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Nine Keys to a Knowledge Infrastructure: A Proposed Analytic Framework for Organizational Knowledge Management

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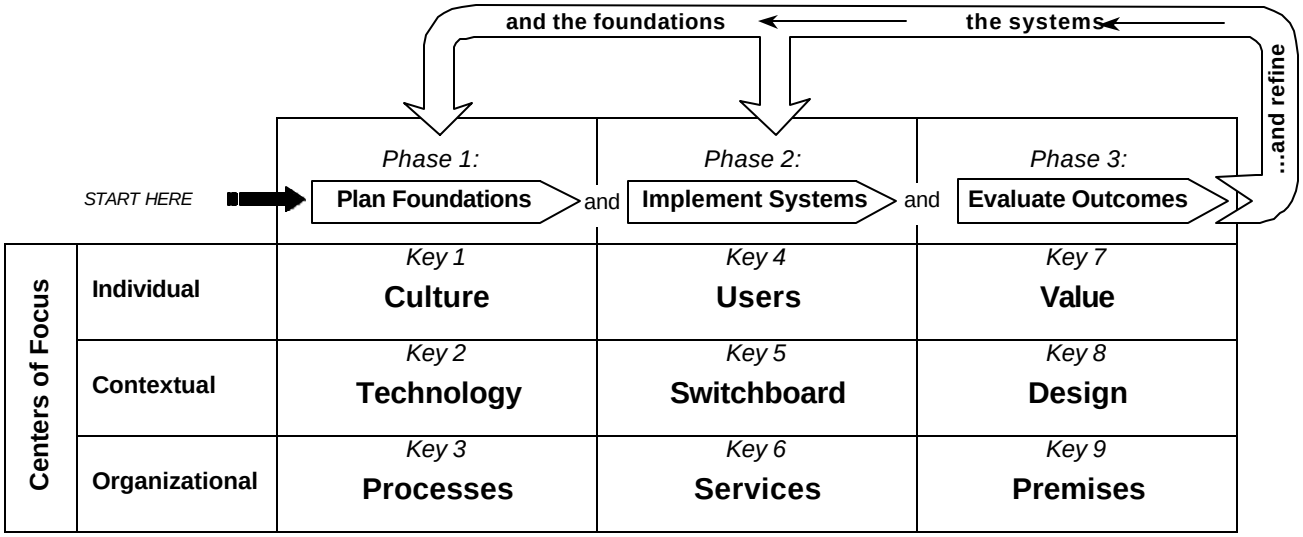
Executive Summary

Knowledge management (KM) is emerging as an activity that demands increasing attention from management in today's knowledge-based organizations.

Since the early 1990s there has been a constant stream of theoretical work on various aspects of KM as well as practical hands-on efforts in KM. As is frequently true of emerging fields, a bridge between theory and practice may be missing. On the one hand, too often KM theory highlights only parts of practical KM efforts, generalizes too broadly for use by an actual organization, or lacks value for people in the organization's trenches. On the other hand, too often known practical lessons and guidelines discussed in the literature on theories of KM—such as the importance of knowledge culture, the need for a critical mass, or the need for on-going evaluation—are ignored or, at best, mentioned marginally.

To bridge theory and practice, *this work proposes one unified analytic framework for KM* that will allow organizations to plan, implement, and evaluate their KM activities.



The Nine Keys to a Knowledge Infrastructure

The proposed framework—consisting of nine keys to a knowledge infrastructure—is designed to be simple enough to work with as well as powerful enough to generate insights about KM—insights that can lead to productive action.

This framework was used in work with a variety of organizations, high-tech and low-tech. Concrete plans were derived from the keys. Experience has shown that the value of the keys stems mostly from their capacity to bring together the various players within a organization in a unified KM effort.

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One

Why Knowledge Management Now?

More and more organizations, small and large, local and global, for-profit and nonprofit, are waking up to the need for knowledge management (KM), and, as a result, the KM market, with its assorted consultants, experts, technologies, and applications, is rapidly expanding.

Individuals and organizations have practiced what can be called knowledge management for ages: cave dwellers learned to adapt to their environment; nations mastered methods for waging war; and farmers discovered how to work the land to the best advantage. The examples are as various as the methods—some are automatic, almost instinctive, others are learned and then applied.

Modern KM is more than merely document organization, decision-supporting systems, artificial intelligence, re-engineering core processes, and many other processes that have become slogans, including "e-" terms. Knowledge management is based on an awareness of the inherent nature—good and bad—of knowledge.[1] *Every KM effort must start from the fundamental understanding that there are good and bad in knowing and good and bad in not knowing.* Like any other social interaction, knowledge management has many dimensions: who knows when, what, to what degree, in what format, and so on.

The force behind the wave of interest and research in KM since the early 1990s derives from three factors.

First is *need.* The knowledge environment is evolving more rapidly than ever before—so much data, information, and knowledge, so many reports, e-mail messages, Web pages, and databases, all of them more accessible than ever.

Second is *recognition of the need.* Upper management has come to recognize that knowledge is a primary strategic asset, hence the formal, organized push to further and capitalize on knowledge.

Third is that *something can be done about the need.* Powerful tools can meet the need. Innovations in computing, networking, and the circulation of knowledge within the classic and extended workplace all are part of what makes knowledge management now a doable effort.

This paper does *not* describe a particular KM solution or offer a blueprint for "doing" KM or include detailed descriptions of positive or negative case studies. Instead, the goal here is to propose an analytic framework for understanding the elements of bringing KM into an

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[1] Davenport and Prusak, 1998.

organization effectively. These elements, or "keys," form the basis of such actions as communication, analysis, and decisionmaking. Why keys? Keys ordinarily open something—a door, a lock, a sound, a mind. A key may be a new perspective, opening a new way to look at something.[2] Here, the nine keys are arranged vertically, according to three phases: planning, implementing, and evaluating; and arranged horizontally, according to three centers of focus: individual, contextual, and organizational.

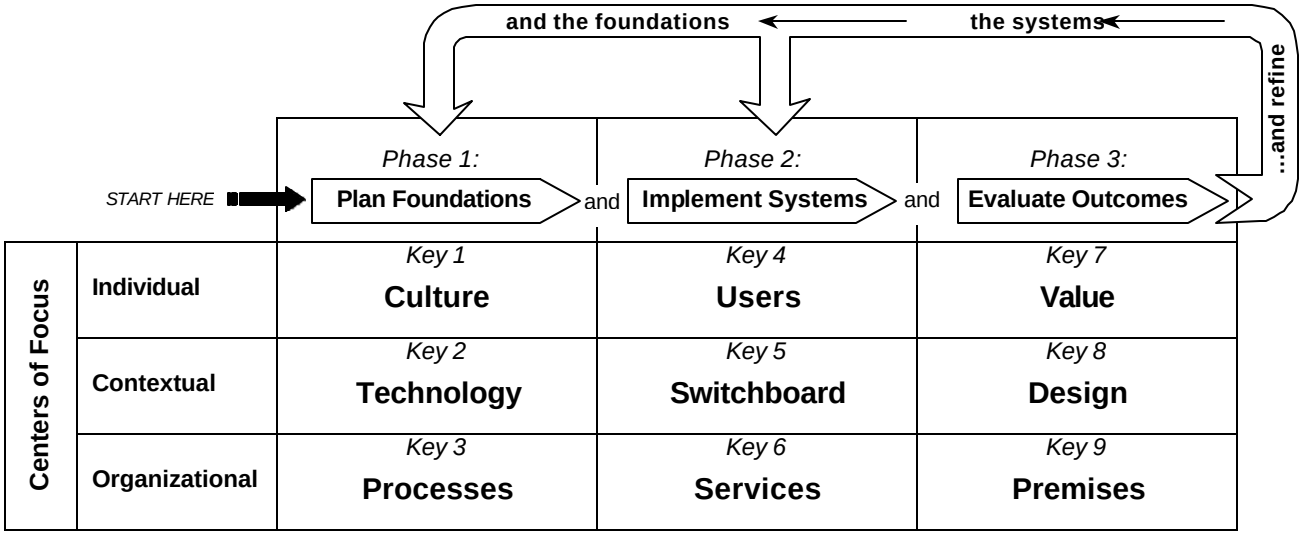

Figure 1-1
The Nine Keys of to a Knowledge Infrastructure

Like any framework, the framework of nine keys is limited by the nature of analytic frameworks. For example, a common framework to represent terrain, the geographic map may highlight some features of a given area and distort others. A blue line on the map may mark a river whose water, in reality, is no longer blue.

The lesson that emerges from the map framework is that certain parts of a framework may look quite different in the real world. In the same way that capturing the true color of every river is neither possible nor practical, so capturing the meaning of each knowledge infrastructure key in the real world is not possible. A map is just a map, not actual terrain.[3] The framework proposed here may offer keys more or less relevant to a particular situation; one key may be the critical

[2]For the use of keys as a conceptual focus, see, for example, Franklin Plewa and George T. Friedlob, *Keys to Improving Your Return on Investments* (Hauppauge, N.Y.: Barrons Educational Series, 1991); Karen Kerkhoff Gromada and Mary C. Hurlburt, *Keys to Parenting Twins* (Hauppauge, N.Y.: Barrons Educational Series, Barrons Parenting Keys, 1992); and Tom Terez, *Twenty-Two Keys to Creating a Meaningful Workplace* (Holbrook, Mass.: Adams Media Corp., 2000).

[3]Kent, 1978.

one, another less so. The nature of each key depends on the context of the organization, which is the subject of the next part.

Two

Overview: From Organizational Vision to the Nine Keys

Before a bridge is built, the site where it is to be built must be identified. Before the nine keys are presented, certain background terms need to be defined and explored. The following discussion is intended to describe the place of the nine keys in relation to other terms used within the setting of organizational life.

First, in brief: A typical *organizational vision* is to realize the organization's potential. Often, success is contingent on whether the organization is a *knowledge organization*. An organization becomes a knowledge organization through practicing *knowledge management*, which is based on a *knowledge infrastructure* (see **Figure 2-1**).

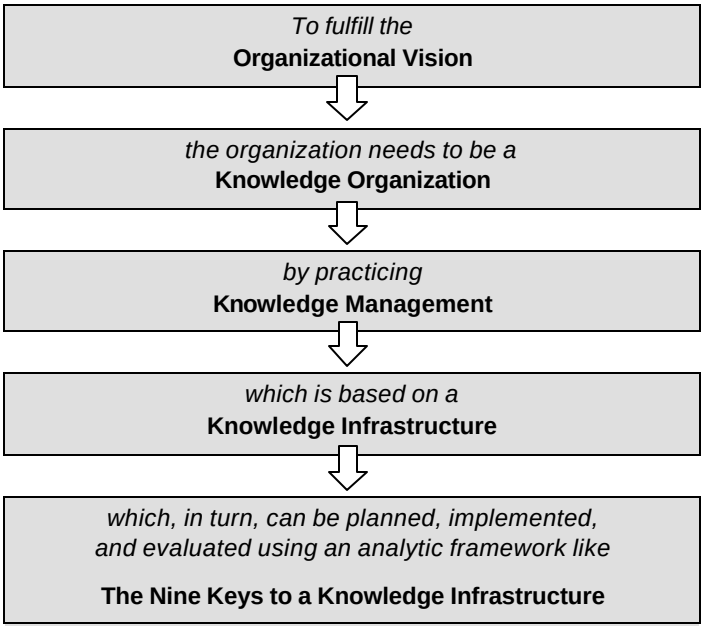

Figure 2-1
Strategic Perspective on a Knowledge Infrastructure

Organizational vision has to do with an organization's strategy, its core competencies and core rigidities, its market and its competitors. Being a knowledge organization is supposed to advance the organizational vision by allowing the organization to harness the value of knowing how to use knowledge, the "good" of knowing, and overcome the "bad" of not knowing.

A *knowledge organization* is an organization that recognizes knowledge as a critical strategic asset and equips itself with the requisite tools to use its knowledge effectively. Often,

faced with rapidly changing market conditions, new players, and increasingly sophisticated and demanding consumers, organizations find that not only is the competition fiercer but, even more important, that the pace of today's world is faster than ever.[1] Speed and accuracy are critical to an organization's vitality, and they are rooted in an organization's ability to exploit its available internal knowledge and glean whatever knowledge it needs from external sources.[2]

What, then, is *knowledge management*? It can be many things to many people, all centering on such actions as canvassing, storing, and using knowledge. The field of KM has been defined in a variety of ways, from clear, denotative statements to connotative, somewhat obscure definitions.[3]

The working definition used here is the following: KM is the art of performing *knowledge actions* such as organizing, blocking, filtering, storing, gathering, sharing, disseminating, and using *knowledge objects* such as data, information, experiences, evaluations, insights, wisdom, and initiatives—all of which, though not identical, are, from the point of view of KM, simply items to be managed. In general terms, KM is the performance of knowledge actions on knowledge objects (see **Figure 2-2**).

Knowledge Management	**=**	**Knowledge Actions**	***x***	**Knowledge Objects**
the art of performing knowledge actions on knowledge objects…		*organizing, storing, gathering, sharing, disseminating, using…*		*data, information, experience, evaluations, insights, wisdom, initiatives…*

Figure 2-2
Knowledge Management = Knowledge Actions *x* Knowledge Objects

A working definition does not replace discussion of types of knowledge action and knowledge objects. Some theorists are already involved an effort to understand the differences in knowledge, information, data, wisdom, and even luck. Others call for a distinction between tacit and explicit knowledge or between espoused theory and practiced knowledge. Such discussions are good for theory but less valuable for the reality of the organizational world. Real people in real organizations—who are extremely busy selling, developing, and trying to survive—want to know what they need to be know to accomplish specific tasks.

An organization manages its knowledge through a *knowledge infrastructure*. A knowledge infrastructure connects different members of the organization with different sources of internal

[1]Davis and Meyer, 1998.

[2]Tobin, 1998; Allee, 1997; Badaracco, 1991.

[3]For some useful examples, see Prusak, 1997, 229-30; Newman, 1991; Ruggles, 1997, 1.

and external knowledge. Typical examples include formal knowledge interactions—libraries, bulletin boards, the monthly chief executive officer (CEO) letter, employee manuals, standard operating procedures (SOP), e-mail systems, and intranets—as well as informal knowledge interactions—the famous cooler, the whiteboard, random meetings, methods of feedback, and the like.

In fully fledged form, a knowledge infrastructure is one of the organization's core tools and, like the nervous system, it links the other tools. A powerful knowledge infrastructure strengthens the capabilities of the organization; without one, an organization functions at diminished capacity.

In a sense, the nine keys are an expansion of the term "knowledge infrastructure." When people ask, What do we need to manage knowledge, the quick answer is, We need a knowledge infrastructure. When asked to "say some more about this knowledge infrastructure," one could use the nine keys and say that "a good, solid, sustainable knowledge infrastructure allows the organization to plan, implement, and evaluate its knowledge management activities" (see **Figure 2-3**).

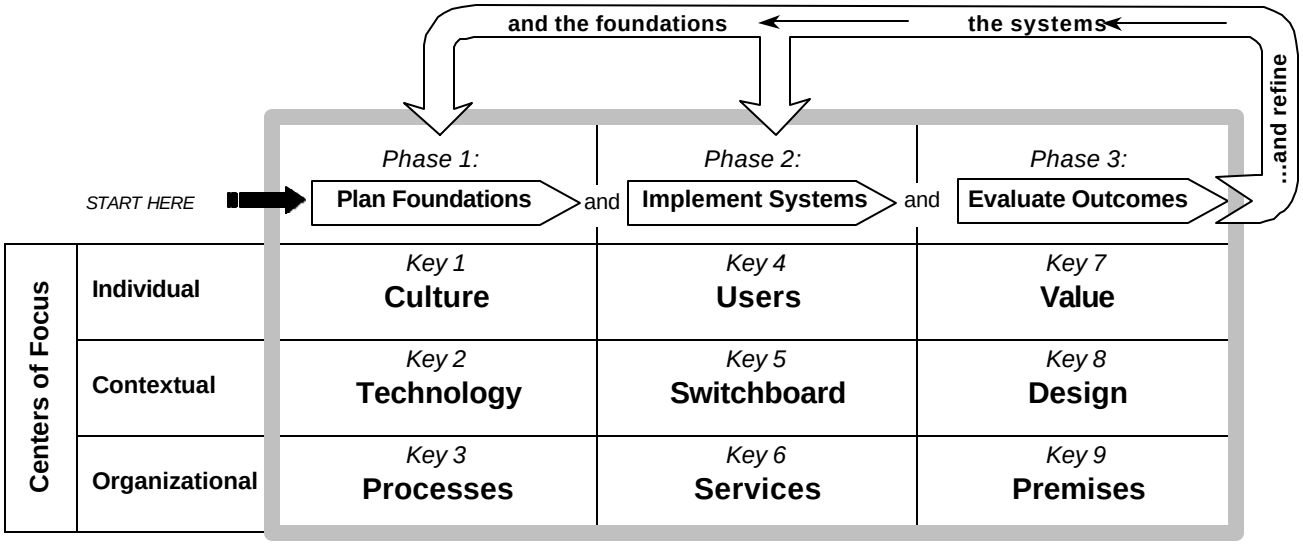

Figure 2-3

Viewing the Nine Keys to a Knowledge Infrastructure Through the Three Recurring Phases

As in building any infrastructure, the first phase is planning, in which those leading the KM initiative lay necessary foundations. This leads to the second phase, actually building or implementing the systems. With the systems in place, the organization is ready for the third—and often ignored—phase, evaluation, which, in turn, leads to modifying plans and refining systems

in order to meet the organizations needs better.[4] In the figure, the arrows at the top of the framework are intended to convey the sense of recurrence.

[4]Sivan, 1999b.

Three

Phase 1: Plan the Foundations of Culture, Technology, and Processes

A knowledge infrastructure is built on three complementary foundations: *culture*, *technology*, and *processes*.

The first foundation is a *culture* of knowledge. Before an organization can practice KM, it must embrace certain common cultural assumptions.[1] A few knowledge concepts belong to the cultural key:

- The whole of an organization's knowledge is far greater than the sum of its parts.
- Knowledge is not static but lives by being cultivated through an iterative process of dissemination, use, and feedback.
- Knowledge management is a core business process and, as such, needs to have its own defined resources, goals, and monitoring systems.
- All the knowledge cannot be fully managed all the time. Some knowledge is too expensive to manage. What is important is to be able to focus on the most valuable knowledge to manage.
- Knowledge culture is both internal and external. If a member of an organization can go outside the organization to Yahoo!™ or Lycos™ and build a personal portal in 30 seconds, the same capacity should be expected within the organization.

Many other, less obvious knowledge culture concepts will need to become part of the organizational culture, including cognitive overload, redundancy, need-to-know basis, the value of partial knowledge, the value of lack of sharing, and more.

The second foundation is the knowledge *technology*. Managing knowledge only by trading pieces of paper or even trading simple e-mail messages is obsolete, not to mention inefficient. Paper—as well as paper binders, paper cabinets, and papers staplers—will be replaced by their twins in informational technology, such as digital documents and document folders. Now that personal computers with built-in high-bandwidth networks can be bought for about $500, a common foundation of organizational knowledge technology is feasible, which may be the greatest qualitative departure from earlier systems of KM.

KM technology has spread out over different dimensions—computers, networks, and other information technology hardware, and KM-specific software. Most software still attends to individual KM challenges rather than to resolving such challenges comprehensively. As the KM market matures, more as well as more powerful KM software will become available. But, for

[1] Pacey, 1983; Argyris, 1998.

now, an organization needs to plan a basic hardware foundation that can adapt to an assortment of KM technologies.

The third foundation is knowledge *processes*. With the cultural and technological foundations in place, actual organizational procedures can be "knowledge-ized." Classical business practices may be viewed through the knowledge prism. A university, for example, has several core processes—teaching, hiring faculty, research, and recruiting students. A knowledge perspective on the "students" will call for on-line life-long learning, allowing students to stay in touch with both the school and their teachers. A student is not necessarily only a student but also a mentor, a marketing representative, and, of course, a future financial donor.

Knowledge-based processes, by their nature, need resources. They compete with others for resources. Organizations need to choose where to invest their time, money, and people. The role of the leaders of KM is to identify where KM will give "the biggest bang for the buck."

These three foundations—culture, technology, and processes—are essential to the planning stage of building a knowledge infrastructure. To introduce KM without adequate planning is to sacrifice fundamentals to haste and enthusiasm.

Four

Phase 2: Implement the Systems of Users, Switchboard, and Services

With enough of the foundations in place, the organization is ready to implement its KM operation, namely, an active connection of three main components, the *users* of the knowledge infrastructure who access knowledge *services* through a knowledge *switchboard*.

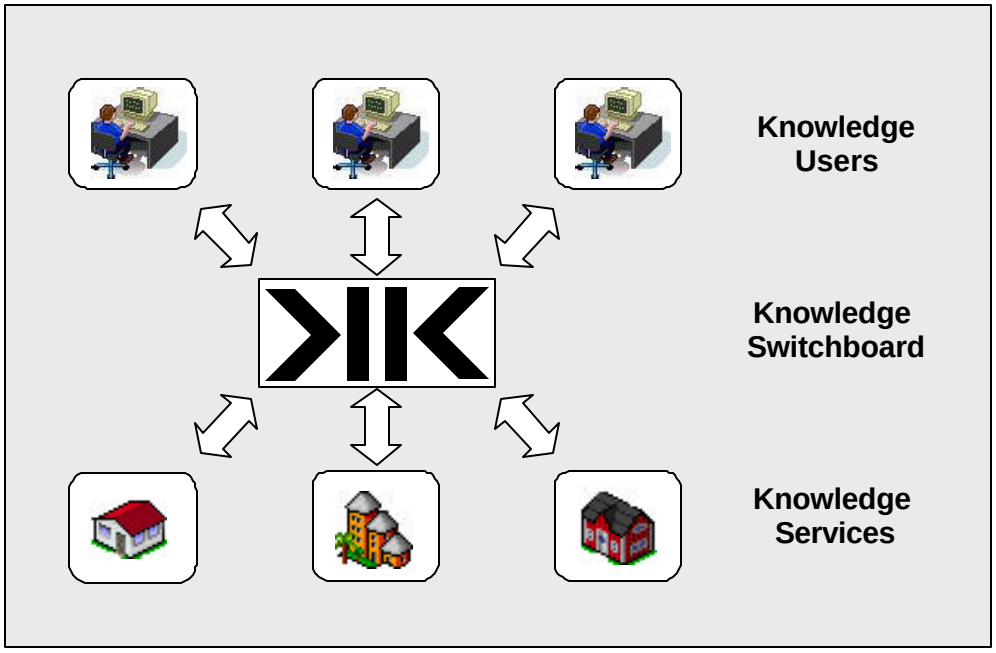

Figure 4-1
Basic Architecture of the Infrastructure Systems

Knowledge *users* are, first and foremost, the people who practice KM—although machines and systems also can practice KM (but this is a side issue that belongs to the realm of classic information technology). Beyond organizational workers, knowledge users include clients, suppliers, and other groups. Recruiting users and encouraging and supporting them during the knowledge process is a main focus of the organization, because KM ultimately depends largely on the extent to which the system is used. Knowledge use refers to one or more actions, such as gathering, selecting, updating, trading, and contributing knowledge to one or more knowledge objects. Users need to understand which type of action to perform and when.

The knowledge *switchboard* is the technical mechanism that implements the users' activities. A "transparent" black box—transparent to the user—must be secure, powerful, and "user friendly." The switchboard must respond to and perform the users' knowledge activities without users feeling its weight or being burdened by it. As the conduit through which users

access knowledge services, the switchboard needs to present an inviting, comprehensible interface, the human-machine interface, which gives the knowledge services a standard look and feel and has built-in evaluation capacities to measure the overall effectiveness and level of use of the knowledge infrastructure.

The switchboard links knowledge users with knowledge *services*. The goal of the services mirrors the overriding goal of the knowledge infrastructure, namely, to make knowledge more useful. The concept of a knowledge service is familiar from "service"—doing something that benefits some group. The knowledge service both houses the knowledge that users will need and affords the context for users of the various knowledge activities, such as add, sort, view, update, and delete. By their nature, knowledge services are dynamic: they evolve, expand, and dissipate as the needs of the users and the organization change. Knowledge services may be imagined as a house, which houses knowledge and where knowledge actions are performed, where knowledge users can enter, stay, and, ultimately, influence its rooms and even its overall design.

In the second phase, implementation, the KM systems are built. Building the infrastructure begins on a limited scale and expands as more knowledge users and knowledge services are added. From this point on, the knowledge infrastructure grows according to need, expectation, and evaluation, which occurs in the third phase.

Five

Phase 3: Evaluate Outcomes: Value, Design, and Premises

One essential, but often overlooked, feature of a knowledge infrastructure is its built-in capacity for evaluation. Proof of the use and effectiveness of KM—that is, evidence of its viability as an organizational tool—is integral to the success of KM efforts. Far from a luxury, evaluation is a main source of information, first, about KM and, second, about the organization. Evaluation demonstrates the *value* of knowledge services, allows re-*designing* of the knowledge infrastructure and, ultimately, influences an organization's *premises*, which are rooted in its vision.

The first mode of evaluation, which may be called summative, is *value*, or, in corporate terms, the return, financial and nonfinancial, on investment (ROI).[1] Knowledge services are created in specific ways so that their use will enhance both the organization as a whole and the individual members of the organization. The duality of the purpose of a knowledge infrastructure is critical, because an organization whose employees are intent on advancing themselves improves its chances of success. Every dollar invested in a well-designed knowledge infrastructure can contribute to savings, efficiency, and overall capabilities. Saving, efficiency, and capabilities need to influence the organization as a whole and its individual members.[2]

The second mode of evaluation, which may be called formative, is related to *designing* the knowledge infrastructure as a whole as well as to specific knowledge services. Evaluation and feedback prompt questions about the effectiveness of services and thus push for constant re-*designing* of the services. To return to the image of knowledge services as a house (see the last paragraphs of previous part), if a service houses too much knowledge without sufficiently breaking it down into rooms, the situation will need to be corrected. If a house is opened before it is needed, it may need to be closed, at least temporarily; if a service is introduced before users need it, it may need to be removed, at least temporarily. Such questions about the design of services are critical to the success of the infrastructure.

The third mode of evaluation, which may be called reflective, becomes a means to examine the organization's *premises*, from tacit assumptions to operational strategies.[3] Knowledge that emerges from the use of the KM infrastructure can fundamentally affect the organization's decisions, strategies, and priorities. Knowledge is used, re-used, redirected, and "re-purposed" to enhance both tactical and strategic visions.

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[1]Phillips, 1997.

[2]Sivan, 1999a.

[3]Myers, 1996.

The ninth key, *premises*, holds the greatest value for the organization (see, for example, **Figure 2-3**). It embodies the potential for rapid and painless change. Knowledge services, users, and technologies change, and a good infrastructure will accept change easily. Indeed, the goal of a knowledge infrastructure is to make available knowledge usable, and the best means to accomplish that over the long term is a sustainable system—one that can expand and mold itself to an organization's changing knowledge needs.

Six

Viewing the Keys Through a Focus (Individual, Contextual, Organizational)

As shown in **Figure 6-1**, the nine keys to a knowledge infrastructure are integral and work both horizontally and vertically.

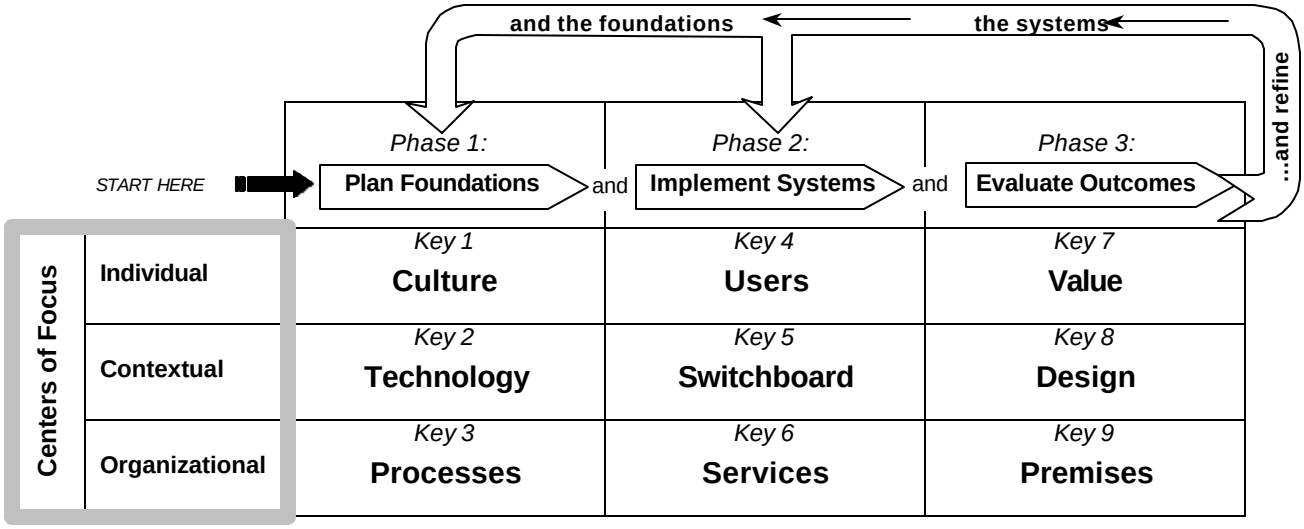

Figure 6-1
The Centers of Focus: Individual, Contextual, and Organizational

The top row of three keys focusses on the *individual person* in the knowledge infrastructure. Knowledge culture is a function of people: a culture is created and promoted by the individuals who are part of the organizational system. Clearly, knowledge users belong to this category, as does the key of value (in the evaluation phase), which measures how much individuals, on an organizational and personal level, are the focus of the knowledge infrastructure. The keys in the top row focus not only on the individual person but also on the value of a particular knowledge service to the organization.

The middle row of three keys focusses on *context*, also called the ecology of KM, which is the setting of the knowledge infrastructure. Any contemporary form of KM is based on technology, and which technology environment will be chosen and created is determined in the planning stage. The particular switchboard, along with other KM tools, is implemented in the second phase, while the design and usefulness of basic knowledge tools are evaluated and questioned.

The bottom row of three keys focusses on the *organization*. The processes that the organization follows, the type of knowledge it acquires and disseminates, and the formative use of knowledge all focus on the organization's view of itself. Taken together, the individuals (knowledge users), the context, and the organization are the centers of focus, because all three create the KM system.

Seven
Epilogue: How to Use the Keys

The interested reader may re-examine ways the framework of nine keys to a knowledge infrastructure can be applied. The keys can help in an analysis of the current state of KM or, on a more limited scale, in an analysis of a particular KM initiative, an assessment of a particular knowledge system, or the design of a new KM initiative. Such potential uses only hint at the framework's generative power.

Is the proposed framework the only one for a knowledge infrastructure? Of course not. But both experts and newcomers to KM can use this framework. Novice users can use it as an analytic checklist, in which the keys can prompt analytical questions about an issue. Expert users, more familiar with the ins and outs of KM, may use the analytical matrices of two or three interlocking keys to approach an issue. In this way, the framework may be adapted and modified for a particular context to become the starting point for an organization's KM effort.

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Acronyms

CEO chief executive officer

KM knowledge management

ROI return on investment

SOP standard operating procedures

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