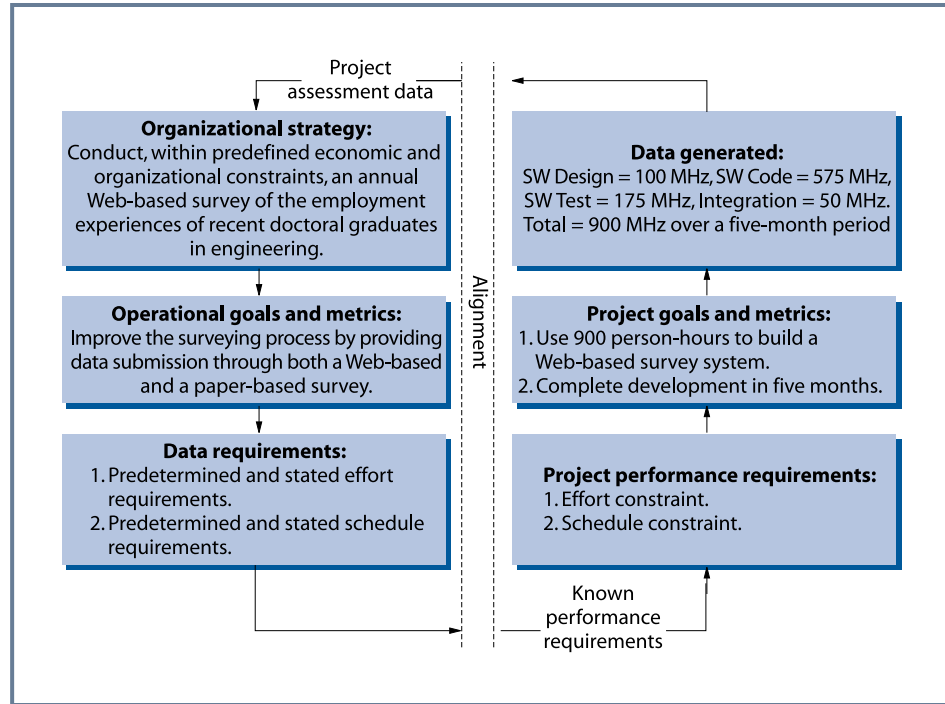
About the Authors

Shirley A. Becker is an associate professor of computer science at Florida Institute of Technology and co-director of its Software Engineering Research Center. She is also the editor-in-charge of the *Journal of Database Management* and co-editor of the book *Cleanroom Software Engineering Practices*. Becker received an MBA from St. Cloud State University and an MS and a PhD in information systems from the University of Maryland at College Park. She is a member of IRMA, IEEE, and ACM.

Mitchell L. Bostelman is a quality assurance consultant at American Management Systems and is an associate of the AMS Center for Advanced Technologies. Before joining AMS, he worked in the non-profit sector as a software project manager, systems archi-tect, and database administrator. His is also the co-author of the chapter "Linking Strategies and Operational Goals" in the book *Software Process Improvement: Concepts and Applications.*

Bostelman received a BA in economics from the University of Maryland and an MS in information systems from American University. He is a member of ACM and the Society for Software Quality.

Readers may contact Becker at Florida Institute of Technology, Computer Science, 150 West University Blvd., Melbourne, FL 32901; e-mail becker@cs.fit.edu.

www.manaraa.com