

KNOWLEDGE NAVIGATION AND MANAGERIAL INFORMATION SYSTEMS

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ABSTRACT

This paper explores the applications of “Knowledge Navigation” in managerial information systems. Knowledge Navigation uses the analogy of navigation and it is based on four main elements: 1) Destination, 2) Compass, 3) Map, and 4) Scale. The management of goal-seeking and proactive-organizing entities requires also four main elements: 1) Goals, 2) Valuation, 3) Internal Structure, and 4) Appraisal. An analogous comparison between the above parallel sets elucidates Knowledge Navigation: The goal of an organization is like destination of an exploratory mission. Actual structures and communities of practice work like a map that depicts the main relationships in an organization. Appraisals, which quantify past achievements, act like the measuring scales in the navigation system. Valuation, which is the basis of decision-making, acts like a compass to give us direction for future actions.

This paper compares the role of the different parts of Knowledge Navigation for the growth and development of organizations. It argues that similar to an exploratory mission, we need a complete set of navigational tools, but the compass plays a pivotal role. For knowledge-intensive activities, we need to develop new managerial information systems that act like a compass to incorporate the role of knowledge and innovation in the process of decision-making.

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This paper explores the applications of “Knowledge Navigation” in the managerial information systems. Knowledge Navigation uses the analogy of navigation to explicate the management of goal-seeking and proactive organizational entities. This paper compares the role and importance of the different parts of the Knowledge Navigation model for the survival and development of organizations. It argues that similar to an exploratory mission, we need a set of knowledge navigation tools, but the compass plays a pivotal role. Conventional cost analysis procedures have been developed to assist managerial decisions in the industrial era. For knowledge-intensive endeavors, we need to develop new managerial information systems that act like a compass to incorporate the role of knowledge and innovation in the process of managerial decision-making.

KNOWLEDGE NAVIGATION

The metaphors of navigation and maps have often been used to explain knowledge phenomena in management studies. For instance, *Fortune* magazine, July 26, 1993, includes a section on strategy, with a picture of a map, a magnetic compass and a measuring compass (scale). That section, however, does not elaborate the interrelations between the two systems: navigation and strategy. Edvinson (1997) also describes a Knowledge Navigator as a metaphor for the management of intellectual capital. Lee (1994: 22) has also used the navigation metaphor to explain cognitive complexity, stating that: “Effective leaders know the direction in which they are headed. Their organization’s strategic vision provides the compass but not the roadmap.”

Amidon (1999) and Amidon & Mahdjoubi (1999) elaborate on more structured views on the application of navigation for business planning.

Maps, systematic presentations and models of the world, usually represented on a flat surface, show a view of an entire region and visually depict its juxtaposition in relation to adjacent territories. From ancient times, humans have produced maps to depict and visualize the Earth geographically. Modern maps work as taxonomies, demonstrating commonalities or differences between different areas. In addition, maps facilitate measurement by providing a scale of valuation. To be useful for accurate measurement, a map must impose a pertinent taxonomy, and a precise scale of appraisal. Maps illustrate people's perception of their environment. You select what is important and you discard what you think is not important.

The present study explores the analogical relationships between navigation and management. A navigational system may be organized into four main elements: 1) Destination, 2) Compass, 3) Map and 4) Scale. **Destination** is the goal of the navigation or exploration. The **Compass** element assists us to value our path and to find out the desired direction to pursue. **Maps** depict the structure of the area of intended action. **Scale** lets us appraise relative distance and what we have performed so far.

In its very basic form, an organization may be perceived as an entity that transforms resources into more valued products and services. A goal seeking and proactive organizing system can be perceived as an entity that intends to achieve goals; but to achieve its goals it needs to reorganize itself actively and continuously. In this context, an organization defines objectives, analyzes its past achievements, values new opportunities and then reorganizes itself.

Recalling the organization of a navigation system, as described earlier, a knowledge navigation may be imagined as a system with four main parts: 1) Goals, 2) Valuation, 3) Organization (Internal Structure) and 4) Appraisal.

Using the analogy of navigation, **Goals** of an organization are similar to the **Destination** of navigation. Decision criteria and future-oriented **Valuation** are like a **Compass**. The **Structure**

of the Organization is similar to a **Map**. Past-oriented **Appraisals** are like the **Scale of Measurement**, used to let us quantify our achievements. See Diagram 1.

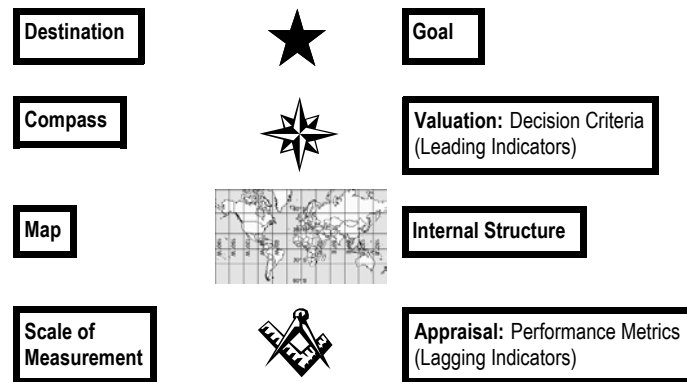


Diagram 1: Knowledge Navigation Model

Goals define where the organization is heading or desires to head. **Valuation** involves the formulation of decision criteria that let us envision and develop new alternative decision scenarios. Valuation utilizes future-oriented criteria (leading indicators). **Organization** involves the imposition of structure that binds the system together. Organizations operate in their respective external system. **Appraisal** involves performance criteria to quantify (measure) past achievements. Appraisal covers past-oriented criteria (lagging indicators). In many administrative studies, future-oriented valuation procedures often refers to “management accounting” and past-oriented appraisal procedures generally refers to “financial accounting.”

Evaluation may be regarded as a combination of valuation (decision criteria - leading indicators) and appraisal (performance metrics - lagging indicators). As Kokkonen (1995) indicated, to be balanced, evaluation must always be connected with the goals of the organization, and the goals again, must be viewed in the larger context of external systems, such as social, economic, cultural, and political systems.

The “valuation” and “appraisal” systems have distinct features. For the valuation system and decision criteria, we likely need to look at the value system, comparable to the Earth’s magnetic field, and to develop a set of spectrum-like procedures, which are based on pattern recognition,

trend evaluation, and anomaly detection, to assist us in making decisions. This process might be similar to using color in stress analysis, for instance in mechanics. For the internal valuation (compass,) we need to develop new valuation methodologies, which can explain why many good top management decisions are not necessarily based only on pure measurement, but on intuition as well. Hayashi (2001), for one, asserts that business executives rely on their keen intuitive skills, otherwise known as their “gut,” to make crucial decisions. He then notes that over the years, various management studies have found that executives routinely rely on their intuitions to solve complex problems when analytic methods (such as cost-benefit analysis) simply won’t do. He also emphasizes that the type of instinctive genius that enables a manager to craft the perfect strategy for usurping competitors could also involve an uncanny ability to detect patterns, perhaps unconsciously, that other people either overlook or mistake for random noise. For an appraisal system (scale,) we are likely to need more rigorous (digital-like) measurement procedures to let us communicate to external bodies the results of the internal decisions, as well as to provide the basis of a structured (financial) measurement to let us interact a wide range of external valuations.

Understanding the relationships between the *past appraisal* and *future valuation* parameters tends to be a key factor in understanding the nature and behavior of goal-seeking and proactive-organizing entities. Although we can easily measure and appraise past achievements, our efforts should be more devoted to using them for future actions to reach goals. The best use of the study of the past appears to be to correct our path towards the future. Obviously, we have limited control over the outcomes of the past when they have already happened. We can plan and foresee the desired future outcomes. We can set goals and reorganize and realign resources, and then make new decisions to achieve those goals.

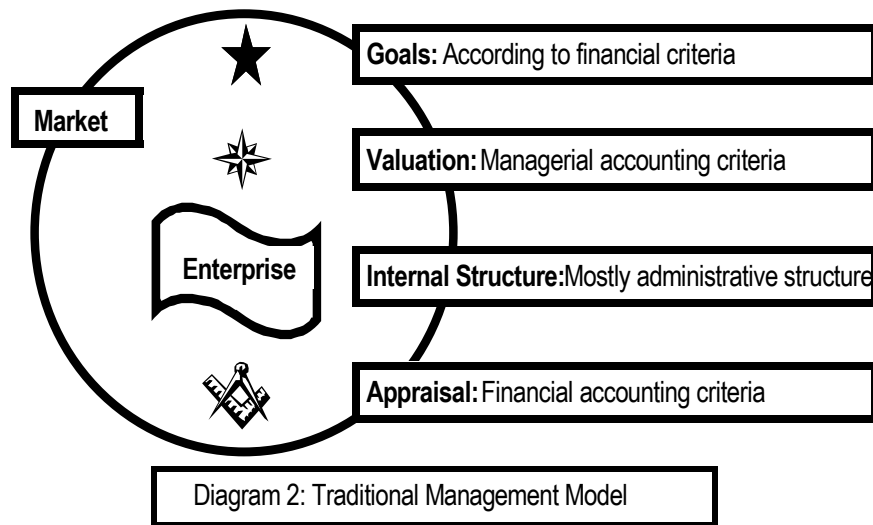
There are some cases where valuation and appraisal can mix with each other. For instance, if we assume that we live in a status quo condition, then the future seems to be either similar to the past, if not a linear continuation of the past. In such cases, we may use past appraisal criteria as indicators for future valuations. The other way is pure trial and error; to make a change based on the future valuation system, wait to see the results, and then repeat this process indefinitely.

One other case in which we can use past appraisal indicators, as a surrogate for future valuation, is when a system is predictable and repeatable and we know exactly how the system is going to work. In this case we can (likely) use the past achievement indicators as a surrogate for future valuations. For example, if we are on a routine trip, then past achievements (like how much we have traveled or even how much gas we have used) can serve as indicators of how close we are to the goal. But if we are on an exploration trip, just measuring how much we have traveled (a past achievement indicator) is not sufficient to find out how much further there is to travel. That is, in an exploratory trip we are not sure how much more is left to reach the destination or goal, as we do not know the nature of the external system.

MANAGEMENT MODELS

This paper has so far has discussed the Knowledge Navigation model. The rest of the paper deals with the application of Knowledge Navigation in explaining managerial information systems. Financial accounting may be said to include the appraisal component of the managerial information system in the traditional management model. In this configuration, the inputs needed for an organization include “costs,” and costs are further classified under the cost of labor, cost of material, and cost of overhead (such as depreciation of equipment, cost of process, and cost of R&D). From this point of view, revenues (due to sold products) are the outputs of an organization.

In traditional management model, managerial accounting acts as the basic valuation and decision-making tool to compare alternatives and conduct future actions. In addition, this model assumes the organization operates in a perfect market, as the external system. Goals tend to be defined in terms of financial criteria. The administrative procedures hold the organization in the traditional management models. The consistency of financial variables between goals, valuation (managerial accounting) and appraisal (financial accounting) is the key strength of the traditional management model, as depicted in Diagram 2.



Lack of attention to the role of knowledge, innovation, and uncertainty is likely one of the biggest deficiencies of the traditional management model. If the future could be exactly foreseeable and if the future were a linear continuation of the past, then the organization could set the path for the future only according to financial criteria and hope to achieve its goals. However, the practical actions of life and management are not as simple as that. The future is not as certain and predictable as desired, and the systems that we are dealing with are more complex than that represented by the traditional management model. Consequently, the above configuration is not sufficient when non-linear factors like new knowledge and disruptive processes such as innovation are taken into consideration. We need to develop new configurations to help us make better decisions to achieve the desired goals.

Lev (2001: 33) has also noted that managerial information systems (such as managerial cost accounting) that provide managers with information on costs, revenues, and deviations from budgets, are almost exclusively geared to industrial-age physical and labor inputs. The costs commonly allocated to products, processes or activities (activity-based costing) are raw material, labor, and overhead (for example, depreciation). Intangible inputs, such as R&D and customer acquisition costs, are usually considered period expenses and are not typically allocated to the products and processes. He concludes such information systems are wholly inadequate for the management of knowledge-based organizations, and these systems have contributed a lot to the difficulties of managing intangibles.

NEW MANAGERIAL INFORMATION SYSTEM FOR COST ANALYSIS

The integration of knowledge-sensitive performance metrics and appraisal in the new business models has been a main concern of studies such as *Intellectual Capital* (Edvinsson & Malone, 1997) *Balanced Scorecard* (Kaplan & Norton, 1996) and *Corporate Longitude* (Edvinsson, 2002). Valuation methods and decision criteria, however, have not received the same level of attention, although back in the 1990s Peter Drucker anticipated that “for most knowledge-based and service work, we should, within 10 to 15 years, have developed reliable tools to measure and manage costs and to relate those costs to results” (Drucker 1993).

A method entitled “*Knowledge-Based Cost Analysis*” (Mahdjoubi, 1998) is one of the systematic methods to address this need to develop a new managerial information for cost analysis. In this method, input variables of production are classified as follows:

1. Knowledge and information: which are *generated, developed* and *applied* in a process
2. Human resources (labor): which are *developed* and *applied* in a process
3. Equipment and machinery: which are *utilized* in a process
4. Material, energy and services: which are *consumed* in a process

In the knowledge-based managerial information system for cost analysis, costs are classified into two groups: “Substituting” and “Enabling.” The Substituting (consuming) costs are related to variables that must be substituted, if the process of production is repeated. So, for each new production replication, similar resources are required so the process can be repeated. Material and energy are mainly related to the substituting costs. If we plan to replicate the production process, equivalent amounts of material and energy are consumed.

Not all production resources are depleted. For instance, as Paul Romer (1992; 1993) indicates, an idea (knowledge) can be used over and over again by everyone, provided it is communicated. He considers ideas as the instructions that let us combine limited physical resources in arrangements that are ever more valuable.

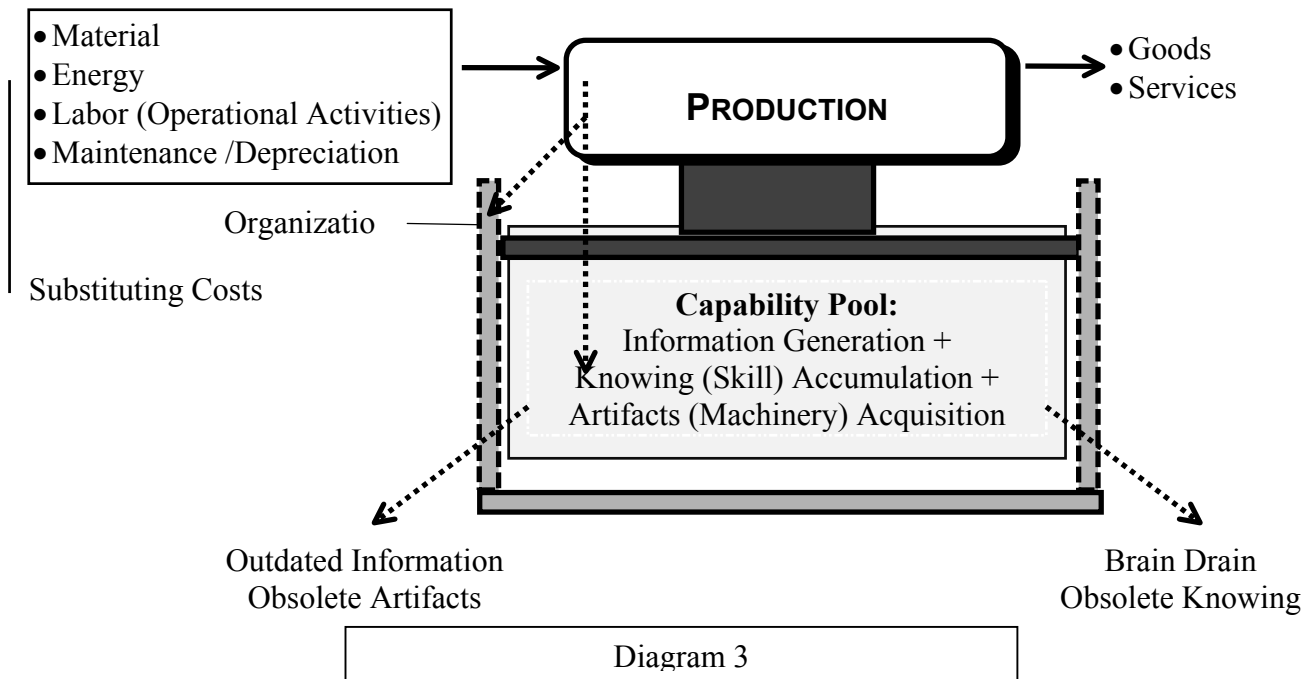
Activities of the people in an organization may vary from new knowledge generation to new applications for the existing knowledge. Efforts can be related to improving the capabilities of oneself or those of a colleague, as well as improving the general organization of a business. The acquisition of capabilities that relate to improving skills are traditionally referred to as the “learning curve.” Improving the organization’s structure is related to improving its corporate culture.

Investments in people, usually referred to as human resources, can be broken down into improvement in operations, knowledge generation, skills and organizational development. Costs related to operations can often be thought of as “substituting” costs, since similar operational costs are incurred when performing the same process. However, the costs of knowledge generation and skill and organizational development, which relate to improving the capabilities of a system, can be grouped under “enabling.” In the same way, maintenance/depreciation of machinery may be regarded as a “substituting” cost, while acquiring a machine is an “enabling” cost.

The structure of conventional managerial information systems of cost analysis has generally been oriented towards the consumable aspects of the production process such as material, energy, operation, maintenance and depreciation. However, a new knowledge-based dimension has been added to this system. In conventional managerial information systems of cost analysis, all knowledge endeavors, as well as the cost of utilizing artifacts (depreciation, maintenance, insurance and related taxes) are sometimes consolidated into “overhead.”

The “substituting” and “enabling” costs are not linearly added or subtracted. They may be presented as the two dimensions of a vector or matrix. In this respect they are similar to the latitude and longitude in the navigation systems. The horizontal dimension deals with the common impacts of production being analyzed in conventional managerial information system of cost accounting, while the vertical dimension deals with the knowledge aspects of production, such as innovation, education, training, improvements, corporate culture, and so on. The relationships are depicted in Diagram 3. The classifications of substituting and enabling are not absolute. They constitute a spectrum of behavior, where material and energy occupy one side and

knowledge the other. Artifacts (equipment) and human resources are in the middle of this spectrum.



The above diagram indicates that enabling resources (knowledge, skill, and artifact) create a “capability pool,” which allows the substituting resources to be transferred into goods and services. The capability pool, however, by itself, is exposed to continuous depletion due to forces like brain drain or obsolescence of information, skills and artifacts. “Organizational capabilities” play a key role in developing and updating the capability pool. Organization is a key essence of any business. As Peter Drucker (1993) indicates, “the function of organization is to make knowledge productive.” Knowledge-based managerial information systems for cost analysis have a wide range of applications, from the software industry to engineering services. This topic, however, will be discussed in more detail in a separate paper.

In conclusion, this paper has proposed and explained the Knowledge Navigation model, which may be used to map the dynamics of organizational progress toward its goals. Obviously, organizations involved in the proactive act of knowledge navigation must be forward and outward looking enough to continuously generate and process knowledge that is not necessarily available from conventional managerial information systems for cost analysis. Accordingly, the

paper proposes the development of “knowledge-based information systems for cost analysis” model that serves to support dynamic and knowledge-intensive organizations. Knowledge-based managerial information systems for cost analysis support organizational efforts to continually reorganize and adapt during their accelerated and concentrated pursuit of objectives.

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