

## THE 'I' IN IT – A PANCHA KOSHA VIEW

K.R. Srivathsan

Indian Institute of Information Technology and Management – Kerala

Email: director@iitmk.ac.in

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ABSTRACT: Thus far Information Technology has grown mostly from the 'T' or Technology side of IT. As this technology is becoming mature and supply of the same is exceeding demand, it is becoming a superspecialty. The 'I' side of IT is steadily becoming more important. Subjects like taxonomy, metadata frameworks, information systems organization, semantic web, knowledge management, etc. are getting increasing attention. In future, the 'T' will be more and more shaped by ways the 'I' is generated and used in different domains of real world and activities of daily life. The dynamics of 'I' or information as driven by those who use it requires relevant practical paradigms that are aligned with knowledge based wealth creation activities. Present approach of pushing more technology in the form of Enterprise Applications Integration [EAI] has to be integrated with processes that sustain effective Knowledge Management and culture of learning organizations. In this paper we bring out that the ancient Indian Vedic view of Pancha Kosha, i.e. the five-layers view of conscious human existence, together with a 'Knowledge Plant' (K-Plant) management model to provide some deep insight into how we holistically integrate people, process and technology with capacity to drive the information space in ways that sustain knowledge enabled wealth creation by organizations. The same approach is also useful in building virtual knowledge-driven enterprises. We also refer to implementations of such virtual enterprises supporting knowledge management systems in three kinds of organizations. All the three implementations support the information-interaction-collaboration framework for the kind of K-Plants approach stated in this paper. The three are generic enough to cover a wide variety of real-world organizations.

**Key Words:** Knowledge Management, Information Systems Organization, Enterprise Applications Integration, Decision Support Systems, Virtual Enterprises, Information Systems, Information Sciences, Systems Thinking, Learning Organizations, Organizational Behaviour, *Pancha Kosha*.

### 1. THE NEED

As the world hurtles from computers and networks through Information – Communication Technologies (or ICT) and convergence towards the emerging Knowledge Society era, ***we need appropriate paradigms that help us master and sustain knowledge based wealth creation***. Knowledge in a domain is used collectively by members of any group that works focused in wealth creating activities. They act in the real world in ways that sustain value propositions for the customers and stakeholders of that group. Knowledge based wealth creation depends upon understanding information and the capacity to use the insight gained from it in a given context to arrive at right judgments. Further, any group using information to create wealth should be equipped to act upon such judgments in ways that create value for the beneficiaries and stakeholders it serves. The tools and systems provided by ICT and convergence

should be so deployed and made available such that they facilitate such collective insight-driven actions. In this paper we propose a *Pancha Kosha* paradigm that allows us to integrate the complex information systems and processes, the organization and management of the people or groups that use them such that IT can sustain effective value propositions to all concerned.

Information of value is that which effects a change of state of a user or a group that becomes aware of it. Henry Kissinger, in a speech delivered in Aug. 2003 at New York stated that, “**The role of technology should be to bridge the gulf between the availability of information and the ability to use it.**” Bridging this gulf is the key to building enterprises in the Knowledge Intensive Products and Services area. President of India, A.P.J. Abdul Kalam constantly lectures upon building a knowledge driven economy as the central theme of his Vision-2020 [1,2,3]. The capacity of any organization to exhibit the characteristics of a Learning Organization [4] depends critically on systems thinking and knowledge management within the organization driven in relation to the wealth-creating activities it is engaged in.

It is increasingly recognised that such capacity is enhanced very substantially by groups working focused in knowledge driven activities and create value by the systematic practice of Knowledge Management. [or KM], KM the art of involving in every organized activity of an institution or organization the People, Process and Technology to

- a) **Capture** and accumulate knowledge of people in an organization.
- b) **Disseminate** knowledge where and when it’s needed.
- c) Enable people to **re-use** the knowledge work of others.
- d) Provide an environment to **collaborate**.

We call the above aspects as the CDRC (for capture, disseminate, re-use and collaborate) functions of KM. Current KM literature [5] deals with how to (a) set up an IT framework to facilitate this CDRC; (b) how to build KM practices over an Intranet of any given company or organization that facilitates retention of organizational knowledge; and how to factor it into the management business and its growth [6].

However, we say that the above four CDRC functions are effective only if the group’s management of the information dynamics (i.e. the information generation and utilization processes) obeys the following five ‘fundamental Rights’: **Right Information** to the **Right Person or Group** at the **Right Time, Right Place** and in the **Right Context**. We call these five rights as the 5Rs. The effective application of KM by any group not only respects the CDRC functions, but also drives the capacity to sustain the 5Rs in ways that sustain the value propositions for the customers and stakeholders served by the group. The challenge that we address in this paper is **to extend the KM paradigm from a purely technology driven, or, ‘platforms’ based intranet approach into a holistic Pancha Kosha paradigm** wherein the people and processes in organizations are aligned with the facilitations provided by ICT and convergence. Such organization is necessary to build and efficiently manage **Knowledge Intensive Products and Services [KIPS]** as often referred to by Abdul Kalam (visit [www.presidentofindia.nic.in](http://www.presidentofindia.nic.in)).

In the global web-based information space with access to the ever-expanding horizon of information, the only efficient way for groups to work focused is to build their own relevant **Knowledge Estates [K-Estates]** over which they support their own KM functions. Our approach is to enable each organized group that uses ICT and convergence to build and manage its own K-Estates over which they manage their own **Knowledge Plant [K-Plant]** that help them drive their KIPS functions. Such knowledge estates are capable of aligning quickly with the people and processes that support KIPS functions. The usage of the phrases K-Estates, K-Plants or K-Citizen will become in the context of this paper will be clear as we further go through this paper.

## 2. THE THREE TIERS OF CONVERGENCE

**Convergence in Technology** is now well established and getting deployed rapidly. It is coming in the form of multimedia integration, IT, communication, and entertainment over the global net. Its very success has paved the way for studies and methods on how to exploit it in the different domains of business, economics, industry, education and diverse services. At a higher level, we are now deploying this ICT or convergence in different forms of Enterprise Applications Integration (EAI see [7] for coverage on different aspects of EAI), web-enabled services in the form of e-commerce, e-governance, e-learning, etc. At this higher level, we may call this as **Convergence in Management**. It is about integrating the people and processes in any organization over the technology framework of convergence.

To effectively bring about this convergence in management, we need to build several component information systems that are aligned with the logic of the business and associated processes. In some sense, this is already happening in systems that support workflow, document management, web-enabled databases, learning management systems, digital library, etc. However, when we have to customise these enterprise applications for target domains (such as health, education, manufacturing, agriculture, finance, etc.), considerable work needs to be done in the development of appropriate classification methods. In fact the logic behind the classification itself delineates the boundary on the kind of knowledge questions that the systems is capable of supporting. This subject or domain specific knowledge map or taxonomy often has to be developed over a **confluence of disciplines**. For example, let us take the case of developing a knowledge portal for agriculture trade. Such a portal needs to have underneath information systems built upon the classification of components related to the particular kind of trade, the related agriculture domain and finance or business related information. We may call such confluence of disciplines as the **Convergence of Disciplines**.

In the emerging knowledge driven economy, we have to master all three tiers of convergence in prototyping and managing the corresponding systems that support enterprise application integration.

### 2.1 People, Process, Technology and Convergence in Management

Today the true or market value of any company or organization is not so much judged by the physical and financial assets it commands, but by the ability it has to create wealth and sustain value propositions

through their capacity to mobilise human and relations capital. This is illustrated by the Skandia's [8] model given in Fig.1.

Traditional view of assets is shown on the left. Most companies treated and managed the three assets they possessed – the financial or structural, the human and the relations – separately by different management groups. The human and relations assets were not really treated as capital assets in a demand driven economy. Development of human capacity was and is often relegated to the human resources development functions. Customer and stakeholder relations, i.e. the relations, were largely driven by marketing and public relations. Since the 1990s, the weight assigned to structural capital has drastically dwindled. **Today companies are assessed not by what they possess, but by what they can deliver competitively with what they are equipped with.** With globalisation and competition, migration of talent has become a serious issue. Retention and building organizational knowledge has become a major priority. Hence an integrated approach to managing all three capitals of an organization – the physical and financial assets, human and relations capital has become a necessity. This need for holistic management of the three capitals is at the root of most organizations going for EAI. **This integral perspective of capital management is forced by the need to be strongly competitive in a global marketplace where supply of goods and services is in excess and knowledge-worker retention a major concern for every industry.**

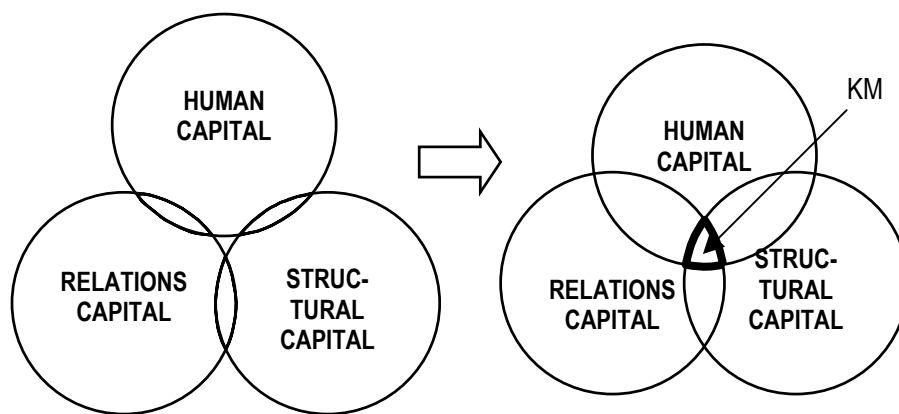


Fig. 1: A KM view of Skandia's Model of Organization's Capital

It may be useful to point out that the present audit mindset of governments in India, coming from the imperial days of the Raj accounts mainly the structural capital. It was a system designed by the empire to help measure what share the ruler could take in the form of some tax. Capacity for knowledge enabled wealth creation and sharing were outside the purview of such audit. It is a tragedy in India that even in the democratic framework of today with concern for development, our government continues inertially to a large extent this audit mindset and only feebly addresses how we promote and empower people through knowledge and skills to create wealth. This attitude of government is what makes governance ineffective and very expensive. **A positive audit attitude needs to provide indicators through assessment, accounting the capacity that is built and the capacity to retain the human and relations capital of an organization to generate real (not speculative) wealth.** Such audit will help align the management

to steer the organization in ways that maximizes wealth creation within the constraints it is forced to work. This is the role of effective knowledge management and **convergence of people, process and technology**. This potential is realized only when the leadership and management of the organization is driven with objectives in consonance with vision and value propositions. Organizational learning needs to be a part of the culture to sustain this convergence as it is becoming essential for its healthy survival in a competitive and global environment.

### 3. THE PANCHA KOSHA MODEL OF KNOWLEDGE SOCIETIES

In the context of the three tiers of convergence stated earlier, there is a need for appropriate information organization and knowledge management paradigm. **The paradigm should reflect the ways people are engaged in any focused wealth creating activity**. It should delineate the boundary between the technology facilitation part of knowledge connectivity and the people driven organizational and processes part that uses the technology to create wealth through **knowledge interactions**. In this paper we present a *Pancha Kosha* paradigm to structure knowledge driven organization that **allows for human values to command attention over the value propositions that drive future knowledge enabled businesses and activities**. This addresses to some extent the difficult issue of how to efficiently combine human values driven social context of interaction and collaboration in a globalised economy with business value-propositions driven organizations of knowledge activities.

#### 3.1 The Pancha Kosha description

According to Indian tradition, every conscious and intelligent being is equipped with Pancha Koshas, i.e., five sheaths or layers. This model is stated in the *Taitriya Upanishad* [9] and interpreted in many Indian texts. These are respectively stated as follows.

(i) **Annamaya Kosha**, or the physical body that is sustained by food (or Anna). This is the gross or body of the individual.

(ii) **Pranamaya Kosha**, or the vital energies (i.e. Prana) provided by the harmonious functioning of the different component 'pranas' - breathing, circulation, nervous systems, digestive and inner organs like the liver and the glands that endows the body with life. Without **prana**, the body is dead and not alive.

(iii) **Manomaya Kosha**, or capacities like reflex, emotion, and similar functions of the mind and the system that sustains the instincts for self-preservation, perpetuation and related expressions. With Manomaya, the being responds to stimuli – both of the external world and of the instinctive or emotional world .

(iv) **Vigyanamaya Kosha**, or the discriminative faculty that helps in undertaking action according to what is 'right' and what is 'wrong' in the course of thinking and action. It is said that this aculty is dominant among human beings and weak among animals. It is also said that if humans do not use this faculty with wisdom and compassion, they may be worse than animals!

(v) **Anandamaya Kosha**, or the sheath of bliss. This corresponds to the state of bliss one attains when one is in total harmony with the internal and external environment even as one is engaged in action as necessitated by our state of living in the world. At this level, the person who works, the object of his work and the process of work itself constitute one holistic entity.

A small clarification is needed at this point in applying this concept of *Anandamaya* to people, processes and systems. One may say from a systems perspective that a human being exhibits the characteristics of *Anandamaya* as an emergent state. The main philosophical difference is that in the Indian and eastern traditions, this *Anandamaya*, or the state of bliss is the natural innate state of the conscious being. But this state gets masked by the conditionings one is born with and induced by the conflicting desires and reactions while living in a material world. It is also stated to be elusive unless one follows righteous actions with the right attitudes as dictated by conscience and discriminative faculty.

What is important in the above five-layer view of one's existence is the capacity for a holistic understanding of ourselves in all our aspects of life. In the systems thinking perspective the five have to function together harmoniously. This subject of sustainable attitudes – individual and collective – for harmony, happiness, need for a compassionate approach, etc. is vast. Indian tradition – from Vedas to Puranas, Upanishads, Bhagavat Gita, and the different schools of philosophy with many a sage or scholar – have been writing and interpreting this field. It is in no way the author's aim to write any commentary on any aspects of these under the context here. But with the increasing interdependence of modern life, we have little choice but to take cognisance of the intensely individual and spiritual ways of conducting our lives that has a base on which **to build a model for practicing in modern times a collective behavioural version of the Pancha Kosha** description stated above. To understand the functions and purpose of one layer we have to take cognisance of its relations with the immediate one or two neighbouring layers. The functions of each layer need to be practiced in the appropriate spirit. This is beautifully stated in the following two lines from the Yogavaasishta [10].

*Bhaaro vivekina: shastram bhaaro jnanam cha raagina: |*  
*Ashaantasya mano bhaaro bhaaro naatmavibho vapu: ||*

In our context, we may broadly translate this as, “For one without discrimination (of what is right action or understanding), the capacity to apply sciences or scriptures is a burden; for one who possesses knowledge but is unwilling to quit old ways and act in the light of one's knowledge, the knowledge itself is a burden; for one who is agitated, the mind is a burden, and for one who does not understand oneself, the body itself is a burden”. In essence, the wisdom spelt out above is that mere possession of faculty and capacity, no matter how awesome it may be from a materialistic perspective will not lead us to prosperity and well-being unless we also drive the same with the right values and processes that sustain our collective harmony and prosperity. The challenge is to build systems and institutions that address the complement of the spirit embodied in the above *shloka*.

Today we speak about Learning Organizations. In the emerging Knowledge society paradigm, what our ancient scriptures speak as quoted above in the light of 'Atmavidya' or self-knowledge at individual level is becoming even more true of organizations (i.e., groups engaged formally in wealth creation activities) themselves. Lou Platt, former CEO of Hewlett Packard once stated that, "HP would be better off if HP knew what HP knew." In some sense this practice of *Atmavidya* increasingly becoming a necessity in organizations or companies is what constitutes a Learning Organization. It is important to note that in the recent investigation of NASA's Shuttle disaster, the investigating committee stated that, "NASA has not demonstrated the characteristics of a Learning Organization". Hence the above *Pancha Kosha* model has much to offer and guide the paradigm for structuring and orienting companies and organizations to build in organizational learning as part of their people and processes management. It is a good sign that in the increasingly globalised knowledge economy, those enterprises, which are ethical, accountable and socially responsible, are the ones that are steadily growing.

In some sense, the above is reflected in the state of confusion prevalent in our modern society. With all its possession of information, immense amount of knowledge of the material world, ICT, capacity to carry out Herculean technological feats, etc., we appear to be at a dead-end when it comes to ***integrating people, processes and technology in ways that build and sustain harmonious, happy and prosperous societies built upon sharing and caring over a democratic and honest business or enterprise framework***. The reason for stating the above paradigm is to help us build a practical reference framework that helps our human values and concerns to arrive at right value propositions which in turn drive the '***New Society of Organizations***' as Peter Drucker [11] describes the emerging knowledge centric era. Such propositions should drive our knowledge activities at different levels – government, business, enterprise, societal or individual – over an integrated global knowledge-managed convergence framework.

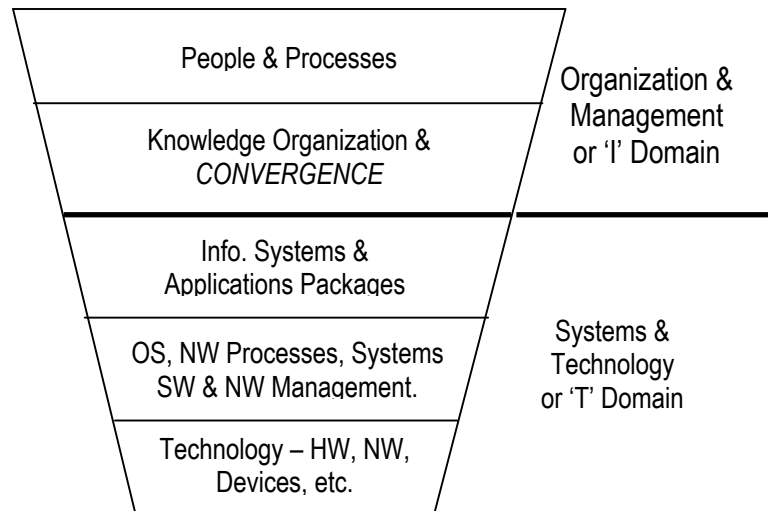
As a first step, we develop in this paper a model for knowledge societies that is built over the global network upon an analogous framework to the *Pancha Kosha* of human existence described above. In arriving at this framework, we assume that we have little choice as human society but to live with the reality of increasing globalisation and all that related to the needs of societies functioning in healthy interdependent ways. Mahatma Gandhi once stated that, "It is every man's right to be independent; but it is every man's duty to be interdependent." ***What we try to arrive at is a structure that helps in managing such interdependence over a knowledge framework supported through convergence of people and processes over the vast network and knowledge connectivity underneath***. It is essential that we all be intensely aware at this point that we are building together a paradigm of living that is at the intersection of technology, management, governance, society, sciences and culture that is driving every corner of collective human activities.

### 3.2 The Five Layers of Knowledge Driven Organizations

ICT and media are fast growing from their infancy and adolescence period to the more mature adulthood era of being driven by knowledge management and knowledge enabled societies over virtual organizations. Ganesh Natarajan, in one of his 'Ganesh' columns in Dataquest articulates on how driving sustainable value propositions in IT is really the need of the hour. He goes to the extent of suggesting that something like a Knowledge Enabled Operational System (calling it KEOS) is necessary in all IT driven organizations to effectively manage the activities of economic importance. We may then ask where exactly in the hierarchy of information collection, processing, interaction, collaboration or knowledge management are the functions of such KEOS can be imbedded. Such imbedding should be natural in ways that we as individuals function in the kind of organizations and daily life we are likely to confront with. In this context, we present a five-layer view – a material knowledge interaction view analogous to the *Pancha Kosha* stated earlier – for a society that is engaged in knowledge enabled wealth creation over a convergence framework. It is illustrated in Fig. 2. The order of the layers is presented in reverse in conformance with the layers in networks.

In this figure, we have delineated the boundary between the 'Technology' side of IT and the 'Information' side of IT from the following consideration. The lower three layers consider themselves with the collection, processing, presentation and interaction within the information space. The functional considerations and the different logic associated with each of the diverse systems of these layers are no doubt inspired by the need to address the real world problems. Each of them is much like the assumptions, models and approximations that we make to build a branch of science. These assumptions and models in turn are inspired by the need to address a class of problems. The class of such problems addressed becomes a branch or subject in itself. However the structure and behaviour of the upper two layers are more determined by the real world needs of people using the system to solve real world problems. Another way to see it is that while roadways are laid to principles of Civil Engineering and Town Planning and cars and trucks are designed and manufactured in factories, the rules of traffic discipline, fleet management, vehicles and driver registration, traffic governance and policing belong to the real world of people who use it. The upper two layers in Fig. 2 more belong to the latter. However, the design of automobiles and trucks is no doubt partly dictated by the associated real world uses, nature of the roads and traffic discipline.

In our presentation, the 'Information' side is taken to be the way people will use and apply it to solve real world problems and needs. It is the discipline behind such information management that is at the substratum of knowledge based wealth creation paradigms. The 'T' or Technology side of IT concerns with building the information infrastructure, the mechanisable parts of the information processing, communication and presentation of information. With the progress of technology, goods and systems on the 'T' side are available like commodities. ***The 'I' side of IT is about enabling and building capacity of people to use ICT and convergence in diverse ways to sustain knowledge enabled wealth creation in their respective domains, i.e. to serve the associated Knowledge Intensive Products and Services functions.***



**Fig. 2: The Five Layers of Knowledge Managed Organizations**

### 3.3 *Pancha Kosha* and three-way communications in organization

The *Pancha Kosha* model has much in common with the conventional management hierarchy. For example in an organization, the lowest corresponds to the physical infrastructure, real estate, transport, the equipments and facilities, etc. The second layer is the administration and offices, personnel management, recruitment, etc. The third layer is the set of facilities and systems that focus on the business and services provided by the organizations. Fourth (the *vigyanamaya*) is the set of processes and capacity of the management and groups to act with wisdom and discrimination that provide or sustain the value propositions of the business or services offered. ***The uppermost, i.e., Anandamaya is achieved and expressed in the share-and-care attitude and the feel-good-factor of triad of the people in the organization, the stakeholders and its customers or beneficiaries.***

Maslow's hierarchy of needs of employees in an organization – consisting of physiological, safety, social-esteem and self-actualisation - also corresponds to the *Pancha Kosha* description in the organizational behaviour context [12]. However, the real test and taste of a successful organization is the perceptible feeling of *Anandamaya*, something like the collective 'feel good factor' that pervades it. It may be viewed as an emergent property of correct implementation and practice of KM in the right spirit at all levels. We may also take the stand that the goal of any organization is to attain this *Anandamaya* in consonance with the purpose for which the organization has been set up. Such *Anandamaya* is elusive unless the organization, the attitude of serving its customers and the feel-good-factor of its stakeholders are all integrated in every substantive decision and action.

Anurag Srivastava of Wipro Infotech says that the spirit of KM in an organization is something amorphous and pervades like the protoplasm in a living cell. It pervades everywhere within the cell, is the medium that nourishes the health and in which the cell's genes grow and multiply. Analogously, the spirit of KM should pervade an organization at various levels and ensure that the behaviour of a living healthy organism is exhibited and felt by all who constitute it. ***Not to take cognizance of this pervasive aspect***

***of knowledge management is akin to developing real estate indiscriminately without the environment or ecological impact that will forebode a future disaster in globalised world.*** This requires that effective communications exist both vertically and horizontally in every group driven activity. First is the communications within members of the group that is sensitive and respects the right information at the right time and the right context. The second is the communication across related groups for effectiveness. The third is the communications between the group and its stakeholders in the context of the vision, mission and objectives of the organization. Effective EAI implementation in every enterprise should facilitate this three-way communications. To ensure such communications, we need to understand the information – knowledge interactions in any knowledge enabled wealth creation activity.

#### **4. INFORMATION AND KNOWLEDGE INTERACTIONS ENVIRONMENT**

In any job, whenever we work in knowledge driven tasks or activities, we are engaged in either self-study mode, or, in group-study mode wherein we communicate and collaborate with other members of the group. The first happens when we study reports, books, journals, technical documents, etc. The second happens when we work over email, message boards, groupware, etc. Whether the group is formal or informal, it is bound by shared responsibilities among the members of the group. Healthy groups stay focused in delivering the service they are intended to execute.

***Hence we state that in a Knowledge Society, the Knowledge Citizen, or K-Citizen as we shall refer, is the focused group that is attending to the different tasks associated with sustaining the services or values delivered by the group.*** In developing information systems for enterprises, the author finds that this notion of a K-Citizen is very useful. We as individuals work in different roles within an organization. In the different roles, we contribute by providing our expertise or skill-set to the corresponding K-Citizen as suited to its tasks and objectives. The best help an enterprise information system can provide is to assist us in the context switching involved in moving from one K-Citizen activity to another.

***This notion of K-Citizen is useful to understand, groom, equip, and ensure collective accountability of every activity over the K-Estates of a knowledge society.*** Till date our management, legal and accounting mechanisms have focused too much on individual responsibilities and propriety. Oftentimes how well an individual is equipped to carry out the assigned tasks through his being part of a K-Citizen hardly gets the attention. In a knowledge economy, how well the K-Citizen is equipped to manage and benefit from the 5Rs (see Section 1) is central to the processes of wealth creation. If we are to build the culture of learning organization, it is as important to educate the K-Citizens and empower them as we do to educate individuals. In other words, every organization must impart education in two levels – one at the individual level and one as being part of a K-Citizen. The K-Citizen needs to be educated constantly in its own rules, roles and processes. Education and transfer of tacit knowledge at individual level takes place more often due to oneself being a part of K-Citizen. In fact the context in the education at individual level comes mostly from the kind of K-Citizen association he/she is likely to be

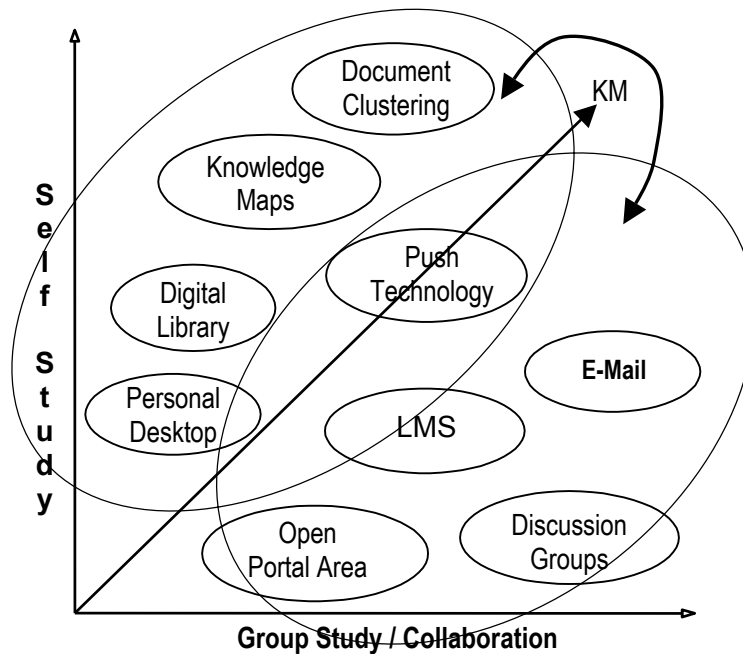
engaged in. In the emerging era, the K-Citizen is nurtured and aligned with the organizational objectives even as some of its members may leave and others join, will determine the health of the organization.

The terms ***K-Estates and K-Citizen*** need some elucidation. A K-Citizen is a formal or voluntary group of members engaged in organized wealth creation activity. A member of such a group is an individual who is a ***Knowledge Worker*** as Peter Drucker often refers to. Wealth creation refers to not only material wealth; it may be any activity that the K-Citizen and its customers find mutually rewarding and of value. For example, it may be a group project of students working for a term-paper in a class, or a troupe teaching best practices in public health in the rural area. It may also be a marketing group or a products design and development group in a company. The longevity of the group is determined both by the nature of the group activity and its health. In a business with significant demand for its goods or services, the quality of knowledge management and culture of learning organization imbibed by the members of the group determines how healthy a K-Citizen the group is. The utility for such a K-Citizen notion is based upon the following characteristics of group driven activities and the need to nurture such groups as single beings.

- i) In any knowledge-enabled activity, the knowledge worker is a member of some specific group that is engaged in focused work to deliver a service or achieve results. Such a focused working group may be within an organization, or have members from different organizations.
- ii) In a deeper sense, ***it is focused working groups that generate wealth by applying its collective capacity, core competency and knowledge***. Hence it is correct to state that ***a Knowledge Society or Knowledge Economy is driven by K-Citizens***. An individual is a reduced case of a one-member K-Citizen.
- iii) ***An individual as member of a K-Citizen alternates between self-study and group-study*** supported by the lower three layers of the ICT framework shown in Fig. 2. In the group study mode, he is engaged in different forms of collaboration over synchronous or asynchronous convergence driven framework.
- iv) Every K-Citizen must also be a continuous (group) learner. This brings in the broader aspects of nurturing the collective learning, or the capacity of a learning organization to be sustained as part of the work environment.
- v) The distinction between the citizen of a Civil Society and the K-Citizen of a Knowledge Society needs to be kept in focus. A civil citizen as Knowledge Worker contributes to several K-Citizens' activities through his/her membership in the groups. But a K-Citizen has several civil citizens as its members and is a focused group that generates and uses collective knowledge to create and sustain wealth generation activities.
- vi) The people and processes (the fifth layer in Fig. 2) is the way the K-Citizen uses the facilitation provided by the Knowledge Organization layer and benefit from using the convergence supported by knowledge sharing and judgment driven actions using the technology underneath.

vii) In the web-accessed knowledge management world, the interplay between an individual's self-study and his/her group collaboration activities in a given K-Citizen context evolves naturally, each reinforcing the other. The individual himself/herself is able to switch contexts with efficiency from one set of group activities to another set of group activities.

In the context of our learning and doing – taking place over a **convergence powered knowledge estate framework** – we may say that we alternate between individual, or, self-study and collective, or, group-study. **When such self-study or group-study happens, there is a qualitatively new dimension of accountability that gets added with regard to the footprints such activities leave behind over a K-Estate.**



**Fig. 3: Personal and Group Interface for Knowledge Interactions**

To understand the above we illustrate in Fig. 3 the two (non-orthogonal) dimensions of self-study and group-study and the kinds of component knowledge interaction spaces in which the objects of the study and interaction are placed. This explanation of the functions shown in Fig. 3 (a modification of an old illustration obtained from M/s Aptech's website) is given below.

When we work over our own configured K-Estate, we use a variety of information access, interaction, collaboration procedures and tools. When these are done in a web-enabled work, we use E-Mail, Digital Library, Internet Radio, message boards, groupware etc. In a web-based knowledge estate, what may normally be called as self-study also becomes implicit collaboration. For example, in a company's enterprise portal, when we access a work specific document of interest, we also leave a trace behind as a log of activity. If the portal is smart, it will also add the user name as a tag to include the user name as a person interested in the subject. This helps enterprise build an implicit collaboration that enhances capture of tacit knowledge. This happens by informing other interested readers that so and so may be a

person who has some knowledge about the subject of the document. The different knowledge interactions components shown in Fig. 3 are briefly explained below.

1. Digital Library: Refers to the electronic form of library where classification of documents (multimedia included) follows conventional library sciences principles. There is much more flexibility available under an online Digital Library. The view and classification may be generic like a Dublin Core, and also custom made to suit the company's way of looking at archival document clusters. Further, personalised view and e-publications related workflow are useful additions in this kind of library. This subject is still evolving.
2. Personal Desktop: A personalised organization consisting of component knowledge interaction functions, links to current active documents and work areas and links to sites of interest to permitted sites. This is a feature that becomes possible because of the web-enabled organization of all documents.
3. Knowledge Maps: There are two types of knowledge maps. One is enterprise specific and relates to the ways the business and processes related knowledge is generated and organised. It will include a navigational map for the different of knowledge areas in an enterprise. A second type of knowledge map is more generic or pertains to very large volumes of information as in datawarehouses. It may denote any custom classification in a subject area based upon custom classification. For example standards pertaining to a design and development process may be classified into a knowledge map that describes better the relevant organization of knowledge pertinent to the subject, it could be the way plant species are classified in Botany, or a class of molecules in Chemistry. The latter leads us to building custom data warehouses. Such a classification helps will lead us to use imbed efficient search tools and the present developments in Semantic Web.
4. Document Clustering: This refers to the way a group, or K-Citizen organizes informally the different kinds of documents relevant for managing and generated by its activities. This is best done under specific groupware area. Here we may cluster project report, group findings, guidelines, progress reports, tasks related documents, customer requirements, etc. Each K-Citizen activity will require its own document cluster and some of its documents will be visible to the entire organization.
5. E-Mail: This has been a major collaboration tool and will continue as such. However, from a K-Citizen interaction and the individual's requirements, the present email clients are poor in design and need much improvement. The logic of E-Mail interactions between groups juxtaposed with a K-Citizen's internal knowledge requirements is not well supported. Capacity to organise single view access from multiple mail accounts for the individual is yet to get adequate attention.
6. Discussion Forums: Tools such as usenet and message boards have been quite popular. These allow informal socialisation that is important to engage the employees and management to discuss openly issues of common interest.

7. Open Portal Area: The public pages of a portal or shared across employees within an organization helps new employees and recruits align themselves quickly to the company's vision and objectives. It also helps build the image of the organization and sell its differential or value proposition to the world at large. It may also have interaction areas that help the outside world interact with the organization.
8. Push Technology: This is a reference to the ability of any smart Enterprise Portal to observe identified activities and alert corresponding person(s) or K-Citizen who have to act upon such activities. For example, the administrator of a particular service will be alerted automatically whenever a new employee leaves or an old employee joins who should be added to / deleted from the service with a log of the action taken. Various task assignments, monitoring of exception events, etc. are efficiently built using appropriate alert systems. Alerts may also be coming from external world through call centre activities, SMS messages or customers' requests over a portal interface.
9. Learning Management System (LMS): Since continuous education and retraining forms an essential part of any learning organization, LMS should form a natural component of any Enterprise Knowledge Portal. In academic and training establishments, LMS together with the Digital Library form the central components of the EAI.

The different components need their respective metadata structures for their organization. Hence any EAI will have to build upon appropriate mix of metadata databases. It helps to appreciate that every piece of information, knowledge component or interaction belongs to one of the three classes: (a) Knowledge Archival Class; (ii) Utilitarian Class (iii) Events or Transactions class. Archival knowledge classification is more like the conventional library. It may further be classified into generic and application or domain specific (like classification of legal documents under e-Governance) classification. Utilitarian class is like document clustering, where different kinds of documents (e.g., project proposal, task management, reports, relevant subject documents, training plans, etc.) are co-located as part of groupware. Events or transactional information provides logs of events, alerts against relevant new events, etc.

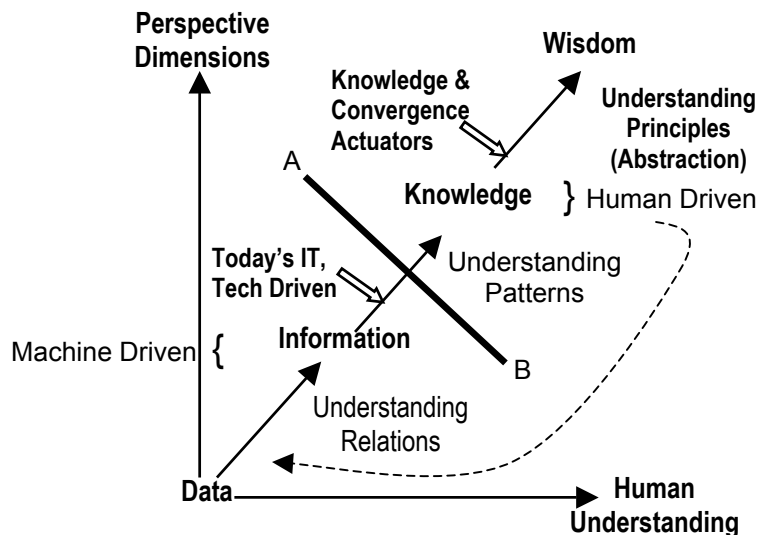
A KM platform (local or virtual) is one that facilitates the functions of the members of a K-Citizen to work seamlessly and efficiently to offer knowledge intensive products and services. In the figure, we have delineated two groups of knowledge interaction objects in two ellipses. This is only to indicate that some of them are more of group study and less of self-study oriented and vice-versa. The 45o line is annotated by KM for Knowledge Management to indicate that the entire Knowledge Interaction Interface is driven underneath by a KM paradigm as practiced in the concerned organization. The dynamics of this paradigm is reflected in the switching between the group study mode of the K-Citizen and the self-study modes of the citizens who drive the component functions of the K-Citizen.

What Fig. 3 illustrates is the kind of knowledge interactions that any good Enterprise Application Integration [EAI] should support. Just like the Web browser or windows like GUI used in PCs for a personal computing environment, we may call Fig. 3 as the **Knowledge Interactions Interface or Kill that is important for a Knowledge Interaction Environment over seamless Information-Interaction-**

**Collaboration Spaces** of the future. This is precisely the kind of interface that is needed to drive the 'Knowledge Enabled Operating System' stated by Ganesh Natarajan over which the EAI is built. The curved arrow in Fig. 3 is shown to illustrate that an activity in self-study mode may lead to some group study mode and vice versa either explicitly or implicitly.

## 5. K-CITIZEN AND THE KNOWLEDGE PLANT MODEL

There is even more close analogy between the behaviour of an intelligent healthy individual in real world and that of a K-Citizen. In an ideal learning organization, every K-Citizen will be a healthy organism that reacts to stimuli from the external world or be directed by its own initiatives to drive the objectives it has been given or set for itself. **Every K-Citizen is set up by the organization's executive to sustain specific focused set of activities or tasks.** The management and the K-Citizen's leadership itself sets the objectives and deliverables from time to time. Such a K-Citizen is equipped with its own K-Estate accessed and managed through its EAI area. Over such a K-Estate, the K-Citizen manages its own 5Rs – Right Information at Right Time, Right Place(s), Right Person(s) and in the Right Context – as relevant to the tasks at hand. Managing the 5Rs requires corresponding processes. Our aim here is to study the nature of such processes of a K-Citizen both in the 'T' or technology and in the 'I' information side of IT functioning over its own Knowledge Estate facilitated by the EAI.



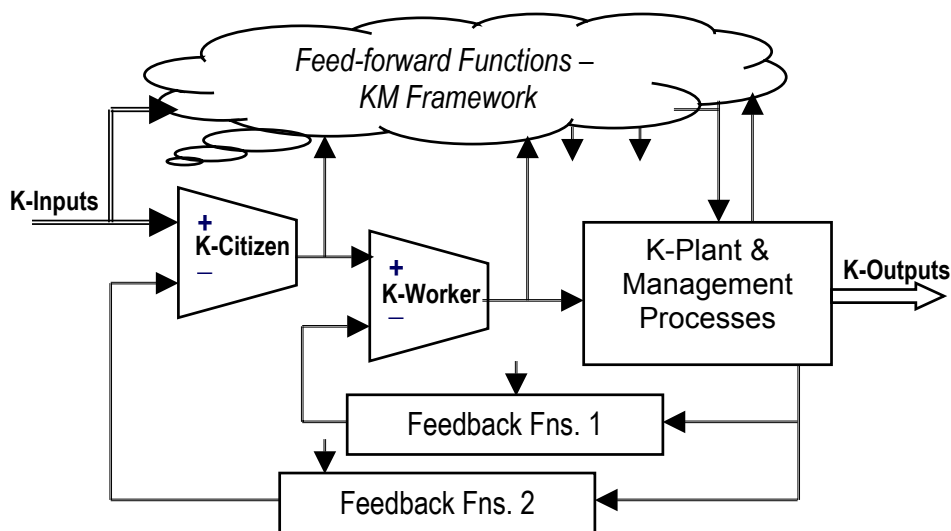
**Fig. 4: A View of Information – Knowledge Interactions**

In Fig. 4 we illustrate a familiar idiom used by teachers in Knowledge Management with some enhancements. The horizontal axis in the figure refers to the increasing level of human understanding – from amorphous data to the human level of wisdom. The vertical axis is variously presented as connectedness, or context intelligence. We have used the term perspective dimensions indicating that with increasing level of abstraction, connectedness and context intelligence, the better will be the quality of judgment and knowledge driven action. Below the line AB is the area where ICT is used to gather data and process the same (including advanced tools such as Artificial Intelligence, Software Agents, etc.). AB

represents the boundary at which such processed information is presented to the K-Citizen, or person(s) who benefit from the information. Above the line AB are the areas where it is humans who act upon such information as presented and act upon it for generating value or wealth.

**Humans use convergence** (i.e. pushing new information, using communication, media appliances, network services, interactive content, etc. combined to provide different services) **to facilitate knowledge based wealth creation**. When humans use convergence driven tools of ICT, more data gets generated and this is put back into the data processing and communications area again. The curved dotted arrow indicates this. Below line AB is where much of today's IT is developed. When it comes to activities above line AB, we are now moving into subjects like EAI and Knowledge Management. However these subjects are not effectively practiced. Without such practice, the value proposition offered by IT is rather limited.

When viewed in the manner as illustrated in Fig. 4, and explained as above, we will be in a position to appreciate that every **K-Citizen is actually driving its wealth creation activities over a K-Plant** in which the constituent members of a K-Citizen are measuring, estimating and taking appropriate actions to achieve the intended objectives. In such a K-Plant, the indicators and actuators used by the K-Citizen are provided by the IT (below AB in Fig. 4) and ICT (above AB) respectively by the technology framework underneath. **The middle layer of Fig. 2 provides the mechanisable parts of such indicators and actuators**. Fig. 5 illustrates a simplified and abstract view of such a Knowledge Plant.



**Fig. 5: Knowledge Plant Model**

No doubt every K-Citizen as a focused activity group has its manager or leader at its top, middle level managers and the field level of workers. But it is ultimately the coherent group, i.e., the K-Citizen that manages and drives the K-Plant. Hence the model also brings about collective accountability of the members who constitute the K-Citizen of the associated K-Plant. This model aligns well with the observation of Peter Drucker [6] when he says that in the society of organization, every knowledge worker

lends his services or expertise to the organization. Such fundamental change in organizational behaviour brings its own ethics and code of conduct, accountability and discipline related issues. Such issues are best addressed from the role of what each K-citizen performs and the relation between collective responsibility and individual responsibility.

There are several implicit functions and behaviour that are immanent in the K-Plant model of Fig. 5. Firstly, the plant has a corrective feedback part in the lower half. K-inputs like targets to be met, time schedules for the different activities, etc. are given to the K-Citizen. ***The K-Plant itself is equipped with its own knowledge base, indicators and actuators needed by the K-Citizen to drive the K-plant.*** It is a multiple corrective feedback loop with their overlapping observables and controllables. The observables at different levels are provided through the feedback functions and indicators used by the K-Citizen over a typical EAI Portal and otherwise. The individuals working within get their own indicators. Their actuators are the various convergence tools available and accessible over the Knowledge Interaction Interface, or, KII as we had illustrated in Fig. 3 earlier.

The K-Plant also has the feed-forward functions shown as a cloud in its upper half. We may say that this corresponds to the monitoring and control functions exercised by the senior management or executive of the organization in which the K-Citizen and its K-Plant are a part. As a K-Plant is driven, monitors of its state are constantly furnished to the executive. Normally the executive that sets up the K-Citizen functions does not intervene in its day-today functions. However whenever the K-Plant falters, or the executive wishes to change the state of the K-Citizen – like enhancing its scale of activities, closing its operations, mid-course corrections, or, changing its portfolio, it may intervene using its authority and carry out the desired change.

One of the hottest topics in IT today is the Enterprise Applications Integration, or EAI. EAI is becoming a necessity for every organization, enterprise or e-governance. How the K-Plant model of Fig. 5 with the KII of Fig. 3 allows us to develop effective EAI is briefly described in the next section.

## **6. EAI AND DEVELOPMENT OF A PLATFORM FOR K-PLANTS**

In any organization, EAI attempts to provide an environment for knowledge and business management in an integrated sense. True KM is not merely about setting up shared repositories, groupware or providing group mail and convergence technology support. It is the capacity to set up and efficiently administer a K-Plant for every K-Citizen in an organization. Each K-Plant will have its own KII view of its information over the total knowledge space of an organization. Such organization may extend beyond the boundaries of its workers and include its stakeholders and customers. Since every knowledge worker is a member of more than one K-Citizen, the associated KII of the K-Plant should help the knowledge worker to switch efficiently across the different contexts associated with the respective K-Citizens in which he has membership.

Current approach for implementing EAI in industry is to make custom EAI portals for each organization. Typically these are built over a J2EE platform with an object database underneath. However without building the KII driven dynamics of K-Plants organization, each such portal stands alone and difficult later to link to other K-Plants' domains. Till date these EAI are used only within Intranets and hence such a need to build K-Estates by cross-linking shared knowledge domains in different organizations are given minimal attention. However ***the demand for such linked K-Estates is already there***. For example these are very much in need in areas like Education and E-governance where knowledge activities transcend boundaries of component organizations. In such cases the custom EAI portal approach is expensive and later gets stuck due to rigidity. ***Hence there is a strong need to build a commodity like enterprise applications software where we can address the Knowledge Organization and Convergence functions*** that help implement the 4th layer of Fig. 2 for any organization.

IIITM-K, through its technology and business incubation program nurtured the development of a new class of Education Servers with practically full KM capabilities. The group that worked under the program later launched itself successfully into the company Transversal E Networks (P) Ltd. (TeN, see [www.transversalnet.com](http://www.transversalnet.com)). The Education Servers were based upon concepts that were originally developed at the author's ERNET facilities at IIT Kanpur. In early 2002 these servers were installed in leading institutions like IIT Madras, IISc Bangalore, and M/s US Software in Technopark. Trial versions were given to M/s Tata Infotech, ER&DC (now Centre for the Development of Advanced Computing, or, CDAC Trivandrum) and some others for study, testing and comments. Later these led to advanced versions and variants of the Education Servers to cover KM applications, Digital Libraries and Data Aggregation and Dissemination Portals.

In the next section, we briefly review three leading implementations among over 25 such installations, each different, of the KM servers where they support the K-Plant based activities for diverse groups within the member organisation(s). Each of them is managed in different ways over a mix of networked servers. It is shown that such K-Plant managed behaviour amounts to creating and sustaining virtual enterprises.

## **7. EARLY ATTEMPTS AT IMPLEMENTATIONS OF EAI**

In all three cases cited here, the methodology adopted was based upon identifying the functional groups that gain from having its associated IT facilitated K-Plant equipped with relevant indicators and actuators. The KII for the different functional groups was configured using the TeN platforms over a suitable middleware. IIITM-K having incubated the TeN platforms has also built good command and capacity in the area of web-based information and interaction systems developments. The examples are given here as case studies to show how the concept of K-Plants may be implemented and managed in different ways over either a central server or to support an expert group with members from different organizations facilitated by a network of enterprise servers.

The first case is an Intranet based EAI for a large R&D and projects management organization. The second is from the higher education sector where groups of teachers in a particular subject and working

in different colleges may form a virtual enterprise through a course knowledge and collaboration space spread over multiple EAI servers. The third case is one of supporting multiple virtual enterprises using both EAI servers and ICT tools like television broadcasting, mobile messaging, etc. Here the challenge is to provide K-Plants driven by experts and program managers that reach out to those who will gain by its functions.

### **8.1 Case Study 1: Aeronautical Development Agency (ADA)**

ADA serves as a major project coordination and R&D centre of the Defense Research and Development Organization (DRDO) of the Govt. of India. They are a premier R&D body engaged in the design and development of the Light Combat Aircraft (LCA) and many cutting edge Aerospace related software, hardware, materials, manufacturing and systems developments. They have a few hundred eminent scientists and engineers with some of the best R&D facilities and CAD/CAM environment of the country. They also fund R&D in dozens of other R&D organizations, industry, premier institutions such as the IITs that carry out complex systems design, modeling, simulation and analysis. In 2002 ADA decided to establish their EAI for providing an integrated KM environment for their different projects and development groups. It was based on a single central server with Apache and Tomcat running over a Linux environment. The EAI platform was built over the Trans-E server package. It was customised over a period of several months with its standard Groupware, Digital Library, etc. It provided the kind of KII depicted in Fig. 3, served through a personal browser based desktop for every user.

ADA had built over time a rich collection of enterprise utilities in the form of different in-house developed MIS components that served the needs of its employees to interact and access most of the administration and other services. Practically all of them were integrated into the EAI Portal for viewing over a standard web-browser from any client system on the LAN. The platform supports terminal mobility to the user within the Intranet for the KII functions. Today all ADA employees access the diverse services through the EAI Portal. Several key groups are using the groupware for knowledge sharing and interactions. While the KM part is supported by the groupware, the KII was made available seamlessly across the organization with personalised components. Such total integration was achieved by a joint team of ADA systems engineers, engineers of TeN and IITM-K with no outside inputs.

This early implementation of the EAI for one of the country's largest R&D and projects agency validated the open architecture called the Info-Space Operating System (iSOS) developed at IITM-K and TeN. The iSOS based Trans-E server systems are now well proven in ADA and several other places as a convenient and quick way to implement and launch advanced EAI in complex organizations at near commodity level prices. The experience demonstrated that users quickly adapt to the new EAI services. It provides the kind of integrated KII based environment described in section 4 without recourse to configuring or customisation of commercial enterprise packages most of which support only one or two component KII functions, inflexible and expensive to maintain. Another significant advantage of the iSOS based implementation is that the different component services are maintained and serviced by the

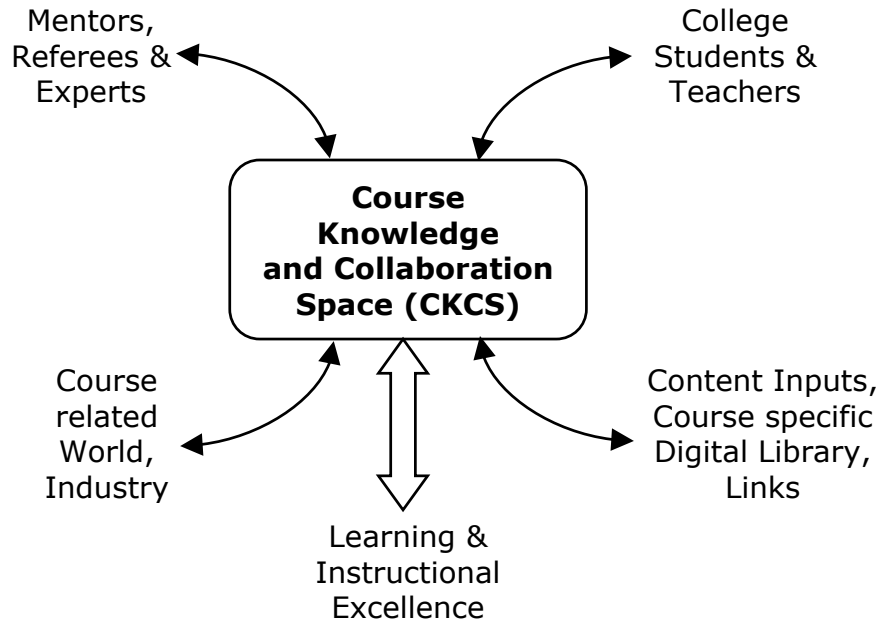
respective domain-specific administrators over the web. The system administrators need only to maintain the underneath systems, network and hardware. ***This decoupling of services from systems and hardware is very essential in maintaining complex information and computational systems.*** In this case study, the members of the different K-Citizen group are under one coherently managed organization.

## **8.2 Case Study 2: Kerala Education Grid (KEG) – Example of Virtual Enterprise**

KEG (see [www.edugrid.ac.in](http://www.edugrid.ac.in)) is the first project of its kind in India in the Higher Education sector. The focus of the project is to support quality education through Technology Enhanced Learning and Teaching (TELT). The aim is to support learning-centric education with the vision, “Quality Education to all independent of geography”. There are several major problems in the colleges with regard to providing quality education. First is the lack of experienced and knowledgeable teachers. Second is the near absence of IT facilitated tools and services in the learning aspects of education. Even most of the IITs have not adopted TELT as a way of life. Thirdly an examination & marks oriented culture that stifles even bright students from striving for true scholarship. Fourthly, lack of resources and inefficient use of resources like labs and libraries where they exist. There are several more problems not listed here. In the KEG project, an approach is being taken to promote use of TELT in each subject area. The best way to tackle this problem is to provide a web-enabled environment in each course where the teachers of a subject in the different colleges form a group, or, K-Citizen and function as a community of practitioners. The way this problem is addressed in the KEG has two important components as stated below.

- (i) Establish and manage a Course Knowledge and Collaboration Space (refer to Fig. 6 for CKCS) in each subject that is linked suitably in the education servers of every member institution. Over this space, the community of practitioners involving the teachers of the subject from the different colleges and the KEG supported subject experts share and collaborate for creating, exchanging content, teacher training and support asynchronous interaction over group specific message boards and email. KEG itself has central portal that facilitates and coordinates such collaborations.
- (ii) The CKCS environment needs one EAI like education server with associated backend systems for different kind of services in each member-college that allows us to manage a distributed K-Plant for each subject area that is managed by group of teachers (the K-Citizen here) across the different institutions.

The K-Plant associated with each subject needs to be managed over the CKCS that runs across multiple Education Servers located in the different colleges and institutions. Different functions of the K-Plant may be managed by different persons located in the different institutions. For each subject area, there is one central EAI server that supports the CKCS coordination. Users may access its services from their respective local servers. It is an area where we are gaining experience. The details of what the Education Grid is about are given in [13]. The iSOS platform based EAI like education servers from TeN allows us to establish such extranet based virtual enterprise solutions.



**Fig. 6: CKCS in Education Grid**

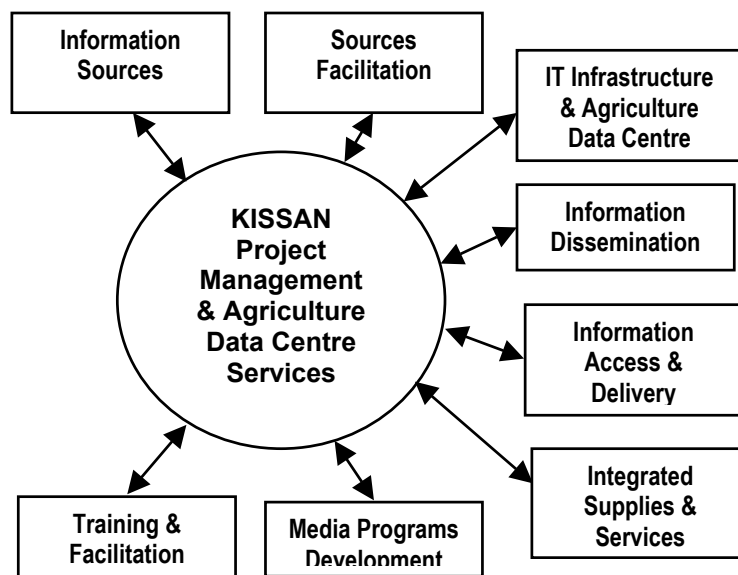
Education Grid poses several challenges and vast opportunities for the Education sector and the Knowledge industry in general that are barely addressed today. When properly driven with vision, the Education Grid will result in making institutions and universities to Knowledge Resources Centres that will enable all learners to access over the net computational and knowledge resources of immense value. This will make academic institutions into knowledge services providers, blurring the divide between academics and industry. The reader is referred to [14] where the concept of virtual learning campuses is developed as an extension of the Education Grid. A national thrust in this area has the capacity to launch India as the leader in the emerging knowledge driven world and economy of the future.

### 8.3 Case Study 3: KISSAN – Example of Virtual Enterprise with unknown members

The Karshaka Information Systems, Services and Networking (KISSAN-Kerala) project was launched a few months ago to address the empowerment of farmers and farm related government and business activities using IT.

Unlike the Education Grid, in the KISSAN case ***the K-Citizen members for any focused activity come from heterogeneous organizations or individual farmers located anywhere in the state.*** For example, the members of the K-Citizen that address best practices, supply and trade related issues in, say the banana crop in Kerala, may come from (i) the Kerala Agricultural university, (ii) the Farm Information Bureau, (iii) the Agricultural Extension Field Officials, (iv) the Directorate of Agriculture of the Government, (iv) Banana related traders' association, (v) Agriculture Products Export Development Authority, (vi) related supply chain organisations for Banana cultivation who provide inputs such as controllers, tissue culture plants, nutrients, etc., (vii) information providers such as market prices,

weather, the banana related interaction portal management, (viii) involved NGOs like the Krishi Vigyan Kendras, etc.



**Fig. 6: COMPONENT ACTIVITIES IN KISSAN**

The variety of activities such members of the K-Citizen should address is illustrated in Fig. 7. The K-Citizen identity and its virtual EAI support are provided by the KISSAN Project management centre. A major issue is how to address those members of the K-Citizen such as the banana farmers whose identity is not always known. Here, we have used some ICT tools effectively to reach out and equip them with the 5Rs. We propose to achieve this using the following combination of component solutions.

- (i) Besides the central portal EAI portal for the KISSAN project, the project plans to install several satellite EAI portals in the concerned agencies. All of them are linked over the Internet or a VPN as needed. Adequate localization of the EAI portal has been achieved for interactions in Malayalam.
- (ii) Conduct regular telecasts and mass media programs to alert the unknown members of the K-Citizen on the programs and services that are offered. In the telecast, the farmers may be guided as to how to interact with the concerned experts and support group.
- (iii) Multiple ways of querying and interacting with the different experts groups are being supported. A farmer or interested person may request for attention through call centre, or through the central Agri-Portal (see <http://www.kissankerala.net/>), or even by SMS from a mobile phone. For example in the SMS mode, the message with a published (and informed over a television program) prefix code and received by the central server is automatically routed to the concerned members of the expert group and the nearest field person or extension official. The nearest field person visits or calls the farmer and initiates necessary action that addresses his concern. The field person may interact with appropriate ICT tools to interact with the remote experts to provide the best solution to the farmers.

The KISSAN project aims to support arbitrary number of strategy focused expert groups who help drive the numerous and different kinds agricultural activities. It is possible to adopt the KISSAN approach in many areas of e-governance such as community health, disaster management, etc. The description of the KISSAN project here is kept brief and only to the point that the concept of K-Plant and K-Citizen membership may be extended beyond today's practice over a centralized intranet. A separate detailed paper is under preparation on the extranet and ICT based virtual enterprise solution developed under the KISSAN project.

What the KISSAN Project illustrates is that in the implementation of EAI supported K-Plant activities, one is not and should not be restricted by Portals only. We expand the scope of the EAI immensely by optimally combining mass media, consumer devices and services like the mobile phones, smart Call Centre concepts, etc. However the paradigm and model of K-Plant is the central concern that needs to be driven in productive and accountable ways.

## 9. CONCLUSION

In this paper we have brought out that the concepts of Knowledge Management are best extended and practiced along the line of a Pancha Kosha model as applied to focused groups whom we call as K-Citizen. Such K-Citizen groups consisting of Knowledge Workers are the ones that sustain the knowledge based wealth creation processes. Each K-Citizen has members who are close knit and work in a **share-and-care** environment supported by a group collaboration space over an EAI Portal that acts like the fulcrum of the K-Plant environment. Such group space should be equipped with the IT and ICT facilitated appropriate indicators and actuators over a knowledge organization and convergence framework. The members of the K-Citizen access and manage their concerned K-Plant by a Knowledge Interaction Interface over the EAI system.

In the last part of the paper three sample cases where such K-Plants have been set up in different ways and managed in three kinds of enterprises. The first is a centralised large R&D and follows conventional EAI implementation. The second is the example of the Kerala Education Grid where teachers of each subject specific course across homogeneous organisations form K-Citizen like groups as a virtual enterprise over distributed EAI like Education Servers. The third is the case of KISSAN project where we show how multiple complex virtual enterprises whose roles and objectives are managed by respective strategy-focused groups are sustained over a set of heterogeneous organizations and possible unknown members in the community at large.

The models and concepts proposed in this paper are helpful in taking the field of Knowledge Management towards understanding and managing knowledge enabled wealth creation paradigms in any human endeavour. It is about time that we study the organization, study and management of the 'I' in 'IT' along the above lines and make IT useful and productive for the welfare in the context of the increasingly globalised economy. The approach shown here has the potential to address the capacity building and as effective management base for the emerging knowledge driven economy. The concepts and the

framework presented here will be of some help in building a Knowledge Society Vision for the country as a whole.

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