Communications and information processing as a critical success factor in the effective knowledge organisation

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Abstract: A conceptual framework and an architecture for an Effective Knowledge Organisation (EKO) is developed that emphasises the important role of Communications and Information Processing (CIP) in enabling the EKO and in facilitating the creation of a dynamic knowledge capability. The architecture links 'core' knowledge management, intellectual property management, individual learning, organisational learning and innovation modules with CIP as the linchpin. The organisation's need to distinguish among these components of an EKO is argued by comparing and contrasting the different conceptual bases, objectives, processes, systems, performance measures and culture of each module. This viewpoint integrates many concepts and applications from various literatures, but it is somewhat contrary to the conventional wisdom which has tended to de-emphasise the significance of communications and information technology in knowledge management. Instead, according to this view, CIP is a critical success factor for the EKO.

Keywords: critical success factors; knowledge; knowledge management; communications and information processing; Effective Knowledge Organisation (EKO); organisational learning; individual learning; intellectual property; innovation; intellectual property management.

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1 Introduction

Recently, it has become fashionable to downplay the significance of an organisation's information processing and communications capabilities for the success of Knowledge Management (KM) (Cross and Baird, 2000). It is certainly true that KM's salient issues go far beyond the infrastructure of information systems (King *et al.*, 2002). Nonetheless, this paper argues and demonstrates that an organisation's communication and information processing capability is a critical success factor (Rockart, 1979) in creating an Effective Knowledge Organisation (EKO).

2 Knowledge management: how can organisations better utilise knowledge?

The resource-based view of the firm provides grounds for the practical application of 'knowledge' (Conner and Prahalad, 1996). The key question is "How can the myriad intellectual resources of an organisation be most effectively leveraged to produce improved organisational performance?"

When one considers the various kinds of data, information and other intellectual resources that an organisation possesses, the answer is fairly clear. The most important kind of intellectual resource – the variety that has perhaps the greatest potential for improving organisational results – is that which exists in the minds of its most accomplished professionals and that which is embedded in its organisational processes, its products and its relationships with customers and suppliers.

This variety of knowledge is usually initially tacit in nature (Polanyi, 1966; Nonaka, 1994); it is laboriously developed over a long period of time through 'trial and error' (Kogut and Zander, 1992), and it is underutilised because "the organisation does not know what it knows" (O'Dell and Grayson, 1998). Thus, the knowledge possessed by one expert professional may be unrecognised by others in the organisation or even, at different times, by the expert himself. Other similar knowledge is embedded in business activities and relationships that have been created over time through the implementation of a continuing series of improvements.

Simply stated, if every organisational participant were in a position to have access to the most current knowledge possessed by the most accomplished professional in a given area or to understand the knowledge that is embedded in organisational processes and relationships, and if this access were at a time and place at which it was most relevant to his or her decisions and actions, the potential for improved organisational results is likely to be staggeringly great. This is the goal of knowledge management.

3 What is knowledge management?

A wide variety of interpretations of KM is extant in the literature. It is perfectly appropriate if an organisation that has diagnosed its needs and opportunities develops a function labelled 'KM' that includes an array of various knowledge-related activities. For instance, a firm that has a wealth of patents might decide to try to leverage them by developing a system that utilises a patent database that facilitates matching the needs of potential clients with existing patents so that a stream of new licensing income may be generated. And, because this process deals with intellectual assets and may make use of some of the same software as does KM, such a firm may reasonably choose to locate that patent management function under the KM umbrella (Spender, 1996).

However practical and sensible this may be, it does serve to muddle thinking about KM. This is so because however similar to KM some of the activities in patent management may be, it is not an element of 'core' KM, which focuses on tacit knowledge rather than on the explicit knowledge which is reflected in patents. Moreover, such co-location and joint responsibility does not work well often because of the very different objectives, foci and cultures that are associated with the two kinds of activities.

So, in part, therein lies one of KM's problems. In some firms, various knowledge-related activities are organised and housed with the KM department or function. Because of this, KM looks different to an outsider who views various firms. And, a reasonable person might therefore conclude that if what is called KM in various firms is so different, two questions are posed. How can there be a field or body of knowledge called KM? And, how can KM be assessed in terms of its ability to impact organisational performance?

There is a clear need for a framework and an architecture that can be used to understand the relationship among various kinds of information and knowledge, the relationships among various knowledge-related activities and how those activities can be organised to create positive organisational results. Such a framework should clarify the similarities and differences among various knowledge and learning activities and allow for the synergistic architectural design for an *Effective Knowledge Organisation* (EKO).

4 An EKO conceptual framework

There are so many 'buzzwords' that relate to the role of knowledge in organisations; it should not, therefore, be necessary to create a new term – the effective knowledge organisation. However, the common modifiers that are applied to 'organisation' in this context (*e.g.*, 'knowledge-creating,' 'learning,' 'knowledge-based,' *etc.*) are inadequate in that they either emphasise only one of the knowledge objectives that organisations pursue (*e.g.*, 'knowledge-creating'), or they emphasise only some of the knowledge-related processes that organisations use (*e.g.*, 'learning') or they are so innocuous as to have little meaning (*e.g.*, 'knowledge-based') (Senge, 1990; Nonaka, 1994; Grant, 1996).

There are five elements that make up an EKO conceptual framework:

1. understanding the need for a dynamic knowledge capability
2. specifying the EKO's multilevel objectives
3. recognising the distinctions among various 'levels' of data, information and knowledge
4. identifying the 'core' of KM
5. specifying the precise objectives, goals and foci of other critical knowledge-related organisational capabilities.

Such a conceptual framework enables the creation of an integrated architecture for the EKO that can be synergistic and internally consistent.

4.1 The organisation's need for a dynamic knowledge capability

'Dynamic capabilities' reflect the firm's ability to 'integrate, build and reconfigure competencies to address rapidly changing environments' (Teece *et al.*, 1997). The concept of an EKO is based on that of a *dynamic knowledge capability*, which emanates from the resource-based theory of the firm (Wernerfelt, 1984; Conner and Prahalad, 1996). A dynamic knowledge capability is a complex, integrated and internally consistent set of capacities to acquire/create, store, transfer and share knowledge effectively and efficiently, to continuously improve the application of knowledge to business processes, practices, products and relationships and to enable higher-impact behaviours by organisational participants. This results in improved levels of organisational performance (*e.g.*, Zollo and Winter, 2002).

The importance of such knowledge capability for an organisation has come to be conceptually well understood because knowledge is so different from other organisational resources. Knowledge capability can be complex, multifaceted and, unlike many other capabilities, extremely difficult for a competitor to imitate or duplicate. Hence, it can play an important role in an organisation.

However, the role commonly attributed to a vaguely defined knowledge capability – that of creating a competitive advantage for an organisation – may be infeasible, except in the case of knowledge-intensive businesses such as consulting firms and law firms, unless knowledge capability is integrated into an architecture of other strategic capabilities (Eisenhardt and Martin, 2000).

An EKO is therefore an organisation that creates a broad, complex and internally consistent dynamic knowledge capability and integrates it with other strategic business capabilities and with its environment in an overall organisational *strategic capabilities architecture* (King, 1995). For instance, an EKO might integrate knowledge capability with the capability to develop and market a continuing stream of product enhancements and new products. Further, it might collaborate with other organisations through systems, joint ventures or strategic alliances to develop, distribute or promote products. This strategic capabilities architecture might then constitute a core competence of the organisation, whereas the knowledge capability alone is unlikely to be a core competence (Grant, 1996).

4.2 Objectives of an EKO

The second element of a conceptual framework for an EKO is a precise description of the various knowledge-related objectives that such an organisation should seek. The absence of such precise objectives is one of the main 'sticking points' that have resulted in so many different concepts of KM.

The purpose of an EKO is to create a dynamic knowledge capability and to integrate it with other strategic business capabilities and with the environment in order to do the following:

- improve the quality and range of applications of knowledge
- improve organisational processes for innovation, individual learning, collective learning, collaborative problem-solving and knowledge-sharing

- improve the quality and the impact of the decisions and behaviours taken by the organisation
- improve organisational performance.

This variety of multistage models is coming into increasing prominence in KM (*e.g.*, Lee and Choi, 2003). It vitiates the 'means versus ends' arguments that have been made regarding the KM field (Easterby-Smith *et al.*, 2000). The EKO conducts activities to improve and communicate knowledge (the infrastructure), to improve individual learning, collective learning and collaborative decision-making and to enhance innovation (the means); the EKO also focuses on the making of better choices and the exhibiting of improved behaviours and on 'bottom line' organisational performance (the ends). The infrastructure and the means, which are so much discussed in the KM literature, are typically of no great value in isolation.

These multilevel objectives are inherent in the EKO because, while improved performance must emanate from improved decisions and actions which are, in turn, based on improved processes and on improved knowledge, no expenditure for processes and knowledge is justified unless it can translate into 'bottom line' results. Thus, the 'means' are necessary, but not sufficient, objectives for an EKO.

4.3 Understanding data, information and knowledge

The third element of the framework on which the EKO architecture is based begins with distinguishing among three words that are in everyone's vocabulary. Defining the differences among data, information and knowledge may be thought of as a hackneyed topic and some have even decried it (*e.g.*, Alavi and Leidner, 2001,p.109). Developing a sophisticated understanding of these differences, however, is crucial to the understanding of similarities and differences among the various elements of the EKO architecture. Once these distinctions have been made, the various knowledge-related activities may be organised into their proper and mutually supportive roles in an overall architecture for the EKO.

It is widely understood that data are numbers or other symbols that are unevaluated, that information is data that have been evaluated and that knowledge "is possessed in the minds of individuals. . . . related to facts, procedures, concepts, interpretations, ideas, observations and judgments" (Alavi and Leidner, 2001,p.109). Such knowledge is potentially predictive and may lead to diagnoses and better understanding of business issues, processes and objectives.

For instance, for 'core' KM the kind of knowledge that is of major interest is professional expertise – the meaningful and useful collection of data, information and relationships tempered by experience that resides in the minds of individuals who have high levels of professional competence and/or which is embedded in the organisation's processes, products and supplier and customer relationships (Edvinsson, 1997).

Making these definitions useful, however, requires that finer distinctions be made. Figure 1 describes six levels of data, information and knowledge that may be usefully distinguished. Examples are given from the contexts of sales and medicine to clarify the differences between, and relationships among, the levels. The bottom two rows of the table respectively illustrate systems and statistical analyses that are appropriate to each level.

Figure 1 Data, information and knowledge

	Traditional domain of CIP			Domain of knowledge management (enabled by CIP)		
	Data	Low-level information	High-level information	Know-what	Know-how	Know-why
Business context	Sales data	Sales data cross-classified by region, product, *etc.*	"Mined" data showing interesting relationships or "out of control" categories	Ability to respond to a stimulus with a predetermined action	Ability to diagnose complex patterns of stimuli	Ability to deal with interactive effects, anomalies, etc.
Medical context	Treatment reports	Treatments cross-classified by age, symptoms and gender of patient	Treatment effectiveness by category	Ability to assess symptoms and prescribe simple treatment	Ability to diagnose complex diseases	Ability to diagnose multiple interacting problems
Illustrative system	Transaction processing systems	Executive information systems; competitive intelligence systems	Data mining; emergent systems	"Best practices" and "answers to frequently-asked questions"	Expert systems, expert networks	Communities of practice, personal consultants, group support systems, virtual workspaces
Illustrative statistical analyses	Descriptive statistics such as sums, means and standard deviations	Cross-tabulated descriptive statistics	Exploratory analyses; "identification of out of control" data points	Correlations	Multiple analysis of variance	Path analysis

Data versus information

As shown in the first column of Figure 1 (labelled ‘data’), sales data are those that are typically reported in highly aggregated form, probably in dollar terms for a particular time period. Comparable medical data might be the number and types of treatments provided to patients in a given month or year.

The second column shows how such data may be given added value through information processing to produce ‘low-level’ information. In the sales context, this may be through cross-classification by product, geography or time period. In the medical context, this may be treatment data organised by patient gender, age or medical diagnosis.

The third column of the table shows ‘higher-level’ information that is created to produce higher value. This information may be produced as the result of multidimensional inquiries made to databases or through the use of analytic software such as datamining (*e.g.*, Kim and Street, 2004). In business, these might be a category of cross-classified sales results that are more than 20% above the average of sales for all categories. In medicine, this level of information might be created by extending the treatment cross-classification to include some identification of those treatment subgroups that show extraordinarily high response (cure) rates. When such information is in the mind of a person, since it is tacit in nature, some have discussed this highest level of information as ‘know that’ type of knowledge (*e.g.*, a person knows that sales levels were higher this month than last) (Kogut and Zander, 1992), but most consider this to be simply information.

4.4 Knowledge versus information

The three rightmost columns in Figure 1 delineate various levels of knowledge (Alavi and Leidner, 2001,p.113). The first of these three columns shows the least sophisticated variety of knowledge, sometimes referred to as 'know what' (*i.e.*, knowledge that specifies what action to take when presented with a set of stimuli). For instance, a salesperson who has been trained to know which product is best suited for various situations has a 'know what' level of knowledge.

This is the level of knowledge that is easy to apply. This 'know what' level of knowledge has been incorporated into many computer systems such as medical diagnosis systems. The professional or system possessing this level of expertise needs only to receive stimuli and to react in a programmed manner with the appropriate predetermined response. A 'best practices,' 'lessons learned' or 'answers to frequently asked questions' database can provide this level of knowledge to individuals who may not themselves possess it (King and Marks, 2004). This is also the level of knowledge that is made accessible to case managers in the insurance and banking industries or to General Electric's customer service representatives who use database systems to address customer questions about products ranging from dishwashers to locomotives.

The next higher level of knowledge is 'know how' (*i.e.*, knowing *how* to decide on an appropriate response based on a diagnostic process, whether in sales, medicine, or any other area. Such knowledge is required when the simple programmable relationships between stimuli and responses, which are the essence of 'know what' knowledge, are inadequate.

This might be the case, for instance, when there is considerable 'noise' in the symptomatic information so that the direct link between symptoms and diagnosis is uncertain. The 'know how' type knowledge permits a professional to determine which treatment or action is best, even in the presence of significant 'noise'. A professional who is able to take a preliminary 'diagnosis', such as 'best practice' from a KM database or a set of ranked potential diagnoses from a medical diagnosis system, and interpret these 'suggestions' in the light of his/her expertise is operating at this level of knowledge.

The highest level of knowledge is 'know why' knowledge. At this level, an individual has a deep understanding of causal relationships, interactive effects and uncertainty levels associated with observed data or symptoms. This will usually involve an understanding of underlying theory and/or a range of experience that includes many instances of anomalies, interactions and exceptions to the norms and conventional wisdom of a profession.

For instance, understanding that a preliminary diagnosis may be wrong because the system or professional that produced it does not have the range of expertise and experience to effectively deal with symptoms that have multiple causes (*e.g.*, liver disease coupled with heart malfunction and diabetes) represents such deep knowledge of physiology and disease processes. Knowing that an unusually high level of sales might be due to an interactive effect – an influence of one factor that only operates at certain levels of another factor – would also represent such 'know why' knowledge.

As depicted at the top of Figure 1, the three levels of data and information are the traditional domain of Information Processing (IP) while the three levels of knowledge are the domain of Knowledge Management (KM). One simple but useful way of viewing

KM is that it involves processes and systems that enable the explication and communication of higher levels of information and knowledge so that such knowledge may be made useful to those who themselves possess only lower levels.

4.5 'Core' knowledge management

The fourth element of framework is understanding 'core' knowledge management – a set of organisational activities and systems that facilitate or enable the explication, codification and communication, or the direct person-to-person transfer, of mission-relevant professional expertise in a manner that is focused, relevant and timely for an organisational recipient (King, 1999). Thus, 'core' KM can be an element of a dynamic knowledge capability. This may be made clearer by parsing the definition.

4.5.1 Professional expertise

The content of core KM is professional expertise. Professional expertise is one element of the intellectual capital of an organisation (Zack, 1999a).

Organisations do frequently apply such knowledge when they address large issues. For example, if one wishes to develop a system for ensuring that maximum reuse is made of internally developed software, the individuals who have the most experience with software reuse would normally be assigned to the project, if only as advisors (Markus, 2001).

However, this usually cannot be done for less-significant decisions. The result is that less-experienced people make decisions and take actions that could be improved if the knowledge and experience of the real experts in the area were available to them.

4.5.2 Explication, codification and communication

Since professional expertise and embedded knowledge are usually initially tacit in nature, they must be made explicit, codified and communicated to those who do not possess these. The usual methods of conveying tacit knowledge from one individual to another, such as through apprenticeships, are often too inefficient and costly to be the primary mode for knowledge transfer in an organisation (Huber, 1991).

Thus, KM must focus on making tacit knowledge explicit by such devices as motivating experts to explicate their specialised knowledge, by benchmarking the business processes of world-class companies or by identifying 'best practices' within one organisational sub-unit that may be useful to other sub-units. These may then be codified, captured in repositories (databases) that may be accessed by others in the organisation (Edvinsson, 1997; Zollo and Winter, 2002).

4.5.3 Knowledge transfer

Transferring such tacit knowledge may be done without codification, as in person-to-person contact through expert networks. Such networks identify persons who are expert in specific through directories that enable those who need such knowledge to contact them and ask questions.

Knowledge transfer occurs when an expert provides knowledge to a novice, as is the case when a consultant works with users to implement an ERP system that the users must understand and utilise (Ko *et al.*, 2005). 'Knowledge sharing' is similar to 'knowledge transfer', but the 'sharing' term often refers to exchanges of knowledge that do not have a clear objective and do not require knowledge utilisation as they do in knowledge transfer (King and Marks, 2004).

Although person-to-person transfer may be relatively inefficient, it can be very effective when the objective and intended use of the transfer is clear.

4.5.4 Mission-relevant knowledge

Knowledge that is mission-relevant is directly related to the business and its objectives. General information such as that about the operation of global economic conditions and the implications of industry sales trends are therefore not appropriate content for 'core' KM; nor is general management knowledge or management adages and principles. It is the nature of the knowledge content that distinguishes core KM from some other knowledge-related organisational activities such as innovation and learning (O'Dell and Grayson, 1998).

4.5.5 Focus, relevance and timeliness

To usefully think about core KM requires that three criteria be emphasised: focus, relevance and timeliness. Knowledge sharing that is unfocussed, such as when someone tells a 'war story' at the water cooler about a great professional insight that they have had, may have some value, but unfocused sharing is extremely cost-inefficient because it will not be contemporaneously relevant to the jobs of most of those to whom it is told (Leavitt, 1996).

It is the capturing of such professional competence and its subsequent dissemination – at an appropriate time to an appropriate individual or context without requiring that recipient to incur large search costs – that is the essence of core KM (Thorn and Connolly, 1987; Figallo and Rhine, 2002).

4.6 Key knowledge-related organisational activities

The fifth element of the framework that enables a dynamic knowledge capability to be created involves the specification of the differences and potential synergistic relationships among key knowledge-related activities to create a comprehensive and integrated knowledge capability. These key knowledge-related activities are Communication and Information Processing (CIP), Intellectual Property Management (IPM), Individual Learning (IL), Organisational Learning (OL) and Innovation (I), as well as core Knowledge Management (KM).

Table 1 shows that, while these activities have similarities in terms of their knowledge relatedness, they are quite different in terms of their conceptual bases, foci, objectives, processes, supporting systems, performance measures and cultures. These similarities and differences require that an organisation which is attempting to develop a dynamic knowledge capability design an appropriate capabilities architecture that specifies the interactions among the activities and processes so that they are internally consistent.

Table 1 Comparison of the knowledge-related elements of the EKO

Knowledge-related organisational element	*Communications and Information Processing (CIP)*	*Intellectual Property Management (IAM)*	*Individual Learning (IL)*	*Organisational Learning (OL)*	*Innovation*	*Core Knowledge Management (KM)*
Conceptual basis	The worth of information for improved management	Codified Knowledge as a capital asset	Both formal and informal training are required for learning	Enhancing group competencies and organisational capacities	Creativity can be enhanced	Professional expertise can be leveraged through sharing
Focus	Data and information, primarily of a numerical nature	Tangible intellectual assets; patents, copyrights, brands, trademarks and other *explicit*, but usually non-numerical, assets.	Creating more valuable human capital	Social capital; developing general competencies and capacities such as team work, anticipating change and continuous improvement	Creating new products, processes and problem solutions	Mission-relevant professional expertise that is *tacit* in nature
Objective	Provide decision support and organisational performance data and information to organisational participants	Maximise return from existing intellectual property	To enhance the value of human capital through education and training	Facilitate group learning and group capacities for dealing with change	Create maximum potential for return from new ideas	Acquire, explicate and communicate professional expertise
Process	Acquisition, storage dissemination and application of data and information; systems development processes	Licensing, use of brokers to sell licensing rights	Formal training programmes as well as apprenticeships, on-the-job training *etc.*	Organisational Development (OD), teamwork, empowerment, case management, development-focused career paths, and quality programmes	Establishing revenue goals related to new products, brainstorming, making funding available for small projects, idea fairs	Benchmarking, best practices, expert networks, self-organising groups

Table 1 Comparison of the knowledge-related elements of the EKO (continued)

Knowledge-related organisational element	*Communications and Information Processing (CIP)*	*Intellectual Property Management (IAM)*	*Individual Learning (IL)*	*Organisational Learning (OL)*	*Innovation*	*Core Knowledge Management (KM)*
Systems	Computer and communications systems and applications; systems for planning and control	Topical keyword search systems; databases of client needs	Computer-based training; career planning	Environmental scanning and competitive intelligence; CSCW, emergent systems, performance measurement systems, executive information systems and 'digital nervous' systems	Group support systems for idea generation; online application and approval for funding of small projects	Databases and directories, expert systems, shared electronic workspaces, GSS for problem solving
Performance measures	Efficiency and effectiveness of acquisition, storage and dissemination and application of information; user satisfaction	Incremental ROI from new revenue streams; quantification of the value of intellectual property	Number of programmes successfully completed; advancements of those trained	Cycle times and costs; productivity; customer satisfaction; quality	ROI from new products and processes; patents applied for/ awarded; projects funded	Quality and timeliness of decisions; knowledge-sharing behaviour; reuse of knowledge; maintaining pace of market leaders, *etc.*
Culture	Efficient operations; effective support of business functions; cutting-edge computer technology utilisation	Financial-based leveraging of existing property	'University' culture	'Change-friendly' culture	'Creativity-friendly' culture	Knowledge-sharing culture

4.6.1 Communications and information processing

The first column in Table 1 depicts Communications and Information Processing (CIP). Traditionally, Information Processing (IP) refers to the paradigm of information systems which involves the collection of data and their transformation into successively more useful and more valuable explicit information. The data are primarily numerical, although textual data such as reports of sales calls and summaries of recent events may also be routinely dealt with by IP.

The field of Information Systems (IS) operates on the IP paradigm of identifying relevant explicit data, acquiring data and incorporating data into databases that are designed to make them readily available to users in the form of routine reports or responses to inquiries. IP also includes the application programmes that transform data into more valuable information that relates to particular decisions or functions in the organisation (Cross and Baird, 2000). Recently IP has given way to CIP as the various computer-based communications networks of the organisation have been incorporated into a single function.

CIP adds value to data or information in two major ways: by transforming it into higher-value information and by making it available more widely. The transformation is accomplished through the creation of highly organised relational databases and through the operation of analytic programmes. The dissemination is enabled through the creation of inquiry capacities in systems and the development and management of communications networks (King, 2004).

CIP has primarily been related to data and information rather than to knowledge. However, the IT infrastructure that has been created to implement CIP in organisations is of great importance to KM and to other knowledge-related organisational activities.

As shown in the various rows for the first column in Table 1, the *conceptual basis* for CIP is the value that can be created by information in enhancing the quality of management processes and decisions. The *foci* of CIP are data and information, which are primarily numerical in nature.

The *objective* of CIP is to provide relevant, timely and useful data and information to organisational participants and to create databases and computer programmes to enable production scheduling, resource allocation and a host of other applications throughout the organisation. These CIP activities transform data and low-level information into higher-valued information. The *processes* of CIP involve the acquisition, storage and dissemination of data and information using computer and communications *systems* for the enhancement of planning and control capabilities of the organisation. The systems development processes through which new databases, applications and systems are created is also a primary CIP process.

The *performance measures* for CIP involve the efficiency and effectiveness of these systems and the satisfaction of system users. The *culture* that is essential to this set of processes is one that emphasises CIP efficiency and cost-effectiveness and the ‘cutting-edge’ application of computer technology.

4.6.2 Intellectual property management

The second column of Table 1 is labelled Intellectual Property Management (IPM). This represents the activities that are involved in leveraging existing explicit (codified) intellectual property in the form of patents, brands, product formulas, research reports, trademarks and the like, in order to create additional value. This is accomplished by creating repositories of such intellectual property and refining and distributing it.

Intellectual property can be made more accessible and usable through the use of an information infrastructure that is developed, operated and maintained by the Information Processing (IP) activity (Zack, 1999b). The systems and applications that IP develops to facilitate the management of intellectual property are often similar to those that are used in KM.

As shown in Table 1, the *conceptual basis* for this activity is that such explicit knowledge may be thought of as a capital asset. The *objective* of having an organised activity to deal with this element is the maximisation of revenues and return on these assets.

The *processes* that an organisation may use to achieve this objective are the creation of licensing programmes for the assets, the use of brokers to facilitate such transactions and the development of security programmes to ensure that trade secrets are not compromised. At least one firm in Britain, BTG PLC, has made a business of the brokerage of such intellectual property. It can license 8500 patents involving 300 technologies from its ‘provider’ clients to a myriad of ‘user’ clients who may need these technologies in their businesses.

While this asset transfer business focuses mainly on patents and technological information, other intellectual assets such as brand names and product formulas are under constant scrutiny in some firms as consideration is given to licensing, brand extensions and other means of creating new revenue streams and thereby enhancing returns.

The *systems* that may be used to support this element of an effective knowledge organisation are keyword indexing systems, databases, websites and software to enable relevant assets to be identified and matched with client needs as well as security systems to protect confidential material.

The appropriate *performance measure* for IPM activities is the incremental Return on Investment (ROI) from the new streams of revenue that are generated from these activities. Associated measures may involve the quantification of the value of these assets so that non-incremental ROIs may be calculated – the quantification of the value of all of a firm’s intellectual assets (Wiig, 1997; Andriessen, 2004).

The *cultural* dimension of this activity is the culture of the financial officer who wishes to maximise returns on assets and to take advantage of every opportunity for incremental financial gain. Each of the other knowledge-related capabilities has less direct linkages with bottom-line performance, so that the culture of intellectual property management is clearly distinct from those of the other elements of knowledge capability.

4.6.3 Individual learning

The individual learning module emphasises the training and education of individuals. The focus is on the enhancement of the value of the organisation’s human capital. This approach maximises the opportunities for both formal and informal learning through the institution of corporate universities, managerial development programmes, on-the-job training and apprenticeship programmes as well as through the establishment of informal mentoring programmes.

An effective individual learning programme focuses on both explicit and tacit knowledge. The conceptual basis for the individual learning strategy is that while explicit knowledge can be transmitted formally, the maximisation of individual learning requires that tacit knowledge be communicated as well. Since the transfer of tacit knowledge, particularly that which exists in the minds of experts, 'cannot be codified and can be observed only through its application and can be acquired only through practice' (Grant, 1996,p.111), this strategy usually involves both formal and on-the-job training, which enable an individual to capture the knowledge of experts through observation, imitation and practice.

As shown in Table 1, the *focus* and *objective* of the individual learning module is the creation of high-valued human capital through the transfer of both explicit and tacit knowledge. Its *processes* and *systems* are the employment of a range of education and training programmes that are specifically designed to maximise adult learning; some of these usually involve computer-based systems.

The *performance measures* that are appropriate to individual learning include the measurement of the programmes successfully completed and the resultant career advancements. The *culture* associated with this approach is a 'university culture' – one that values learning, informed debate and academic freedom. If that culture is suffused with the assumptions and practices consistent with andragogy (King and Malhotra, 2001), it will be one in which there is greater self-motivation and less need for extrinsic rewards. The firm that adopts the individual learning programme in pursuit of a learning organisation is 'betting on its people'; enhanced individual learning will translate into improved organisational behaviours and performance.

4.6.4 Organisational Learning (OL)

Organisational Learning (OL) is one of the oldest, and yet least-understood, elements of an organisation's knowledge capability (Schulz, 2002). Organisations exhibit learning, or adaptive behaviour, over time in terms of goals, search attention patterns, standard operating procedures, decision rules and a wide variety of other ways.

Clearly, organisational learning, sometimes called adaptive learning, is related to individual learning. Indeed, some early views of OL did not clearly distinguish individual and group learning. However, modern views of OL recognise that ' learning by a social system cannot be equated with the sum of the learning processes undergone by individuals' (Probst and Buchel, 1997).

The organisational learning activities shown in Table 1 therefore focus on 'learning by social systems' that results in changes in shared knowledge, values, normative standards and behavioural patterns in an organisation. This may be thought of as the creation of 'social intellectual capital' (Akgun *et al.*, 2003).

As indicated in Table 1, the *conceptual basis* of OL is that social capital in the form of various group and organisational competencies and capacities can be developed, refined and enhanced to enable the organisation to adapt to changing circumstances and demands. The *objective* of OL is to facilitate such learning through organisational processes.

The *processes* that organisations use for OL are diverse (*e.g.*, formal training in effective teamwork, adoption of organisational development techniques, change management, case management, employee empowerment and continuous improvement techniques and programmes). Other tools are managerial in nature, such as the creation of career paths that can facilitate organisational learning and the creation of work groups with constantly changing teams who must continually reintegrate their knowledge in order to work effectively.

The *systems* that support OL are also diverse: systems to provide competitive intelligence and environmental scanning systems to permit the environment's destabilising forces and the need for change to be identified and anticipated, virtual workspaces that facilitate group decision making, Computer-Supported Cooperative Work (CSCW) systems, emergent systems that can adapt to provide new outputs for the same inputs when the system has 'learned' that they are warranted, systems to support teamwork, negotiation and group problem solving and performance measurement systems to monitor continuous improvement (Goodman and Darr, 1999).

The *performance measures* that are appropriate to OL include reduced cycle times and costs for product development, project completion and order fulfillment, improved productivity, increased customer and employee satisfaction and improved quality. The *culture* for OL is one in which change is treated as normal and even desirable, one that minimises 'future shock' and one that emphasises andragogy rather than pedagogy as an approach to individual learning (King and Malhotra, 2001).

4.6.5 Innovation

The fourth column of Table 1 is labelled Innovation (I). Innovation is a proactive process that is conducted in an organisation that has the purpose of generating, evaluating, developing and implementing new products, processes and techniques. Sometimes this has been referred to as 'knowledge creation' (Nonaka, 1994). While the innovation process has been studied for many years, many firms have begun to devote more attention to innovation as competition has become more fierce (Paulus and Yang, 2000).

Innovation is clearly related to change and to learning and, as a result, it is sometimes confounded with OL. However, innovation focuses on generative learning, or creativity, while the primary focus of OL is adaptive learning (Huber, 1991).

As shown in Table 1, the *conceptual basis* for innovation is that organisational creativity – the generation of new ideas by organisational participants – can be deliberately enhanced. The *objective* is to maximise useful organisational innovation through creativity-enhancing activities. The *foci* are on ideas for new products, new processes and new solutions to problems.

Creativity-enhancing *processes* include group processes such as brainstorming and the use of metaphors and analogies as well as business-oriented processes such as establishing goals for the proportion of revenues that should emanate from new products, providing seed money for preliminary studies on new ideas and conducting 'idea fairs' or 'share fairs' for employees (Bell *et al.*, 2002).

The *systems* that can support creativity enhancement include group support systems for idea generation and evaluation and online application and approval systems for providing funds to small projects on a non-bureaucratic basis (von Hipple, 1994).

The *performance measures* that may appropriately be applied to innovation are the proportion of revenues derived from new products and processes, the number of patents applied for and/or awarded as well as other intermediate measures such as the number of developmental projects funded. Companies such as 3M have long used such measures to reflect their innovation objectives.

The creativity *culture* that supports this area is one that has been much discussed in the creativity literature. It has such attributes as tolerance for the failures that will inevitably result when innovations are pursued, the valuing of ideas that are generated (even if they are not pursued), the willingness to 'think outside the box' and the postponing of the evaluation of ideas until they are fully formulated (McGill *et al.*, 1992).

4.6.6 'Core' knowledge management

The conceptual basis, focus, objectives, processes, systems, performance measures and culture of the previously discussed core KM – the acquisition/creation, possible codification and sharing of mission-relevant professional expertise that is often largely tacit in nature to organisational participants and contexts in a manner that is focused, relevant and timely – are described in the last column of Table 1.

A basic premise of core KM is that tacit knowledge can, in part, be made explicit and perhaps codified. Many of the practices of KM, such as best practices, benchmarking, *etc.*, involve the explication and codification of tacit knowledge through the observation of its application and practice.

Two basic approaches to KM have been identified (*e.g.*, Zack, 1999a; Earl, 2001). The two ways may be described as 'codification' or 'personalisation'. Codification focuses on making tacit knowledge explicit and available to multiple recipients. Personalisation focuses on the dialogue between people, say an expert and a non-expert, through such capacities as communicator networks that are supported by directories, profiles of expert's areas of expertise, *etc.* Both of these approaches may be part of core knowledge management, although many organisations emphasise one or the other (Hansen *et al.*, 1999).

As shown in Table 1, the *conceptual basis* of core KM is that the value of mission-relevant professional expertise can be leveraged through explication and sharing. The *objective* of core KM is to facilitate this explication and sharing through the development and operation of analytic programmes, repositories, activities and systems (Alavi and Leidner, 2001).

The *processes* of core KM are diverse since they either directly focus on making professional expertise explicit or on implementing systems that facilitate doing so. Some elements of KM systems do the former, such as through creating databases with 'answers to frequently asked questions'.

These processes normally involve human intervention, such as panels of experts who evaluate the worth of submissions to a 'best practices' database (O'Dell and Grayson, 1998).

The *systems* that are useful in core KM are expert networks and directories, repositories of knowledge and expertise, expert systems, shared virtual workspaces, virtual facilitation for self-organising teams and many more.

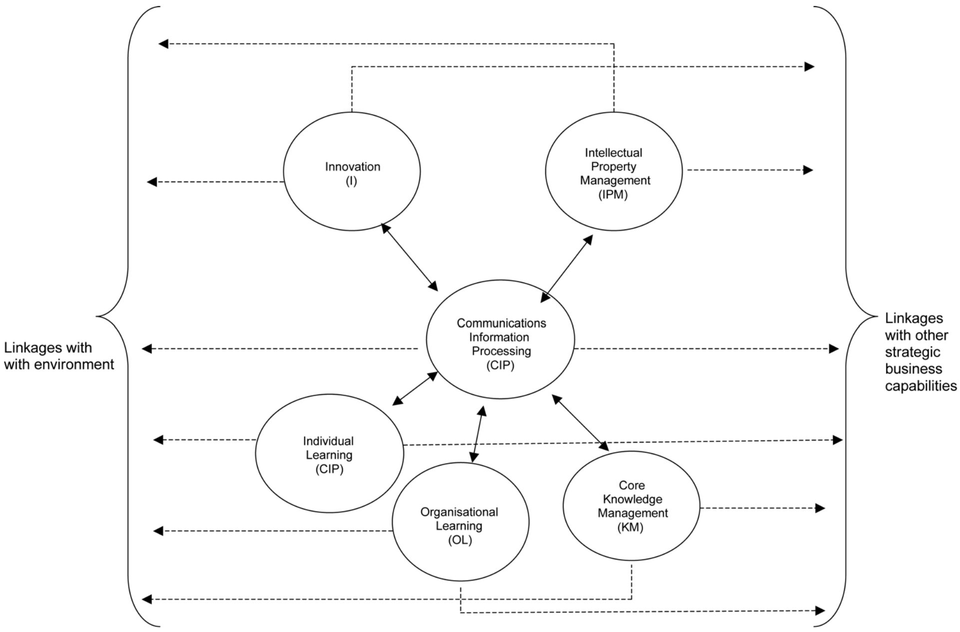
The *performance measures* that are appropriate to 'core' KM are the quality and timeliness of decision making, increases in knowledge-sharing behaviour, level of reuse of existing knowledge, less dependence of the organisation on a few key individuals, reduced administrative costs and less redundancy (Andriessen, 2004).

The *culture* of core KM is one of knowledge sharing. This is perhaps the most difficult of the cultures to implement since it requires that the ubiquitous 'knowledge is power' and its consequent 'knowledge hoarding' assumption (Markus, 2001) be transformed into one in which sharing is appreciated and rewarded.

5 The EKO architecture

Based on these five activities, Figure 2 shows the architecture of the dynamic knowledge capability for an EKO. The figure shows core KM to be linked to other knowledge-based organisational modules, innovation, organisational learning, intellectual property management and information processing to create a dynamic knowledge capability.

Figure 2 The EKO architectural framework



This overall knowledge capability is, as shown at the right of the figure, to be integrated with other business-related capacities, such as the capacity to manufacture aluminum in a low-cost manner or the capacity to deliver rapidly a stream of product enhancements and new products. It is also linked, as shown at the left of the figure, with the organisation's environment through environmental scanning, competitive intelligence and interorganisational systems and collaborative processes (Powell *et al.*, 1996; Shaker and Gembicki, 1996; Ingram, 2002). These linkages may either be an element of one or more of the constituent capabilities or be conducted centrally to serve all of them.

5.1 CIP's role in the architecture

CIP is the linchpin of the knowledge capability framework in Figure 2 since it develops and operates the systems and processes to support other knowledge-related activities and the infrastructure for the communication of data, information and knowledge, thus enabling the other capabilities of the EKO. This view of CIP is valid whether the organisation relies primarily on a 'repository' view of KM or a 'personalisation' view in which knowledge transfer primarily takes place between humans through such communication-based systems such as expert networks and communities of practice.

Thus, CIP is a key element to the EKO since it serves to clarify the distinction between CIP and other activities, which are commonly confounded in the literature; it also identifies a core capacity that an organisation must possess if it is to be an EKO. Clearly, good CIP does not ensure good KM, but it enables it. CIP is therefore a 'critical success factor' for KM in that it is necessary, but not sufficient, for KM success (Rockart, 1979).

The creation of an EKO places new demands on CIP to provide the infrastructure and the capacity to operate. For instance, CIP's support of the other EKO elements requires it to cope with new varieties of content than that which has been the focus of traditional IP. This content is largely textual in nature, ranging from patent applications and filings, to sales contact reports, to benchmarking studies – all of which must be provided to users in a fashion that meets the core KM criteria of relevance, timeliness and focus as well as the key IP criteria of accuracy and efficiency.

CIP must also place greater reliance on nontechnical and non-automated processes to facilitate other knowledge-related activities. Since most KM systems cannot be totally automated, they require human intervention to make judgements concerning whether knowledge submissions are worthy of inclusion in a system, whether a new 'best practice' should replace an existing one, who should be a recipient of newly explicated knowledge, *etc.* IP must work with persons outside the IS organisation to develop and operate effective KM systems.

IP must also expand its horizons to include a variety of facilitation mechanisms which may not be highly technical in nature. Some information processing processes may require only validation and legitimisation; for instance, 'communities of practice' at a single site may primarily involve face-to-face communications and group meetings. Moreover, while the case of a community of practice that relies primarily on face-to-face contact may be interesting, in general, such communities operate on a multisite basis that requires technological support that can only be provided by CIP (Bieber *et al.*, 2002; Bechky, 2003).

The portrayal of the role of CIP in the EKO that is shown in Figure 2 may be anathema to some who see CIP as peripheral to other knowledge-related activities (Cross and Baird, 2000). However, with the growing globalisation of enterprises and the consequent dispersal of individuals and functions to far-flung locations, there is an ever-increasing need to 'pull together' individuals who possess diverse sets of knowledge to engage in collective learning and collaborative problem solving on a routine basis. Reliance on face-to-face and other nontechnological practices is increasingly an exception to the rule. Thus, Figure 2 describes a situation that is increasingly the norm and the traditional view of CIP as involving only 'automated' computer systems or inquiry-driven databases, a view which is increasingly obsolete (Kankanhalli *et al.*, 2003).

5.2 A knowledge architecture as a core competence?

Can the architecture of Figure 2 implement a dynamic knowledge capability that is an organisation's core competence? This is an oft-stated goal for KM or for a dynamic knowledge capability, but is it realistic?

To be a core competence, a capability must meet the following criteria (King, 1999):

- has evolved slowly over time through collective learning and information sharing
- is not readily enhanced through additional investment
- is a synergistic 'bundle' of capacities or capabilities
- cannot be readily duplicated by others
- cannot be readily transferred to others
- creates a competitive advantage in the perception of customers and the market.

Although, it is currently fashionable to discuss knowledge management, or a knowledge capability, as a core competence, such few capabilities usually can meet all of these criteria (Argote and Ingram, 2000). For instance, few would argue that KM alone can create a competitive advantage in the minds of customers, except perhaps in the special case of an organisation that is in the 'knowledge business'.

However, an architecture such as that in Figure 2, in which KM is integrated with environmental scanning capacities, other knowledge-related capabilities as well as with key business capabilities, has the potential to create a core competence because it may well be able to meet these criteria.

5.3 Architectural linkages

The architecture of Figure 2 does not show direct linkages among the knowledge-related activities because these activities have such substantial differences (as demonstrated in Table 1). They are best conceptualised, organised and administered as distinct entities. If the linkages are initially conceptualised in a 'star' network as in Figure 2, the various EKO processes will best be able to concentrate on their specific conceptual bases, foci, objectives and processes so that they may be fully developed and integrated on a designed basis. Since the various EKO activities will increasingly be carried out at different geographic locations or by individuals scattered throughout various departments of the organisation, these CIP-enabled linkages will usually be crucial to the successful development of the EKO.

This suggests that an organisational merging of the various activities is not desirable since it would inevitably lead to 'culture clashes'. Of course, this does not mean that personal communications among individuals who concentrate in the various areas is discouraged. Indeed, just the opposite is true, since all of these knowledge-related activities are enhanced by easy and open communications. The linkages through CIP suggest that it is IP's task to develop infrastructure, systems and processes that facilitate and motivate such communications while also maximally enabling face-to-face contact within each area and among the various areas of the EKO when it is desirable and feasible.

6 Summary

The EKO represents a goal to be sought, and it is a challenge to implement the dynamic knowledge capability that is a requisite for it. An Effective Knowledge Organisation (EKO) is one that creates a dynamic knowledge capability that integrates various knowledge-related capabilities on a synergistic and internally consistent basis. This can be done only through a knowledge architecture that shows how the integration can take place and how it can function effectively.

The EKO framework and the description of the highly varied conceptual bases, foci, objectives, processes, systems performance measures and cultures of the component activities outlined in Table 1 should constitute a warning to management that these activities should be developed separately with appropriate linkages through CIP. To attempt to develop them as an integrated whole would be futile because of these differences.

For the EKO and each of the knowledge-related processes to prosper and be effective, CIP must provide support and enablement. To do this, traditional CIP must transform itself by focusing greater attention on human interactions that are so important in an EKO and on the role of human beings as integral elements of systems.

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