

# Knowledge Quotient™ (KQ): A Way to Measure the Knowledge Intensity of Your Team

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## **Abstract**

We report on a joint university-corporate effort to develop a conceptual framework to measure the business impact of knowledge management (KM) in the context of the corporation's initiation of a network of knowledge communities. The effort attempts to integrate the unique needs of corporate practitioners as well as the theoretical perspectives of academic researchers. The framework highlights the importance of a comprehensive planning/measurement perspective as well as the alignment of KM and strategy and introduces the concepts of knowledge quotient (KQ) and KQ life cycle.

We gratefully acknowledge the support and collaboration from Unisys Corporation's KM team in participating with us and providing the context of this study. All references to specific Unisys data have been removed from this paper for proprietary reasons.

The Pennsylvania State University is the proud owner of the Knowledge Quotient™ (KQ) developed by the eBusiness Research Center (eBRC) in the course of this study.

## Author Biographies

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information infrastructure and policies with organizational and competitive business context. He received his Ph.D. in business administration from the University of Rochester.

## Background

Measuring the impact of KM is predicated on the establishment of one or more value systems. The obvious value system to most business executives is economic, but KM value systems frequently include such dimensions as customer or employee satisfaction and/or loyalty, customer intimacy, process or product quality, and innovation (e.g., frequency of patents). The goal of KM may be expressed in one value system, especially at the planning stage, but may materialize in other value systems—either instead of, or in addition to, initial expectations. Conventional business planning may oblige KM planners to seek economic measures for its impact. But, if measurement systems rely solely on economic measures, the profound and varied effects of KM could evade measurement—indeed the investment might be shown as loss making (economically).

## Conceptual Framework Overview

We begin our development of a conceptual framework for KM metrics by describing the overall enterprise framework for KM. KM is being implemented at many organizations through the enablement of knowledge communities. These communities form an informal network separate from the organization's formal structure.

Within the overall enterprise framework for KM we then address the issue of measuring the impact of KM at multiple levels within the organization. Currently, the focus is on measuring the impact within knowledge communities, but we have developed a comprehensive framework that permits theoretical extension to multiple levels within the organization—not only knowledge community, but also individual, enterprise, and functional department. We accomplish this by stressing the development of outcomes/metrics that are capable of multiple application. Our focus then turns to measuring the impact of KM in communities.

We first address the process of deriving community outcomes, identifying impacts to community stakeholders, and developing metrics to measure those outcomes and impacts. We then introduce the *Community KM Planning/Measurement Framework* to guide the community in categorizing its knowledge resources, activities, and outcomes in a comprehensive grid along four domains—*Members, Customers/Stakeholders, Process, and Technology*.

At this point, we introduce the concept of the knowledge quotient™ (KQ). A KQ score is one overall number that can be used to track progress in implementing KM in an organization. Conceptually, a KQ can also have multiple domains to support a finer-grained analysis of progress. Theoretically, individual domain scores can be calculated by weighting and combining individual metrics from resources, activities, and outcomes in that domain. A KQ can be calculated at multiple levels of the organization from individual to group to enterprise and within both formal departments and informal knowledge communities. Theoretically, KQs from lower organizational levels can be aggregated into a composite KQ at a higher level. We discuss the importance of developing standards as a prerequisite to aggregation. One particular advantage of the KQ is the ability to do trend analyses at multiple levels. Weighting individual

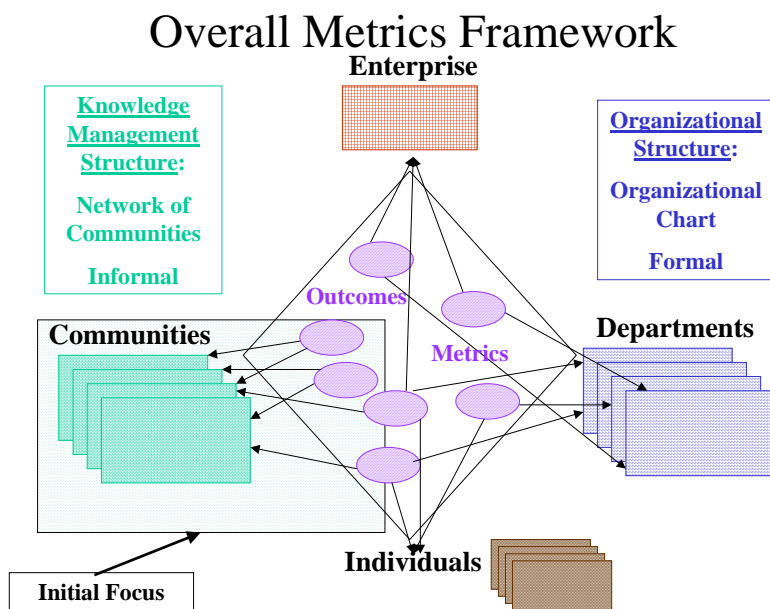
outcomes/metrics in calculating a domain score and weighting domain scores in calculating a KQ are critical to the flexibility of the aggregation process. It is possible for different sets of weights to be applied at different levels of aggregation. This flexibility allows measurement needs at each level to be met. Weights can also serve as management levers at all levels to shape implementation of strategic goals. The KQ concept offers the possibility of deriving a single number to concisely capture the impact of KM initiatives.

We then discuss the importance of aligning KM and strategy. We call on the Balanced Scorecard (Kaplan and Norton, 1996) and a strategic perspective we call the Balanced Triad based on work by Karl-Erik Sveiby (Sveiby, 1997, 1998) to assist in this process. After briefly describing the two strategic frameworks, we work through the process of mapping KM metrics to strategic goals in both frameworks. We close this section by addressing the iterative nature of strategy and KM alignment and the feedback loops that exist between them.

To address specific needs in its implementation of KM we present a simplification of the KM and strategy alignment process. First, we focus only on outcome metrics and remove consideration of resource and activity metrics. Second, the synthesis of the two strategic frameworks into the *KM Star Planning/Measurement Framework* simplifies the alignment process by focusing on only one comprehensive strategic framework. This framework provides an overarching consistent strategic context for the entire knowledge community enablement process—from initial “business case” through derivation of community outcomes to their eventual measurement.

Finally, we introduce the concept of the knowledge quotient™ life cycles and describe the steps in the process at both the community and enterprise levels. The steps are similar for both processes but take place, for the most part, at their respective levels.

## Overall Enterprise Framework for KM



The implementation of KM is generally being driven through enabling the formation of knowledge communities. The structure of knowledge communities is different from the formal structure of the enterprise as depicted by the organizational chart. Thus, most organizations make the decision to implement KM through an informal organizational structure. The implication of this is that KM as a whole will be characterized by norms and collaboration as opposed to authority and control. Overseeing the process of community enablement and providing important direction to the collection of individual knowledge communities is the KM Community. The knowledge communities are related through an informal network of communities. Finally, individuals participate in both structures—formally, as employees in departments, and informally, as members of knowledge communities relevant to them.

## **Measuring the Impact of KM at Multiple Levels Within the Organization**

The impact of KM can initially be measured at the community level. Each knowledge community determines its own outcomes and metrics within the overall KM context. Therefore, we originally focused on developing a metrics framework with the rather narrow scope of identifying a comprehensive list of metrics, defining their formulation, indicating appropriate areas of use, etc. As we proceeded in developing a conceptual metrics framework, however, we determined that an important criterion was the capability of extending it beyond the individual community. The unique quality of knowledge as an asset, as opposed to other types of assets, is that the more it is used, the more value it has. In that spirit, we decided that the leveraging of knowledge outcomes and metrics also added value to the KM initiative. Thus, the metrics framework developed builds on the overall enterprise framework for KM.

There are probably some community outcomes/metrics whose value is strictly internal—important only to the sustainability of the individual knowledge community. However, conceptually there are other outcomes/metrics that can be extended within the KM structure to other communities, down to individuals, up to the enterprise as a whole, and across to formal organizational units through their stakeholder roles in knowledge communities. The ability to extend metrics beyond the individual community—to other knowledge communities as well as both vertically to the individual and to the enterprise and horizontally to the formal organizational units—assumes a level of standardization of some metrics.

An example of an outcome that permits extension both vertically and horizontally would be re-use of software modules. In the application software developer knowledge community that outcome has a high priority, and the community has set as a target metric for that outcome the average number of times each module is used. The higher the average, the more re-use. This outcome would presumably also be important to other software and hardware developer knowledge communities, and they could measure it the same way. At the individual level, one aspect of a developer's performance appraisal could include the number of modules re-used as well as a measure of new modules contributed that others re-use. In the formal functional areas which house the software developers, re-use has both efficiency and effectiveness impacts and could be measured respectively by decreasing time to develop and increasing quality and stability of software. At the enterprise level, impacts can be seen in both financial and knowledge assets. Reduction in development and service cost and increase in sales revenue

enhance the company’s financial assets. Increases in intellectual capital represented by raising the expertise of developers (human capital) as well as by enhancements to the software library that stores modules, facilitates search, and eases access (structural capital) enhance the company’s knowledge assets.

## Measuring the Impact of KM in Communities

### Community KM Planning/M Measurement Framework

The *Community KM Planning/M Measurement Framework* introduced here, as its name indicates, be used by the knowledge community for both planning and measurement purposes. The framework is comprised of a grid adapted from work by Jan Mouritsen (2001). The columns in the grid represent the knowledge community *Outcomes* and the knowledge *Resources* and *Activities* undertaken by the knowledge community on which the outcomes depend. The rows represent the domains which can be used to categorize knowledge community resources, activities, and outcomes. We adapted Mouritsen’s Analytical Accounting System to form the basis of our framework. We changed the title of the *Effects* area to *Outcomes* to reflect the language used by Unisys in its KM initiative. We also changed the titles of the domains *Employees* and *Customers/Publics* to *Members* and *Customers/Stakeholders* respectively to more accurately reflect the nature of the knowledge communities.

### Knowledge Community Planning/M Measurement Framework\*

Domains \ Areas	Resources	Activities	Outcomes
Members			
Customers Stakeholders			
Process			
Technology			

\*Adapted from Mouritsen

The *Members* domain covers resources, activities, and outcomes related to knowledge community participants. In our continuing example of software developers, developers in companies partnering with an organization on a particular application would be prime candidates for community membership.

The *Customers/Stakeholders* domain covers resources, activities, and outcomes related to knowledge community customers and stakeholders. This domain includes customers, suppliers, and other stakeholders both external (e.g., regulators) and internal (e.g., department managers) to the organization. Each community selects the customers and stakeholders most relevant to its

scope. In the software development example, Quality Assurance might be a stakeholder which would be impacted by, as well as an influencer on, the software standards developed by the knowledge community.

The *Process* domain covers resources, activities, and outcomes related to the processes, methodologies, etc. available to the knowledge community as well as the business processes that can be impacted by KM initiatives. Again, using our example, developing a procedure to search for and identify modules appropriate for software re-use would fit within this domain.

The *Technology* domain covers resources, activities, and outcomes related to the information technology and infrastructure available to the knowledge community as well as the technology that can be impacted by KM initiatives. In the software development example, the acquisition or development of a software library would fall within the *Technology* domain.

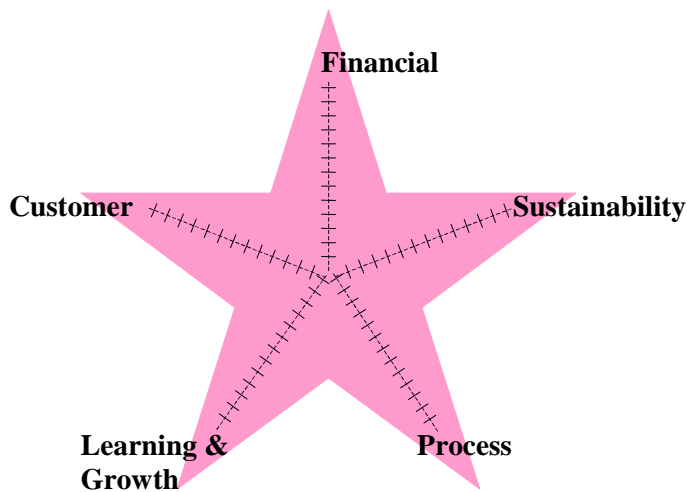
Individual metrics should be identified for each entry in the planning grid. Some entries may have multiple metrics. The definition of metrics is a critical piece of the process. It is only with valid measures that any statement concerning progress toward a goal can be justified. Metrics need to be auditable because this allows them to be categorized and classified. Objective measures are best but not always possible given the state of the art. It is better to collect subjective data on an outcome and gradually objectify it over time than it is to ignore it altogether by not collecting any data at all. Finally, the cost of collecting data should be small relative to the benefit it can provide to the community.

Theoretically an overall score for the knowledge community, as well as scores for each domain, can be derived by weighting and combining the individual metrics. We will address this issue in more detail in the section on Knowledge Quotient.

## **Knowledge Quotient™ (KQ)**

A knowledge quotient™ score is one overall number that can be used to track progress in implementing KM in an organization. Unlike an individual intelligence quotient (or IQ), an organization's KQ is not assumed to be relatively stable over time. On the contrary, the expectation is that it will continue to grow, and that the KQ is an easy way to measure and track that growth. Thus, the KQ concept offers the possibility of deriving a single number to concisely capture the impact of KM initiatives.

# Knowledge Quotient™



Conceptually, a KQ can also have multiple domains to support a finer-grained analysis of progress. The number of domains is dependent upon the theoretical framework supporting the KQ. Theoretically, individual domain scores can be calculated by weighting and combining the individual metrics from resources, activities, and outcomes in that domain. Typically, the score along each domain would focus heavily on outcomes, but can be tailored to include resources and activities as well. To facilitate calculation, not to mention understanding, metrics should be chosen such that an increasing score is desirable in each of the domains.

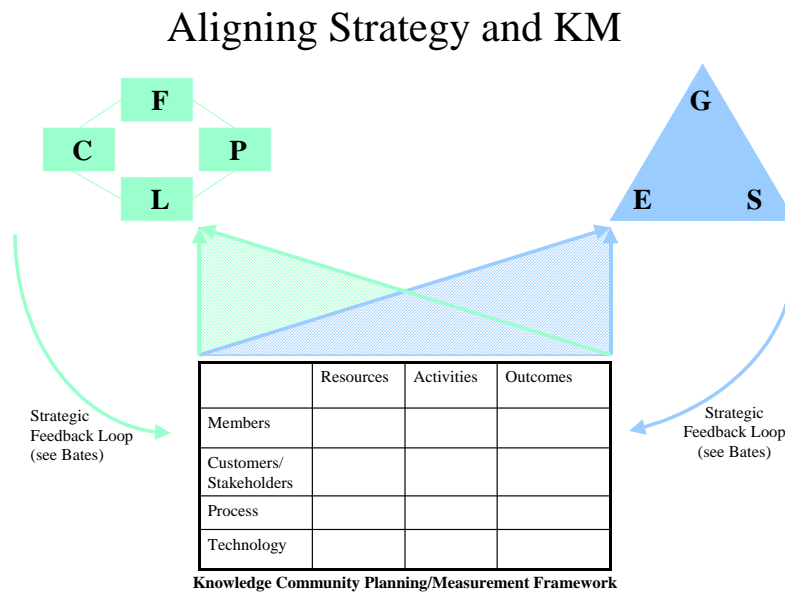
A KQ can be calculated at multiple levels of the organization from individual (IndividualKQ) to group (GroupKQ) to enterprise (EnterpriseKQ) and within both formal departments (DepartmentKQ) and informal knowledge communities (CommunityKQ). Theoretically, KQs from lower levels of the organization can be aggregated into a composite KQ at a higher level. Thus, for example, CommunityKQs could theoretically be aggregated into an enterprise-wide EnterpriseKQ. However, a critical consideration in aggregating is the development of standard metrics. Defining metrics within an individual knowledge community can be done without any regard for how similar metrics are defined elsewhere. However, if an outcome is to be aggregated across communities to a higher level, standardization becomes critical for metrics to be meaningful. An important role of the KM leadership in an organization is overseeing the development of metrics standards to permit aggregation.

One particular advantage of the KQ is the ability to do trend analyses at multiple levels—from individual outcome/metric score to domain score to multiple levels of the KQ. How does the level of knowledge in a community, as represented by its KQ score, change/improve over time? Weighting individual outcomes/metrics in calculating a domain score and weighting domain scores in calculating a KQ are critical to the flexibility of the aggregation process. It is possible for different sets of weights to be applied at different levels of aggregation. So, for example, in an individual knowledge community, the weight for a particularly important domain is set very high (perhaps the *Customer* domain in a sales community), whereas at the enterprise level the

weight for that domain is more balanced with other domains. This flexibility allows measurement needs at each level to be met.

Weights can also serve as management levers at all levels to shape the implementation of strategic goals. For example, if the enterprise is undertaking a quality initiative and it is critical to align KM processes with that initiative, outcomes/metrics in the *Process* domain can receive a higher weight to reward alignment with the strategic thrust.

## Aligning KM and Organizational Strategy



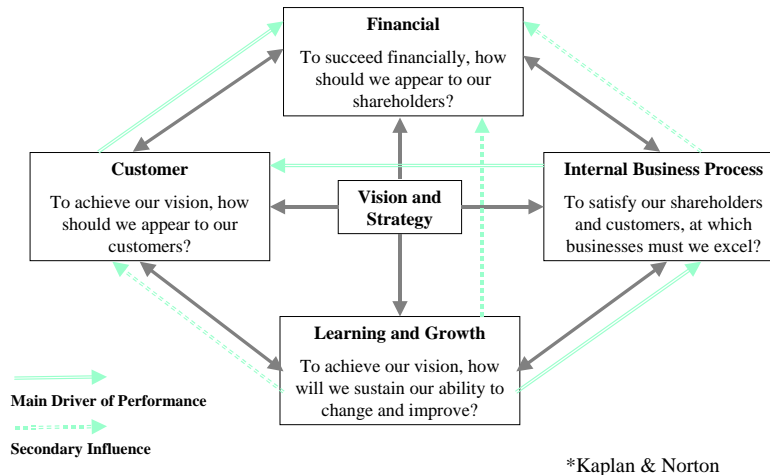
### Aligning Strategy and Knowledge Management

Two organizational strategy frameworks are presented that have different, but overlapping, perspectives: *Balanced Scorecard* and *Balanced Triad*. These frameworks were both originally developed to be used by the formal organization. One benefit of employing them both in the KM context as well as the formal organizational structure context is the potential for a comprehensive strategic measurement framework integrating both the KM and operational perspectives of the organization.

These strategic frameworks can be applied at the knowledge community level as well as the enterprise level. A benefit of employing these two frameworks at the community level is that the impacts of KM can be mapped to both simultaneously in support of their different strategic foci. Finally, the use of these two frameworks at the knowledge community level serves as an overarching framework for the whole of the community enablement process—from deriving outcomes to measuring benefits. In this way it provides a means for the community to realize its knowledge strategy and identity.

## Balanced Scorecard

### Balanced Scorecard\*



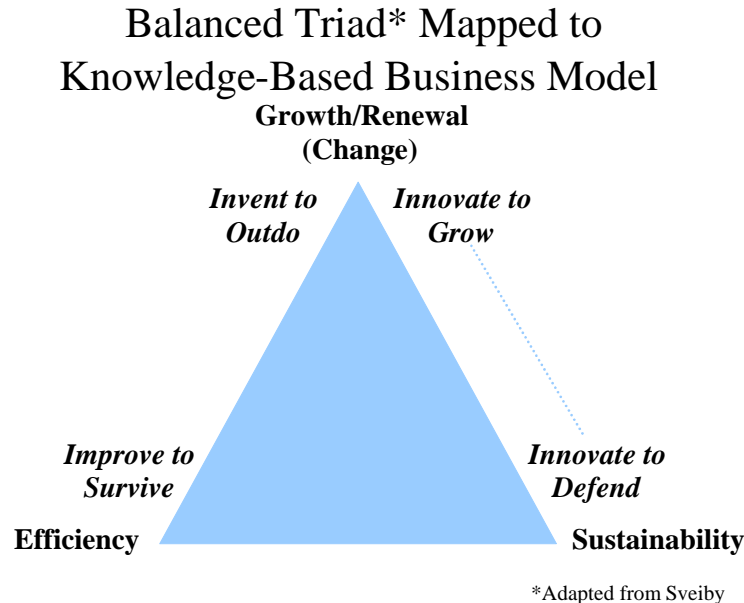
## Balanced Scorecard

The Balanced Scorecard, introduced by Robert Kaplan and David Norton (1996), was designed to broaden the scope of organizational performance metrics. The framework was originally conceived to be used within the formal organizational structure. However, it is being introduced here to provide a comprehensive framework on which to map knowledge community metrics to organizational and knowledge community strategy.

Vision and strategy are at the center of the Balanced Scorecard model. The model includes four performance domains: *Financial*, *Customer*, *Learning and Growth*, and *Internal Business Process*. The *Financial* domain metrics are designed to assess the financial performance of the organization. The *Customer* domain metrics are intended to assess the management of customer relationships by the organization. The *Learning and Growth* domain metrics broadly capture performance characteristics in the areas of employees, information systems and motivation. These metrics are forward-looking. Finally, the *Internal Business Process* domain metrics focus on the operations inside the organization—particularly on the critical value-adding activities that lead to customer satisfaction and enhanced shareholder value.

The Balanced Scorecard model can be extended to apply to multiple levels of the organization. Outcomes and their metrics can be defined in such a way that they can be combined in multiple configurations and rolled up to form a balanced scorecard not only for the enterprise as a whole, but also for subunits of the formal organization such as functional areas, departments, divisions, etc.

## Balanced Triad



### Balanced Triad Mapped to Knowledge-Based Business Model

The Balanced Triad, adapted from Karl-Erik Sveiby (1997, 1998), was designed to provide a framework for the strategic goals of knowledge assets. The framework was originally conceived to be used within the formal organizational structure to track the “health” of knowledge assets. However, it is being introduced here to provide a comprehensive framework on which to track the “health” of an organization—enterprise or knowledge community—by mapping community metrics to organizational and community strategy. This model includes three performance domains: *Growth/Renewal (Change)*, *Efficiency*, and *Sustainability*. The *Growth/Renewal (Change)* domain metrics focus on organizational change—its growth and renewal rate. These metrics are forward-looking. The *Efficiency* domain metrics indicate how well an organization is using its capacity. These metrics focus on cost. Finally, the *Sustainability* domain metrics focus on the stability of the organization as well as its flip side—the risk of organizational mortality. These metrics are indicators of organizational effectiveness. Different change, efficiency, and sustainability measures should be employed for different stakeholders.

### Aligning Strategy and KM

Aligning strategy and KM is an iterative process. Knowledge community metrics (especially outcome-related metrics) can be individually mapped to strategic goals on both frameworks—Balanced Scorecard and Balanced Triad—thus showing how the communities impact the organization’s and their own strategic goals. Strategic goals at the organizational and community levels can, in turn, impact the planning around resources, activities, and outcomes at the community level.

## Mapping KM Metrics to Strategic Goals

Metrics from all cells of the *Community KM Planning/Measurement Framework* are potential candidates to map to individual strategic goals. See Figure 1 for an example of this mapping of metrics from the planning/measurement framework to strategic goals within the domains of the Balanced Scorecard and Balanced Triad frameworks.

It may be that certain areas (columns), domains (rows), or cells of the framework's grid are inherently more, or less, relevant to one goal than another. For example, the *Members* domain is closely related to the *Learning and Growth* domain in the Balanced Scorecard. Likewise, the *Customers/Stakeholders* domain is closely related to the *Customer* domain in the Balanced Scorecard. Finally, all metrics in the *Outcomes* area may be particularly critical to map to both frameworks. One aspect of a knowledge community's success can be determined by its contribution, or mapping, to the organization's as well as its own strategic goals.

### Mapping KM to Strategic Goals

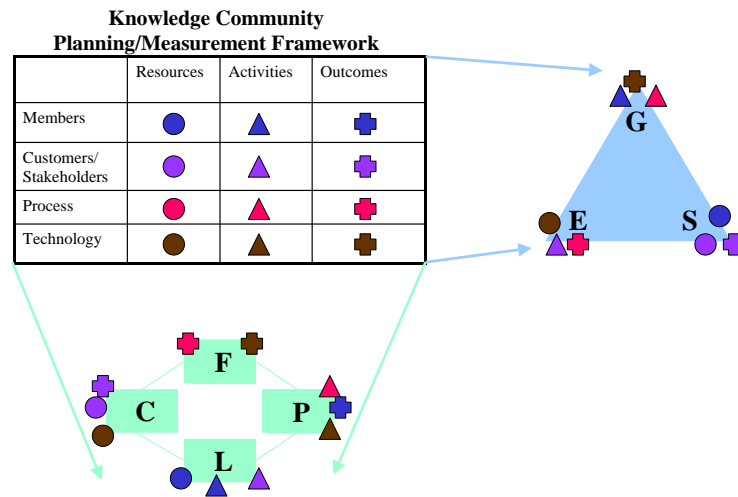


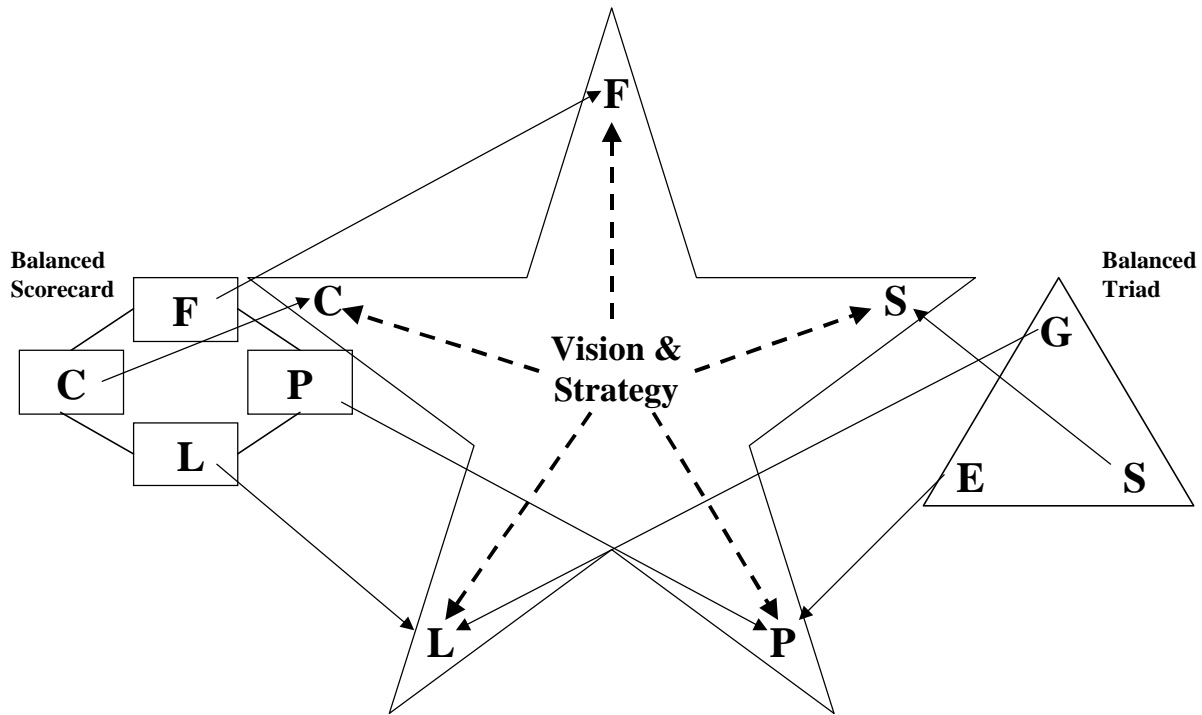
Figure 1. Mapping Knowledge Management to Strategic Goals

## Synthesizing the Frameworks—KM Star Planning/Measurement Framework

In early stages of KM implementation, a simplification of the framework that eliminates consideration of resources and activities is desired. An extension and synthesis of the two organizational strategy frameworks—Balanced Scorecard and Balanced Triad—is presented to serve as an overarching framework for the community enablement process—from deriving outcomes to measuring benefits.

The two strategic perspectives are overlapping to some extent and can be combined to form five domains: *Financial, Customer/Stakeholder, Learning, Process, and Sustainability*. Because of the five domains, we have labeled this extension of the basic framework the *KM Star Planning/Measurement Framework*. This framework simplifies the process of aligning KM with

strategy. The vision and strategy of the knowledge community comprise the core of the *KM Star Planning/Measurement Framework*. Figure 2 shows graphically the mapping of the Balanced Scorecard and Balanced Triad goals to the KM Star.

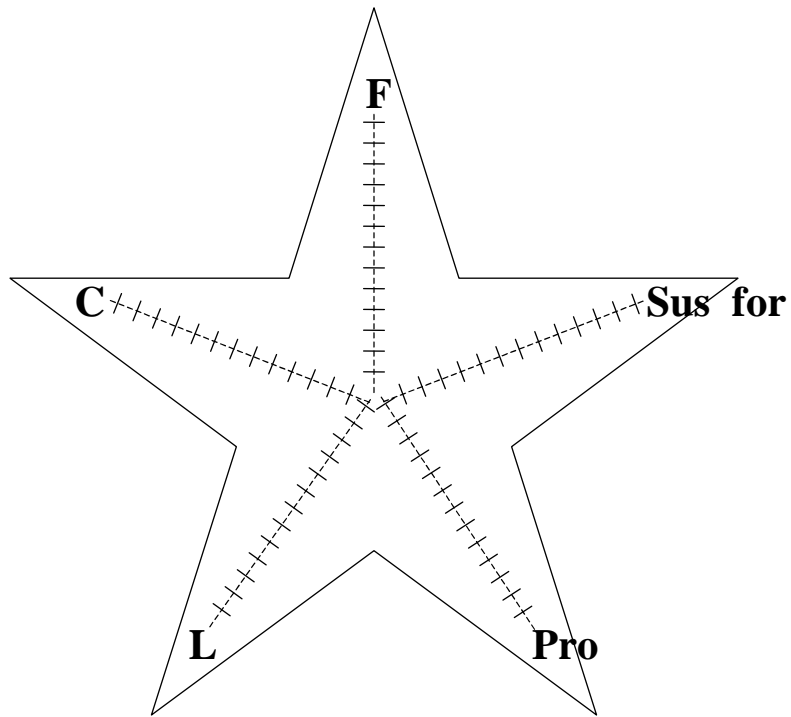


**Figure 2. Synthesizing the KM Star.**

The five domains of the KM Star provide an overarching strategic context within which to derive community outcomes as well as to measure their impacts. The rows of the planning/measurement grid represent the domains of the KM Star: *Financial*, *Customer/Stakeholder*, *Learning*, *Process*, and *Sustainability*. The column permits community outcomes to be categorized according to the domains of the KM Star. The planning/measurement grid provides a mechanism for a community to visualize and assess the comprehensive pattern of its portfolio of outcomes.

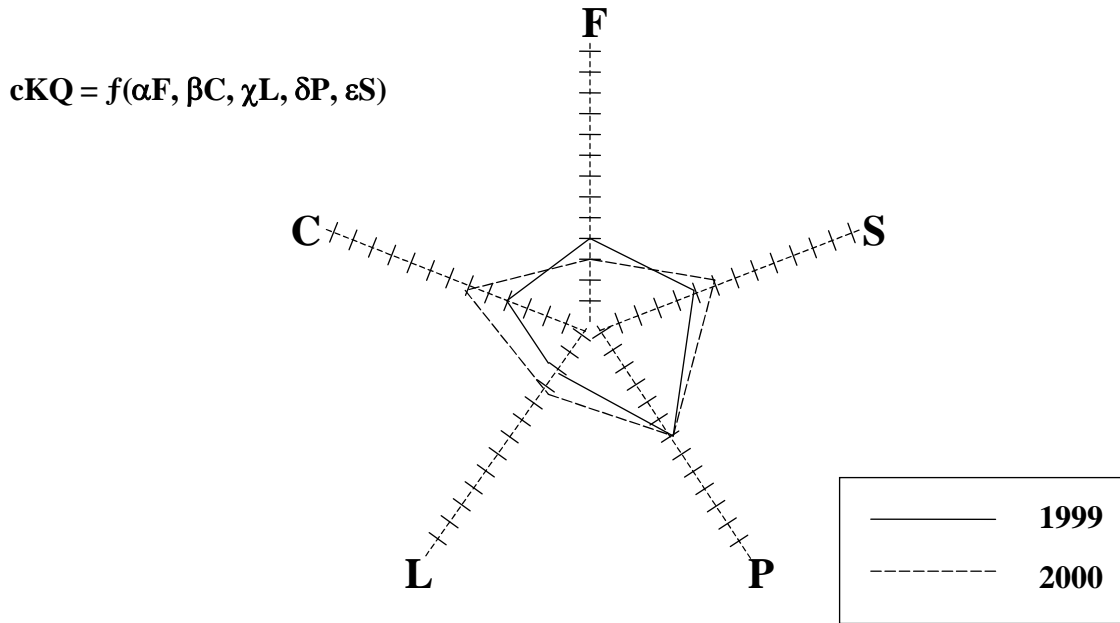
The KM Star planning/measurement framework provides an overarching consistent strategic context for the entire community enablement process—from initial “business case” through derivation of community outcomes to their eventual measurement.

When the knowledge quotient™ concept is applied to the KM Star planning/measurement framework, five domains result: *Financial*, *Customer*, *Learning*, *Process*, and *Sustainability*. Figure 3 depicts this application. As presented in the generic model, these domains support a finer-grained analysis of progress. Theoretically, individual domain scores can be calculated by weighting and combining the individual metrics of outcomes categorized within that domain.



**Figure 3. Knowledge Quotient™.**

A graphic representation such as the radar screen in Figure 4 can be used to enhance understanding and communication about community knowledge metrics by domain as well as overall. All measures must be defined such that moving out along a domain axis is “good”.



**Figure 4. CommunityKQ™ (cKQ).**

## Knowledge Quotient™ Life Cycles

The KM planning/measurement process is an iterative one which can perhaps best be described as a life cycle process taking place at multiple levels of an enterprise. This paper describes the life cycle at the knowledge community and enterprise levels. The conceptual description of the process is similar from one level to another. The CommunityKQ™ life cycle represents the basic model; the EnterpriseKQ™ life cycle is an extension of that and differences will be addressed following a description of the basic process.

### Community Knowledge Quotient™ (cKQ) Life Cycle

The Community Knowledge Quotient™ Life Cycle is graphically presented in Figure 5. It is adapted from Bates/Cordiant as described by Thomas Stewart (2001). Many of the individual steps are discussed in greater detail in preceding sections of this paper and will not be repeated here. The graphics accompanying each step can serve as pointers to the appropriate background material.

The process begins with identifying focus areas for KM in knowledge communities. One technique leaders can use is to plot community resources and activities in a 2x2 grid with axes *Value* and *Unique*. In this way it is clear which resources and activities are both valuable and

unique to the community and its stakeholders and should be nurtured. Similarly, areas that need improvement can be identified, and KM initiatives designed to enhance their value and/or uniqueness from the community's perspective.

In Step 2, knowledge communities identify outcomes (with accompanying metrics) to address their particular drivers. Thus, the nurturing and building of strategic core competencies becomes one of the important contexts for the communities in deriving their outcomes.

In Step 3, a CommunityKQ™ is calculated from the individual metrics at the end of each planning/measurement cycle to assess progress toward goals.

In Step 4, results of the CommunityKQ™ calculation are then benchmarked against other knowledge communities, organizations, and/or standards.

In Step 5, as a result of the benchmarking in the previous step, strengths and weaknesses in current KM initiatives, as well as opportunities for future KM initiatives, are identified.

Finally, in Step 6, follow-up managerial actions are formulated and fed back into the focus areas for KM for the subsequent planning/measurement cycle. And the CommunityKQ™ life cycle process continues...

## **Enterprise Knowledge Quotient™ (eKQ) Life Cycle**

The Enterprise Knowledge Quotient™ Life Cycle is graphically presented in Figure 5. It is fundamentally similar to the Community Knowledge Quotient™ Life Cycle process just presented, but with two important differences. First, the strategic context is that of the enterprise as opposed to the knowledge community. Hence, most of the processes take place at the enterprise level. Second, an aggregation of measures across communities is necessary to form the EnterpriseKQ™.

The process begins with identifying focus areas for KM across the enterprise. Top managers are encouraged to plot organizational resources and activities in a 2x2 grid with axes *Value* and *Unique*. In this way it is clear which resources and activities are both valuable and unique and should be nurtured by the knowledge communities that "own" them. Similarly, areas that need improvement can be identified, and knowledge communities formed to address those focus areas. As in the previous description of the CommunityKQ™ Life Cycle, knowledge communities identify outcomes (with accompanying metrics) to address their particular drivers.

In Step 3, CommunityKQs™ are calculated from individual metrics at the end of each cycle to assess progress toward goals. Again, this is the same as the CommunityKQ™ Life Cycle previously described.

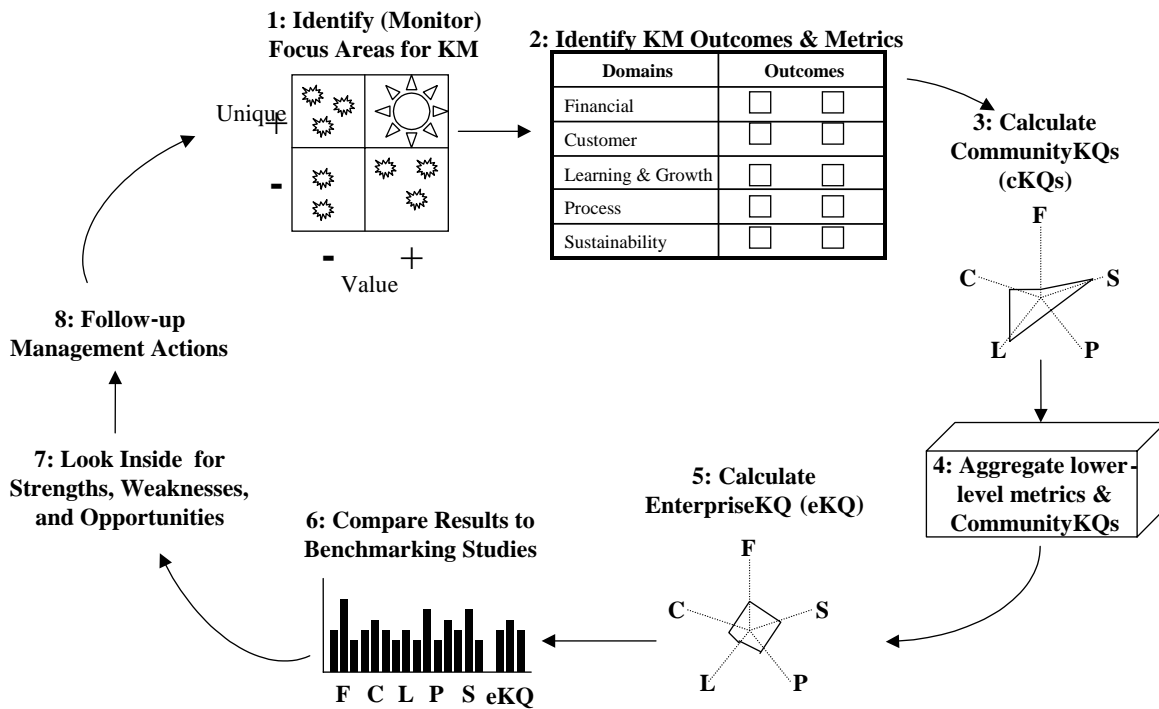
In Steps 4 and 5, the EnterpriseKQ™ Life Cycle differs from the process previously described at the knowledge community level because in order to calculate an EnterpriseKQ™, CommunityKQs™ and possible other lower-level metrics need to be aggregated.

In Step 6, the results of the EnterpriseKQ™ aggregation and calculation process are then benchmarked against other organizations and/or standards.

In Step 7, as a result of the benchmarking in the previous step, strengths and weaknesses in current KM initiatives, as well as opportunities for future KM initiatives are identified at the enterprise level.

In Step 8, follow-up managerial actions are formulated and fed back into the focus areas for KM enterprise-wide for the subsequent planning/measurement cycle.

And the EnterpriseKQ™ life cycle process continues...



**Figure 5. Community and EnterpriseKQ™ Life Cycle. Adapted from Bates/Cordiant.**

## Next Steps

And the cycle continues, too, in the development of the Community KM Planning/Measurement Framework. The most logical next step would be to do a beta test with one of the pilot communities. This would allow for further refinement and get buy-in from community members, before rolling out the framework across the enterprise-wide network of knowledge communities. In addition, from the pilot implementation, a benchmark could be developed with practical and primary data, which would then provide the foundation for future activities.

Within the academic world, opportunities exist to expand the Knowledge Quotient concept and further refine it theoretically. In addition, incentive mechanisms, as well as organizational structure and culture, play important roles in knowledge management and need further investigation in relation to the framework.

In our research, we have not seen anything that comes close to the comprehensive framework introduced here in the area of metrics for knowledge management. We believe that the idea of a Community Knowledge Quotient is a powerful concept for metrics in the domain of knowledge management. We extend this concept to the enterprise level and suggest a framework for life cycle management. Finally, the framework links measurement to planning and design, and aligns knowledge management initiatives to business strategy.

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