

THE GLOBALISATION AND VIRTUALISATION OF KNOWLEDGE

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ABSTRACT

Knowledge, as a strategic business focus, has become a hot topic. After several years of groundbreaking articles, publications and pilot projects, the years 1995-6 saw a surge in interest among business managers. This is reflected in the number of conferences and new management books and articles devoted to some aspect of knowledge management¹. The same period has also seen a phenomenal uptake of the Internet by the business community, representing an increasing 'virtualisation of products and services. These apparently unrelated trends are both part of a 'growing globalisation of information and knowledge related activities.

This paper explores how these convergent trends - of globalisation, virtualisation and knowledge - are changing the shape of the environment within which we live and work. More subtly, these trends represent another convergence - that of Western and Japanese thinking about the future global economy.

The Momentum of Knowledge Management²

The interest in knowledge as a strategic lever is not new. Some 400 years ago Francis Bacon wrote a treatise on knowledge and also expressed an even earlier notion that "knowledge is power". In the 1970s and 1980s, there was a growing body of work on artificial intelligence which was also a key part of Japan's MITI's 'fifth generation' computer programme. However, knowledge based systems failed to fulfil their promise of becoming part of the mainstream of computers. Instead they are just a strand, albeit now a growing and important one, of the overall

computer market. In retrospect it seems that developers focused too much on what has been described as falling into the trap of trying to develop "thinking machines" rather than using machines to augment human thinking"³.

A more general view of the growing and pervasive role of knowledge in business activities, came from several forward thinking writers, in different parts of the world, whose work was published in the early and mid 1980s, but was not widely recognised by the business community at the time. The two examples that stand out in my mind are Sveiby⁴ and Masuda⁵. Sveiby, writing about the 'know-how company', described its characteristics and drew distinctions between management and professional know-how. Masuda described quaternary industries as distinct from the well known classification of primary (agricultural), secondary (manufacturing) and tertiary (services) industries. His quaternary categories were information, knowledge, arts and ethics industries, categories that we are now starting to recognise in the late 1990s, but which must have taken some foresight to envisage when his book was first written (in Japanese) in 1980. He also foresaw in his chapter on the 'information utility' many of the features of the Internet that we discuss later in this article.

These two strands are included among others from several parts of the world that Amidon has portrayed in a time-line ('hindsight') showing the evolution and convergence of thinking and writing about knowledge as a strategic focus⁶. More recent and more widely published examples from the US stream of the time-line include contributions from Drucker⁷, Quinn⁸, and notably Tom Stewart, whose articles in Fortune have done much to bring the subject to the attention of senior executives⁹.

However, in my work as a consultant and researcher on the subject, the one work that is continually cited to me by practitioners is the ground breaking book *The Knowledge Creating Company*, by Ikujiro Nonaka and Hirotaka Takeuchi¹⁰. Several ideas in this book were first published in an article of the same title by Nonaka in *Harvard Business Review* in 1991¹¹. Perhaps at that time, Western business managers were too preoccupied with downsizing and business process reengineering, so it was only the publication of the book in 1995, coinciding as it did with growing business interest in the subject, that attracted wider attention. The book is unique in that it brings together Western ideas and Japanese experience. My discussions with managers indicate that the most single contribution it has added to their thinking is the distinction between explicit and tacit knowledge and the conversion processes between them. Nonaka and Takeuchi describe explicit knowledge as that which:

"can be expressed in words and numbers and can be easily communicated and shared in the form of hard data, scientific formulae, codified procedures or universal principles"

and contrast it with tacit knowledge which *"is highly personal and hard to formalise. Subjective insights, intuitions and hunches fall into this category of knowledge."*

The four conversion processes they describe are:

- Tacit-to-tacit (socialisation) - where individuals acquire new knowledge directly from others;
- Tacit-to-explicit (externalisation) - the articulation of knowledge into tangible form through dialogue;
- Explicit-to-explicit (combination) - combining different forms of explicit knowledge, such as that in documents or on databases;
- Explicit-to-tacit (internalisation) - such as learning by doing, where individuals internalise knowledge from documents into their own body of experience.

The authors point out that these are the fundamental processes for creating new business value through developing and sharing knowledge. My own observation is that most people believe it is the conversion from one type to the other (i.e. tacit-to-explicit and vice versa) that give the greatest value adding potential. This seems reasonable in that knowledge once in explicit form can be more easily transmitted and multiplied by automation, but that it does need converting and assimilating into another person's tacit knowledge for application to a different situation.

In a recent conference presentation¹² Takeuchi pointed out that the Japanese are more at home working in and from the tacit knowledge domain, whilst Westerners are more comfortable handling explicit knowledge. Thus the Japanese innovate (turning tacit into explicit knowledge) through a high degree of socialisation and externalisation. He cites how his own behaviour changes when he moves with his work between the US and Japan. Research done for Business Intelligence confirms that the initial focus of knowledge management programmes in many Western companies is on explicit knowledge. The first activity addressed by many of them is the building of knowledge databases (so that companies get to "know what they know"), with human knowledge transfer processes being added only later¹³.

The interest in Nonaka and Takeuchi's book is just another indication that the business world is now taking the subject of knowledge seriously. It has also been fuelled by the active promotion by several of the major management consultancies. For example, Arthur Andersen, as well as sponsoring a knowledge symposium, have developed a Knowledge Management and Assessment Tool (KMAT), which is used to diagnose the position of companies on a number of knowledge management dimensions. Ernst and Young's Innovation Center based in Boston has evolved an earlier focus on information management into one on knowledge management, and also runs a

multi-client programme on the subject. Price Waterhouse actively promotes their internally used KnowledgeViewSSM knowledge database as an example of their credentials in this field. These consultancies recognise that they are predominantly knowledge based businesses and that by reusing knowledge they already have they can benefit their clients and their bottom line.

Amidon summarises the growing impetus towards managing knowledge as follows²:

"the momentum of knowledge management has now reached a stage of critical mass of insight. Dedicated expertise across all disciplines are exploring and defining new management practices fundamental to capitalising upon the knowledge based economy".

The Role of Knowledge

Although the strategic importance of knowledge is relatively obvious for a management consultancy, it plays an increasingly important part in products and processes. For example, Botkin and Davis discuss the role of knowledge in products¹⁴. They describe six features of knowledge-based businesses:

- (1) The more you use knowledge-based offerings, the smarter they get.
- (2) The more you use knowledge-based offerings, the smarter you get.
- (3) Knowledge-based products and services adjust to changing circumstances.
- (4) Knowledge-based businesses can customise their offerings.
- (5) Knowledge-based products and services have relatively short life cycles.
- (6) Knowledge-based businesses enable customers to act in real-time.

Examples of the growing intensity of knowledge in products are the intelligent oil drill, which 'knows' the shape of the reservoir it

is drilling, and the intelligent car, whose engine management systems can monitor performance of vital parts and 'knows' when they need servicing.

Leveraging knowledge in processes means applying the best available knowledge to a situation, such as handling a customer query, an operational problem or development of a new marketing campaign. In the era of business process engineering, much of the emphasis has been on making existing repetitive processes more efficient. Many of these are highly standardised and automated i.e. explicit knowledge. As a growing number of businesses have learnt to their cost, through this 'streamlining', often accompanied by downsizing, much implicit knowledge held by those formerly intimately involved with the process has been lost to the front-line. It is no accident that for certain crucial processes or incidents, companies will spare no expense to bring to bear the expertise needed. Thus oil companies have traditionally flown out knowledgeable experts to remote oil rigs to solve operational problems, rather than allowing on-site operatives to rely on the explicit knowledge in the locally held field manuals. In contrast BP has made virtual teamwork using videoconferencing a key plank of their knowledge strategy, thus avoiding such travel in many cases. Insurance companies like CIGNA in their process reengineering for underwriting have captured much of the implicit knowledge known by their best underwriters into various help screens and documents that sit behind the standard process screens.

These are companies that are aware of the contribution 'of knowledge in their products and processes that flow through to significant bottom line business benefits. A growing number of similar cases have been reported¹⁵. Some examples include:

- Hoffman La Roche who by considering the knowledge needed to prepare clinical trials documentation for the approval authorities have contributed to faster time to market for new drugs.

SM Knowledge View is a service mark of Price Waterhouse

- Price Waterhouse whose KnowledgeView® brings existing knowledge of best practices to their consultants world-wide and allowed them to provide better solutions to their customers wherever they are located.
- NEC, the Japanese electronic company, whose articulation of its core knowledge base, helped redefine the company's mission as 'computers and communications', markets in which it has shown continuing success.
- Dow Chemical whose attention to its intellectual property in a languishing patent portfolio has generated significant additional revenues through licensing and other agreements.
- Skandia, a Swedish based insurance company, whose management focus on intellectual capital (the knowledge in its people and processes) has helped it grow from a small regional company to number five in the world in its market segment.
- Kao, a household and chemical products company, whose focus on open knowledge sharing among employees has helped propel it into new markets.

Knowledge Management in Practice

So what is this topic of knowledge management really about? A useful working definition is "the systematic management of knowledge processes - the gathering, creation, organising, storing, disseminating and use of knowledge". As the above examples show, some companies, or parts of them, have for some time understood the role of knowledge and have in place processes and support mechanisms to help its creation and flow, thus generating costs savings or added value for customers. My current research suggests that what is happening now is that leading edge companies (at least in the West) want to make knowledge content and processes a more explicit part of their strategy. This is partly driven by the often expressed feeling that unless something is explicit (back to the Western comfort with explicit knowledge) and measured, it simply doesn't get properly managed. Thus the last few years has seen a growing number of appointments of 'Chief Knowledge Officers' and people in similar roles with job titles such as Vice

President of Intellectual Capital, Director of Knowledge, Director of Innovation.

In practice, we have found that the key strands of their responsibilities and the scope of the knowledge management programme which they initiate include the following:

- Knowing what you know - identification of knowledge that actually exists within the company and is used on a regular basis. Simply recording such knowledge, as on a knowledge database, can save companies money by stopping 'reinventing the wheel' and buying in knowledge that already exists (the author knows of one company who commissioned market research for knowledge that already existed). It can also avoid those downsizing operations where only belatedly is it realised what knowledge a company has inadvertently lost.
- Clarifying what type of knowledge is important, for example to add value to current operations or to develop new products and services. A tool found useful in many companies is that of developing knowledge maps, showing the relationship of various types of knowledge to key business processes and activities.
- Creating knowledge centres - such centres are both physical (e.g. a library) and virtual (e.g. online databases), employing a mix of 'knowledge editors' and people who liaise with knowledge providers and users. Their main role is to coordinate knowledge and to act as a focal point for knowledge capture and sharing. Such a centre will act as a hub of a knowledge network - a point of contact for those seeking or having knowledge.
- Introducing effective knowledge processes - very often this requires combining librarian and information systems skills. Activities include classification of material and developing company-wide thesauri (a common language has turned out to be a powerful part of many knowledge management programmes)¹⁶.
- Developing supporting processes and infrastructure. Important here are creating the climate and culture for knowledge sharing and the development of new ideas. This may involve both physical elements, such as

holding events such as 'knowledge fairs' and the design of office space¹⁷, as well as 'softer' cultural aspects such as training and personal development programmes, inducing appropriate behaviour patterns. Reward and recognition systems in many cases also need attention.

- Developing a technology infrastructure for knowledge sharing. These are computer networks, databases and various knowledge support systems and tools. Some are very niche and focused, such as an expert systems or a case based reasoning system. What we are finding, is that those making the most contribution are those that allow knowledge sharing on a large scale, connecting knowledge around an enterprise to an individual's desktop. This is the focus of the virtualisation aspect of this article.
- Embedding knowledge into strategic management processes, especially planning and measurement processes. Companies (such as Skandia) that have made attempts to measure some of the intangible aspects of their business - the capabilities of their people, the knowledge embedded in processes, customer capital, capacity of innovation, and so on - seem to gain a better perspective on the contribution of knowledge and therefore find the necessary investment for all the other support activities mentioned here.

These activities, as noted earlier, are now gaining a momentum of their own, at least within a corporate context (intra-firm). We now review the other major trend, that of virtualisation, which can also dramatically affect the nature of the knowledge management process in the inter-firm arena.

Virtualisation

The advances in information and communications technologies (ICT) are almost unparalleled in the world of science and technology. MIT's landmark *Management in the 1990s*¹⁸ study indicated that over a ten year period, information technology showed a 25 times price-performance improvement, compared to 1.4 times for six other major

product groups. Makridakis¹⁹ notes that the industrial revolution, that caused such change with our way of living and working, was brought about by a technology (steam power) that gave a mere 15 times improvement in price-performance over previous technologies. Combining these facts, we see that the progress of computers and communications is like an industrial revolution every seven years!

We have all witnessed the changes this has brought about. Today's personal computers are more powerful than the mainframes of the 1970s. They also come in a wide choice of packaging (laptops, notebooks, personal digital assistants etc.), and have more functionality, such as multimedia. But the biggest change is that of connectivity. It was much less than a decade ago when personal computers were commonly interconnected through LANs (local area networks) and often even less when they were first interconnected through a corporate network. For many people, it has only been in the last year or so when such networks were opened to the outside world through communications gateways.

Add to these hardware changes the growing sophistication of communications software, particularly electronic mail and to a lesser extent groupware products such as Lotus Notes, and the opportunities to change ways of working are immense. Many of these opportunities were experimented with by pioneering companies in the 1980s. For example, Digital exploited its internal network (DECnet) to develop successful products using engineering teams distributed around the world²⁰. Others, like Xerox were using distributed and group meeting decision support systems for processes such as strategic planning. A useful framework that epitomises these new opportunities is that of Johansen's groupware grid²¹ that shows the dimensions of time and space (Figure 1).

Developments in ICT open up new ways of exploiting the dimensions of time and place of this grid. Furthermore, the cost effectiveness of

Different Place	Remote Dispersed "Tele-"	Asynchronous
Same Place	Conventional - Meetings etc.	Message Centres
Same		Different
Time		

Figure 1 - A Communications Framework

the technologies that are shrinking the importance of time and space are causing a rethink of conventional work patterns. Thus, for many purposes the notion of location becomes irrelevant. When you call a local phone number for customer service, it is highly likely that you will be routed to a remote call handling centre. Locations such as County Wicklow in Ireland and Glasgow in Scotland have become the European call handling centres of companies like Dell and British Airways. This reconfiguration of work across time and place is leading to a growing number of so called 'tele-activities', such as teleworking (working from home or in a telecottage rather than in a conventional office), teleselling (dealing with customer over the phone rather than over the counter), and even telemedicine (diagnosing over a video link rather than in a doctor's surgery).

Furthermore the location (or time) of activity does not have to be discrete as in a call centre. Activities can be chunked as dispersed in a myriad of ways over time and space. The number of possibilities is large. Even activities that traditionally have required a physical presence, such as product development, can generally be reengineered and subdivided to open up more opportunities. However, as Coulson-Thomas has identified in the COBRA research project, few companies have taken into account this teleworking dimension or the opportunity to radically rethink their supply chain in their business process reengineering initiatives²².

This move to virtualisation has been developing rapidly over the last few years and has attracted a corresponding vocabulary. Indicative of this are book titles like *The Virtual Corporation*²³ and *Virtual Communities*²⁴, both incidentally highly thought-provoking visions of the future, but drawing on practices that are already visible today. Some of the examples of virtualisation that are increasingly found are:

- Virtual Products and Services - sold through electronic networks e.g. telebanking, telemarketing; significantly reducing costs of many activities and creating opportunities to reach distant markets easily. Information related products, such as newsletters and software are now being widely distributed through the Internet.
- Virtual Offices and Workplaces²⁵ - teleworkers, working in a location independent manner (sometimes at home), and flexible offices (with several desks per employee); companies adopting telework save millions on their office real estate; and gain flexibility for rapid reorganisation.
- Virtual organisations and corporations - working in teams and co-operatively across company boundaries to create the organisation needed for specific projects; gaining significant flexibility in the use of people.

This is completely starting to create a new 'information geography' different from physical geography. As far as software development is concerned, India and the province of Bangalore in particular is the backroom software

development office for a significant number of US and European organisations. Even the remote island of Mauritius, in the Indian Ocean, is positioning itself as "the informatics business park for data downloading and processing". Its aim is to position itself as the Singapore of Africa²⁶. Interestingly it seems to have difficulty in defining which continent it really associates with - it is geographically off Africa, over 60 per cent of its population are Indian in ethnic origin, yet its entrepreneurial drive into information world comes from Asian business people. So it sees itself as "the meeting of the (Western) Cartesian mind and the Asian mind".

Although virtualisation has been available to large companies with necessary network investments, it is the rapid uptake of the Internet, a network of computer networks whose use is reported to be more than doubling every year²⁷ is making much of this virtualisation accessible to all. It is global and affordable. Although the US accounts for more than 60 per cent of the 12 million host computers connected, the faster rates of growth are in Europe and Asia. Some 40-50 million people in over 140 countries are estimated to have access to the Internet. Although the infrastructure provision varies enormously by country, in developed countries it costs typically \$20 a month or less (not counting local telephone call charges) for unlimited access to the Internet.

In the UK, the Department of Trade and Industry is actively promoting the use of electronic networks through its Information Society Initiative²⁸. It provides strong arguments in terms of costs savings and access to markets. However one study showed that only 5 per cent of all businesses were using electronic mail extensively²⁹. This study suggested three reasons for this low usage compared to the US - lack of awareness, particularly by decision makers who might themselves not be intensive users of the technology, the capital cost (investment in hardware, software and more importantly training); the lack of critical mass in certain sectors. In other words there are insufficient members in a given business network

connected such that parallel conventional procedures are also needed.

For those that have taken the plunge, the business benefits are very visible. Thus even the smallest organisations can participate and a growing number of home users and consumers open up new marketing possibilities for all. Some examples are:

- An international yacht broker whose business has significantly increased through use of the Internet
- An Australian software company who now selling its software world-wide without incurring the costs of overseas agents
- A musician's database that helps to give musicians access to opportunities not previously available to them cost effectively
- Virtual viewing of houses for home seekers currently located in other countries
- Sun Computer corporation who estimates it saves several million dollars annually by providing support to its customers through the Internet rather than via the previous preferred method of telephone
- The development of Yahoo into a world-wide corporate directory of Internet resources, started by two students at Stanford University.

The ways in which the Internet is helping business are through reduced costs, access to wider markets (beyond the locality, treating the world as a potential market), and new business network configurations. The latter applies to both fixed and fluid networks. Thus, it becomes cost effective to have suppliers who are outside ones normal supplier locality. For instance, I use a disabled person who lives 200 kilometres away to do computer work for me, I also contract artwork from a design house in Finland and I work cooperatively on a project with a colleague based in Boston. New opportunities come from developing (virtually) close working relationships with those with complementary knowledge and skills, wherever they may be located.

The Internet has generated such a wealth of new opportunities, by rethinking space and looking at virtual business relationships, that to do it justice would be not be possible in this

short article. For a general overview of the business perspective I refer the reader to *Doing Business on the Internet* by Mary Cronin³⁰. It is however worth emphasising here some key functions of the Internet that are helpful to knowledge workers and will be referred to later:

- The World Wide Web (WWW): this effectively provides a global database of information, one of whose key features are hypertext links.
- Structured information resources and retrieval tools. The ubiquitous 'search engines', such as Alta Vista, that will search the 40 million (and growing) pages for keywords or text is supplemented by a growing number of meta-sources and directories - structured sets of knowledge resources.
- Discussion lists of newsgroups: around the Internet there are over 30,000 such newsgroups or lists to which individuals can 'subscribe' and contribute. For many knowledge workers they are a prime source of new knowledge and, more importantly, contacts and pointers to experts.

An important point to make is that once knowledge is stored on computer and transmitted over a network it is in effect only information or explicit knowledge. Many writers enter debates and draw subtle distinctions between data, information, knowledge and wisdom³¹. In practical situations such distinctions are difficult to draw. One person's information may be another person's knowledge. There is, however, something distinct between tangible codified information stored in a computer and knowledge that is in a human brain whose retrieval and use is very dependent on the context of the knowledge holder. Therefore, the Internet converts and transmits knowledge from the sender, which the receiver may convert back to their frame of knowledge in a different way.

The different facilities on the Internet offer different levels of support in the knowledge conversion processes mentioned earlier. For example, information stored in structured Web pages has been categorised according to some

persons classification, and their use in a given context may be limited. On the other hand electronic conversation, such as through electronic mail or the richer exploration of topics afforded with multiple participants in a discussion group, are getting closer to a knowledge user's needs. The user can explain their context, seek clarification, debate ideas. This is the real power of the Internet towards effective knowledge networking i.e. not the storage of codified information, but as a vehicle to enhance person-to-person information and knowledge exchange³².

Although the Internet has been described as the first example of an information superhighway, today it represents little more than a rudimentary cart-track. Many Internet users access it with modes operating at 14,400 kbps or 28,800 kbps. Often there are reports of congestion, and even blockages³³. The hope is that more universal broadband access e.g. via cable modems will significantly increase throughput, as well as making tools like videoconferencing, more interoperable and accessible.³⁴ Once videoconferencing becomes more universal then additional elements of communication afforded by voice tone and body language can add to the richness of the knowledge exchange. What the Internet does do today though, is show us the possibilities of widespread virtualisation on a global scale, and gives everybody the opportunity to experiment and learn the new skills that will be needed to succeed in a global networked economy where knowledge and virtualisation will be keys to prosperity.

Virtual Knowledge Opportunities

These two developments - the wider adoption of systematic knowledge management practices and the continual improvement of a global infrastructure for information and knowledge exchange - along with general business environment trends, such as the need for global competitiveness and the increasing demands of customers, are driving the virtualisation and globalisation of knowledge. What does this imply in practice? Some of the possibilities are:

- Sourcing knowledge from wherever and whenever it is available - globally. Thus a round-the-clock support service can be offered by having experts around the world on tap.
- Seeking business partners through placing requirement on newsgroups and discussion lists. This is quite a common way of making connections for certain projects, especially in new areas where the participants may not be well known to each other.
- Finding information on knowledge on particular topics of relevance, whether it be market information, product information or general business conditions in a new market. Many people use the Web and discussion groups for this purpose
- Accessing the best available knowledge to solve problems. For example, companies like Teltech³⁵ have a network of experts whose talents are matched and pooled to solve specific customer problems.
- Using the Internet as an electronic global marketplace of knowledge - outsourcing work to the lowest bidder or best expert. While such facilities have not yet been fully developed, there are already electronic auctions (spread out over a few days) for tangible products such as specialist cars.

This shows that supply chains can be globally distributed and either relatively fixed (a network whose participants have already met certain criteria to belong to the network) or variable (accessing unknown talent). There are examples of many of these in practice right now. What is clear is that as more people become connected and large corporations see the immense potential of gaining access to knowledge on a global scale, many of the ways we have come to think about providing customer service and carrying out business activities will be drastically changed.

The essence of knowledge management is getting the right knowledge at the right place at the right time. Why go to the effort of gathering it, structuring it and storing it yourself, in case it is needed? Why not adopt a kaizen strategy - just in time knowledge access - knowing that out there is some database or someone who has

just the knowledge you need, or that there is someone you would be comfortable with in developing new knowledge for mutual advantage? The issue, of course, as exemplified by the consultancy companies, is determining what knowledge has proprietary value. Ideally, there will develop efficient markets in knowledge objects (both of explicit knowledge and access to human expertise) which can be traded in a number of ways electronically over the Internet, just as stock and share and databases are traded in proprietary networks today.

While these knowledge structuring and market mechanisms have not yet been fully developed, the making and nurturing of suitable knowledge connections can be somewhat haphazard. There will also be lurches in the wrong direction. Thus, as established market players enter the electronic arenas, they often bring over inappropriate practices from their established paradigm. For example, many corporate Web pages are full of fancy images created by conventional media agencies that offer little useful information to the potential online buyer, and are certainly not exploiting the one-to-one relationship marketing that the medium is capable of supporting.

Another factor to bear in mind is the personal preference of many people in that they need to "talk eyeball to eyeball" before entering certain business arrangements. This is an area where Western and Japanese use of the Internet may contrast. Doing business remotely and electronically may come more naturally to Westerners than Japanese. That does not mean that the first connection cannot be made electronically. I can recount one personal experience where a Japanese employee of a large company saw my Web pages about virtual corporations³⁶. We had an electronic dialogue, and finally my Japanese contact went out of his way to meet me personally in London. I have to admit though, that it was difficult to show him any of my virtual organisations in operation - simply because they are virtual and changing and don't have an office!

Until we develop more fully these new ways

of working and trading there is much we can do in the meantime to prepare for this likely eventuality. I suggest below some principles that should assist us through the transition.

Principles of Virtual Knowledge Processing

The following principles are offered as a guide to equip knowledge workers with the tools and skills they need to take advantage of a world of virtual knowledge processing. They are intended as illustrative rather than exhaustive. Although they are written from an individual perspective they can be adapted for teams and for organisations. In fact the following have been developed from my experience in creating and managing a market intelligence group and then applying the same principles to my own mode of working.

1. Develop a knowledge schema. This should guide all your collection and storage of information. Your own organisation may have developed a classification mechanism, but your personal interests will focus more on some aspects and less on others. Being in management I based mine initially on the London Business School library classification and mapped my hard copy filing system, personal organiser and computer files on this schema. I have subsequently refined and evolved it for the sorting of periodical cuttings etc³⁷.

2. Identify and log meta-knowledge sources. A growing number of organisations make their money by providing directories and 'resource' sites on the Internet³⁸. Let them do the sifting and sorting, and the updating for you. But do within your schema create a set of useful 'bookmarks' or links to these resource sites from your World Wide Web browser.

3. Subscribe to a customised information service. There are a growing number of services that will either electronically email you daily information or news, provide customised Web pages or alert you to new items of interest. These can be expensive services such as MAID or Individual's FIRST! geared to corporate

subscribers, or lower cost (or free) services on the Internet (e.g Infoseek Personal).

4. Exploit intelligent agents. A new generation of intelligent agents, such as Autonomy, based on artificial intelligence techniques, will roam autonomously over the Internet searching out information they think will be relevant to you. These agents can be 'trained' through indicating the relevance of items founds.

5. Identify knowledge meeting points. These are the places on the Internet - newsgroups, discussion lists, where people who share an interest in your domains of knowledge congregate.³⁹

6. Develop your wider knowledge network. Your personal networks are one of the best assets you can have in the knowledge age. Try categorising them according to your schema. You need to be able to focus in quickly on those most likely to help. Also take advantage of your email address book to store for future reference with a short note those people who may be useful to know in future.

7. Develop your inner network. These are people you really want to develop an ongoing relationship with, since you will want to exchange knowledge regularly. Seek variety in your inner network with a good range of complementary skills. Again technology comes to help, since it is possible to maintain a larger inner network through regular email communication than would be possible simply through phone or face-to-face.

8. Consider a document management or database system. Computers, like filing cabinets have a tendency to hoard information which you have difficulty in retrieving later. Efficient retrieval depends on properly classifying your information (according to your schema) and have a decent retrieval system. This may be as semi-structured test retrieval system such as IdeaList, or a document management system that indexes a wide range of document types such as word processor files.

9. Publish your thoughts before they are final. It is difficult for many knowledge workers, brought up on the notions of quality output first time, to consider publishing 'half developed' ideas in any public forum. Yet this is often how better thinking and better knowledge creation and development takes place. If you invest too much time in a document before going public you are then more closed to criticism because of the time you have invested in it. An iterative process, where a few ideas are discussed and the document develops and grows is a good technique. More people are using discussion lists in this way. However good use of such groups do need clear conventions about the status of messages and documents and the intended action of recipients - techniques and 'netiquette'⁴⁰ not yet well developed in most cases. There is an art to semi-structured electronic conversations.

The above selection shows a mix of information, process, people and technology aspects. This 'holistic' view is essential. As technology improves, for example by providing many more facilities for manipulating knowledge objects (chunks of text, ideas, concepts etc.) in a distributed environment, the leverage of humans working together on projects on a global basis will expand. It is important, however, to explore and experiment with what there is now, since that will provide the essential skills for the future. It is something I have tried to do in my own work as the next section illustrates.

Virtual Knowledge in Practice

A good example of the several of these principles in operation comes from a project I am personally involved in - European Telemwork Development (ETD). ETD is one of over 150 projects supported under the European Commission's ACTS (Advanced Communications and Telecommunications Services) programme⁴¹. This programme, itself part of the fourth R&D framework programme, aims to apply developments in communications technologies, such as multimedia, broadband and satellite communications, cordless office

environments, mobile voice and data telephony, into a wide range of practical applications. These include home shopping, distributed video production and collaborative construction projects.

The formation of the ETD consortium went through several phases - all of which used what we call 'tele-cooperation' - working cooperatively over electronic networks.

1. The idea for ETD was first discussed using electronic mail between people in the UK, Denmark and Belgium; the two main proposers of the initiative first met through the Internet.
2. The main team was enlisted using similar methods. Thus, people who became known through their positive contributions to certain discussion groups and CompuServe forums were approached and worked on developing the proposals for six months before they first met in one place face-to-face. This core team includes people working in six European countries.
3. The main internal management and co-ordination takes place through a combination of closed email distribution lists, and what is effectively a team Intranet operated over the public network. All team documents are initially developed in World Wide Web format for ease of access, compatibility and sharing.
4. The project publishes contact details for its coordinator in 15 European countries, first in email, then fax, then phone. A media service is provided through NewsDesk⁴², an innovative service for journalists that delivers press releases electronically.
5. The project embraces a mix of formal documentation, structured databases, bibliographic data, and on-line discussion groups. We use a wide range of Internet facilities, such as email, the Web⁴³, list servers and a back-end database engine that generates WWW resource pages on the fly.

In effect the main project team of seven is a virtual corporation, with its own ethos, procedures and computer systems (managed remotely from a location in the West of England). All participants are teleworkers,

some working exclusively from home, some working only occasionally from home. There are several layers in the network, which exhibits all the characteristics outlined by Lipnack and Stamps⁴⁴, with ebbs and flows, and nodes and linkages that work at many levels. The core represents the inner layer. Over 30 subcontractors and associates represents the next layer, while outer parts of the network are people who connect into us for specific activities or projects. Although European in focus, the project managers believe that it is only through participation in global networks and co-operating globally with other similar sites, such as Gil Gordon's Telecommuting Web site⁴⁵, and the Institute for Distributed Work in California⁴⁶, will the full potential of these new methods be achieved in Europe.

In working on this project, I have commissioned work from people operating in several different countries. Their ability to communicate electronically and perform the work satisfactorily is what defines their suitability, not their geographic location. In fact I have switched some work from local supplier to an overseas one since the overseas one uses email and the Web while the local supplier does not. ETD is just one of a number of growing examples that demonstrates how information and knowledge intensive work can be done virtually. Some of the things we have learned through our experience in ETD are:

- allow time for relationships to develop and teams to gel; the occasional face-to-face meeting is an advantage, but with the right skill at electronic communications, not essential
- develop technical support mechanisms to help people with their technical problems; the state of the Internet, service provision and quality of software is very variable across Europe (and the world)
- develop 'standards' for communication; these include both technical standards e.g. using MIME for email attachments, as well as templates for different document types and Web pages, and 'rules of engagement' (such as not automatically copying every recipient on an email when replying)

- structure information and messages well; apply the principles of information chunking (such as one topic per message) and use of schema topics for titles, and status of information (draft, revision number, idea, request for action etc.); good classification and subject titling also helps the use of information filtering on receipt of emails (fairly essential when over a hundred messages a day are being received!)
- keep filing away those email contacts of people who conduct themselves well over networks; it's an essential skill for virtual knowledge transfer and such people are those who will get up to speed quicker when you need new knowledge.

Conclusion

Figure 2 shows a simplified schematic of the topics covered in this article. Knowledge is the apex of business strategy and is becoming more virtual and global. Virtualisation is enabled by people (knowledge workers) working together effectively (tele-cooperating) over electronic networks (such as the Internet).

Today, while the Internet and electronic communications are growing rapidly, most use has been for simple electronic mail or information retrieval from the World Wide Web. As these technologies evolve the opportunities to enhance various aspects of knowledge processing, such as document sharing through desktop conferencing, visual cues through videoconferencing, and idea generation and sharing through collaborating on knowledge objects and maps, expands.

The growing corporate interest in knowledge management as a key management focus will create new opportunities for those companies who can extend their knowledge base beyond the company to wider inter-company knowledge networks. All the elements are now coming into place. Today, however, only a minority of companies and individuals are conversant with the strategic options and the profound changes in the nature of work that adopting these strategies entails. As my own experience over the last five years, and more recently on ETD, has shown, we all

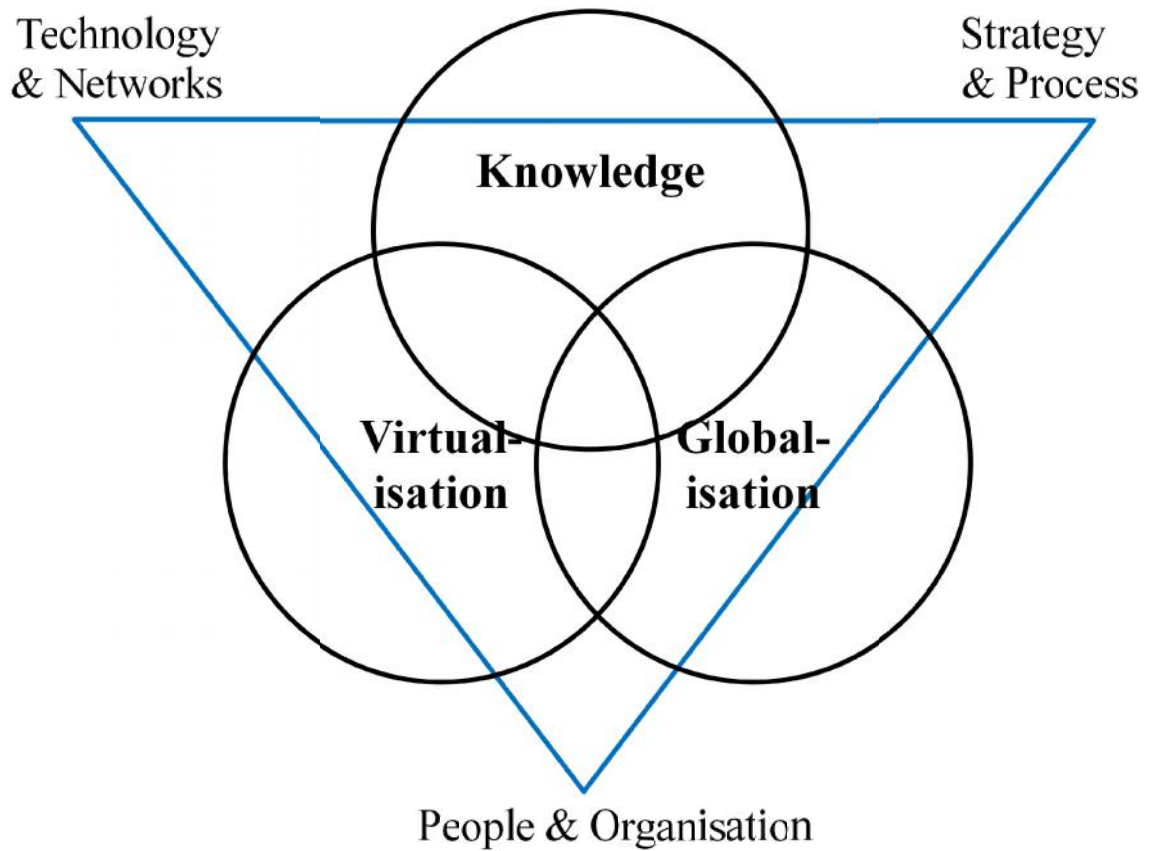


Figure 2 - Outline Schematic Positioning Knowledge

have much to learn and new skills to develop for these to become effective. Furthermore, the pace of new technology and diffusion of new management ideas means that such learning will never stop if we are to be successful.

Notes and References

1 Examples of conferences include *The Knowledge Imperative Symposium*, Arthur Andersen and the American Productivity & Quality Symposium, Houston (September 1995) and *Leveraging Knowledge for Sustainable Advantage*, Business Intelligence (March 1996).

2 I'm indebted to Debra M. Amidon for this phrase - the title of her paper in *Research-Technology Management* (May/June 1996); also available in several languages on the World Wide Web at <http://www.entovation.com/momentum/momentum.htm>

3 'Knowledge Networking', David J. Skyrme, *The Intelligent Enterprise*, pp. 9-15 (Nov 1991)

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5 *Managing in the Information society*, Yoneji Masuda, Basil Blackwell (1990), English; translated from the original Japanese publication, *The Information Society as a Post-industrial Society*, Institute for the Information Society, Tokyo (1980)

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7 'The Coming of the New Organization', Peter F. Drucker, *Harvard Business Review*, (January-February 1988); Drucker is often credited with coining the phrase 'knowledge worker' in the 1950s.

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9 'Brainpower', Thomas A. Stewart, *Fortune*, pp.44-56 (3 June 1991); 'Your Company's

Most Valuable Asset: Intellectual Capital', Thomas A. Stewart, *Fortune*, (3 October 1993)

10 *The Knowledge Creating Company*, Ikujiro Nonaka and Hirotaka Takeuchi, Oxford University Press (1995)

11 'The Knowledge-Creating Company', Ikujiro Nonaka, *Harvard Business Review*, pp.96-104 (November-December 1991)

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16 For example, Price Waterhouse have developed a common International Business Languagesm to map business processes from a wide range of industries and business functions such that global best practice comparisons can be made.

17 Colin Hastings in *The New Organization: Growing the Culture of Organizational Networking*, McGraw-Hill (1993) discusses the contribution of office space design to improved human networking.

18 *The Corporation of the 1990s*, ed. Michael S. Scott Morton, Oxford University Press (1991)

19 'Management in the 21st Century', Spyros;Makridakis, *Long Range Planning*, Vol 22, No. 2 (1989)

20 *Enterprise Networking: Working Together Apart*, Ray Grenier and George Metes, Digital Press (1992)

21 *Groupware: Computer Support for Business Teams*, R. Johansen, Free Press (1998)

22 *Business Process Re-engineering: Myth & Reality*, Ed. Colin Coulson-Thomas, Kogan Page (1995). There is also a short summary in 'Re-engineering new patterns of work: A holistic approach', *I&T Magazine*, European Commission, DGXIII (September 1996)

23 *The Virtual Corporation*, William H. Davidow and Michael S. Malone, HarperBusiness (1992)

24 *The Virtual Community: Finding Connection in a Computerized World*, Howard Rheingold, Minerva Press (1994)

25 A useful taxonomy is provided in 'Flexible Working: Building a Lean and Responsive Organization', David J. Skyrme, *Long Range Planning*, Vol 27, No. 5, pp.98-110 (1994)

26 'A Tiger is Born off Africa', *Business Week* (13 Jan 1997)

27 Surveys such as those done by Forrester Research base figures on numbers of users, although telecomms companies such as MCI report actual traffic on networks is growing at over 300 per cent annually. A useful set of statistics will be found in 'Off the Charts: The Internet 1996', *Internet World*, pp.45-51 (December 1996)

28 *The Information Society Initiative*, Department of Trade and Industry, London (1996). There are also a series of short guides on 'How EDI (mobile telecommunications, email etc.) can work for you'. See also <http://www.isi.gov.uk>

29 A study by Management Technology Associates for the DTI cited in ISI material and summarised at <http://www.mtanet.co.uk>

30 *Doing Business on the Internet*, Mary J. Cronin, Van Nostrand Rheinhold (1995)

31 See for example *Knowledge Management: Foundations*, Karl M. Wiig, Schema Press

(1993) who also shows several taxonomies of different types of knowledge.

32 For an example in the context of market intelligence gathering see 'Global Intelligence Networking: technological opportunities and human challenges', David J. Skyrme, *AGSI Journal*, pp.106-113 (November 1995).

33 The most classic case is that of the intense traffic to download NASA pictures of the Shoemaker-Levy comet, which virtually brought the Internet on the West Coast of America for a short period in 1995. The 1996 trade press reported stoppages at AOL, Netcom and other providers for particular periods (of several hours to more than a day). See 'Internet: The Year (1996) in Review', *Internet World*, (January 1997)

34 Videoconferencing, once hampered by standards. Even today, though, most experts reckon it advisable to check each particular one-to-one connection before relying on a fully working end-to-end connection (network, hardware and software).

35 'Experts for Hire', Carol Hildebrand, *CIO*, pp.32-38 (15 April 1995).

36
<http://www.skyrme.com/insights/2virtorg.htm>

37 For those who collect significant amount of information, an information refining system, based on content analysis techniques of Tom Carney and perfected by Trend Monitor International could be of value. See 'Trend Monitor International', Jan I.C. Wyllie, *AGSI Journal*, pp. 121-123 (November 1992).

38 A classified set of business research resources will be found at <http://www.brint.com>. For example, one category is on knowledge management and organisational learning at <http://www.brint.com/OrgLrng.htm>

39 A useful 'list of lists' will be found at <http://www.liszt.com>

40 Network etiquette.

41 *ACTS Programme Guide*, European Commission, DGXIII-B, Brussels (1996). See also <http://www.infowin.org> (ACTS Information Window) which maintains project descriptions of each project.

42 <http://www.newsdesk.com>

43 The main Web site is <http://www.eto.org.uk>

44 *The Age of the Network: Organizing Principles for the 21st Century*, Jessica Lipnack and Jeffrey Stamps, Oliver Wight Publications (1994)

45 <http://www.gilgordon.com>

46 <http://www.isdw.org>

The Author

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RETROSPECTIVE 2011

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It is over a decade since this paper was first written. At that time that both knowledge management and the internet were in their ascendancy. Of the internet I wrote "although the internet has been described as the first example of an information superhighway, today it represents little more than a rudimentary cart-track". Those were the days of transfer speeds of 0.014Mbps rather than the 8Mbps or more of today. As I look back over what I wrote then, the ways in which the trend of better connectivity, leading to globalisation and virtualisation of work and business, have borne fruit in much the way as predicted. Below I summarise the main points that have struck me on re-reading, both in terms of what panned out as expected and what is different today.

Evolution of language

Today when one mentions virtualisation, one immediately thinks of it in technology terms, the use of computers acting as virtual machines. In contrast, the virtualisation of business referred to in this paper is more often simply referred to as 'online'. Likewise terms like telebanking and telemedicine are now referred to simply as online banking and online medicine.

It is in the area of technology that new terms are often applied to older concepts, perhaps in part to alert people that technology is always changing. Thus (terms not used in this paper) PDAs (personal data assistants) are now known as smartphones, and computer bureaus as SaaS (software as a service). And how much longer will these terms survive!

Interestingly, the terminology of knowledge management remains virtually (did I mean to use that word!) unchanged. In this paper, only the term 'knowledge centre' is probably not widely used today, though you will find a lot of 'knowledge bases'.

What has changed?

As noted above the notion of a knowledge centre, an enhanced library, is not usually at the forefront of a KM programme. Just as today most of us never visit a physical library but browse online, so you will find a portal or intranet as a key part of most knowledge initiatives.

In the section 'principles of virtual knowledge processing' I suggested exploiting intelligent agents. These has turned out not to be as prevalent as anticipated. I suspect that although the technology is not as good as it should be, that the main reason is that people do like to have a high degree of control over what they do at their computer screen. Also untimely pop-ups such as "hey did you know that this is a better document" is annoying. However, we are seeing some amount of intelligence and 'presence awareness' in everyday computing, such as the Google's targeted ads based on your search, and "the following contacts of yours are also online" in various email and social networking programmes.

Again, it is in the field of technology where some of the names have disappeared. The search engine AltaVista (from my old Alma Mater DEC - Digital Equipement Corporation) has all but disappeared (it hangs in there, just, but not for long). And Google, which we often think has been our companion since eternity, was still over a year away from being launched. Other services such as MAID and FIRST! were absorbed into larger organisations.

Overall, other than minor updating, it is this section of principles that I would rewrite. After all, most of us are familiar with 'tagging' these days, but knowledge schemas may still be a bit esoteric!

What's the same

The most remarkable thing to me, and the reason that I have spent time unearthing and reformatting this paper from its early MS Word original, is how consistent many of the themes and approaches are with today's practice. Yes, technology has continued to evolve, as has knowledge management and online working, but the trends were well established by the mid-1990s.

Take for example, the MIT's landmark study *Management in the 1900s* published in 1991¹⁸. It took a long-term view of the progress of technology and how it would affect the way we all do business. The main themes of this paper - the knowledge economy, globalisation and virtualisation (or rather online working!) are all made possible by greater and better connectivity. As noted earlier connectivity in 1997 meant an internal local area network, to which not every professional employee was connected, and a slow speed internet¹, where web pages with images were frowned upon since they slowed down access to textual information.

Today, we are connected fast and from everywhere and from a whole range of devices, including those PDAs, or rather smartphones (Blackberry's, iPhones and the like).

Another point made in the MIT study, and covered in the paper, though perhaps not as much as it should have been, is the importance of the human and organisational dimension in virtual practices - the bottom apex of the triangle in Figure 2.

But taken as a whole, we note that most of the points in this paper stand us in good stead today, for example:

- The **momentum of knowledge management** continues - since 1997 it is more pervasive, being applied in most

business functions and more widely around the world, most notably in recent years in India and Asia.

- The **role of knowledge** is unchanged. There are many more case examples reflecting the experiences of the examples cited.
- **Knowledge management in practice** today uses most of the techniques listed, such as the knowledge audit, but now adds more besides - storytelling being a more recent example.
- **Online businesses and working**, the topics in the section on 'virtualisation', is now more prevalent but follows the approaches used in the main paper.
- **Virtual knowledge opportunities** are as plentiful as ever. There is no shortage of innovation in the market place.

Much of what was written was thinking about conventional and new businesses moving onto the internet. There are perhaps two areas of 'virtualisation' that were overlooked or not foreseen. The first of these is the growth of online gaming and the development of virtual online communities / virtual worlds such as Second Life. The second is the growth of social networking, not just in the social sphere through services like Facebook, but the more professionally oriented services such as LinkedIn.

What this latter point reminds us of, and should have perhaps been given more emphasis in the paper, is the importance of the human dimension in every aspects of business and in particular, the development of technologies that serve a useful purpose. And as was noted on page 8, the importance of "talking eyeball to eyeball" should not be under-estimated.

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April 2011

¹ The 'internet' has gradually been losing its capitalisation "Internet" since about 2002, initially outside the USA. Even CNN eventually dropped the capital I in 2010.